



Research Article

Factors Influencing the Success of Processed Agricultural Products: An Empirical Study from Thailand

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Abstract | This study aims to evaluate the status of farmer groups engaged in processing agricultural products (PAPs) in Thailand and investigate their capacity for innovative prototyping. Data were collected on 55 prototype agricultural products from 1,650 farmers in different regions of Thailand. The data were analyzed through confirmatory factor analysis, path analysis, and structural equation model. The results showed the importance of factors such as entrepreneurial skills, management practices, competitiveness, industrial promotion, and business networks played roles in the success of PAPs. Moreover, the study demonstrated that industrial promotion initiatives had a direct influence on entrepreneurship, prototyping management, competitiveness, and the overall positive outcomes of PAPs. In addition, the establishment of business networks had a positive effect on management, competitiveness, and successful outcomes. This study provided valuable insights for policymakers, industry stakeholders, and PAP farmers' groups in Thailand and other developing countries seeking to improve the performance of their agricultural processing industries.

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Keywords | Innovative entrepreneurs, Model of processed agriculture, Prototyping, Processed agricultural products, Thailand



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Introduction

Thailand is an agricultural country, most of its population are farmers and dependent on agriculture (Nuntapanich *et al.*, 2022; Saqib *et al.*, 2023). The agricultural sector in Thailand employs approximately 30 % of the total labor force, supporting around 6.4 million households in the year 2010 (Sapbamrer *et al.*, 2022). However, compared to other economic sectors, it exhibits slower growth and generates the lowest value added per worker due to high prices and

lower profits of agricultural products (Muangmee *et al.*, 2023; Saqib *et al.*, 2023). Over the past three decades, the contribution of the agriculture sector to the country's national income has declined significantly, representing only 10 % of the GDP in 2019 (UN, 2020). In the past years, agricultural produce prices have declined due to recessional global markets, thus causing domestic purchasing power to decline (Wannaprasert and Choenkwan, 2021; Chaitorn and Saqib, 2022). Due to the price decline and low profit in this sector, according to the Digital Economy

Promotion Agency (2020) of Thailand, between 2010 and 2019, employment in the Thai agriculture sector experienced a decline, representing 20.44% of the total labor force. In comparison to other countries in the region, Thailand ranked lower than Cambodia, the Philippines, Malaysia, and Indonesia in terms of agricultural employment. The decrease in agricultural employment can be attributed, in part, to labor migration towards other sectors, particularly the service sector, which witnessed an increase from 41.11% in 2010 to 46.09% in 2019. Hence, the promotion and development of processed agricultural products (PAPs) in Thailand can play a significant role in employment generation and the revival of the agricultural sector.

The Thai government has employed the Thailand 4.0 strategy to boost value-added agricultural produce and create entrepreneurs of agricultural produce so that Thai farmers can get out of poverty (Somkaun *et al.* 2021). According to the National Statistical Office of Thailand, 40% of the Thai population is in the agricultural sector, yet they possess agricultural property only 114.6 million rai¹ (35.7% of Thailand's land) (NSO 2013). Farmers are divided into two groups: Group 1: the novice who has been doing the agricultural business for not more than 3 years. Group 2: the veteran who has more than 3 years of experience in the agricultural business (NFC 2020). In any case, the novice and the veteran still lack business administration expertise, thus professional management supported by the government is essentially necessary. As described above, the researcher sees the importance of agricultural development by the government and the measurement of driving the SME 4.0 strategem by integrating every sector of the governmental units (Garzoni *et al.* 2020).

The 12th National Economic and Social Development Plan (2017-2021) of Thailand emphasized the advancement of community entrepreneurs as a means to stimulate economic growth at the grassroots level and cultivate a society that encourages entrepreneurship (NESDB 2017). Similarly, the 13th National Economic and Social Development Plan continues to recognize the importance of community enterprise development (NESDB 2023). According to this strategy, Thailand is emphasizing the production of high-value agricultural products and agricultural products that have been processed to enhance the

1 rai= 0.16 ha

agricultural sector (Jongwanich, 2020). This includes utilizing technology to increase agricultural productivity (Muhammad *et al.*, 2023), decreasing reliance on natural resources, and adding value to agricultural products for the high-value food industry (Farah *et al.*, 2022). Approximately 58.21% of community enterprises are engaged in agricultural product production (NESDB, 2023). Thailand's current agricultural development plan highlights the need to add value to agricultural products by leveraging local wisdom in processing to create a competitive advantage and community identity (Sriphong *et al.*, 2022). Setting themselves apart from the competition can involve various strategies, such as offering unique products, implementing effective marketing and branding, providing exceptional customer service, and continuously seeking innovation and improvement (Khurshid *et al.*, 2022). Product innovation can also include enhancements to manufacturing procedures, services, administrative structures, and promotional efforts (Izuogu *et al.*, 2021). Active member participation, focusing on human capital, including knowledge and skills, is also vital (Yaseen *et al.*, 2020). Additionally, other elements of intellectual capital, such as structural capital (organizational processes and infrastructure) and networks and collaborations, should be emphasized (Kiani *et al.*, 2020). Community enterprises, like other businesses, need dynamic capabilities to effectively identify and adapt resources to capitalize on new opportunities and respond to changes in the business environment (Moore *et al.*, 2021).

Processing agricultural products and community enterprises go hand in hand, as community enterprises often engage in the processing of agricultural products to create value-added goods (Yar *et al.*, 2021; Buratti *et al.*, 2022; Suriyankietkaew *et al.*, 2022). Adding value, improving marketability, and raising profitability—all of which help farmers and provide employment—all depend on processing agricultural products (PAPs), therefore promoting economic growth (Saqib *et al.*, 2018; Yaseen *et al.*, 2023). Utilizing nutritional protection helps to preserve food, lower post-harvest losses, and guarantee a consistent food supply, promoting food security and better public health (Bounkham *et al.*, 2022). Rural processing facilities support nearby infrastructural development and economic growth. Environmentally, PAPs maximize resource usage, lower waste, and support sustainable behaviors (Pholphirul *et al.*, 2023). Technological developments motivated by the necessity for effective

processing techniques improve output and product quality (Sharma-Pandit *et al.*, 2020). Community entrepreneurs in the processed agricultural product sector are essential contributors to Thailand's economy (Sann *et al.*, 2022; Pholphirul *et al.*, 2023). They serve as an important link between the agricultural sector and the overall economy, playing a significant role in driving grassroots economic growth, particularly in the aftermath of the COVID-19 pandemic (Husen and Geleta, 2021; Kitipadung and Jaiborisudhi, 2023). By integrating these factors-distinctiveness, innovation, active member participation, and dynamic capabilities-community enterprises in Thailand can enhance their competitiveness, contribute to local economic development, and create a positive impact on their communities and the overall national economy (Somwethee *et al.*, 2023).

Bansomdejchaopraya Rajabhat University (BSRU) and the researcher acknowledged the significance of collaborative efforts in research endeavors, facilitated by the department of industrial development under the ministry of industry and the national farmers council. Expanding upon the aforementioned background, the researcher intends to examine multiple aspects that contribute to the achievement of processed agricultural products in Thailand. The aspects under consideration encompass the business environment, the promotion of processed agricultural goods within the industrial sector, business networks, advancements in processing techniques, practices in company management, and overall competitiveness. The objective of this research endeavor is to get a comprehensive understanding of the key determinants that contribute to the success of processed agricultural goods in Thailand. The results of this study offered significant insights and knowledge that can be effectively utilized by various stakeholders, such as industry participants, policymakers, and researchers, to bolster the development and competitiveness of the processed agricultural products business inside the country. The primary objective of this study is to make a scholarly contribution to the advancement and expansion of the PAPs (Public-Private Partnerships) sector in Thailand through the facilitation of innovation and entrepreneurship. The research endeavors to gain significant insights and lessons that can facilitate the larger progress of the PAPs sector in Thailand by identifying successful innovative entrepreneurs within the industry and comprehending their tactics. The results of this study have the potential to facilitate the

advancement and expansion of the PAPs sector using innovation and entrepreneurship. The research conducted in Thailand can be regarded as a significant point of reference and a source of inspiration for other developing nations that aspire to augment their agricultural value chains, foster economic prospects, and make contributions towards sustainable development.

Materials and Methods

Study population and sample

The research targeted individuals who might one day work in the agriculture processing sector. A total of 55 research groups are selected from the target population throughout Thailand, to collect 30 samples from each. The research groups are designed so that there are at least 30 samples per unit, as Lindeman *et al.* (1980) recommended. The researcher, therefore, collected samples from all 55 locations, each with an equal amount of 30 sets (Muangmee, 2020b). In total, the samples collected were 1,650.

Scope of the study

The study examined different areas of processed agricultural products (PAPs) in Thailand. It uncovered how laws and market conditions outside of Thailand affect the industry as well as the country's efforts to help it grow. Furthermore, the business networks in the field stress how important it is for all stakeholders to work together to make the value chain stronger. Along with management practices like strategic planning and quality control in PAP businesses. The study also showed how innovation drives competitiveness and makes new goods. Lastly, it covered how well PAP businesses have done in Thailand by looking at things like new product development, market growth, and profit.

Data collection

The research methodology encompassed the acquisition of data via a questionnaire survey, which was subsequently subjected to content validity assessment. The validation method encompassed the engagement of three subject matter experts to ascertain linguistic coherence, phrasing precision, and questionnaire content accuracy. The assessment of the questionnaire's questions' consistency with the Index of Item Objective Congruency (IOC) was also conducted. To develop research instruments for examining the prototyping activities of innovative entrepreneurs in Thailand's Processed Agricultural Products (PAPs)

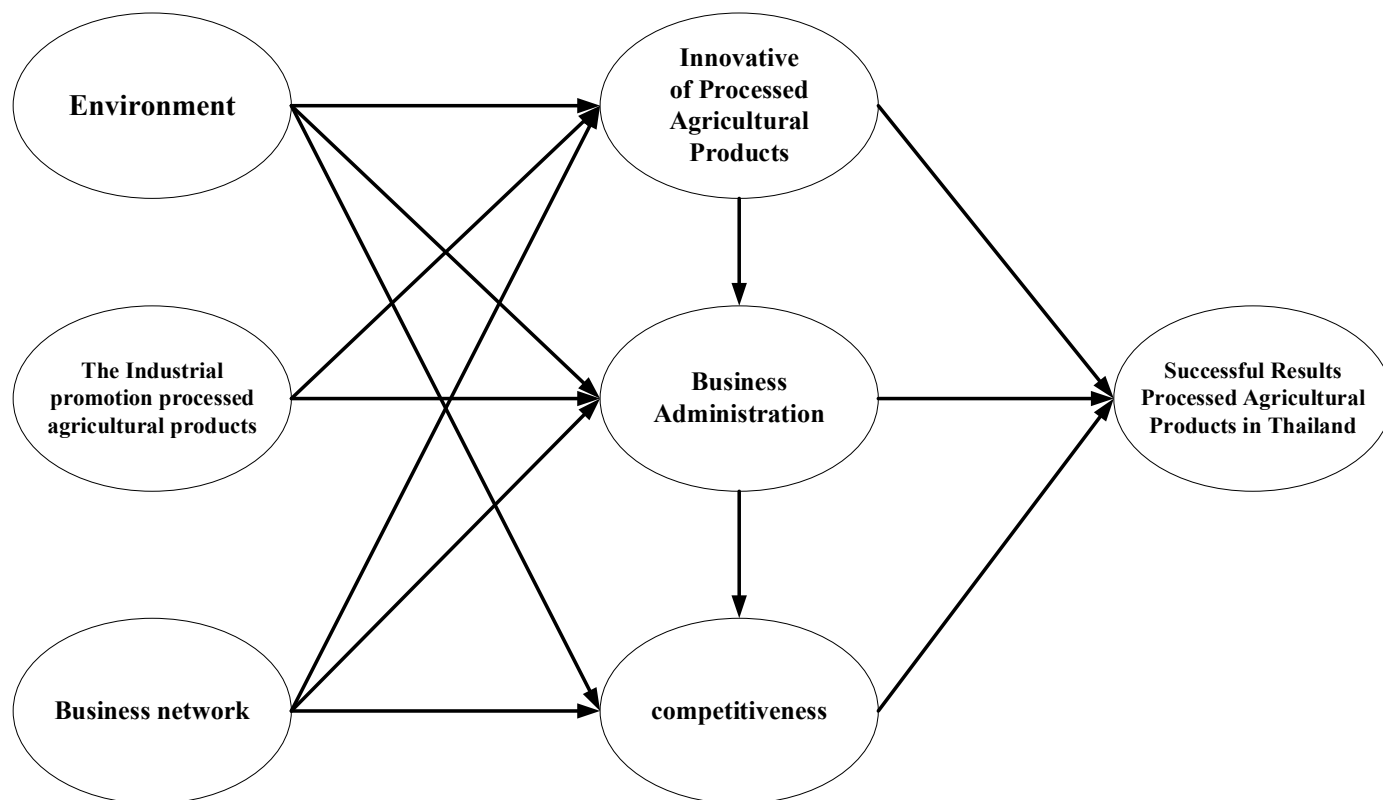


Figure 1. Construct model displaying the effect values between variables.

industry, the formulation of questions was carefully tailored to coincide with the research aims and anticipated advantages. The data collection period for the sample respondents spanned from March 2023 to June 2023.

Data analysis

To establish content validity, the researcher sought expert advice by administering the previously developed questionnaire. The assessment of content validity was conducted by employing the Index of Item Objective Congruency (IOC), with a predetermined minimum criterion of 0.6 as established by [Na-Nan and Saribut \(2020\)](#). If the calculated Index of Consistency (IOC) score surpassed the predetermined level, it signified that the questions were deemed to be consistent. Following this, the survey was distributed to an experimental cohort comprising 50 participants who possessed comparable attributes to the intended population. Subsequently, an assessment was conducted to ascertain the reliability of the questionnaire. The data was subjected to analysis by the researcher to determine the overall dependability coefficient, a measure commonly computed using techniques such as Cronbach's alpha. The data collection for the research study was conducted using the complete questionnaire, which had been verified by the afore-

mentioned process, with a confidence level of 0.95. A total of 1650 replies were collected, facilitating the execution of statistical analysis. In addition, descriptive statistics, path analysis, and structural equation modeling (SEM) were employed to assess and derive insights from the innovative entrepreneurs operating in the processed agricultural products (PAPs) sector in Thailand.

Model construct

Based on the information provided in [Figure 1](#), the constructed model demonstrates the nature of the effect between variables. It shows that the environmental variable has a There is a direct effect on the innovative aspect of processed agricultural products from business administration and competitiveness and competitiveness. Additionally, the effect of the environmental variable on the successful results of processed agricultural products in Thailand is indirectly influenced, with mediation through the variables of innovation of processed agricultural products, business administration, and competitiveness. This suggests that the impact on successful results is not direct but is influenced by these intermediary factors ([Chaitorn and Saqib, 2022](#)). The variable of industrial promotion of processed agricultural products directly impacts the innovative aspect of processed agricultural

products, business administration, and competitiveness. Industrial promotion directly influences these three variables without mediation through other factors (Muangmee *et al.*, 2023). Moreover, it indirectly influences the favorable outcomes of processed agricultural products in Thailand, operating via the mediating factors of Innovation in processed agricultural products, business administration, and competitiveness. The industrial promotion of processed agricultural products and the business network variable directly impact the Innovative aspect of processed agricultural products, business administration, and competitiveness. This means that these two variables directly influence all three of these factors without the need for mediation through other factors.

Results and Discussion

Factor affecting different aspects of processed agricultural products

Effect of environment: Based on the results presented in Table 1, the application of a structural equation model for variable analysis demonstrated a significant direct impact of the environment variable on both the innovative aspect of processed agricultural products (DE=0.51) and business administration (DE=0.60). Additionally, the environment variable exhibited an indirect effect (IE=0.20) and a total influence (TE=0.80) on the aforementioned variables. Furthermore, it is worth noting that there exists a direct effect on competitiveness with a coefficient of 0.55. Additionally, there is an indirect effect with a coefficient of 0.13, and when combined, these effects result in a total influence of 0.68. Nevertheless, the impact of processed agricultural products in Thailand on successful results is mediated indirectly through several factors. These factors include the innovation of processed agricultural products (with an indirect effect coefficient of 0.17), business administration (with an indirect effect coefficient of 0.29), and competitiveness (with an indirect effect coefficient of 0.24).

Effect of The Industrial Promotion Processed Agricultural Products

The promotion of processed agricultural products within the industrial sector has a significant impact on the innovation of these products, with a direct effect size of 0.42. Additionally, this promotion also has a direct effect on business administration, with an effect size of 0.36, as well as an indirect effect of 0.17. When considering the whole influence, the total effect size

of the industrial promotion on processed agricultural products is 0.53. Furthermore, it is worth noting that there is a direct effect on competitiveness with a coefficient of 0.66. Additionally, there is an indirect effect with a coefficient of 0.23, and when considering both the direct and indirect effects, the total influence amounts to 0.89. Additionally, the field of business administration plays a role with a coefficient of 0.17, while competitiveness has the highest coefficient of 0.29, suggesting its significant contribution to the overall success. This suggests that promotional activities play a role in facilitating the efficient management and execution of prototype procedures for processed agricultural commodities. This aids in the enhancement and optimization of product development strategies. Moreover, the promotion of industrial activities has a direct impact on the competitiveness of PAPs. This implies that the assistance and strategies offered by industrial promotion programs contribute to the improved competitive standing of processed agricultural products within the market. Additionally, the encouragement of industrial activities in Thailand has a significant impact on the overall success of processed agricultural goods, albeit through indirect means. The aforementioned indirect benefits are facilitated by various factors, including entrepreneurship, the management of PAPs prototypes, and competitiveness. The promotion efforts contribute to the overall success of processed agricultural products by positively influencing these mediating factors. The findings of our study in agreement with Chatzigeorgiou and Christou (2020), who revealed that the promotion of processed agriculture effectively affects the success of the business. Moreover, Jang and Shin (2019) also supported our findings that the promotion of businesses increases business success.

Effect of Business Network

The business network exhibits a significant impact on the innovation of processed agricultural products (direct effect = 0.49) as well as on business administration (direct effect = 0.68). Additionally, there is an indirect effect (indirect effect = 0.20) and a total influence (total influence = 0.88) resulting from the business network. When considering the combined impact, known as the total influence (TE), it amounts to 0.80. Moreover, it is worth noting that there exists an indirect relationship between the success of processed agricultural products in Thailand and other factors including the innovation of processed agricultural products (with an indirect effect coefficient of 0.17), the application of business administration

principles (with an indirect effect coefficient of 0.33), and the level of competitiveness (with an indirect effect coefficient of 0.16). The business network of PAPs has both direct effects on the management and competitiveness of PAPs prototyping and indirect effects on the successful results of PAPs in Thailand. The findings of this study align with the theoretical framework proposed by [Tajeddini et al. \(2020\)](#), which emphasizes the significance of creating business networks for achieving successful outcomes. The results suggest that industrial promotion initiatives play a vital role in fostering entrepreneurship, improving management practices, and enhancing the competitiveness of PAPs. The formation of business networks has a similar, positive influence on the management of PAPs' prototypes and general competitiveness, which in turn aids in PAPs' successful outcomes. Industrial promotion initiatives are being prioritized by policymakers and industry players to assist PAPs, encourage entrepreneurship, and improve management techniques. Moreover, the development of business networks is encouraged, as they serve as valuable platforms for knowledge sharing, collaboration, and market expansion, leading to sustainable development and success for PAPs ([Muangmee, 2020a](#)).

Effect of Innovative Processed Agricultural Products

The impact of innovative processed agricultural products on business administration is significant, with a direct effect size of 0.41. Similarly, there is a direct effect size of 0.35 between innovative processed agricultural products and the successful results of processed agricultural products in Thailand. Additionally, the influence of innovative processed agricultural products on competitiveness is indirect, mediated through the pathway of business administration, with an indirect effect size of 0.27. Furthermore, it can be observed that there exists an indirect relationship between the impact of a certain factor and the successful outcomes of processed agricultural products in Thailand. This relationship is mediated by the field of business administration, with an indirect effect size (IE) of 0.20. Additionally, when considering the overall influence of this factor, it exhibits a total influence (TE) of 0.55.

Effect of Business Administration

The field of Business Administration is associated with several notable effects on the agricultural sector in Thailand. Specifically, it directly contributes to the positive outcomes of processed agricultural products in the country, denoted as 'DE' and valued at 0.49. Furthermore, it has a direct impact on the compet-

itiveness of the agricultural sector, marked as 'DE' and quantified at 0.66. The efficient administration of the prototype phase has significant importance in the context of product creation and enhancement. This observation suggests that the distinctive characteristics and attributes possessed by these groupings have a significant role in their capacity to engage in effective competition within the market. This suggests that groups possessing distinct traits are more likely to be in a favorable position to provide products of superior quality and effectively distinguish themselves from their competitors. Furthermore, the attributes of the processed agricultural collectives had an indirect impact on the favorable outcomes of their commodities. This observation implies that these attributes exert an indirect influence on the overall performance and results of processed agricultural commodities. The mediating variables of entrepreneurship, PAPs prototyping management, and competitiveness are likely key factors through which these characteristics impact the eventual success of the products. The findings of the study are similar to those of [Bolaños and Barbalho \(2021\)](#), who revealed that a successful business wants knowledge in management and should have the ability to compete to make the business successful. Moreover, [Qalati et al. \(2021\)](#) revealed that medium-sized enterprises (SMEs) in developing countries through innovation and better management can increase their competitiveness.

Effect of competitiveness

It can be seen from the findings that are shown in [Table 1](#) that the variable of competitiveness directly impacts the successful results of processed agricultural products in Thailand. Agricultural products in Thailand, with a coefficient value of DE=0.45.

The value of R^2 for the Innovative feature of processed agricultural products is 0.75, which indicates that the model can explain 75% of the variability seen in this variable. The value of the coefficient for the business administration variable is 0.62, which indicates that the model can account for 62% of the variability in the business administration variable. Regarding competitiveness, the model has an R-squared value of 0.59, which indicates that it can explain 59% of the variability in competitiveness. The R^2 value for Successful outcomes of processed agricultural products in Thailand is 0.65, which indicates that the model can account for 65% of the variability in successful outcomes. The value of Chi-Square is 67.26, and the p-value that is linked with it is 0.12, which indicates

Table 1. Relationships and influence between variables.

Result variable	Innovative processed agricultural products			Business administration			Competitiveness			Successful results processed agricultural products in thailand		
	TE	IE	DE	TE	IE	DE	TE	IE	DE	TE	IE	DE
Event variables												
Environment	0.51*	-	0.51*	0.80*	0.20*	0.60*	0.68*	0.13*	0.55*		0.17*	0.29*
											0.24	
The Industrial promotion of processed agricultural products	0.42*	-	0.42*	0.53*	0.17	0.36*	0.89*	0.23	0.66*		0.14	0.17
											0.29	
Business network	0.49*		0.49*	0.88*	0.20	0.68*	0.80*	0.44	0.36		0.17*	0.33*
											0.16*	
Innovative Processed Agricultural Products				0.41*		0.41*		0.27*		0.55*	0.20	0.35*
Business Administration							0.66*		0.66*	0.78*	0.29*	0.49*
										0.63*	0.14*	
Competitiveness												0.45*
R ²	0.75			0.62			0.59			0.65		

Chi-Square = 67.26, df = 51, p-value = 0.12, CFI = 0.99 TLI = 0.99 SRMR = 0.05 RMSEA = 0.01

Notes: * $P < 0.05$ TE = Total influence, IE = indirect, DE = Direct

that the model seems to fit the data quite well. Other statistics, such as The Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) are both commonly used statistical measures in structural equation modeling to assess the goodness of fit of a model. SRMR of 0.05: An SRMR value of 0.05 is generally considered to be a very good fit. A lower SRMR indicates that the model fits the data well. In this case, an SRMR of 0.05 suggests that the model is a good fit for the observed data. These numbers reflect that the model accurately captures the data that have been observed and indicate that the goodness of fit is excellent.

Following an evaluation of farmer groups engaged in producing PAPs in Thailand, several key areas have been identified for targeted improvement and intervention. These include the imperative need to boost sales, which involves expanding market reach and driving revenue growth. Furthermore, optimizing production efficiency is crucial to ensure that resources are utilized effectively to increase output. Reducing production costs per unit is vital to enhance profitability while creating higher-value products can lead to better financial returns. Additionally, cutting down on losses at various stages of production and distribution is essential to maximize resource utilization and minimize wastage. Addressing these areas of emphasis underscores a commitment to enhancing

the success and sustainability of these farmer groups in the dynamic processed agricultural products sector. [Sriphong et al. \(2022\)](#) reported from the three southern provinces in Thailand that innovativeness in product, process, and market increases the farmers' competitiveness and business. Moreover, the findings align with the concept and theory proposed by [Prasanna et al. \(2019\)](#) regarding competitiveness management, which emphasizes its role in driving efficient business growth. Additionally, the results correspond to the research conducted by [Muangmee et al. \(2014\)](#) which found similar areas of improvement for agricultural product businesses.

Results of the prototyping of selected processed agricultural products

The results reported in [Table 2](#) demonstrate that the prototype outcomes of 55 selected processed agricultural products (PAPs) farmer groups in Thailand exhibited a noteworthy and statistically significant rise in sales, primarily at a high magnitude. The Aiya rambutan drying group, in particular, demonstrated exceptional proficiency in product processing and had a significant surge in sales, with 90 % of their sales exhibiting noteworthy growth. Within the examined cohorts, it was observed that Mulberry network community Enterprise exhibited the most notable level of production efficiency, with a stunning surge of 800 %. Multiple groups were able to effectively lower their

Table 2. *Prototyping results of 55 selected PAPs farmers' groups.*

Prototyping groups	(a)	(b)	(c)	(d)	(e)
Young Farmer Group	55		75		
Beekeeping community Which movie house	40		15		
Manufacturer and development of banana processing Rahan	50		75	300	
Learning Center Group Ban Patthawi Community	28			60	10
Cassava growers in Nong Yai district	40			55	
Herbal-friendly enterprise, Ban Khia community	40	100			
Self-reliant community enterprises Ban Rong Wua Daeng	30		12	7	
Native rice conservation group	40	500			
Tha Kum Kum-Nern Sai Thurian Community Enterprise	37		33	250	
Tapioca Group, Moo 10, Dong Chatchom	36			55	
Agricultural production group	30	50	50		
Napier Grass Growers	40		50		
La Bua Loi Agricultural Housewife Group	23			300	
Fruit Juice Processing Group	60			40	
Organic Happy Community Enterprise	20			40	
Learning Center for Plant and Herb Plantation	30		33	20	
Group of manufacturers and distributors of rice grain varieties	40				3
Pig farmers group Phra Thong Kham district	40			80	
Multi-purpose liquid production group	48			30	
Organic rice production and processing group	50	100	50	150	
Ban Dong Bang Community Enterprise	30	100	50	250	
Ban Bang Nu Community Enterprise	38			100	
Thung Yai Banana Processing Group	20	8	75	200	
Fairy Mushroom Cultivation Group, Ban Tha Chang	30	100	50		
Farmers group producing sea mouth shrimp paste	37		50	10	
Tamarind House Processing Group	9		50	10	
Agricultural Product Processing Group, Ban Lao Sub-district	5				15
Complete banana growers in Phayao Province	42			70	3
Poram Asen Housewife Group	19			15	5
Tachee Latex Community Development Enterprise	40			313	
Boat farmer group	30			267	5
Thung Thai Wisdom Community Enterprise	28		20		10
Organic Fruit Farmers Group, Li River Basin	8			300	10
105 Community Enterprise, Organic Agriculture	52			100	
Ban Bang Chak Thai Food Processing Group	26	50	50		
Tourism enterprise by Ban Sai Khao community	39		25	60	
Mulberry Network Community Enterprise, New Theory	35	800	2		
Ban Na Farmer Farmer Community Enterprise	30	20		300	10
Chao Pla Salid Adult Community Enterprise	20	30	10		5
Rice Seed Production Group	20	30	10	15	
Rice Seed Promotion and Production Center	50		8.3	160	
Mae Sin Farmers Group develops non-toxic citrus production	39		10	600	
Mango Grower Enterprise, Chok Anan	35			100	5
Kadae Herbal Community Enterprise	29	25		300	5
Aiya rambutan drying group	90			3000	

Prototyping groups	(a)	(b)	(c)	(d)	(e)
Kuan Tomma Housewife Group	28			200	
Community Enterprise for Sustainable Agriculture Consumers	30			5	15
Pho Tak Rice Processing Community Enterprise	40			300	
Mudmee Silk Weaving Women Community Enterprise	37		25	33	
Kut Mak Fai Agriculture Cooperative Limited	40			333	7
Bhutan Mushroom Cultivation Community Learning Center	48	400	75		
Organic rice production community enterprise Thung Charoen	30	30	10	5	
Farmers Community Enterprise	38	80		15	5
Hat Yai Community Enterprise Group	29			100	15
Erie Organic Silk Production and Processing Group	60			300	5

Notes: The numbers in the table are percentages. a= Increased sales, b= Increased production efficiency, c= Reduce production cost per unit, d= Developed products have increased value, and e= Reduce loss.

production costs per unit, with four specific groups standing out for achieving the highest level of cost reduction. The cassava group involved in the development of processed bananas, the Thung Yai banana processing group, and the Bhutanese mushroom culture community learning are all entities or communities likely engaged in agricultural or food processing activities. All of these groups experienced a significant reduction of 75 % in their production costs. The increase in value was mostly noted in the Aiya rambutan drying group, which had a substantial rise of 3,000 % as a result of product development. The agricultural product processing group, the Ban Lao sub-district community enterprise for sustainable agriculture consumers, and the Hat Yai community enterprise group have all achieved a significant reduction of 15 % in losses. Their efforts in reducing losses can have a positive impact on the efficiency and sustainability of agricultural and food processing activities. This is a commendable achievement that can contribute to better economic and food security outcomes for the communities involved.

The findings from the prototyping conducted with the 55 selected PAP farmers' groups in Thailand have unveiled several encouraging and favorable outcomes. These results may signify improvements, innovations, or achievements that are noteworthy for the agricultural sector in Thailand. Our findings are supported by Cooper (2019), who emphasized that businesses can achieve greater productivity and success through new product development and a focus on quality. The results indicate that the farmer groups experienced increased sales at a high level, indicating a positive response from the market to their processed agricultural products. This is consistent with the idea that

new product development and quality can contribute to business growth and productivity (Zehir and Narcikara 2016; Zhao *et al.* 2023). Furthermore, the prototyping efforts led to increased production efficiency among the farmer groups. This suggests that the introduction of innovative processes and practices enhanced their overall production performance. Additionally, the farmer groups were able to reduce production costs per unit, indicating improved cost management and efficiency. This aligns with the notion that businesses can achieve greater success by controlling costs and optimizing production processes (Al-Dhubaibi, 2021). The development of products with increased value was another positive outcome observed among the farmer groups. This implies that the prototyping efforts led to the creation of higher-value products, potentially resulting in improved market positioning and customer satisfaction (Zehir and Narcikara, 2016; Muangmee, 2020b). Moreover, the farmer groups were able to reduce losses, indicating effective loss prevention strategies.

The findings of the study on prototype innovative entrepreneurs in the PAPs sector in Thailand reveal that the characteristics and attributes of agricultural groups in the country exert a direct influence on the entrepreneurial inclination of individuals or entities involved in this industry. These characteristics likely play a significant role in shaping the entrepreneurial mindset and activities of those engaged in PAPs, which can have implications for innovation, competitiveness, and overall success within the sector. For example, the study shows that there are direct effects on the management of PAPs prototyping in Thailand. These direct effects are likely to impact how PAPs are managed, including factors such as production meth-

ods, quality control, and overall operational efficiency. In addition, there are also direct effects on the competitiveness of these PAPs. This suggests that factors related to the management of PAPs play a crucial role in determining how competitive these products are in the market, potentially affecting their market share, pricing, and market penetration. Additionally, there are indirect implications for the successful outcomes of processed agricultural goods in Thailand. This suggests that the distinct attributes of the groups have an impact on their approach to and execution of the prototype process for their processed agricultural products.

Conclusions and Recommendations

This study provided valuable insights into the assessment and prototyping of PAPs in Thailand. The results highlighted the importance of various factors such as entrepreneurial skills, management practices, competitiveness, and the role of industrial promotion and business networks in driving the success of PAPs. The study emphasizes the need for processed agricultural groups in Thailand to focus on developing entrepreneurial skills and exploring their potential. Enhancing sales, production efficiency, and value creation is crucial for achieving success and sustainability. The study is based on self-reporting from the respondents and may have biases. The study focused on specific variables related to entrepreneurial characteristics, management practices, competitiveness, and prototype innovativeness. Despite these limitations, the study contributes valuable findings to the understanding of PAP farmer groups in Thailand and their prototype innovativeness. The results demonstrated that industrial promotion efforts have direct effects on various aspects of PAPs, including entrepreneurship, prototyping management, competitiveness, and successful outcomes. Similarly, the establishment of business networks positively affected management, competitiveness, and successful results. The study provided practical implications for policymakers and industry stakeholders, emphasizing the significance of supporting industrial promotion efforts and encouraging the development of business networks to foster an entrepreneurial environment, enhance management practices, and drive competitiveness. The study through a holistic approach addressed entrepreneurship, management, competitiveness, industrial promotion, and networking of PAPs. By incorporating these strategies, developing countries can create a fa-

vorable environment for the success and sustainability of their own PAPs sector, contributing to economic growth and job creation. Future research can build upon these findings and address the limitations by employing larger and more diverse samples, utilizing longitudinal designs, considering a broader range of variables, and employing a mix of research methodologies.

Novelty Statement

This study is the first to emphasize the crucial importance of entrepreneurial abilities, managerial practices, industrial promotion, and business networks in developing PAPs. These findings offered significant recommendations to policymakers, industrial players, and PAP farmer organizations in Thailand and other developing nations to improve their agricultural processing sectors.

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Conflict of Interest

The authors declare no conflicts of interest related to this research. This study was conducted impartially and without any external influences that could compromise its objectivity or integrity. The authors have no financial or personal relationships with any individuals or organizations that might bias the findings presented in this paper.

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