GUIDELINES FOR SUSTAINABLE INDUSTRIAL MANAGEMENT OF AGRICULTURAL PROCESSED FOODS

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ABSTRACT

The purpose of this study was to study guidelines for sustainable industrial management of agricultural processed foods. It was a mixed-methodology research including the qualitative research through in-depth interview and the quantitative research by collecting the quantitative data from 500 chief executive officers of the agricultural processed food industrial corporates. The data was analyzed by descriptive, inferential, and multiple regression statistics. The findings showed that the four variables of the guidelines for sustainable industrial management of agricultural processed foods were Alliances, product innovation, marketing and general management. The sample group focused on every variable at a high level.

The results of the structural equation model analysis were proved through the evaluation criteria with the empirical data with the Chi-square probability of 0.053, the relative Chi-square of 1.183, the correlation index of 0.963, and the root index of the mean square of the error estimate of 0.019. The results of research hypothesis test indicated that the Alliances directly influenced the product innovation at statistically significant level of 0.001, the Alliances directly influenced the general management at statistically significant level of 0.001, the general management directly influenced the marketing at statistically significant level of 0.001, the product innovation directly influenced the marketing at statistically significant level of 0.001. The results of the study revealed that the mean of guidelines for sustainable industrial management of agricultural processed foods was at the highest level. The definitions of Alliances referred to not taking advantage of commercial partners, product innovation referred to supporting employees to implement their skills and new knowledge to create innovative technology of products, general management referred to giving a chance to everyone in the organization to freely express their opinions on work performance, and marketing referred to increasing the channels of advertisements or public relation to access the target groups as much as possible. And the small, medium, and large enterprises focused on the guidelines for sustainable industrial management of agricultural processed foods at statistically significant level of 0.05.

Keywords: Agricultural Processed Foods, Alliances, Product Innovation, Marketing, General Management.

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INTRODUCTION & LITERATURE REVIEW

The economics of Thailand is mainly based on the agricultural goods including the value of agricultural products, employment, and export. It is necessary to increase the value of agricultural products to make the national economics more stable (Office of the National Economic and Social Development Council, 2018). Supporting the agricultural product processing can increase the value of agricultural goods; creating new products with the development of agricultural products can motivate the agricultural entrepreneurs and create the guidelines for sustainable promotion, and development of the agricultural processed foods (Kasikorn Research Center, 2018). Moreover, the export of agricultural processed foods is another choice for the entrepreneurs to study and extend their markets, but it was found that the export of agricultural processed foods tended to decrease as in the Figure 1 below.

Figure 1 shows the value of export of agricultural processed foods during 2016-2020 tended to constantly decrease as in the graph with 51,233 million baht in 2016, 48,610 million baht in 2017, 42,762 million baht in 2018, 39,064 million baht in 2019, and 37,514 million baht in 2020, respectively.

Moreover, it was found that the value of gross domestic products (GDP) of the agricultural processed foods of Thailand during 2016-2020 tended to constantly decrease with 8.46 percent in 2016, with 8.33 percent in 2017, with 8.12 percent in 2018, with 8.03 percent in 2019, with 7.99 percent in 2020, respectively.

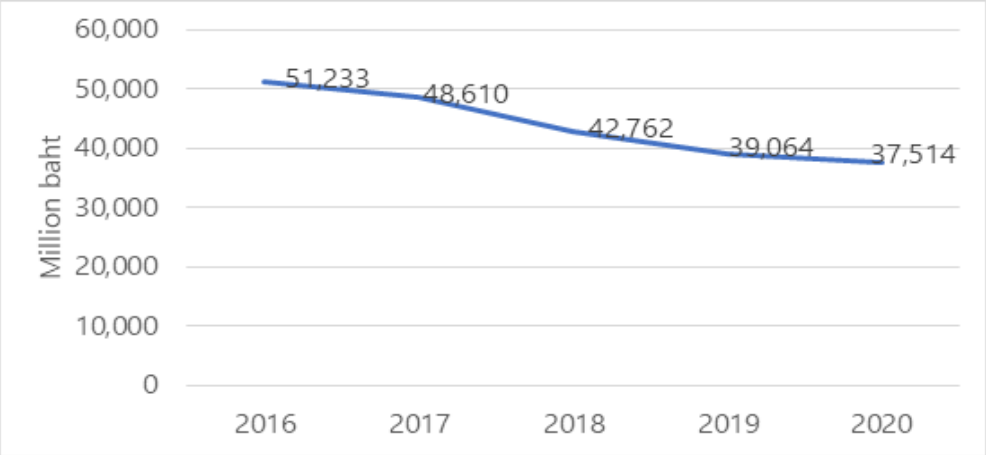

FIGURE 1
THE VALUE OF EXPORT OF AGRICULTURAL PROCESSED FOODS DURING 2016-2020

The issues show the importance of sustainable development of agricultural processed products to increase the quality and value of agricultural goods. Besides, it plays an important role of creating the related industries including packaging, and transportation which influence the economic development and rural employment (Thailand Science Research and Innovation, 2019). Therefore, the researchers were interested in the study of guidelines for sustainable industrial management of agricultural processed foods. This study focused on Alliances to create product innovation and appropriate management to support the marketing management accessible to all consumers. The main factors of sustainable industrial management were 1)

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concept of Alliances, 2) concept of product innovation, 3) concept of marketing, and 4) concept of general management. The results of the study could be the guidelines for sustainable industrial management of agricultural processed foods.

The Concept of Alliances

It is about information and knowledge sharing focusing on the overall objectives to determine the alliances' competencies (Niesten & Jolink, 2015) with agreement of collective benefits and the business partners have different competencies and experiences to enhance employees' work performance capabilities (Belgraver & Verwaal, 2018). And the significance of organizations among alliance network can increase the bargaining power as well (Silpcharu & Thaisom, 2020).

The Concept of Product Innovation

It is the knowledge process of technology and resources (Schoen, 2017), and cooperation of all sections/departments to get guidelines for development of new products (Rezende da Costa et al., 2018) to meet the organization's needs, and social and economic requirements (Kuhl, 2017). Besides, the capabilities of implementing new technology are skills which lead the entrepreneurs to success (Roopsing & Artsri, 2019).

The Concept of Marketing

The customer participation in manufacturing products and providing product value and services to customers (Pencarelli & Forlani, 2018) and understanding the nature, opinions, and interesting activities can create the content marketing (Bua-In, 2021) to make a good relationship between the buyers and sellers, to improve, correct, and develop the relationship between the buyers and sellers as long as possible (Manual, 2019) and finally to build the customer and brand loyalty (Lerro et al., 2019).

The Concept of General Management

The leadership potential is necessary for organization's operations and management to maintain the organizational competencies of resources for industrial competitiveness (Purwanto et al., 2019). The constant preparation of management is necessary to meet the organizational aims and consumers' expectations (Fayaz et al., 2020). The good management must be implemented for internal manufacturing process, and external supporting process to enhance the consumer confidence (Moses, 2017).

Objectives

The objective of the study was to develop the structural equation model of the guidelines for sustainable industrial management of agricultural processed foods.

Hypothesis

In accordance with the objective and related literature, the researcher determined four hypotheses based on the related theories as follows.

H_1 *The Alliances variables directly influence the product innovation variables.*

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The collaboration in the forms of cooperation, information sharing can develop the innovation of work performance competencies (Loukes, 2015), and create the stable value of and collective benefits for the business partners (Bouncken et al., 2020).

H_2 The Alliances variables directly influence the general management variables.

The cooperation focuses on the management of work performance in all sections to get ready for changing situations. Successful food producers must create the database of cooperation to share information to all sections in the organization (Watson, 2016) to enhance the entrepreneurs' management efficiency of resources from primary materials to product delivery to consumers (Ebner, 2016).

H_3 The general management directly influence the marketing variables.

The factors of demography and economics influence the consumers' expenses, and the policy of food and nutrition are guidelines for development of various kinds of products, and determination of marketing strategies (Leschewski, 2016). Moreover, creating the product value to meet the customers' expectations is implementing the knowledge and skills of the organization to create product brands for customers to remember (Pramod, 2016).

H_4 The product innovation variables directly influence the marketing variables.

The implementation of nudge theory focuses on creation, design, and adjustment of the product innovation based on the market needs or adjustment of production innovation based on customers' behavior (Kittipong, 2015) to make it different in terms of marketing to be a business leader (Leepaitoon et al., 2020). Moreover, innovation influeces the marketing competencies of organization and advantage index of business compettiveness (Anuntaruttana & Roopsing, 2020).

RESEARCH METHODOLOGY

This study is the inductive research with mixed method approach used as follows.

1. The qualitative research with in-depth interview: there were nine experts including three experts of industrial business management, three experts of management from government sector or related organizations, and three academic experts. The experts were interviewed through open-end questions including four major components from the literature review: 1) Alliances, 2) product innovation, 3) marketing, and 4) general management. The issues obtained from the interview were used to design a questionnaire for the quantitative research.
2. The quantitative research: the researchers distributed the questionnaire with the IOC verified to the executives of industrial businesses of agricultural processed foods in Thailand. It took three months to collect the data from 9,516 respondents. The sample size of 500 respondents included 250 samples from the large industrial businesses and 250 from the medium and small industrial businesses.
3. The qualitative research was conducted through focus group discussion with 11 experts who verified the structural equation model of guidelines for sustainable industrial management of agricultural processed foods.

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RESULTS

The research results of the importance level of guidelines for sustainable industrial management of agricultural processed foods were as shown in the followings.

Table 1
MEAN AND STANDARD DEVIATION FOR GUIDELINE FOR SUSTAINABLE INDUSTRIAL MANAGEMENT OF AGRICULTURAL PROCESSED FOODS

Factor	Large Industrial Businesses			Small and Medium Industrial Businesses		
	$\bar{X}$	S.D.	Importance level	$\bar{X}$	S.D.	Importance level
Overall	**4.02**	**0.39**	**high**	**3.90**	**0.46**	**high**
1. Alliances	3.80	0.44	high	3.70	0.52	high
2. Product Innovation	4.05	0.46	high	3.88	0.54	high
3. Marketing	4.10	0.47	high	4.02	0.51	high
4. General Management	4.14	0.43	high	3.98	0.52	high

Table 1 shows the overall importance level and the four factors of the structural equation model of guidelines for sustainable industrial management of agricultural processed foods. For the large industrial enterprise, it was found that the overall importance level was high with the mean of 4.02, and when considering each item, it was found that the importance level of every factor was at a high level: the general management with the highest mean ($\bar{X}$=4.14), followed by marketing ($\bar{X}$=4.10), product innovation ($\bar{X}$=4.05), and Alliances ($\bar{X}$=3.80), respectively. For medium and small industrial enterprises, it was found that the overall importance level of the guidelines for sustainable industrial management of agricultural processed foods was a high level with the mean of 3.90. When considering each item, it was found that the importance level of every factor was at a high level: the marketing with the highest mean ($\bar{X}$=4.02), followed by general management ($\bar{X}$=3.98), product innovation ($\bar{X}$=3.88), and Alliances ($\bar{X}$=3.70), respectively.

The comparison results of the overall importance level of guidelines for sustainable industrial management of agricultural processed foods revealed that the importance level was different according the business size at statistical significance level of 0.05. The large enterprise focused on the guidelines more than the medium and small enterprises did.

The evaluation criteria of the congruence of the structural equation model of sustainable industrial management of agricultural processed foods consisted of 1) CMIN–ρ (Value>0.05), as cited in the study of Arbuckle (2011), IBM SPSS AMOS v.20, 2) CMIN/DF (Value<2.00) as cited in the study of Arbuckle (2011), IBM SPSS AMOS v.20, 3) GFI (Value>0.90) as cited in the study of Arbuckle (2011), IBM SPSS AMOS v.20, and 4) RMSEA (Value< 0.08) as cited in the study of Arbuckle (2011), IBM SPSS AMOS v.20.

Therefore, the researchers improved the model as suggested by Arbuckle (2011) by considering the value evaluated through the SPSS program to eliminate each of inappropriate observed variables. After the model had been improved, it was found that the Chi-square probability was of 0.053 (>0.05), the relative Chi-square was of 1.183 (<2.00), the goodness of fit was of 0.963 (>0.90), and the root index of the mean square of the error estimate was of 0.019 (<0.08). Therefore, the structural equation model passed the evaluation criteria and fitted the empirical data as shown in Figure 2 below.

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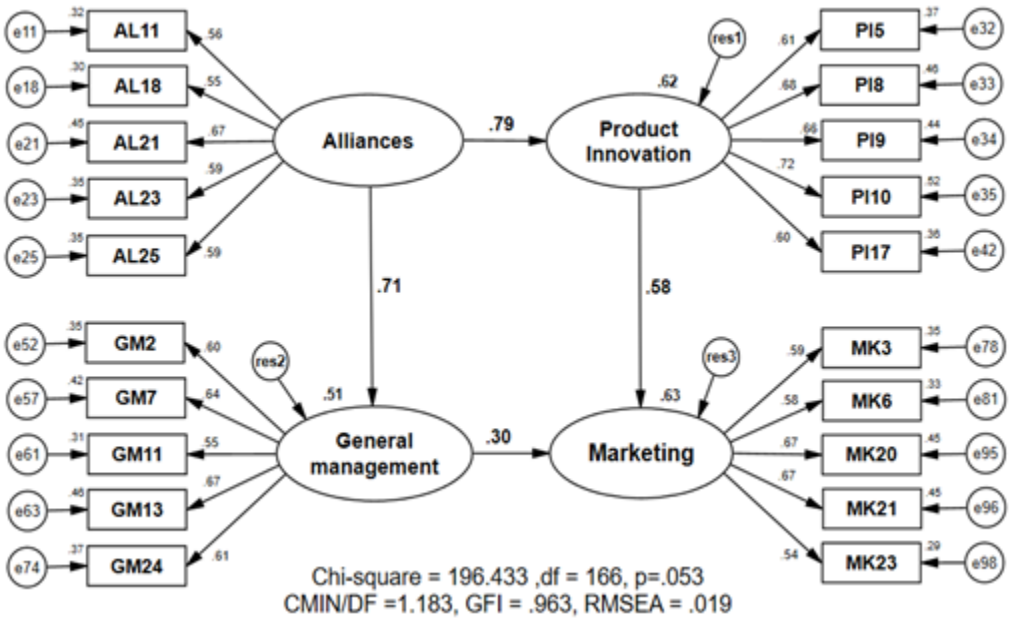

FIGURE 2
THE STRUCTURAL EQUATION MODEL OF GUIDELINES FOR SUSTAINABLE INDUSTRIAL MANAGEMENT OF AGRICULTURAL PROCESSED FOODS IN THE STANDARDIZED ESTIMATE MODE

Figure 2 the results of analyzing the causal influences among the variables in the structural equation model of sustainable industrial management of agricultural processed foods in the standardized estimate mode found that in the hypothesis 1, the Alliances variables directly influenced the product innovation variables at statistical significance level of 0.001 with the standardized regression weight of 0.79: the hypothesis 2, the Alliances variables directly influenced the general management variables at statistical significance level of 0.001 with the standardized regression weight of 0.71: the hypothesis 3, the general management variables directly influenced the marketing variables at statistical significance level of 0.01 with the standardized regression weight of 0.30: and the hypothesis 4, the product innovation variables directly influenced the marketing variables at statistical significance level of 0.001 with the standardized regression weight of 0.58. The statistics gained through the model analysis after the model had been approved were shown in Table 2 below.

Table 2 the Alliances variables directly influenced the product innovation variables with the standardized regression weight of 0.79, at statistical significance level of 0.001, a squared multiple correlation (R^2) of 0.62 and a variance of 0.10, and direcly influenced the general management variables with a standardized regression weight of 0.71, a statistically signifcant level of 0.01, a squared multiple correlation (R^2) of 0.51, and a varaince of 0.11.

The product innovation variables directly influenced the marketing variables with the standardized regression weight of 0.58, at statistically signifcant level of 0.001, a squared multiple correlation (R^2) of 0.63, and a varaince of 0.09.

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The general management variables directly influenced the marketing variables with the standardized regression weight of 0.30, at statistically signifcant level of 0.001, a squared multiple correlation (R^2) of 0.63, and a varaince of 0.09.

Table 2
STATISTICS GAINED THROUGH MODEL ANLYSIS AFTER MODEL IMPROVEMENT

Variables	Estimate		R^2	Variance	C.R.	P
	Standard	Unstandard				
ALLIANCES				0.21		
PRODUCT INNOVATION	0.79	0.89	0.62	0.10	9.10	***
GENERALMANAGEMENT	0.71	0.75	0.51	0.11	8.49	***
PRODUCT INNOVATION			0.62	0.10		
MARKETING	0.58	0.57	0.63	0.09	7.40	***
GENERAL MANAGEMENT			0.51	0.11		
MARKETING	0.30	0.32	0.63	0.09	4.55	***
ALLIANCES				0.21		
AL11	0.56	1.00	0.32	0.45		
AL18	0.55	0.97	0.30	0.45	9.33	***
AL21	0.67	1.22	0.45	0.38	10.61	***
AL23	0.59	1.11	0.35	0.48	9.80	***
AL25	0.59	1.16	0.35	0.51	9.85	***
PRODUCT INNOVATION			0.62	0.10		
PI5	0.61	1.00	0.37	0.45		
PI8	0.68	1.08	0.46	0.37	11.76	***
PI9	0.66	1.03	0.44	0.36	11.59	***
PI10	0.72	1.07	0.52	0.28	12.29	***
PI17	0.60	0.94	0.36	0.42	10.73	***
MARKETING			0.63	0.09		
MK3	0.59	1.00	0.35	0.47		***
MK6	0.58	0.97	0.33	0.47	9.95	***
MK20	0.67	1.11	0.45	0.37	11.04	***
MK21	0.67	1.04	0.45	0.33	11.02	***
MK23	0.54	0.79	0.29	0.39	9.47	***
GENERALMANAGEMENT			0.51	0.11		
GM2	0.60	1.00	0.35	0.41		
GM7	0.64	1.08	0.42	0.38	10.63	***
GM11	0.55	0.87	0.31	0.39	9.56	***
GM13	0.67	1.11	0.46	0.34	10.94	***
GM24	0.61	1.00	0.37	0.39	10.24	***

Note: *** Statistical significance level of 0.001

The Alliances variables consisted of five observed variables: the variable of communication channels for public relation, information sharing, news and the business partners' experiences for effective operations (AL11) with the standardized regression weight of 0.56, the variable of the status analysis of business partners for sustainable management (AL18) with the standardized regression weight of 0.55, the variable of the business operation evaluation and the report on the performance outcomes to the business partners for better operations (AL21) with the standardized regression weight of 0.67, the variable of social networks with cooperation of stakeholders through various kinds of technology (AL23) with the standardized regression weight of 0.59, and the variable of collaboration with government sector, networking, academic institute, and business partners (AL25) with the standardized regression weight of 0.59.

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The product innovation variables consisted of five observed variables: the variable of implementation of innovative technology to design eco-friendly product packaging to attract the customers (PI5) with the standardized regression weight of 0.61, the variable of implementation an innovation to continuously manufactur new products or services for customers (PI8) with the standardized regression weight of 0.68, the variable of employees' awareness for the development of innovatibe technology (PI9) with the standardized regression weight of 0.66, the variable of budget to create or develop new sufficient products or services for consumers (PI10) with the standardized regression weight of 0.72, and the variable of budget provided for research and development of innovation (PI17) with the standardized regression weight of 0.60.

The marketing variables consisted of five observed variables: the variable of product promotion to attract the customers' attention to enhance the product sales (MK3) with a standardized regression weight of 0.59, the variable of customer base to produce new products for consumers (MK6) with the stanardized regression weight of 0.58, the variable of development of online and offline channels accessible for customers (MK20) with the standardized regression weight of 0.67, the variable of product development based the consumer's culture in each region (MK21) with the standardized regression weight of 0.67, and the variable of product deveopment with clear identity to meet the customer's needs (MK23) with the standardized regression weight of 0.54.

The general management variables consisted of five observed variables: the variable of clear work performance plan of employees (GM2) with the standardized regression weight of 0.60, the variable of risk management plan in each step of work performance (GM7) with the standardize regression weight of 0.64, the variable of quality standardization of products (GM11) with the standardized regression weight of 0.55, a factor of machine maintenance schedule in the factory following the principles of engineering (GM13) with the standardized regression weight of 0.68, and the variable of organizational policies implemented for all of the employees to understand and strictly follow (GM24) with the standardized regression weight of 0.61.

DISCUSSION

The findings of this research on the guidelines for sustainable industrial management of agricultural processed foods can be used as the guidelines for sustainable industrial management of agricultural processed foods under the rapid social and economic changes for effective and sustainable business operations. The results of the study can be discussed in each item as follows.

1. For the research results: the overall comparison of the variables of the guidelines for sustainable industrial management of agricultural processed foods between the large enterprise and medium and small enterprises found that it was different at statistical significance level of 0.05. The small enterprise was limited in both management and financial skills but it was important for competency enhancement to produce agricultural products with low costs of investment in rural communities (Uzoejinwa et al., 2016). Moreover, the small enterprise realized the consumers' culture and behaviors. Meanwhile the large enterprise had better technological potential and capabilities of raw material management (De, 2017).
2. For the hypthesis test: it was found that the Alliances variables directly influeced the product innovation variables with the highest standardized regression weight of 0.786. The empirical data showed that the business partners with various relationships of society, businesses, and government sector could meet various business aims including information, experience, and expertise sharing to

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create innovative technology ti reduce the manufacturing costs and increase the organization's profits (Zhang et al., 2019).

3. For the hypothesis test: it was found that the Alliances variables directly influenced the marketing variable with the highest standardized regression weight of 0.676. The empirical data showed that the strategic collaboration between manufacturers and retailers in the food industries could develop the marketing focusing on quality and value of foods and effective food service system for customers (Dobrosotskiy & Shpakova, 2019).
4. For the guidelines for sustainable industrial management of agricultural processed foods, it was found that the mean of marketing and the general management variables was at the highest level of 4.06. This reflected the importance of marketing and general management variables that directly influenced the sustainable industrial management of agricultural processed foods. The marketing was an important factor to enhance the expansion of processed foods to consumers. The management under the changing environment and consumers' behaviors must be adapted according to the marketing mechanisms to provide the food quality and value to consumers (Djupegot & Nenseth, 2016). The marketing is a upstream driver of agricultural processed food procedure influencing the customer's nutrition and behavior (Baker & Friel, 2016).

CONCLUSION

The guidelines for sustainable industrial management of agricultural processed foods consisted of 4 major factors shown and prioritized as follows.

For general management, organizational executives must assign the management systems in accordance with the organizational goals through the coordination of employees for effective operations including standardization of product, utilization of raw materials, financial management, transportation, quality control of product, and machine maintenance.

For marketing, it is the channel for presentation of products and services provided to customers. At present, there are various channels for customers to access. The entrepreneurs can provide the appropriate channels to present their products and services to the target group. It is the opportunity to create product brands to enhance customer confidence and reliability. It is also the channel of collecting customers' recommendations and opinions for better product and service quality.

For product innovation, the collection of data of customers' needs, evaluation of organizational competency, marketing opportunity, and evaluation of manufacturing process potential is conducted to create new products in accordance with the data collected and to be confident in the product quality before distribution.

For Alliances, it consists of information sharing, and agreement and commitment of collaboration including utilization of resources to enhance successive cooperation efficiency and sustainable relationship, and easily accessible channels of communication among business partners.

Recommendations for Further Studies

1. The structural equation model should be applied to other processed food industries for better clarification.
2. The sufficiency economy variables should be conducted in the study of industrial management for sustainable businesses.
3. The study with in-depth interview of executives from the successful medium and small enterprises should be conducted.

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