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Guidelines for preparation of food industry to certification the ISO 22000 food safety management system

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Abstract

As a significant statistical finding, the amount of food factories in Thailand with ISO 22000 certified remain low when compared to those of many other countries, therefore upgrading to international standard is necessary. The purpose of this research was to study a Guidelines for preparation of the food industry to certify the ISO 22000 food safety management system and develop a structural equation model of such guidelines. Qualitative research was done by in-depth interviews with 9 experts to create tools and conducted a Focus group discussion with 11 qualified persons to find consensus on the model of this research. For Quantitative research, collecting quantitative data was done using the survey with questionnaires from 500 food industry executives, which used descriptive, referential and multiple statistics for data analysis. The results shown that the Guidelines for preparation of industrial entrepreneurs to certification the ISO 22000 food safety management system consisted of 4 elements prioritized according to the found means as follow: 1) Organization Readiness ($\overline{x}$ = 4.54), the most important items are the keeping of contracts to work that operate in accordance with policies and regulations. 2) Learning and Growth ($\overline{x}$ = 4.50), the most important item is the use of teamwork. 3) Data Insight ($\overline{x}$ = 4.50), the most important items are the research and collection of documents requesting ISO 22000 certification. And 4) Collaboration Network ($\overline{x}$ = 4.45), including cooperation with institutions under the government in supporting experts and academics for training. As for the hypothesis test, the study showed that when classified according to the age of the ISO 22000 certificate at the

statistical significance level of 0.05. The analysis of the developed structural equation model revealed that it passed the assessment criteria and was consistent with the empirical data. The calculated values of probability of chi-square, the relative chi-square, the index of consistency, and the root mean squared error of approximation were 0.094, 1.098, 0.946, and 0.014, respectively.

Keywords: ISO 22000, Food Safety, Food Industry, Certification.

Introduction

According to the economic objective of stable and sustainable growth, under the 20-year Thai national strategic plan (B.E. 2561-2580): building competitiveness by enhancing the potential of entrepreneurs, to expand trade and investment opportunities of agriculture, create value for processed agriculture and security agriculture and also Thailand Industrial Development 4.0 Strategy for 20 years (B.E. 2560 - 2579) that has focused on the target industry (First S- Curve and New S-Curve) Agro-Food Processing and Biotechnology Sectors including Food and Beverage Industry, Agro-Processing and Bio-Industry which are the future economic drivers (Ministry of Industry, 2016 : 24-25), it is necessary to restructure and enhance the competitiveness of basic and supporting industries to support country plan.

ISO 22000 is a neutral and internationally accepted as food safety standard by the International Organization for Standardization – ISO, an independent organization that aims to create international standards for trade neutrality by the number of food industry factories in countries around the world that have received ISO22000 certification including in East Asia and Pacific, 23 countries (International Organization for Standardization, 2022)

When considering the ranking from the number of food industry factories certified by the ISO 22000 food safety management system, the top 10 of the East Asia and Pacific countries in 2012 – 2021 ranking from 1st-10th which are China (CN) Japan (JP) Taiwan TW) Vietnam (VN) Malaysia (MY) Thailand (TH) Indonesia (ID) Korea (KR) Australia (AU) and Singapore (SG).

From the ranking, the number of food factories in Thailand that received ISO 22000 certification is still inferior to other countries in the East Asia and Pacific countries such as China, Japan, Taiwan, Vietnam, and Malaysia which shown that Thailand's food safety standards are still inferior to its competitors. Therefore, it is necessary for Thailand to urgently develop and build confidence in the quality assurance and safety of the food production process by elevating the standards of food industry entrepreneurs to

international food safety standards ISO 22000 to eliminate the weaknesses and develop growth in order to achieve the goals of the 20-year Thai national strategic plan (B.E. 2561 – 2580), ensuring the safety agricultural products certified by international standards to be accepted by both domestic and international markets, Ranking : the number of food factories in East Asia and Pacific that have been certified by ISO 22000 since years 2012–2021 as in Figure 1.

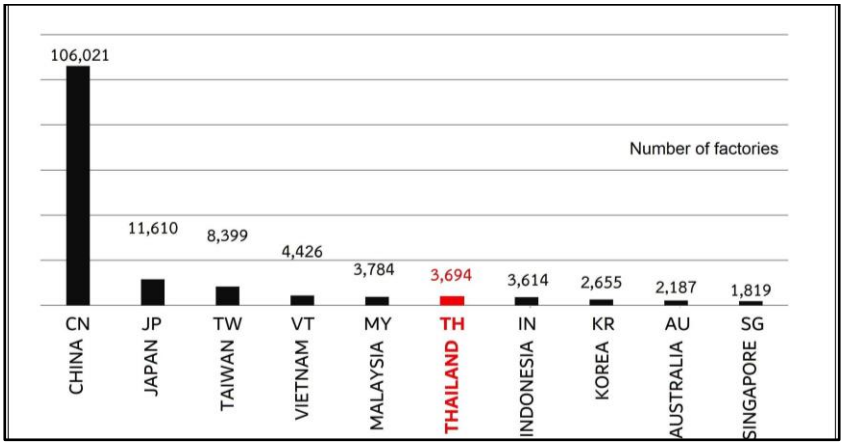

Figure 1. Number of food industry factories in East Asia and Pacific that have been certified by ISO 22000 in 2012–2021.

Research Objectives

1. To study the components of the guidelines for the preparation of food factories for food safety management system certification of ISO 22000

2. To develop a structural equation model for the preparation of food factories for food safety management system certification of ISO 22000

Literature Review

From literature reviews, conceptual and theories, on International Standard ISO 22000 second edition 2018-6 food safety management systems, the requirements for any organization in the food chain (International Organization for Standardization-ISO, 2018) has been developed within the ISO high level structure (HLS) in order to improve alignment between ISO management system standards, enables a food industry organization to use the process approach, coupled with the PDCA cycle and risk-based thinking, align or integrate a food safety management system (FSMS) approach with the requirements of other management systems. Food industry

organizations based on a FSMS implement and strategic decision can help improve its overall performance regard to level of a food safety hazard. ISO 22000:2018, requirements on the second edition cancels and replaces the first edition (ISO 22000:2005), the revised are such as clause 4.1 risk analysis, clause 4.2 analysis on the need and expectations of interested parties, clause 5.1 Leadership responsible, clause 6.1 planning the limits of actions to address risks and opportunities, clause 7.2 competence persons, clause 7.4 the effective communication, clause 9.1 monitoring, measurement and analysis of performance evaluation, clause 10.1 improvement with appropriate corrective action. It has also incorporated: the CODEX HACCP principles, ISO 22000:2005 and ISO22000:2018. The core principle of ISO 22000:2018 are the specific hygiene with FSMS and hazard control of operation for a food industry organization throughout a food chain, the Prerequisite Programmes (PRPs) to operation control an occurrence of contamination, the Operational Prerequisite Programme (OPRP) to control likelihood of hazard and define a criterion acceptable, and traceability. The development of PRPs shall ensure that appropriate with the ISO/TS 22002 series, standards, codes of practice, guidelines and applicable to statutory, regulatory, and agreed with a customer requirement. The implementation shall identify PRPs in the documented information such as selection, establishment, monitoring, verification and approved by the food safety team. The PRPs maintaining shall update to facilities, the prevention and reduction of contaminants including food safety hazards in the products, processing entire of production system and workplace environment. The analysis of the impact of ISO 22000 new version on food industry Thailand (Management System Certification Institute-MASCI, 2021) Considering from the transition period, the level of change in the standard to HLS is what affects the competence of food industry operators in adjusting to the standards according to the new announcement. It is important for human resources to promote knowledge of the new requirements. However, there is an opportunity to change timely for the end of the adjustment period due to the extension of the deadline from the outbreak of COVID-19.

The Law of Readiness of Thorndike (1913 : 128) any learning can take place if the person is ready both physically and mentally to learn about that, The conceptual theories of Downing and Thackray (1971 : 14-15) concluded that readiness has 4 components which are 1) Physically. 2) Intellectually. 3) Environment. 4) Emotions Motivation Personality and the components of the preparation guidelines for the food industry to apply for certification of food safety management system standards ISO 22000 including 4 aspects as follows:

1. Data Insight aspect. About Information Management – IM (Venkatraman, 1996) it is related to the cycle of activities of the

organization including stakeholders throughout the chain to ensure quality and the benefits of obtaining the necessary information for decision's making in management activities, information management consists of the acquisition of information, access and dissemination data, change in data, storage and security of data by research about Guidelines for Business Advantage Management for Export of Thai Industrial Products (Dankaew and Silpcharu, 2020) found that, data and information technology factors directly influence to the resource factors.

2. Organization Readiness aspect. From the theory of 4M's (Drucker, 1973) have said about The Principles of Management that cover access to all relevant factors of 4 aspects. The 4M's Approach are : Man, Machine, Material, Method The research on Guidelines for Private Educational Institute for Sustainable Development (Nanthasudsawaeng, Roopsing and Sincharu, 2020) found that, the overall of Organization Structure Components has the highest priority for sustainable private education management practices.

3. Learning and Growth aspect. From the studies of Balanced Measurement Theory (Balanced Scorecard - BSC) (Kaplan and Norton, 1992) shows that, implementation to be seen in a concrete way for the organization to achieve its goals effectively through the management process with a perspective of 4 aspects, Financial Perspective, Customer Perspective, Internal Process and Learning and Growth Perspective, and every aspect has a coherent between strategy and goals, The research on Guidelines of Industrial Business Development by Good Governance Principles for Sustainable Growth (Suriyo, Sawatenarakul and Worawattanaparinya, 2021) found that, the Team Management Variables is the most importance to the development of industrial business organizations according to great governance for sustainable growth because the efficiency and effectiveness of the business is depends on the development of the team members' abilities with diverse cultures to be able to work in the same principles and goals.

4. Collaboration Network aspect. From the study of the Collaborative Model Theory (Clark and Wilkes-Gibbs, 1986) has summarized the main idea that, references are controlled by the speaker alone, in the form of working together and the interlocutor is collectively responsible for negotiating adequately the expression of the reference from the speaker, until they accepted each other, the number of references that have been mutually accepted will be stored and will be picked up and used again when a new reference is made in the next conversation, The research on A Business Model of Small and Medium-Sized Enterprises: A Case Study of the Textile and Clothing Industry in Thailand (Sawatenarakul and Roopsing, 2021) found that, the variables of collaboration network caused to share of

the resources in the business group of textile and garment industry in Thailand, members of the network also share knowledge, skills and new techniques to improve product standards and quality. the research of Guidelines for Sustainable Industrial Management of Agricultural Processed Foods (Thurapun, Sawatenarakul and Worawattanaparinya, 2021) found that, alliances is a main factor in the sustainable management of the agro-processed food industry which includes the sharing of information collaborative agreement and commitment lasting relationship. Using resources to continuously enhance cooperation and communication channels that are easily accessible, it presents the components of the guidelines for the preparation of food factories for food safety management system certification ISO 22000 as in Figure 2.

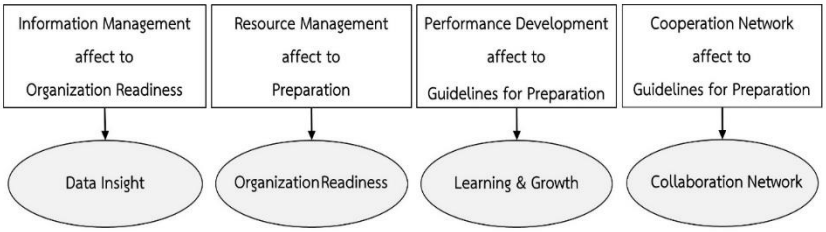

Figure 2. Elements of guidelines for preparation of food factories for food safety management system certification ISO 22000.

Research Methodology

This research is to create new knowledge (Inductive Research) using Mixed–Methodology Research. It consists of 3 sections as: Qualitative Research with In–Depth Interview techniques, Quantitative Research with collecting survey data and Qualitative Research Focus Group Discussion techniques.

To confirm the validity of this research model:

1. Qualitative Research with In–Depth Interview techniques, the population used in this research was 9 experts, with selecting a Purposive Sample group choose the Qualification of Experts criteria which appropriate according to the Doctor of Business Administration Program Executive Committee Industrial Business Administration Faculty of Business Administration King Mongkut's University of Technology North Bangkok, the research on “Guidelines for preparation of food industry to certification the ISO 22000 food safety management system” Consists of experts in 3 groups which are: a group of food industry business executives 3 people, a group of experts from government organization 3 people, and a group of experts from educational institutions 3 people.

2. Quantitative Research, The population used in this study were executives of certified food factories of ISO 22000 since years 2012-2021 totaling 3,694 cases, the researcher determined the group's size that was at a very good level for 500 samples, in line with Comrey and Lee, 1992 (Silpcharu, 2020) and A Multistage Sampling method was used consisting of executives from certified food industry factories ISO 22000 that not over 10 years in totaling of 250 samples and 250 samples of executives from food industry factories that have been certified ISO 22000 for more than 10 years, which also uses probability random sampling Lottery Method.

3. Qualitative Research Focus Group Discussion techniques, to certify the structural equation model by 11 qualified persons, using a Purposive random Sampling method.

Results

1. The results of the analysis of the preparation guidelines of food industry factories for certification of ISO 22000 food safety management system standards can be classified into 4 elements, namely:

Data Insight aspect,

Organization Readiness aspect,

Human development aspect (Learning and Growth). And,

Collaboration Network aspect. It shows that the empirical data is consistent with the values as: p-value = 0.094, CMIN/DF=1.098, GFI = 0.946, and RMSEA = 0.014 statistically significantly at 0.001 which is consistent with literature and empirical data and passed the consideration criteria of Arbuckle (2016) by showing the structural equation model, guidelines for the preparation of food industry factories for certification of ISO 22000 food safety management system standards after model improvement as in Figure 3

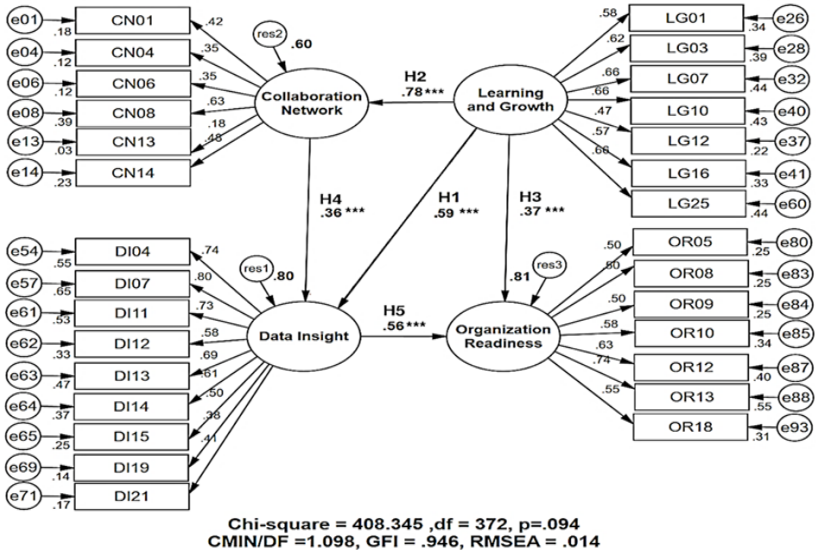

Figure 3. Structural equation model guidelines for food industry preparation for ISO 22000 food safety management system certification.

2. From Figure 3, the results of hypothesis testing to analyze the causal influence between latent variables in the model structural equations for the preparation of food industry factories for certification of food safety management system standards ISO 22000, 5 hypotheses found that, consistent with the hypothesis that was set 5 of them, namely:

1) H1 : Human Development Aspect (Learning and Growth) directly influence the Data Insight components aspect statistically significantly at level 0.001 have the value of Standardized Regression Weight at 0.59

2) H2 : Human Development Aspect (Learning and Growth) directly influence the Collaboration Network components aspect statistically significantly at 0.001 have the value of Standardized Regression Weight at 0.78

3) H3 : Human Development Aspect (Learning and Growth) directly influence the Organization Readiness components aspect statistically significantly at 0.001 have the value of Standardized Regression Weight at 0.37

4) H4 : Collaboration Network Aspect, directly influence the Data Insight components aspect statistically significantly at 0.001 have a value of Standardized Regression Weight at 0.36. And,

5) H5 : Data Insight Aspect directly influence the Organization Readiness components aspect statistically significantly at 0.001 have a value of Standardized Regression Weight at 0.56

3. The level of importance to the preparation guidelines of food industry factories for certification of ISO 22000 food safety management system standards found that, overall, the importance is at the highest level with an average score of 4.50, as for the results of consideration each aspect was at the highest level of 3 aspects, in descending order of importance as follows:

1) Organization Readiness Aspect have an average score at 4.54

2) Human Development Aspect (Learning and Growth) have an average score at 4.50 (S.D = 0.34) and,

3) Data Insight Aspect have an average score at 4.50 (S.D = 0.35) . As for each aspect that is very important, one aspect is the Collaboration aspect with an average score of 4.45.

4. Comparison of importance level from the components of the preparation guidelines of food factories for ISO 22000 food safety management system certification. Classified by periods certified with ISO 22000 and testing the difference between 2 independent population means by t–test found that, overall when categorizing by period of ISO 22000 certification, there are differences, with food industry factories that have been certified to ISO 22000 for more than 10 years which is concentrating on preparation guidelines of food industry factories to apply for ISO 22000 food safety management system certification, more than food industry factories that have been certified to ISO 22000 for a period of less than 10 years statistically significantly at level 0.05 by showing the comparison of the importance of the preparation guidelines of the food industry for the certification of the ISO 22000 food safety management system standard. as in Table 1.

Table 1. Comparison level of the importance for preparation guidelines of food industry factories for ISO 22000 food safety management system certification.

Components preparation guidelines of the food industry to apply for certification of food safety management system ISO 22000.	Less than 10 years.			More than 10 years.			t–Value	P–Value
	$\bar{x}$	SD.	Importance level	$\bar{x}$	SD.	Importance level		
With overall	4.42	0.29	High	4.57	0.24	Highest	-6.67	0.00*
1. Data Insight	4.41	0.36	High	4.59	0.31	Highest	-6.01	0.00*
2. Organization Readiness	4.43	0.33	High	4.64	0.24	Highest	-8.19	0.00*
3. Learning and Growth	4.46	0.34	High	4.54	0.34	Highest	-2.58	0.01*

4. Collaboration Network	4.37	0.32	High	4.53	0.27	Highest	-5.93	0.00*

Discussion and Conclusion

1. It was found that, the Readiness of the Organization is the most important element with an average of 4.54 which is consistent with the research on Strategies for Creating Marketing Advantages in Agro-Processing Industry Business (Pansantia, Wattanakomol and Silpcharu, 2022) which concluded that Organization Management aspect is the most important and strategic for creating marketing advantages in processed Agro-Industry Businesses.

2. It was found that each item in the elements of Organizational Readiness aspect is the storage of contracts and, agreements which follow the policies, regulations and measures, including external consultants or experts, management and quality system teams, have the most importance level with an average of 4.68 which is consistent with the research on Data-driven innovation: An Exploration of Outcomes and Processes within Federated Networks (Rizk, 2021) The research found that a model of analyzing insights data to generate business value and finding gap in the use of innovation in business analytics, there are factors that affect doing Data-Driven the most of organization is collaboration of stakeholders and personnel within the organization which affect the development of the organization's business.

3. When comparing the importance levels of aspects guidelines to the preparation of food factories for certification to ISO 22000 food safety management system standards and classified according to the period of ISO 22000 certification, the statistics are different significantly at level 0.05, Organizations that have been accredited with ISO 22000 for more than 10 years give importance to guidelines for the preparation of food factories for certification of ISO 22000 food safety management system standards more than organizations that have been certified with ISO 22000 less than 10 years statistic significantly at level 0.05. This result is consistent with the research on Data Management in an Operational Context: A study at Volvo Group Trucks Operations (Enofe, 2017) found that, different workflows of past operations and current operations, have different workflows which is one of the main causes of quality deviation and the timing also affects the differences in managing and operating within the same business entity.

4. The results of the analysis of the structural equation model, the preparation guidelines of the food industry for the certification of the ISO 22000 food safety management system standard found that, the human development component (Learning and Growth aspect) directly influence the most to the Collaboration Network aspect with

equal weight at 0.78 and it is consistent with the research on A Study of the Influence of Collaboration Networks and Knowledge Networks on the Citations of Papers in Sports Industry in China (Zhang, 2022) have studied and found that, mechanisms of knowledge generation and networking influence the reference of research because each research work has to develop knowledge to occur and result in networking and cooperation.

5. Hypothesis test results from the structural equation model, guidelines for the preparation of food industry factories for certification of ISO 22000 food safety management system standards after model improvement of Standardized Estimate mode found that, human development component (Learning and Growth aspect) which influence to Data Insight aspect have a highest overall influence with the highest Standardized Regression Weight at 0.87, which is consistent with the research on Digitalization of HRM: A study of success factors and consequences in the last decade (Mosca, 2020) found that, studying the consequences of conversion (Human Resource Management: HRM) to digital and factors in HRM it also determines the success of entering the work process with digital technology, this is still limited in efficiency and HRM has resulted in digitalization with both positive and negative effects.

Suggestions

Based on the research on the preparation of food factories for the certification of the ISO 22000 food safety management system standard as a guideline for the public and private sectors in conjunction with educational institutions to solve the problem of standardization, which is an indicator of the food safety quality of the Thai food industry, the researcher proposed guidelines for the preparation of food factories for ISO 22000 food safety management system certification in 2 issues as follows:

1. Policy Level Recommendations.

1) Government sector involved in preparing industrial factories to apply for ISO 22000 certification, namely: the Ministry of Industry, Ministry of Agriculture and Cooperatives Ministry of Commerce and the Ministry of Finance, should have a policy to promote entrepreneurs in the food industry by supporting academics and knowledge and understanding in terms of training, consulting analytical laboratories standard certification marketing and public relations including the source of funds to successfully prepare for certification of ISO 22000 food safety management standards.

2) Ministry of Education should develop a curriculum on quality system management, this includes management of the ISO 22000

food safety standard system and specific professional courses related to activities throughout the chain of the process of preparing industrial factories for certification of ISO 22000 food safety management standards from vocational/high school levels up to the university level, to develop personnel in related fields such as routing product development, QC/QA, training, consulting, laboratory analysis and standard certification, etc. in order to create personnel with knowledge and competence with specific professional skills to support the preparation activities.

2. Recommendations at the operational level of food industry factories, should develop personnel and factory standards to be reliable and internationally accepted, for example, personnel should be trained according to ISO 22000 standards with specialist such as National Food Institute (NFI) etc., should use consultants certified according to ISO 22000 standards with experts such as Institute for Small and Medium Enterprises Development (ISMED) etc., should choose an analytical and calibration laboratory that has been certified to ISO 17025 such as Central LAB THAI etc., and should choose a standard accredited body that has been certified to ISO 17020/17021 such as Management System Certification Institute (MASCI) etc., This is a support for food factories in Thailand to be successful in preparing for certification of ISO 22000 food safety management standards in a sustainable manner.

Recommendation for further research

This research collected data from a sample group of food industry entrepreneurs in Thailand who registered with the Department of Industrial Works, to get more accurate information, for the further research should study a large number of food industry entrepreneurs in Thailand who not qualify for registration with the Department of Industrial Works, such as small and medium-sized of food industry (SMEs / Start up) and groups of food processing producers small enterprise etc. as well as should be further expand the scope of raising the standard for entrepreneurs in the food industry to other standards that have a tendency to influence trade in the food industry in the future, such as ISO 50001 (Energy management system: EnMS), ISO 14001 (Environmental management system: EMS), ISO 14064 (Greenhouse gas: GSG) and ISO 14067 (Carbon footprint of products: CFP) etc. This can be used as a policy to prepare and enhance market competitiveness for entrepreneurs in the food industry in Thailand further.

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