CHALLENGES OF HACCP IMPLEMENTATION IN AGRICULTURAL FOOD PRODUCTS IN THAILAND

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ABSTRACT: Agricultural food industry in Thailand generated incomes about 10.5% gross domestic product (GDP) of the country in 2015. The demands of agricultural food products around the world has been increased for years. Agricultural food products from Thailand could not be exported as many as the growth of market demands because of the limitation of food safety guarantees. Analysis and Critical Control Points (HACCP) is a minimal requirement for exported food products to assure food safety. Not all Thai companies in agricultural food industry received HACCP certifications. There might be some challenges that obstructed the implementation of HACCP in the food industry of Thailand. The objective of this research was to identify challenges faced by companies in Thailand when implementing the HACCP in agricultural food companies. An online survey was conducted to collect data from companies in food industry. Twenty companies completed the survey. All twelve challenges proposed in the research survey were experienced by participating companies during the HACCP implementation. The challenges, identified as barriers to implement HACCP, were a lack of employee engagement in HACCP implementation, a lack of employees who understand the HACCP system, and a lack of advanced statistical knowledge. The results suggested companies to develop an effective communication plan to convey the HACCP implementation plan to employees at all levels and to provide training programs, related to HACCP and statistics, to fulfill knowledge and skills required in the HACCP implementation.

Keywords: Hazard Analysis and Critical Control Points, HACCP Challenges, Food Safety Management, Agricultural Food Products

1. INTRODUCTION

The food industry is one of the most important industries influencing the economy of Thailand. Agricultural food products are one of the main types of exported products. In 2015, the agricultural food industry in Thailand generated a revenue of about 10.5% of Thai gross domestic product (GDP). The demand for exported agricultural food products has increased. However, agricultural food products from Thailand could not be exported as many as the growth rate of food markets. Exporting food products to other countries requires food safety certifications, such as Hazard Analysis and Critical Control Points (HACCP) and ISO 22000, to ensure that food products do not contain any hazards and are safe to consume, especially countries in Europe or North America.

HACCP is a food safety management system that is accepted by many countries and can be implemented in companies of all sizes. The implementation of HACCP can result in better product quality and the opportunity to penetrate the new market, especially exporting markets [1]. Complying with HACCP could be a minimal requirement for exporting food companies to be certified. Although food is the main industry in Thailand, not all companies that produce food products have food safety certificates. Meanwhile, many companies tried to implement HACCP but did not succeed. Companies might face common challenges during the HACCP implementation. Knowing these challenges could allow companies to create plans to respond to the challenge, and allow government sectors, such as universities or food agents, to assist companies in achieving HACCP implementation, especially small and medium-sized companies that do not have a lot of resources to invest for establishing a food safety management system. This research aimed to identify the challenges that companies face in implementing HACCP in Thailand.

2. LITERATURE REVIEW

This section includes two part. The first part is the summary of HAPPC process to provide the overview and steps for HACCP implementation. The second part is challenges that could obstruct a HACCP implementation. The literature used to review was related to HACCP and other food safety management systems.

2.1 Hazard Analysis and Critical Control Points (HACCP)

HACCP is a system that is used to identify, evaluate, and control food safety. HACCP can be compatible with other quality management systems, such as ISO 9000, that focus on the quality of products. The application of HACCP is considered for promoting food safety, which is considered one of the aspects of food quality [2]. It is a systematic approach to the identification, evaluation, and control of food safety hazards based on the seven principles presented [2, 3]:

Principle 1: Conduct a hazard analysis.
Principle 2: Determine the critical control points (CCPs).
Principle 3: Establish critical limits.
Principle 4: Establish monitoring procedures.
Principle 4: Establish monitoring procedures.
Principle 5: Establish corrective actions.
Principle 6: Establish verification procedures.
Principle 7: Establish record-keeping and documentation procedures.

To approach these seven principles, the following 12 steps are recommended [2, 3]:

(1) Set up an HACCP team to develop plans that contain tasks, activities, and responsible persons.
(2) Describe products, including all food safety information, such as packaging, containers, storage conditions, durability, and distribution methods.
(3) Identify how the user consumes or uses products.
(4) Construct flow diagrams of all of the operations in food production processes.
(5) Confirm the flow diagrams created in the previous step via onsite checking against the actual production processes.
(6) List all potential hazards associated with each step, conduct a hazard analysis, and consider any measures for controlling the identified hazards.
(7) Determine the CCPs used as a control measure for food safety.
(8) Establish critical limits for each CCP.
(9) Establish a monitoring system for each CCP.
(10) Establish corrective actions.
(11) Establish verification procedures.
(12) Establish documentation and record keeping.

2.2 The Challenges of HACCP

Many changes take place during the transition to the HACCP system. Some companies can endure this transformation, while other companies were unable to successfully implement HACCP. Successful HACCP implementation requires the involvement of all levels in the companies, from top management to work-floor employees. Much new knowledge is necessary to comply with HACCP principles. A few studies on the challenges of HACCP implementations were published. Previous studies on both HACCP and other food safety management systems were used to investigated what makes food safety management systems difficult. ณฑ aspects were considered to be challenges.

2.2.1 Top Management Support

Top management agreement is needed to ensure that the HACCP implementation will have strong support since it requires an investment, human resources, and policy supports [1]. Top management can be key in the implementation process because they can ask all employees to be involved and concerned with HACCP. Authorizations on any investments on equipment, tools, and trainings can be done by the top management. Top management can help the HACCP team in develop company policy. All departments or functions will voluntarily cooperate with the HACCP team. Without top management support, the implementation of HACCP might not be achieved [4].

2.2.2 Consultants and Auditing of HACCP

Companies mostly hire consultants who have a rich knowledge of HACCP and expertise in the food industry field to help in planning and establishing HACCP knowledge for companies [5]. For many countries that have just started using the HACCP system for mandatory food safety certification purposes, it might be difficult to find consultants who have expertise with HACCP. Companies might invite consultants from overseas. In addition to consultants, companies have to connect with auditors or HACCP certification companies to certify their HACCP systems. Unfortunately, it can take a long time to proceed with HACCP auditing when a limited number of auditors exist.

2.2.3 Employee Engagement

Companies have to control all productions and operations to meet HACCP requirements. In addition, all employees who operate in those processes have to pay attention to all standards and procedures [6]. Employees who work in technical areas specifically should have sufficient knowledge to test or run experiments on detecting hazards and controlling food safety. Thus, the HACCP implementation requires collaborations and involvements from all employees. Many employees might perceive that the HACCP system make more workloads and complicated on their job. This leads to negative attitudes on the HACCP system.

Employees might not be motivated to contribute in the HACCP implementation [7]. Without employee engagement, it might be challenging to successfully implement HACCP [4].

2.2.4 Insufficient Knowledge

In production processes, companies must set up the control measures for critical control points (CCPs) in the HACCP system. The control measures might require new techniques or knowledge for testing food safety and monitoring systems or processes [8, 9]. Specific knowledge might be required, such as risk assessments and advanced statistical knowledge, to identify and assess the risks that might occur in the system and to control processes under CCPs [3, 7]. If employees do not have sufficient knowledge, it could challenge companies during HACCP implementation [6].

2.2.5 Suppliers

The HACCP system concerns all processes related to products, from the time they are with suppliers until their delivery to customers. Suppliers should have adequate knowledge about food safety [3]. Companies must develop systems for controlling suppliers in following the standards. If companies do not have collaborations with or involvement from suppliers, the implementation of HACCP might not be successful.

2.2.6 Facilities and Equipment

Companies should ensure that all processes can run under control and produce food product regarding to HACCP requirements. Facilities and building are main factors that companies should consider whether or not building and facilities meet the HACCP requirements. If companies have appropriate building structures and facilities, they might not need adjusting. Some companies have to adjust or rebuild building and facilities to be suitable for the HACCP implementation. When structures and facilities need to be rebuilt or changed, this might be difficult to accomplish due to limitations, such as the size of factory area and the structures of current buildings [10].

When all CCPs are defined, control measures are designed to test and find hazards or risks associated with each CCP. New tools and equipment might be needed [8]. Some equipment is expensive, however, or needs to be imported. Employees who use new tools and equipment also require training to operate them. This can result in more interment costs and in taking a longer time to receive the equipment needed for implementing HACCP.

3. RESEARCH METHODOLOGY

An online survey was conducted to identify the challenges that companies faced during the implementation of HACCP. The survey link was posted on websites, blogs, and webpages related to the food industry. The survey developed for this research included two sections.

The first section asked for participant and company information, such as participant position, company size, and products. The second section included a list of 12 potential challenges that organizations face when implementing HACCP. The list of challenges included on the survey was based on a review of the literature and on experts in the food industry in Thailand. Participants were asked to rate the extent to which a challenge was a barrier to a HACCP implementation. A five-point Likert scale, with responses ranging from 1 (not at all) to 5 (to a very large extent), was used.

4. RESULTS AND DISCUSSIONS

4.1 Participants and Companies

Targeted companies for this research study were companies that produced agricultural food products in Thailand. Twenty companies completed the survey. Of the 20 responding companies, 17 companies had implemented HACCP. The targeted participants for completing the survey included business owners, managers, supervisors, and staffs who worked in the targeted organizations.

Participant positions and company sizes are summarized in Table 1 and Fig. 1, respectively. Participants' positions included production supervisors, general managers, research and development (R&D) staffs, quality assurance (QA) staffs, owners, QA managers, production managers, and others. This enabled the researchers to see the wide range of view on HACCP systems. The highest number of participants identified themselves as supervisors and managers.

Table 1 Participant position

Position	No. of Participants
Production Supervisors	7
General Managers	3
R&D Staffs	2
QA Staffs	2
Owners	2
QA Managers	1
Production Managers	1
Others	1
R&D Managers	1
Total	20

According to the Ministry of Industry Thailand, company sizes are defined by capital investments into three groups. The first group includes small businesses with less than 50 million baht in capital. The second group includes medium-sized business with between 50 and 200 million baht in capital. The third group includes large business with more than 200 million baht in capital. Most participating companies were large businesses. The sizes of the participating companies are summarized in Fig.
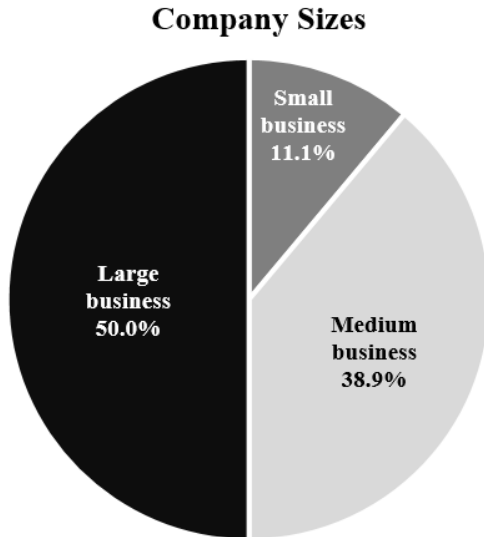
Company Sizes

Fig.1 Company Sizes

4.2 HACCP Implementation in Thailand

Eighty percent of the participants thought that HACCP is very important to the agricultural food industry of Thailand. Participating companies had

implemented HACCP for a range of three years to more than 10 years. Fifty percent of the responding companies had implemented HACCP for more than 10 years. Thus, the majority of the responses were from companies that had experienced the implementation of HACCP for more than 10 years, while the shortest time of implementation reported was three years. On average, companies would take about a year for preparation until getting the HACCP certification.

4.3 Challenges in Implementing HACCP in Thailand

All twelve challenges proposed in the survey were experienced by participating companies during the HACCP implementation. Eight of 12 proposed challenges were rated as the moderate extent to which challenge was a barrier to HACCP implementation. Hierarchical cluster analysis was used to divide challenges into groups, based on perceived barriers while implementing HACCP. The results of hierarchical cluster analysis are shown in the agglomeration schedule in Table 2 and in the dendrogram in Fig. 2. The difference between the coefficients in the agglomeration schedule and in the distances of linkage points in the dendrogram suggest that there are two clusters of challenges, based on perceived as barriers in the HACCP implementation. Cluster 1 included challenges that were more often perceived as HACCP barriers. Cluster 2 included challenges that were less often perceived as HACCP barriers. A summary of the clusters of challenges is shown in Table 3.

Table 2 Agglomeration schedule

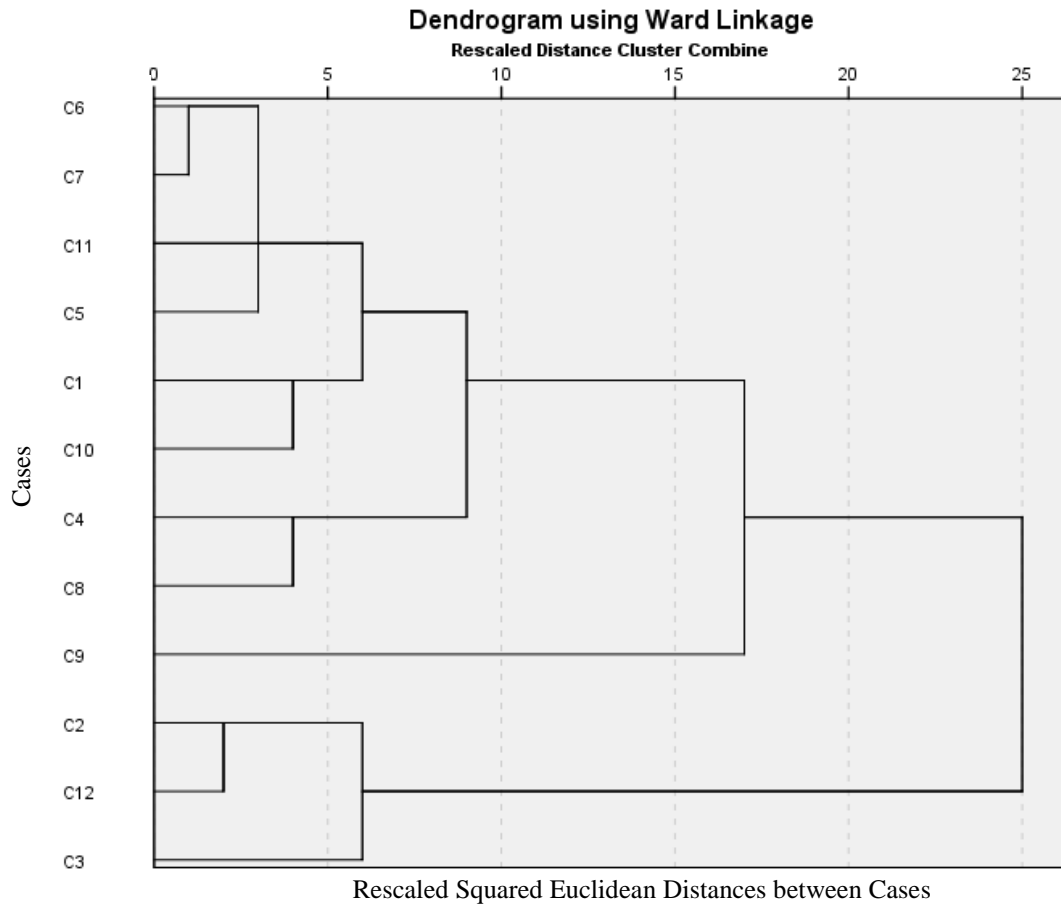| Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	6	7	.000	0	0	3
2	2	12	1.500	0	0	8
3	6	11	3.500	1	0	4
4	5	6	6.250	0	3	7
5	1	10	9.250	0	0	7
6	4	8	12.250	0	0	9
7	1	5	17.333	5	4	9
8	2	3	22.500	2	0	11
9	1	4	30.292	7	6	10
10	1	9	45.333	9	0	11
11	1	2	68.667	10	8	0

Fig.2 Dendrogram of perceived barriers

Table 3 Clusters of challenges based on perceived barriers during HACCP implementation

Code	Items	Mean	S.D.	Cluster
C3	Lack of employee engagement on the HACCP implementation	3.43	1.60	
C2	Lack of employees who understand the HACCP system	3.36	1.15	1
C12	Lack of advanced statistical knowledge	3.29	0.91	
C5	The need for building modification and facility adjustment to suit HACCP requirements	2.93	1.49	
C10	Difficulties of suppliers or vendors with proceeding under HACCP standards	2.86	0.86	
C11	Lack of knowledge about risk assessment in food production processes	2.86	1.10	
C6	The need to acquire new equipment and tools for testing food hazards	2.79	1.25	
C7	Lack of knowledge or techniques for testing food hazards to meet HACCP requirements	2.79	1.25	2
C1	The complication of HACCP certifying processes	2.43	1.02	
C8	Insufficient number of HACCP consultants in Thailand	2.43	1.34	
C4	Lack of management support	2.29	1.49	
C9	The limitation of auditing companies or auditors who can audit and certify HACCP in Thailand	1.71	0.73	

Cluster 1 which are challenges that were perceived more often as a barrier includes a lack of employee engagement in HACCP implementation, a lack of employees who understand the HACCP system, and a lack of advanced statistical knowledge.

Lack of employee engagement is the most concerned as barrier in the HACCP implementation of agricultural food companies in Thailand. According to HAPPC requirements, companies must develop guidelines and work standards for all processes. The developed guidelines might change the way that employees used to work before, or might add more tasks on their jobs, such as, record and report data. Inflexible work and additional tasks could result in the resistance of employees on the HACCP implementation and the negative attitude on HACCP system [6, 7]. This finding is important because it emphasizes how important it is for companies to develop effective plans for the HACCP implementation including communication plans and implementing plan. Companies should communicate the goals and plans of implementing HACCP to employees at all levels. Sufficient information related to the changes of work tasks, the supports by companies, and the trainings should be well transferred to employees. When employees know the benefit of the HACCP implementation and the supports by companies during the HACCP implementation, they might be motivated and cooperate with the company.

Lack of employees who understand the HACCP system and lack of advanced statistical knowledge were also perceived as a large barrier. This result implies that employees might not have insufficient knowledge to work in the HACCP system. Without fully understanding in HACCP and required knowledge, it is difficult to successfully implement Although employees put efforts on the HACCP implementation. Although most technical employees in food companies have back grounds in food science or food technology, they might need additional specific knowledge that can help in analysis data, such as statistics. This finding suggests that companies should create effective training plans to ensure that employees have sufficient knowledge to work on their jobs in the HACCP system.

It is interesting that the limitation of auditing companies and auditors was perceived as a small barrier. This finding suggests that companies easily access to auditing companies and auditors although the HACCP system has been well-known for a decade. The trend of implementing HACCP in Thai companies was increased because of the government policy in agricultural food product exports, the food safety control regulations, and the competition in the market. Thus, the numbers of auditing companies and auditors, supported by both government or private sectors, are also increased to meet the demands.

In addition, the cost of the HACCP implementation is a main challenge faced by companies in many countries [8]. Many participants also agree that the implementation of HACCP are vast investments which is a challenge that can be barriers in the HACCP implementation. Most companies spend much money on consultants, equipment, and modifying facilities [8]. Thus, companies should have a good financial plan when implementing HACCP as well.

5. CONCLUSION

There are many changes and adaptations required in implementing HACCP. Many companies were unable to successfully navigate this transformation. Knowing challenges that companies might face during the HACCP implementation could assist companies in developing plans to handle challenges. The challenges found in this research are similar to the previous research HACCP barrier in other countries and in other products [1, 8].

Challenges that were perceived often as barriers in Thailand were a lack of employee engagement in HACCP implementation, a lack of employees who understand the HACCP system, and a lack of advanced statistical knowledge. Effective communications can help in engaging employees involve in the HACCP implementation. Technical trainings and working with universities and researchers can fulfill in the lacking knowledge and the HACCP implementation. In addition to three challenges mentioned above, companies should also consider other nine challenges. Many companies experienced these nine challenges during the HACCP implementation. This implies that these challenges could occur and obstruct the HACCP implementation.

The limitation of this research was the number of participants. It is difficult to see significant differences in challenges based on perceived barriers. A larger number of companies could provide additional understanding into potential differences in challenges.

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