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Organizational Factors Affecting Safety Implementation in Food Companies in Thailand

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Thai food industry employs a massive number of skilled and unskilled workers. This may result in an industry with high incidences and accident rates. To improve safety and reduce the accident figures, this paper investigates factors influencing safety implementation in small, medium, and large food companies in Thailand. Five factors, i.e., management commitment, stakeholders' role, safety information and communication, supportive environment, and risk, are found important in helping to improve safety implementation. The statistical analyses also reveal that small, medium, and large food companies hold similar opinions on the risk factor, but bear different perceptions on the other 4 factors. It is also found that to improve safety implementation, the perceptions of safety goals, communication, feedback, safety resources, and supervision should be aligned in small, medium, and large companies.

food industry organizational factor safety implementation safety perception

1. INTRODUCTION

The food industry comprises a complex network of activities pertaining to the supply, consumption, and catering of food products and services across the world. The industry employs a massive number of skilled and unskilled workers. According to the Thailand Board of Investment, Thailand has become one of the world's largest and most advanced producers and exporters of processed food products, and is currently the world's largest producer and exporter of canned pineapple, pineapple juice, processed chicken, canned and frozen seafood, rice, flour and starch, and processed shrimp [1]. Thailand's export-oriented food industry brings in ~10000000000 USD annually, and comprises up to 28.3% of Thailand's gross domestic product [1]. However, the number of injuries and fatalities in the manufacturing industry, including the food industry, in the past 7 years has increased by 17.65% [2]. This, in turn, demotivates workers and affects the overall cost, productivity, and reputation of the industry.

According to Aksorn and Hadikusumo, most accidents derive from unsafe behavior and unsafe equipment [2]. Improving safe work behaviors can undoubtedly help organizations to control and reduce their costs, and increase the efficiency of their operations in the long term.

Behavioral safety is a process that creates a safety partnership between management and the workforce by continually focusing everyone's attention and actions on their own, and that of others, safety behavior. It typically involves creating a systematic, ongoing process that clearly defines a finite set of behaviors that reduce the risk of injury within an organization, collects data on the frequency and consistency of those behaviors, and then ensures feedback and reinforcement to ensure support of those behaviors [3].

The safety of the workplace is influenced by a number of factors such as supportive environment, management commitment, perceived risk, workers' involvement, safety communication, safety resources, and safety rules [4, 5, 6, 7, 8, 9, 10]. For example, Rowlinson stated that management

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commitment was crucial in successful safety implementation [4]. Abudayyeh, Fredericks, Butt, et al. mentioned that stakeholders had an important role in continuous improvement in safety [7]. Involvement of stakeholders in safety planning motivates them to accept more safety responsibility. Support for safety training and safety resources could also help in achieving safety goals [3, 7]. Adequate safety information and communication is another key factor in improving safety [8]. The nature and amount of risk perceived by a worker dictates a particular work action [5].

Safety at the workplace can be modified by addressing those major influences. Successful safety implementation, focusing on identifying and reinforcing safe and reducing unsafe behavior, is one means of improving safety performance.

Thus, this paper aims to investigate key factors influencing safety implementation as well as perceptions of safety in food companies in Thailand. The differences in perceptions of safety implementation in small, medium, and large organizations are, if any, to be investigated to effectively plan for safety improvement. To simplify, the term "safety implementation factor" is used in this paper to represent the organizational factor affecting safety implementation.

2. ATTRIBUTES ASSOCIATED WITH SAFETY IMPLEMENTATION FACTORS

Based on manufacturing and food-related safety literature, 26 attributes associated with safety implementation are extracted (Table 1). These attributes are used in developing a questionnaire survey to gather data for the analyses to investigate the differences in safety perceptions in small, medium, and large food companies in Thailand.

3. SURVEY RESEARCH METHOD

A questionnaire survey is used in this study for data collection. It has several advantages, namely, less sampling bias, the ability to collect data on more sensitive information, and sufficient time spent answering the survey [27]. In this study, the questionnaire survey is developed for two purposes: (a) to seek respondents' opinions on the different attributes in the context of their current safety implementation, and (b) to investigate the similarities and differences of safety perceptions, based on the respondents' opinions, in small, medium, and large food companies.

To achieve those two purposes, the questionnaire survey comprises two parts. Part 1 is devoted to gathering demographic information about the respondents and their organizations to ensure that the respondents have appropriate backgrounds. The questions cover the respondents' position, their working experience in the food industry and in the current organization, their involvement in safety in the current organization, and the safety policy used in the current organization, etc. Part 2 covers 26 statements to define the attributes associated with safety implementation. The respondents are asked to rate each statement using a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). The scores achieved from this part are used to perform the statistical analyses to investigate the perceptions of safety in small, medium, and large food companies. Sample statements follow:

- Adequate safety training helps in improving safety implementation.
- Adequate provision of safety resources, such as personal protective equipment, helps in improving safety implementation.
- Regular risk assessment helps in improving safety implementation.
- A good working environment helps in improving safety implementation.
- Two-way communication about safety, top-down and bottom-up, helps in improving safety implementation.
- Reporting accidents and incidents helps in improving safety implementation.

The target industry in this study is the food industry, as food is an important economic sector that generates the employment of over 20 million people [28, 29]. Thai food industry can be divided into seven categories: meat and meat products, seafood products, milk and milk products, fruit

TABLE 1. The 26 Attributes Associated With Safety Implementation

Attribute	Definition	Explanation	Reference
Role overload	lack of balance or reasonableness in the number of expectations from a job- or position-holder	Workers who experience role overload tend to focus on performance rather than safety.	[5]
Safety training	development in oneself or another of safety skills, habits, and attitudes	Training should be used to motivate and assist workers to work safely.	[3]
Safety resources	safety supplies or support	The goals of a safety program cannot be accomplished without adequate safety resources.	[7]
Perceived risk	level of uncertainty regarding the outcome of a decision	The nature and amount of risk perceived by a worker dictate a particular work action.	[11]
Risk assessment	identification, evaluation, and estimation of the levels of risks involved in a situation, their comparison against benchmarks or standards, and determination of an acceptable level of risk	Risk assessment, including all potential risks (such as accidents and injuries, regulatory issues, and environmental releases) should be included in safety-planned activities.	[12]
Workers' capability	quality of being capable	Workers' adequate knowledge, skill, and ability to do their work, especially re risks and dangers in their work, may minimize accidents.	[13]
Workers' relationship	workers' connection	Workers who continually interact with co-workers also rely on them to a great extent to provide a safer working environment.	[14]
Working environment	location where a task is completed	Good housing is a recipe for safety.	[3]
Safety information	safety knowledge	An inadequacy of the safety data collection leads to the lack of focus in safety campaign, and the inability to measure the effectiveness of the efforts.	[15]
Communication	imparting or interchange of thoughts, opinions, or information by speech, writing, or signs	Two-way communication is one of the key factors in improving safety culture.	[8]
Management support	a thing or a person that gives aid or assistance	It is not just management participation and involvement in safety activity that is important, but also the extent to which management encourages the involvement of the workforce.	[16]
Top management commitment	direct participation by the highest level executives in a specific and critically important aspect or program of an organization	An effective safety program requires top managements' commitment to safety.	[17]
Supervision	overseeing (a process, work, workers, etc.) during execution or performance	Supervisors should closely control all the workers' activities to ensure safety and prevent accidents.	[6]
Workers' attitude	manner with regard to a person	Workers' attitude indicates how workers act and they are treated. It determines whether a job will be performed safely.	[18]
Safety report	safety statement submitted in reply to an inquiry as a result of an investigation	A good safety culture organization would generate a substantial number of high quality incident reports.	[19]
Safety budget	an estimate of expected income and expenditure, in relation to safety, for a given period in the future	To achieve safety goals, financial resources should be allocated to aid health and safety policies.	[20]
Worker empowerment	a management practice of sharing information, rewards, and power with workers so that they can take initiative and make decisions to solve problems and improve service and performance	When people feel empowered, safety becomes their own personal goal and responsibility.	[21]

TABLE 1. *(continued)*

Attribute	Definition	Explanation	Reference
Feedback	process in which the effect or output of an action is returned to modify the next action	Monitoring the performance of the workers and using reliable feedback give safety manager a tool to improve their safety programs and technique.	[7]
Safety goal	an observable and measurable end result having one or more objectives to be achieved within a more or less fixed timeframe	Realistic safety goals are needed for effective safety implementation.	[22]
Safety documentation	the recording of a safety event	The main elements of a safety management system are process knowledge and documentation, the records of design criteria, and the records of management decisions.	[23]
Safety accountability	obligation of an individual or organization to account for their activities, accept responsibility for them, and to disclose the results in a transparent manner	To have an effective safety program, safety responsibility must be transferred to individuals at lower levels of authority.	[6]
Workers' involvement	workers included within the scope of operation	Workers' involvement is very important in building workers awareness of safety program and accident or unsafe act investigation and reporting.	[24]
Teamwork	process of working collaboratively with a group of people to achieve a goal	A safety program succeeds when all concerned parties from top to bottom hierarchical levels realize that preventing accidents is everyone's responsibility.	[6]
Safety incentive	inducement such as extra money, better conditions, etc., offered to workers to encourage better work	Reward system that compensates the workers for safe working whilst achieving desired levels of productivity must be devised.	[3]
Organization learning	organization-wide continuous process that enhances its collective ability to accept, make sense of, and respond to internal and external change	Organizations that learn from their experiences are found having better safety score and safety performance.	[25]
Stakeholders' involvement	stakeholders included within the scope of operation	Success in occupational health and safety management can only be achieved through teamwork especially between all project stakeholders.	[26]

and vegetables, starch and starch products, beverages (excluding alcohol), and alcohol [30]. The target group for this study is in the starch and starch products category, as it is in the top three in terms of processed food manufacturers [1, 28]. Target respondents are company personnel in both management and operation positions to gain mixed perceptions of current safety implementation in the organizations.

Aksorn and Hadikusumo divide starch and starch products organizations into small, medium, and large on the basis of the manufacturer's size [2]:

- a small manufacturer represents an organization that has under 50 workers, and has the capital budget of under 10 million THB[1];
- a medium manufacturer represents an organization that has 50–200 workers, and has the capital budget of 10–200 million THB;
- a large manufacturer represents an organization that has over 200 workers, and has the capital budget of over 200 million THB.

Four houndred and fifty questionnaires were distributed in 40 small, 30 medium, and 20 large food companies. Up to 5 questionnaires were distributed in each small company; up to 10 questionnaires were mailed to each large company.

[1] 1 USD = 31.18 THB

4. DATA ANALYSES

This study uses SPSS version 19 to ensure data consistency, and to allow the results to be meaningfully interpreted. Thus, a number of data screening and preliminary analyses, including the normality, the outlier, and the reliability tests, are performed. The screened data are then further analyzed using inferential statistical analyses, including the exploratory factor analysis (EFA), analysis of variance (ANOVA), and Tukey's test.

4.1. Preliminary Analyses

Firstly, the normality and the outlier tests are performed to increase confidence in the data. The screening of continuous variables for normality is an important early step in almost every multivariate analysis. Two important components of normality are skewness and kurtosis [31]. According to Curran, West, and Finch, values of skewness under 2.0 and kurtosis under 7.0 are acceptable [32].

An outlier test is performed to detect a case with an extreme value on one variable (a univariate outlier), or a strange combination of scores on two or more variables (multivariate outlier) [31]. In this study, the 5% trimmed mean and the *z*-score test are performed to detect outliers. According to Pallant, a big difference (over 0.2) between a mean and its 5% trimmed mean may indicate a problem with an outlier [33]. Moreover, *z* scores exceeding ±3.29, at $p < .01$, two-tailed test, may also indicate signs of outliers [31].

4.2. EFA

Following the preliminary analyses, an EFA is performed to explore relationships among variables, in an effort to generate a theory or to facilitate the construct formulation. The results help specify construct development [34, 35].

In this study, the EFA is conducted to gather information about the inter-relationships among a set of safety attributes, and to yield a factor-based scale of safety implementation. When conducting an EFA, three main steps are followed: (a) the assessment of the suitability of the data, using Bartlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) test [33]; (b) the selection of the extraction method; and (c) the selection of the rotation method.

Bartlett's test of sphericity should be significant ($p < .05$) for factor analysis to be considered appropriate. On the other hand, the KMO index should be at least .6 for a good factor analysis [31].

According to Coakes and Steed, the principal components and the principal axis factoring are the most frequently used extraction techniques [36]. In this study, the principal components method is chosen for the analysis to discover which variables in the set form coherent subsets that are relatively independent of one another, as variables that are correlated with one another, but largely independent of other subsets of variables, are to be combined into factors [31]. Varimax rotation method, one of the most popular rotation methods, is also used to maximize the variance of factor loadings, by making high loadings higher, and low loadings lower, for each factor [31, 33, 36]. Moreover, a cut-off factor loading of .35 is used in this study to screen out the attributes that are weak indicators of the factors [37],

After the safety implementation factors are extracted from the EFA, the reliability test is employed to measure the internal consistency of the factors extracted, using Cronbach's α; $\alpha \geq .6$ is considered acceptable for the reliability test [34].

4.3. ANOVA

In this study, a one-way ANOVA is performed to test if small, medium, and large food companies perceive differently on the extracted safety implementation factors. According to Laerd statistics, if the significance value of a factor is under .05, then there are statistically significant differences among factor levels [38].

4.4. Tukey's Test

If the ANOVA shows that there are significant differences in safety perceptions, Tukey's test is employed to further investigate those differences among the groups, i.e., small, medium, and large

companies. The differences in the perceptions of safety implementation among the groups are indicated by $p < .05$ [39].

5. RESULTS

Out of the 450 distributed questionnaires, 383 questionnaires are returned, representing a response rate of 85.11%. From the returned responses, 23 are deemed unusable, due to data incompleteness, and are dropped from the data set. As a result, 360 usable questionnaires provide data for the analyses. Among these, 25.00%, 40.83%, and 34.17% of the responses are from small, medium, and large companies, respectively (Figure 1).

Responses of part 1 of the questionnaire survey reveal that 72% of the respondents are in operation level (Figure 1). Half of the respondents have working experience of at least 5 years, both in their current organization and in the food industry. This indicates the respondents' reasonably high working experience.

The respondents rate their opinions on the 26 attributes in the context of their current safety implementation in part 2 of the questionnaire survey using a 5-point Likert scale. The data gathered from this part are used with the EFA to gather information about the inter-relationships among a set of attributes, and to yield a factor-based scale of safety.

5.1. Screened Data

Data collected from part 2 of the questionnaire survey are examined with the normality and the outlier tests to increase confidence in the data. The normality test reveals that no skewness and kurtosis values exceed the limits of ±2 and ±7, respectively, thus concluding the normal distribution of the data (Figure 2).

The 5% trimmed mean test shows no attribute with high mean differences, providing support for the absence of outliers (Table 2). However, questionnaire 271 reveals the five z scores ±3.29, at $p < .01$, two-tailed test (Table 3). As a result, these data are deleted from the data file, leaving the remaining 359 data available for the EFA.

The screened data are used to perform the EFA to extract the 26 attributes into a number of factors that represent safety implementation.

5.3. Safety Implementation Factors

The 26 attributes associated with safety implementation are analyzed for factor extraction, using the EFA. The first run leads to the removal of the teamwork attribute, as it has factor loading under the lower limit of .35. The remaining 25 attributes are then re-analyzed, and the results extract seven factors that represent the inter-relationships among the group of attributes (Table 4). These seven factors represent the key factors of safety implementation. For convenience,

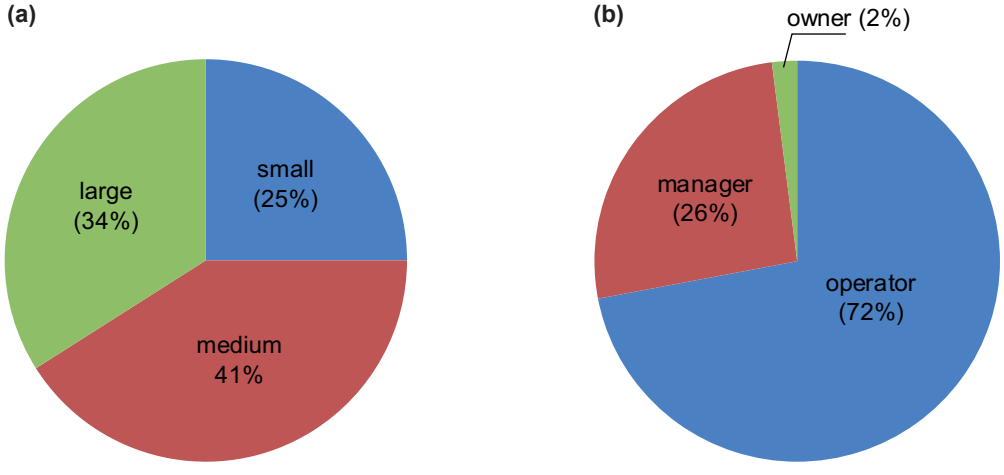

Figure 1. (a) Size of companies and (b) position of respondents.

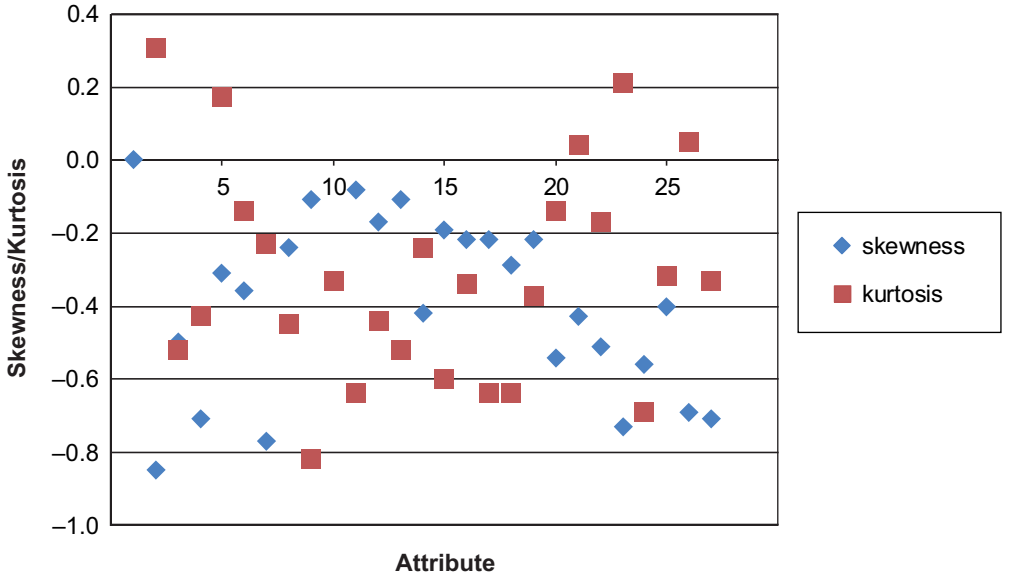

Figure 2. Skewness and kurtosis values of the 26 attributes.

TABLE 2. Mean, Trimmed Mean, and Mean Difference of the 26 Attributes

Attribute	*M*	Trimmed *M*	Difference
Role overload	4.23	4.29	0.06
Safety training	4.30	4.34	0.04
Safety resources	4.38	4.43	0.05
Perceived risk	4.07	4.09	0.02
Risk assessment	4.16	4.18	0.02
Workers' capability	4.42	4.47	0.05
Workers' relationship	3.83	3.86	0.03
Working environment	4.04	4.05	0.01
Safety information	3.79	3.82	0.03
Communication	3.81	3.83	0.02
Management support	3.90	3.91	0.01
Top management commitment	3.84	3.85	0.01
Supervision	3.95	3.99	0.04
Workers' attitude	3.87	3.89	0.02
Safety report	3.96	3.98	0.02
Safety budget	4.06	4.07	0.01
Worker empowerment	3.96	3.99	0.03
Feedback	3.93	3.95	0.02
Safety goal	4.13	4.17	0.04
Safety documentation	4.01	4.04	0.03
Safety accountability	4.21	4.24	0.03
Workers' involvement	4.27	4.32	0.05
Teamwork	4.25	4.28	0.03
Safety incentive	4.22	4.25	0.03
Organization learning	4.34	4.38	0.04
Stakeholders' involvement	4.40	4.44	0.04

TABLE 3. Questionnaire Surveys With *z* Score Exceeding ±3.29

Questionnaire No.	*z* Score
1	3.76, 3.50
3	3.32
8	–3.42
67	–3.61
260	–3.60
271	–4.01, 3.88, 3.35, 4.11, –3.66
283	–3.79

each extracted factor is initially called factor 1, factor 2, etc.

The seven extracted factors are then tested for internal consistency, using the reliability test. The results reveal two factors (factors 6 and 7) with α under the lower limit of .6 (Table 5). As a result, these two factors, together with their associated attributes (safety documentation, safety accountability, safety budget, and safety incentive attributes) are deleted from the data file.

In conclusion, the remaining 21 attributes are grouped into five key safety factors, namely, management commitment, stakeholders' role, safety information and communication, supportive environment, and risk (Table 6). The management commitment factor, for example, is associated with six attributes to explain the management commitment and support on safety. According to Rowlinson, a manager has an important role in achieving a successful safety implementation in the organization [4].

To investigate the similarities and differences of safety implementation in small, medium, and large food companies, the ANOVA is next performed.

5.3. Differences of Perceptions in Safety Implementation in Small, Medium, and Large Food Companies

The one-way ANOVA is performed to test if the small, medium, and large food companies perceive differently on the five safety factors. The results reveal that the risk (RSK) factor bears $p < .05$, thus concluding that there are no differences in perception on this factor in small, medium, and large companies (Table 7).

TABLE 4. The 7 Factors Extracted from Exploratory Factor Analysis

Factor and Its Associated Attributes	Factor Loading
1	
supervision	.60
worker empowerment	.59
management support	.56
workers' attitude	.56
safety report	.45
top management commitment	.41
2	
stakeholders' involvement	.68
organization learning	.66
workers' involvement	.61
safety goal	.40
3	
safety information	.75
communication	.71
feedback	.50
4	
safety training	.68
workers' capability	.60
role overload	.58
safety resources	.48
5	
risk assessment	.75
workers' relationship	.60
working environment	.58
perceived risk	.49
6	
safety documentation	.68
safety accountability	.56
7	
safety budget	.66
safety incentive	.51

TABLE 5. Reliability Test

Factor	Cronbach's α
1	.69
2	.61
3	.65
4	.60
5	.62
6	.44
7	.25

TABLE 6. The 5 Key Safety Factors With Their Associated Attributes

Factor and Its Associated Attributes	Explanation
1. Management commitment supervision worker empowerment management support workers' attitude safety report top management commitment	Successful safety implementation should be initiated from top management of an organization.
2. Stakeholders' role stakeholders' involvement organization learning workers' involvement safety goal	Safety culture cannot be defined in isolation by management, but must instead involve all key stakeholders, such as customers and staff in decision making.
3. Safety information and communication safety information communication feedback	Effective communication is one of the key factors in improving safety. Safety information should be passed down from top to bottom levels.
4. Supportive environment safety training workers' capability role overload safety resources	Successful safety implementation cannot be accomplished with no safety support in, e.g., training safety equipment provision.
5. Risk risk assessment workers' relationship working environment perceived risk	All potential risks should be included in safety-planned activities to maintain safety performance.

TABLE 7. Results of Analysis of Variance (ANOVA)

Factor	*p*
Management commitment	.02
Stakeholders' role	.02
Safety information and communication	.00
Supportive environment	.01
Risk	.09

Therefore, it can be explained that food companies with different sizes hold different perceptions of safety implementation on the management commitment, stakeholders' role, safety information and communication, and supportive environment factors.

To further investigate the differences of perceptions in safety implementation in the management commitment, stakeholders' role, safety information and communication, and supportive environment factors, Tukey's test is performed. The results reveal the following:

- Factors that denote the differences in safety implementation in small and medium companies are the stakeholders' role, safety information and communication, and supportive environment factors.
- Factors that denote the differences in safety implementation in medium and large companies are the management commitment, and safety information and communication factors.

Subsequently, the ANOVA is re-performed for each factor, with its associated attributes, to further investigate the causes of safety divergences among companies with different sizes. Tables 8–9 illustrate the results.

TABLE 8. Results of Analysis of Variance (ANOVA) for Small and Medium Companies

Factor and Its Associated Attributes	*p*
Stakeholders' role	
stakeholders' involvement	.27
organization learning	.10
workers' involvement	.07
safety goal	.02
Safety information and communication	
safety information	.31
communication	.00
feedback	.00
Supportive environment	
safety training	.30
workers' capability	.09
role overload	.05
safety resources	.00

TABLE 9. Results of Analysis of Variance (ANOVA) for Medium and Large Companies

Factor and Its Associated Attributes	*p*
Management commitment	
supervision	.03
worker empowerment	.10
management support	.99
workers' attitude	.24
safety report	.28
top management commitment	.05
Safety information and communication	
safety information	.30
communication	.08
feedback	.00

According to Tables 8–9, it could be concluded that small and medium companies hold different perceptions of safety implementation in the stakeholders' role, safety information and communication, and supportive environment factors, especially in the safety goal, the communication, feedback, and safety resources attributes. Aksorn and Hadikusumo partially confirm that most small companies do not have formal safety standards and goals in place [2]. They usually have a limited budget, and might not be able to provide workers with adequate safety resources and equipment. According to Lardner, Fleming, and Joyner, face-to-face communication, both formal and informal, between management and workers are crucial in improving safety culture [40]. For medium and large companies, however, this could be hard to achieve.

Medium and large companies hold different perceptions of safety implementation in the management commitment, and safety information and communication factors, especially in the supervision and feedback attributes. According to Aksorn and Hadikusumo, supervisors in large companies might not be able to closely control all the workers' activities to ensure safety and prevent accidents [6].

To improve safety implementation, and achieve better safety performance, it is important that the differences in safety perceptions, especially in the safety goal, communication, feedback, safety resources, and supervision areas, be aligned.

6. CONCLUSION

Safety is an important issue, and improving safe behaviors helps reduce accidents. Also, the similarities and differences in perceptions regarding safety implementation in small, medium, and large organizations must be investigated to effectively plan for safety improvement. In this study, the EFA is used to extract a number of safety attributes into five key safety factors, namely the management commitment, stakeholders' role, safety information and communication, supportive environment, and risk factors. The attributes used to explain each of the five safety implementation factors are, however, extracted from the international literature review, and are not specifically limited to Thai practices. The five factors are important in improving safety implementation in Thai food industry, especially in Thai starch and starch products companies. Nevertheless, the factors might not be applicable in some countries, developed ones, in particular.

The results also reveal that different sizes of organizations have safety divergences in the management commitment, stakeholders' role, safety information and communication, and supportive environment factors, but bear similar opinions on the risk factor. Small and medium companies hold different safety perceptions in the stakeholders' role, safety information and communication,

and supportive environment factors. Medium and large companies, on the other hand, disagree on the management commitment, and safety information and communication factors.

The safety goal, communication, feedback, safety resources', and supervision attributes show differences in perceptions of safety implementation in small, medium, and large food companies. To improve safety implementation, and achieve better safety performance in the food industry in Thailand, it is important that these attributes be aligned.

The five key safety implementation factors, however, provide a valuable guideline for the food companies in Thailand to plan for their safety improvement.

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