The Change Management on Food Safety Management of Food Production Enterprises in Shandong Province of China

Xianglin Chen and Tanaset Morasilpin
Southeast Asia University
Corresponding Author, E-mail: s6372A20021@sau.ac.th

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Abstract

The objective of this research were to study 1) change management (food safety culture, organization structure change, technological), food safety risk control and government support effect on food safety management performance; 2) To analysis change management (food safety culture, organization structure change, technological), food safety risk control and government support effect on food safety management performance; and 3) To develop food safety management performance model. The research instrument is a mixed method, collected data from a sample of 600 sample of enterprises reaching above medium-sized scale is distributed in 16 cities in Shandong Province. The statistics for data analysis were frequency, percentage, mean, standard deviation, and structural equation model path analysis.

The results of this research found that: 1) It is found that every factor has a mean at the high level. The analyzed model is an industrial enterprise above the scale are those with product sales revenue of RMB 20 million or more (inclusive) in that year. 2) the number of enterprises reaching above medium-sized scale is distributed in 16 cities in Shandong Province having the Goodness of-Fit Index of = 2.872, RMSEA = 0.058, RMR = 0.024, p-value 0.000; and 3) The influence lines of all factors affect to Change Management on Food Safety Management of Food Production Enterprises in Shandong Province, China. Which is the highlight for change management has a significant impact on the performance of food safety management of the industrial enterprises and the number of enterprises in 16 cities in Shandong Province.

Keywords: Change management; Food safety risk control; Government support; Food safety management performance

Introduction

Food is the most important material basis for human survival and development, and food safety maintains human life and health. A safe, nutritious, and adequate food supply is the primary need of human life. (Wageningen University, 2023: Online) According to statistics released by the World Health Organization (WHO) in 2021, approximately 600 million people worldwide suffer from foodborne illnesses each year, resulting in approximately 420,000 deaths each year. According to incomplete statistics from the Chinese Center for Disease Control and Prevention (CDC), about 200-300 million people experience foodborne illnesses each year, and 600-800 foodborne illness outbreaks are reported each year. This results in hundreds of deaths. (WHO, 2022: Online) Common microbial foodborne illnesses include Salmonella food poisoning, Vibrio parahaemolyticus food poisoning, Aspergillus food poisoning, and Staphylococcus aureus food poisoning. On January 14, 2020, the China Food Safety Development Report (2019) released by the Institute of Food Safety Risk Management at Jiangnan University states that foodborne illness (Foodborne Disease) is one of the world's most Foodborne disease is one of the most prominent

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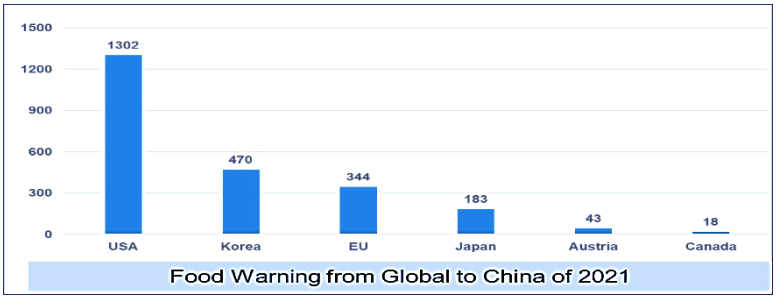
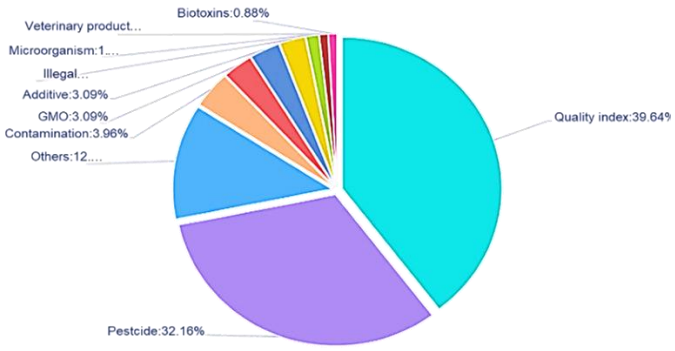
public health problems and the biggest issue facing food safety. (Bintsis, 2017: 531) According to data from the China Health Statistics Yearbook and related domestic and international literature, there were 20,827 cumulative outbreaks of foodborne disease in China during 2001-2017, with a cumulative incidence of 289,068 people, and the overall trend is on the rise. (Lu, et al., 2023: 480) The study shows that foodborne illness remains the largest food safety problem in China, with a high incidence rate and a degree of underreporting. Underreporting rates are estimated to be as high as 90% in developed countries. In developing countries, it is estimated to be over 95% (Sohu, 2020: Online).

In the current food production, handling and transportation, there are also many food safety hazards, such as the addition of illegal added substances, the use of expired food materials, unreasonable use of pesticides, excessive residues of harmful substances, multiplication of pathogenic bacteria, etc. (FAO, 2023: Online) These factors may cause irreversible effects on human health. Domestic and foreign food safety incidents are also frequent, food safety incidents are also leading to high product recall costs and loss of reputation of some manufacturers, and even lost markets or closed as a result.

In addition, with urbanization and international trade, the sources of raw materials, processing locations and the entire supply chain of food have become more complex than ever before, and the supply chain of food from the source to the consumer to complete the final consumption has become longer. (Iakovou, et al., 2015: 294) Food safety is therefore not only fundamental to the survival and development of food enterprises, but also to national stability and economic development. FSM is the implementation of various measures to ensure that the food production process minimizes food safety risks and ensuring food safety has become the core management objective pursued by the modern food industry. (Burki., Ersoy., & Dahlstrom, 2018: 1309) The effectiveness of FSM in production and processing enterprises is particularly critical. 2021 January to December export food statistics report, the European Union, the United States, Australia, Japan, South Korea, Canada notified a total of 2,360 batches of warning food to China, involving 29 categories of products. (Bohman., & Pårup, 2022: 142) Among them, the U.S. notified the largest number of warning products to China with 1302 batches, followed by South Korea and the EU (Figure 1.1-1 below). Among all warning products to China, the top three notified categories are vegetables and their products, aquatic products and their products, and baked goods, accounting for 17.52%, 12.72% and 9.65% of the total respectively. (ECA, 2023: Online) The main reasons for the failure of the products involved in the China Alert are the failure of quality indicators, excessive pesticide residues, and certification issues. Among them, pesticide residues are serious food safety hazards, accounting for 32.16%, which is higher than the statistical proportion in 2020 (Li et al., 2021: 481) (Picture 1-2 below).

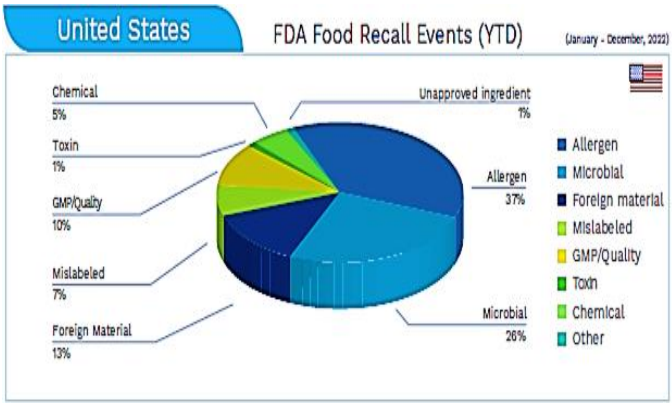


Picture1 Number of warnings for Chinese products from various countries in 2021



Picture 2 Analysis of the causes of non-conforming products, in 2021

2022 Mérieux NutriSciences published the recalls analysis report of USA, Canada and Mexico, showing that in the developed country of the United States, for example, only 7% of food safety recalls were for non-food safety events and 76% were for microbial, allergen and foreign body contamination (Merieuxnutri sciences, 2023: Online) (Picture 3 below)



Picture 3 FDA Food Recall Events

Food safety problems caused by foodborne pathogens pose a great threat to people's health and hinder socioeconomic development worldwide (FAO, 2023a: Online; Liu, et al., 2021: 482) The issue of food safety concerns everyone, food producers, owners and regulators in the distribution chain. In China, there have been food safety incidents such as "dyed steamed buns", "tainted rice", "tainted milk powder" and "lean meat extract". These food safety incidents not only made consumers consume unsafe products, but also led to huge losses to enterprises and industries and even to the country. After the melamine incident (2009), tens of thousands of workers were laid off in dairy industry, about more than 2.4 million dairy farmers dumped their milk, many urban and rural residents' employment and income were affected. (IFCIO, 2023: Online) China's dairy imports jumped from 350,000 MT to 600,000 MT in 2009, and China's dairy industry was greatly damaged. More than a decade after the melamine incident, the incident is still being discussed many times at international food safety conferences as a typical negative case of the food industry. (Ishaq et al., 2014: 723) When enterprises in the internationally renowned food industry do risk assessments of their suppliers, the origin of food ingredients in China even becomes a demerit point. Melamine was not only a food safety event at the time, but also became one of the cases of

adulteration and forgery evaluation as one of the new food safety wind risks in recent years. (Yang, 2009: 113) For food safety incidents with great impact, the damage is not only limited to the victimized consumers, but often extends to the industry and national reputation, and the food safety strategy is one of the important strategic directions in China's development. (Wang, 2022: 1917)

Research Objectives

1. To study change management (food safety culture, organization structure change, technological), food safety risk control and government support effect on food safety management performance.

2. To analysis change management (food safety culture, organization structure change, technological), food safety risk control and government support effect on food safety management performance.

3. To develop food safety management performance model.

Research Methodology

Sample and data collection.

1. For quantitative method, usually when the sample size is below 100, almost all analyses are unstable, and samples above 200 can be called medium-sized samples, and this questionnaire study planned to collect about 600 questionnaires. This study also considered the Yamane formula, Yamane is a commonly used sample survey method that helps researchers determine the size of the sample to ensure the reliability and validity of the results. The specific formula is; n = N / (1 + N (e^2)). Where n denotes the sample size, N denotes the overall size, and e denotes the desired sampling error (0.5), the calculation result is n≈354, and the planned 600 sample size (n=600) is much higher than this number. But the Yamane formula also has some limitations. It assumes that the overall distribution is uniform, while the overall distribution may be uneven. Second, it does not take into account the representativeness and randomness of the sample, which may lead to sample bias and error. According to the data published by news.foodmate.net, the total number of food production enterprises above the scale in Shandong Province counted in 2020 was 3,193. Industrial enterprises above the scale are those with product sales revenue of RMB 20 million or more (inclusive) in that year. And the number of enterprises reaching above medium-sized scale is distributed in 16 cities in Shandong Province, and the probability that the enterprises that can adopt change management are roughly distributed in above medium-sized enterprises is higher, because it needs the support of certain enterprise scale and cost. The plan is to randomly select enterprises from 16 cities to do the questionnaire survey, to avoid individual cities in the case of small size of food enterprises affecting the representativeness of the sample. In addition, considering the size of the population of each city and the distribution of food enterprises are different, the sampling size will focus on densely populated and economically developed cities. Conclusion In this research, the researcher selected the number of samples used in the research at 600 samples.

2. For qualitative method in this study, in addition to the literature review, I conducted face-to-face interviews with two officials from the Market Supervision Administration responsible for supervising food production enterprises in Rizhao City and four food production enterprises from different cities in Shandong Province. All four enterprises had implemented change management and were among the top three in their respective industries. A total of 23 people, including enterprise leaders and department managers, were interviewed, including one general manager,

four quality managers, three production managers, two maintenance managers, three procurement managers, four technology department managers, two sales managers, and three human resources department managers. The interviews took five days.

Instrument

In this research, according to the existing mature scale, and each variable, design the questionnaire, collect a certain amount of empirical data to test the reliability and validity of the scale, and determine the measurement scale of each variable.

At the same time, a small-scale pre-test was conducted, and then the order of the questions and expressions were adjusted according to the results of the test to ensure that the interviewees could correctly understand the contents of the questions and answer them conscientiously by

1. For quantitative methods

In this research, the positive effects of food safety culture, organizational structure change, technological change, food safety risk and government support on FSM performance were derived by designing a questionnaire, using SPSS25.0 and AMOS software for data processing and empirical analysis, the questions and response options for the design assessment elements of the questionnaire were developed based on the scenario descriptions of previous studies. All questionnaires used closed-ended questions. The questionnaire was designed for the attitude category using Likert's five-point scale method, e.g., organizational satisfaction with FSM performance was assessed on a scale of 1 to 5, with 5 being very agree and 1 being the very disagree. The questionnaire can be distributed through the online survey system "Questionnaire Star" in China. The questionnaires are translated into Chinese and distributed through government-organized food enterprises' WeChat workgroups, as well as through direct contact with food enterprises. The study used a random sampling technique to distribute the data using a self-administered questionnaire.

2. For Qualitative Method

Semi-structured interviews are widely used in academia for survey research. In general, Semi-structured interviews were mostly face-to-face exchanges between the researcher and the interviewee on the main content of the study. To explore the understanding, attitude, and motivation of research subjects towards issues related to education in practice.

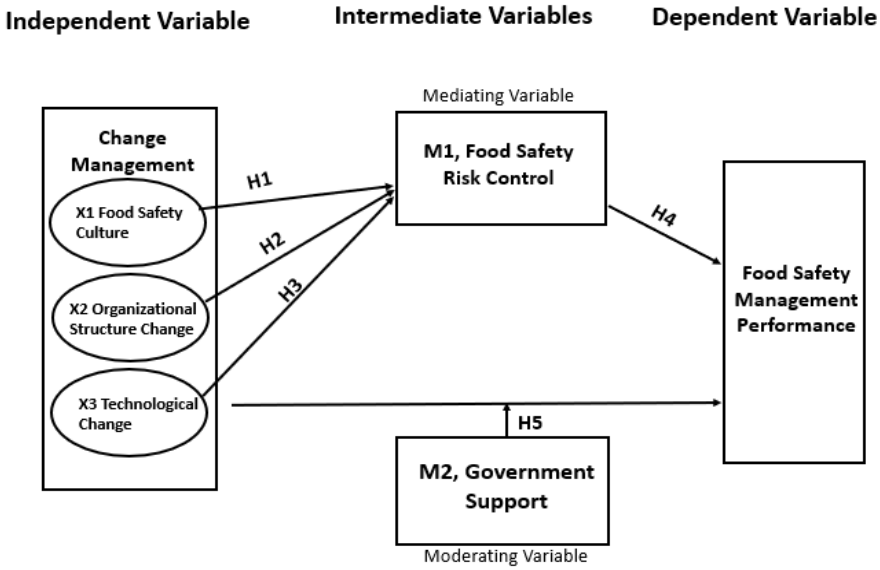
A relevant aspect of this study is the survey of enterprise leaders and department managers from the Market Supervision Administration responsible for supervising food production enterprises in Rizhao City and four food production enterprises from different cities in Shandong Province. All four enterprises had implemented change management and were among the top three in their respective industries. A total of 23 people.

Data Analysis

The data analysis software used in this study was SPSS and AMOS, with the help of which the reliability and validity of the scales, the basic descriptive statistics of the samples, and the regression model for hypothesis testing were statistically analyzed.

Research Conceptual Framework

This study is based on classic change management theories. Peter Drucker's series of management theories, Deming's PDCA theory, risk management theory, Chinese and international food safety regulations and the Global Food Safety Initiative (GFSI) food safety standards. Through extensive literature review and expert interviews, it is shown that the independent variables related to the impact of change management on food safety management performance include food safety culture, organizational structure change, technological change, and the positive impact of food safety risk control as an intermediary variable on the dependent variable of food safety management performance. Government support serves as a moderating variable between change management and food safety management performance. Therefore, the researcher can develop a conceptual following by



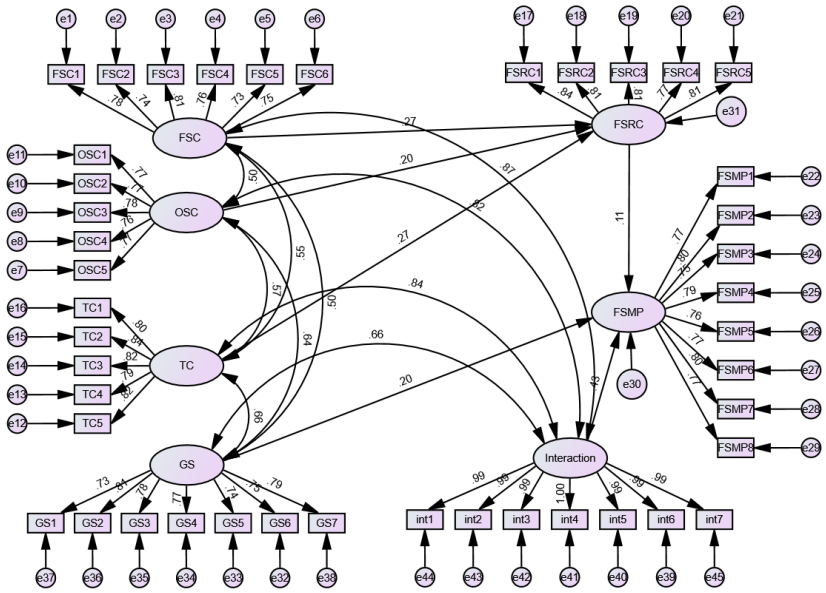
Picture 4 Research Conceptual Framework

Research Result

For Quantitative Method

1) studying changes management (food safety culture, organization structure change, technological), food safety risk control and government support effect on food safety management performance.

Structural Equation Modeling, using AMOS 26.0, a structural equation model was constructed with Change Management (Food Safety, Organizational Structure Change, and Technology Change) is an independent variable, Food Safety Risk Control, and Government Support as an mediating variables to Food Safety Management Performance as the dependent variable for model testing.



Picture 5 Structural equation modeling (unstandardized coefficients)

Table 1 Degree of model fit

Index	X^2	df	P	X^2/df	GFI	RMSEA	RMR	CFI	NFI	IFI
Acceptable Value	-	-	>0.05	<3	≥0.9	<0.10	<0.05	≥0.9	≥0.9	≥0.9
Value	2423.723	844	0.000	2.872	0.939	0.058	0.024	0.946	0.920	0.946

From the above table, the model fitting was analyzed, and the chi-square degrees of freedom ratio χ2 /df f was less than 3, and most of the other indexes were fitted better by the test value, which indicated that the structural equation model was fitted better.

2) to analysis change management (food safety culture, organization structure change, technological), food safety risk control and government support effect on food safety management performance.

Table 2 Results of path significance test

Path	**Estimate**	**S.E.**	**C.R.**	**P**	**Conclusion**
FSC→FSRC	0.271	0.052	5.394	<0.001	H1 Accepted
OSC→FSRC	0.202	0.055	3.897	<0.001	H2 Accepted
TC→FSRC	0.273	0.058	5.079	<0.001	H3 Accepted
FSRC→FSMP	0.109	0.041	2.275	0.023	H4 Accepted
Interaction →FSMP	0.435	0.016	7.641	<0.001	H5 Accepted

The standardized path coefficient of FSC on FSRC is 0.271, with a p-value of less than 0.05, indicating that there is a significant positive effect of FSC on FSRC (H1 Accepted).The standardized path coefficient of OSC on FSRC is 0.202, with a p-value of less than 0.05, indicating that OSC presents a significant positive effect on FSRC (H2 Accepted).The standardized path coefficient of TC on FSRC The standardized path coefficient of TC on FSRC is 0.273, with a p-value of less than 0.05, indicating that TC presents a significant positive effect on FSRC (H3 Accepted).The standardized path coefficient of FSRC on FSMP is 0.109, with a p-value of less than 0.05, indicating that FSRC presents a significant positive effect on FSMP (H4 Accepted).The interaction term of Change Management and Government support is 0.109, with a p-value of less than 0.05, indicating that OSC presents a significant positive effect on FSRC (H4 Accepted). The standardized path coefficient of the interaction term between Change Management and Government support is 0.435, with a p-value less than 0.05, indicating that Government support has a significant positive moderating effect on Change Management and FSMP (H5 Accepted).

The mediation effect test was conducted using the AMOS bootstrap method, choosing a sampling number of 5,000 and a confidence interval of 95% to conduct the test, and the following results were obtained:

Table 3 Summary of intermediary results

Path	Mediating effect	95% CI of mediating effect	P value	Conclusion
FSC=>FSRC=>FSMP	0.030	0.004~0.067	0.018	H6 Accepted
OSC=>FSRC=>FSMP	0.022	0.003~0.048	0.025	H7 Accepted
TC=>FSRC=>FSMP	0.029	0.004~0.064	0.023	H8 Accepted

For Qualitative Method

3. Developing food safety management performance model. Analysis of Interview Results (Semi-structured) by the third of objective, the results can shows that:

Based on the summarized analysis of the interview information, both the management of the enterprises and government officials agreed that the main impact of change management on food safety management was the construction of a food safety culture, and that the positive effects brought by changes in organizational structure and technological changes were the greatest. Through change management, food safety risks were effectively reduced, thereby improving food safety management performance. In addition, government regulation and support were important factors and one of the driving forces for enterprises to adopt change. Furthermore, support for compliant production and product standardization enabled enterprises to avoid customer complaints and government penalties. The answers of the interviewees are also consistent and believe that change management has a significant impact on the performance of food safety management.

Table 4 hypotheses studied in this research:

Hypothesis	Analyses Path	P value	Conclusion
H1	FSC→FSRC	<0.001	Accepted
H2	OSC→FSRC	<0.001	Accepted
H3	TC→FSRC	<0.001	Accepted
H4	FSRC→FSMP	0.023	Accepted
H5	Interaction →FSMP	<0.001	Accepted
H6	FSC=>FSRC=>FSMP	0.018	Accepted
H7	OSC=>FSRC=>FSMP	0.025	Accepted
H8	TC=>FSRC=>FSMP	0.023	Accepted

Discussions

Through a literature review, it was found that there is limited research on the overall performance of food safety management. Many scholars have focused mainly on the catering industry, which deals with direct food consumption, or on the analysis of foodborne hazards, such as the collection, cultivation, breeding, initial processing, and retail sectors of food raw materials. Some researchers have conducted separate studies on supply chain management in food safety management within the production and distribution sectors. (Iakovou, et al., 2015: 312) Others have examined the impact of food safety culture, change leadership, and information management on food production enterprises. However, there is a lack of comprehensive research and analysis from the perspective of change management, examining the factors that affect the performance of food safety management. (Burki., Ersoy., & Dahlstrom, 2018: 1312) There is also a lack of studies that consider food safety risk as a mediating variable.

From the official research reports, it can be observed that many scholars have examined the role of government in food safety management. (Bintsis, 2017: 532) This includes the effectiveness of government legislation, establishment of standards, and supervision and enforcement. However, the research models have not investigated government support activities as moderating variables in the relationship between change management and food safety management performance. (Bohman & Pårup, 2022: 274)

Therefore, this study analyzes the impact of various dimensions of enterprise management change on food safety management performance, providing a more comprehensive and systematic theoretical framework.

Due to the complexity and multiple stages of the entire food supply chain, food safety is influenced by various factors, including the origin of materials, climate, production and processing levels, supply chain, management, government support, economic and political environment, and other factors. Among them, food production and processing are crucial stages that can reduce or increase food safety risks. (Wageningen University, 2023: Online) This is because production enterprises need to achieve economies of scale, and the quantities of food production and processing involved are also of a certain scale. Therefore, processed foods are not limited by the shelf life and storage restrictions of natural foods. Production and processing enterprises can

expand the geographical scope of food products to a global level, which means that the affected population and regions are more extensive, and the consumption time span of food products is longer. (Li et al., 2021: 484) If enterprises and governments manage this stage of food safety well, they can control food safety risks in the food source and supply chain effectively. Therefore, the production and processing stage is one of the most efficient and critical stages for controlling risks in food safety management. (IFCIO, 2023: Online) This study provides practical guidance for the industry, government, and enterprises to focus limited resources on key processes and improve food safety management performance by effectively controlling food safety risks through change management. (Yang, 2009: 115; Wang, 2022: 1971) In particular, when food production enterprises develop and achieve a certain production scale, this study provides a theoretical basis and practical foundation for using change management to improve food safety management performance.

Conclusion

The purpose of this study is to investigate the impact of change management on the performance of food safety management and explore its underlying mechanisms, providing a theoretical and practical basis for food production enterprises to improve their food safety management performance. Therefore, this study aims to construct a new theoretical framework to study the impact of change management on the performance of food safety management in food production enterprises, and to study the most relevant food safety culture in change management. The relationship and impact of change organizations and information management on food safety risk and government support as mediating and moderating variables on food safety management performance. This study serves as a theoretical and practical supplement to existing research on food safety management performance and provides new research ideas for future researchers.

Enterprises can learn from successful change management models to achieve self-transformation, establish organizational structures, food safety culture, and information management that meet their own development needs. This study also provides references for industry development and government support needs. The government can promote or encourage enterprises to adopt change management methods to improve their food safety management performance through supervision and provide corresponding training and guidance support from a service perspective to help food enterprises implement change management to improve their food safety management performance.

Synthesize the overall finding as structural equation model was constructed with Change Management for Food Safety, Organizational Structure Change, and Technology Change effected Food Safety Risk Control, and Government Support and Food Safety Management Performance in the model testing.

Recommendations

Recommendations in this research

1. A broader range of research can be conducted on change management. For example, the impact of strategic change and process change in change management on food safety management performance can be explored. In particular, the effect of process change may vary depending on the specific industry type of food production enterprises. Some enterprises' business models may be significantly affected by process change, such as those involved in the production and supply chain processes of short shelf-life products.

2. More in-depth research and analysis can be conducted on food safety culture, organizational change, and technological change. This can be done by considering the development scale or specific industry of the enterprises and constructing different theoretical frameworks for change management accordingly. Alternatively, based on the management background of enterprises, they can be categorized into foreign-owned enterprises, state-owned enterprises, and private enterprises, among others. This would allow for a more detailed analysis of the impact of change management on food safety management performance under different ownership backgrounds and provide reference for government support interventions and industry development.

3. This study adopts a positive research approach to facilitate questionnaire surveys and interviews. Other scholars or institutions can consider conducting negative research by leveraging their own identities and support resources. This would involve analyzing the challenges of food safety management performance in enterprises that have not adopted change management. It would provide the industry, enterprises, and government with an understanding of the necessity and motivation for change management.

4. Failed enterprises can be selected from the industry to conduct investigative research. Analyzing case studies of failed enterprises would help identify common factors and issues contributing to their failures. This would provide valuable reference for industry development and enterprise transformation.

Further research

Due to the broad scope of change management, this study did not conduct a comprehensive analysis of all elements involved in change management. Based on a literature review, official regulatory trends, and expert interviews, the study focused on the impact of three core elements of change management on food safety management: food safety culture, organizational structure change, and technological change. These three elements are most relevant and commonly present in the entire food production industry and food safety management. However, the study did not explore the impact of strategic change and process change involved in change management on food safety management performance.

During the research process, support from official personnel helped with sample selection and questionnaire distribution. The survey data was collected through questionnaire surveys or interviews with management personnel related to food safety management in the enterprises surveyed. The primary questionnaire data came from the enterprises' own responses and could not obtain more data information from social media or official regulatory perspectives to verify whether these enterprises have been subject to regulatory penalties or have significant food safety non-compliance issues during inspections. Due to the lack of corresponding funding support and time constraints during the research process, this survey could not cover most enterprises, thus having limitations of a sampling study.

Furthermore, there are not many relevant research dissertations both domestically and internationally, especially domestically. Most of the literature is related to government regulatory laws and regulations or performance aspects. Alternatively, it may be due to inaccurate literature search during my research process. There are limited references that can be consulted during the research process. If this survey could obtain support from food industry associations and acquire more industry information and historical data, it would help to improve the depth and breadth of this research survey, and the collected samples and data may be more representative.

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