A study of implementation strategies for food safety management system in global supply chains

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Acknowledgements

Nothing worth having comes easy as Theodore Roosevelt said, and a day is too long, a year is too short for a PhD student, which is true in my case. This is the moment of which I have dreamed since the first step to University of Liverpool Management School. It was a long, intellectually challenging and emotional journey, and I would not have come to the end of it without the kind support from important people and funding bodies that I would like to take this opportunity to express my sincere gratitude.

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Abstract

Global food supply chains consist of a vast number of stakeholders, and involve an enormous variety of structures, logistics that change rapidly and diversify continuously (Kafetzopoulos, Psomas and Kafetzopoulos, 2013). Implementing a food safety management system (FSMS) is a regulatory requirement for every food firm in global food supply chains (CAC, 2009). The success of each company's FSMS in preventing foodborne hazards depends on its correct implementation and application - processes which can be influenced by a wide variety of factors. Despite the increasing importance of successful FSMS implementation, there is a paucity of evidence on continuous improvement opportunities. This thesis is a pioneering response containing six chapters that aim to:

- Present a systematic review the literature of food safety management in global supply chains.
- Qualitatively investigate why a factor is considered critical to the success of food safety management in the context of Chinese and Vietnamese fishery industry.
- Propose a model for measuring the FSMS implementation based on their regulatory requirements.
- Empirically test the proposed hypotheses to confirm critical success factors and explore the relationship between FSMS and business performance.
- Identify Best practice among the studied firms.
- Explore the differences among groups in term of their critical success factors (CSFs), supplier selection and the quality of supply chain relationship.

The thesis concludes that apart from critical impacts of internal factors such as management responsibility and human resources on FSMS implementation, collaborative and supportive supply chains as well as many activities of food-safety governance play significant roles in enhancing food safety management in China and Vietnam. Furthermore, it examines the

degree to which the implementation of FSMS influences the operational and financial performance of these firms. The evidence provided in the thesis facilitates food firms' managers to target critical resources and supports, and identify effective policies, practices and procedures to improve FSMS implementation leading to better overall business performance. The research findings propose the use of CSFs as a more proactive approach to identifying the mechanism to enable continuous improvement opportunities for the current FSMS according to each firm's status, particularly for Small and Medium-size Enterprises (SMEs) with limited resources.

Theoretically, this thesis contributes to the field of food safety and supply chains management by identifying and exploring the impact CSFs on FSMS implementation from three levels including the organisational, market and broader environments. Six CSFs have been identified through the sequential mixed method, namely management responsibility, human resource, organisational resources, external support, collaboration, and food-safety governance. It also proposes the measurement of FSMS implementation constructed on the key regulatory activities instead of being limited to HACCP principles or only considered FSMS implementation as a part of quality management. Additionally, critical shreds of evidence are provided to clarify the relationship between FSMS implementation and business performance which is an identified research gap as well as an important motivation for the manufacturing and exporting sector in developing countries to continuously improve their current practices.

In addition, the thesis identifies good practice in implementing food safety management system among the studied companies and provides several suggestions for firms to improve their current practices. For instance, food processing firms should enhance collaboration with their stakeholders in global supply chains since this significantly contributes to FSMS implementation. Likewise, they should follow food safety criteria when selecting suppliers and develop a better relationship with their stakeholders in the supply chains on food safety issues. Moreover, the outcome of the empirical research presented in this thesis has revealed the positive impact of FSMS implementation on operational performance, as well as the positive impact of operational

performance on financial performance. The thesis suggests that the effective implementation of FSMS can significantly contribute to the realisation of operational and financial improvements in food manufacturing in order to increase companies' competitiveness in the highly dynamic global marketplace. It also presents the critical roles of other parties such as government and authorities and business associations. More considerable efforts are needed to enhance their activities in supporting and governing food firms' FSMS implementation.

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Abbreviations

Word	Meaning
AVE	Average Variance Extract
CAC	Codex Alimentarius Commission
CN	China
CR	Composite Reliability
CSFs	Critical Success Factors
EC	European Commission
ISO	International Standard Organization
FAO	Food and Agriculture Organization
FSMS	Food safety management system
HACCP	Hazard Analysis and Critical Control Points
KPI	Key Performance Indicator
OA	Other activities
PRPs	Prerequisite Programs
QC	Quality Control
SC	Supply chain
S.D.	Standard Deviation
SCM	Supply Chain Management
SEM	Structural Equation Modelling
SLR	Systematic Literature Review
SMEs	Small and Medium-size Enterprises
RQ	Research Question
VN	Vietnam
WHO	World Health Organization
QUAL	Qualitative
QUAN	Quantitative

CHAPTER 1 INTRODUCTION

1.1 Chapter introduction

This chapter introduces a general research background and specific research needs, followed by the research questions, the scope of the research as well as the research contributions. The structure of the thesis is also provided to present the synopsis of the different stages in the research design.

1.2 Research background

At present, food on our tables come from every corner of the globe instead of being predominantly regionally localising as the last several decades (Roth et al., 2008). There are two primary reasons for global sourcing including lower costs and insufficient local supplies according to the study of Roth et al. (2008). They also state that under the pressures for cost reduction, the mainstream food supply chain model moves beyond regional to include global participation for importing to reduce costs and exporting to generate revenues in all levels of the chain. The resulting food supply chains are typically accompanied by (1) additional costs for oversight, logistics, pipeline inventory, and quality management; (2) heightened vulnerability and greater supply risks stemming from potential supply disruptions, lack of accountability, lower visibility, and quality failures; (3) issues concerning global financing and funds transfer; and (4) lower responsiveness due to longer lead times (Roth et al., 2008; Marucheck et al., 2011). In addition, the recent food safety incidents affecting global food supply chains such as Melamine in Chinese milk products (Roth *et al.*, 2008), Salmonella-contaminated peanuts in the U.S (Leighton, 2016), dioxins in the Republic of Ireland (Bánáti, 2011), E.coli contamination of bean sprouts in Germany and France (Soon, Seaman and Baines, 2013), Tesco horse meat scandals in the UK (Sarpong, 2014) have raised public awareness of the ubiquity of food products. As a result, food safety is one of the most challenging issues for the food industry in the context of global food supply chains.

Food is safe if it is not harmful to the consumer at the point of consumption when it is prepared and/or eaten according to its intended use (ISO, 2005). Food safety is the most crucial component of the food quality that also includes sensory properties (namely taste, odour, colour), shelf-life time, reliability and

convenience (Aramyan *et al.*, 2007). Food safety risk is categorised and discussed as an operational risk in global supply chains. It means that 'the distribution of outcomes related to adverse events within the firm affects a firm's internal ability to produce goods and services, quality and timeliness of production, and/or profitability' (Manuj and Mentzer, 2008). It is one of the most significant challenges in the context of the global food supply chains because of its significant repercussions (Manuj and Mentzer, 2008; Whipple, Voss and Closs, 2009). First, most of the food products are natural, perishable and could be injurious to consumers if they have not been managed in a timely and safe manner. Second, food supply networks are global, complicated, and highly interconnected, leading to higher risk exposure (Trienekens and Zuurbier, 2008). Comparatively, globalisation of food industry as other industries has sparked heightened awareness of the various risks and vulnerabilities that products are exposed to moving along the supply chain continuum and sourcing to manufacturing, transportation, distribution and final sale to the consumer (Marucheck *et al.*, 2011). Third, food and beverage products are at risk of intentional or unintentional adulteration more than other products (Whipple, Voss and Closs, 2009). Last but not least, end product testing is not an efficient approach to ensure food safety in food production due to the difficulty associated with determining safety risks before consumption and the potentially devastating effects of food safety failure on human life (Marucheck *et al.*, 2011). For these reasons, there is no way around it without suffering the consequences of non-compliance, regardless of whether food enterprises realise both industrial or economic benefits or not (Mensah and Julien, 2011).

As a result, the food industry is responsible for establishing an effective and efficient food safety management system (FSMS) as regulatory requirements to ensure that foods present minimal risk to the consumer in the global food chains (CAC, 2009). An FSMS is made up of a group of interacting or interdependent elements forming a network to ensure that food presents minimal risk to consumers (Scott and Chen, 2010). It is a highly custom-made system as a result of the implementation of various quality assurance and legal requirements into each company's production, organisation and environment (Jacxsens *et al.*, 2011). No matter what different between firms within supply

chains are, the ultimate purpose of FSMS is to ensure that foods are safe concerning foodborne hazards at the time of human consumption. The success of FSMS in preventing foodborne hazards depends on its correct implementation and application (Fotopoulos, Kafetzopoulos and Psomas, 2009; Kok, 2009). Although most of the standards claim that FSMS could be 'applicable to all organisations, regardless of size, which are involved in any aspect of the food chain and want to implement systems that consistently provide safe products' (ISO, 2005), the implementation of FSMS is not always successful leading to outbreaks of food safety incidents (Roth *et al.*, 2008; Marucheck *et al.*, 2011). In FSMS implementation, the most challenging and complex tasks are to minimise food safety failure and to respond to the need for continuous improvement (Mensah and Julien, 2011).

At any scale (regional, national, local, and factory), implementing FSMS could face many challenges because the global food supply chains that are complicated by a large number of stakeholders are involved with an enormous variety of structures, logistics, and chain participants will undoubtedly change rapidly, scale-up and diversify continuously (Gorris, 2005). Thus, the implementation of FSMS could be influenced by many factors (Kirezieva *et al.*, 2013; Kirezieva *et al.*, 2015). The literature suggests that some factors are more critical and could contribute to the system success more than others (Kafetzopoulos and Gotzamani, 2014; Kirezieva, Jacxsens, *et al.*, 2015). Historically, the concept of 'critical success factor'(CSF) was first introduced by Daniel (1961) and has been renewed by John Rockart as 'the limited number of areas in which results if they are satisfactory, will ensure successful competitive performance for the organisation' (Rockart, 1979). The universally accepted definition of CSFs was given by Boynton and Zmud (1984) as 'those few things that must go well to ensure success for a manager or an organisation, and, therefore, they represent those managerial or enterprise areas that must be given special and continual attention to bring about high performance'. The theory of critical success factors has been widely used since then in enabling the organisation to focus on the most important factors that lead to the achievement of their desired goals (Bai and Sarkis, 2013). Some studies have shown the application of the CSF theory in different areas

including both supply chain management (e.g. Bai and Sarkis, 2013; Dinter, 2013; Grimm, Hofstetter and Sarkis, 2014; Netland, 2016; Shankar, Gupta and Pathak, 2018) and food quality management such as Fotopoulos, Kafetzopoulos and Psomas (2009), van Asselt *et al.* (2010), Kafetzopoulos and Gotzamani (2014) and Habibah Abdul Talib, Anuar Mohd Ali and Idris (2014). The application of CSF theory assistances managers in reducing the complexity of food supply chains and quality management by defining and recognising critical points to improve their expected goals such as lean implementation, sustainability supply chain, food quality and safety.

Furthermore, apart from food safety objectives, FSMS implementation are applied in the expectation that it could help to increase positive impacts on the business. A well-implemented FSMS should deliver benefits for firms that go well beyond food safety objectives. For example, increasing sales revenue thanks to rising consumer confidence in the safety of the purchased food (Javee and Masakure, 2005), obtaining a ticket for accessing the global food value chain (Mensah and Julien, 2011; Macheka *et al.*, 2013), reducing operating cost and lower insurance charges for avoided costs such as food safety incidents, recalls and complaints (Whipple, Voss and Closs, 2009), satisfying the need of stakeholders/customer (Thomsen and McKenzie, 2001; Fotopoulos, Kafetzopoulos and Gotzamani, 2011), improving efficiency and process control (Escanciano and Santos-Vijande, 2014) and so on. It is obvious that managers of food firms need to balance between costs and benefits of their FSMS implementation and the positive impact of FSMS on food firm's business performance is the target to which they aim.

1.3 Research needs

Given the importance of maintaining a good practice of FSMS implementation, the identification of enabling a mechanism for the success of FSMS implementation is critical to reduce potential failures and to respond to the need for continuous improvement. There is a growing body of literature that recognises the roles of CSFs in facilitating food manufacturers to focus only on the most important factors that lead to the achievement of their desired quality control level (Mensah and Julien, 2011; Kafetzopoulos and Gotzamani,

2014; Kirezieva, Luning, *et al.*, 2015), leaving food safety objective in the global supply chains limited. Up to now, far too little attention has been directly paid to the need for a mechanism enabling successful FSMS implementation to assist food firms in recognising and understanding their critical points and consequently contributes to guaranteeing and improving food safety. For the reason that it is difficult to consider all factors equally important contributing to the system success that requires to be improved by firms, particularly for SMEs with finite resources. Focusing on the wrong CSFs or even not knowing their existence influences FSMS implementation and hampers businesses making more profit (Kafetzopoulos and Gotzamani, 2014).

In addition, in international food trading, food safety regulations and standards have become essential frameworks to control and enhance food safety management (FAO, 2011), namely the British Retail Consortium's global food safety standard (BRC), the International Food Standard (IFS), Hazard Analysis and Critical Control Point (HACCP), the Safe Quality Food (SQF) 2000 Level 2, and the ISO 22000:2005. Underpinned by these standards and regulations, the implementation of FSMS establishes a framework for uniformity in requirements, audit procedures and mutual acceptance of audits, and reassure retailers and branded manufacturers of the capability and competence of suppliers (Mensah and Julien, 2011). Mortimore and Wallace (2013) affirm that HACCP by itself cannot control food safety even though it is the centre in the way that risk-based program requires hazard analysis and risk evaluation skills. A variety of prerequisites and other management support activities are also needed as a whole in manufacturing food. The existing literature on FSMS implementation is extensive and focuses mainly on HACCP while other requirements and activities namely prerequisite programmes, traceability, control of nonconformity, validation, verification, and continuous improvement receive less attention (Cormier *et al.*, 2007; Ball, Wilcock and Aung, 2009; Kafetzopoulos, Psomas and Kafetzopoulos, 2013; Green and Kane, 2014).

There are only some studies identifying CSFs of food safety management to facilitate food firms' managers in decision-making and managing at various levels and smooth functioning of FSMS implementation. For instance, using

the case study of leafy green production in three European regions, Kirezieva, Jacxsens, et al. (2015) points out the possible influence of many factors from three fundamental dimensions of these environments (Figure 1.1).

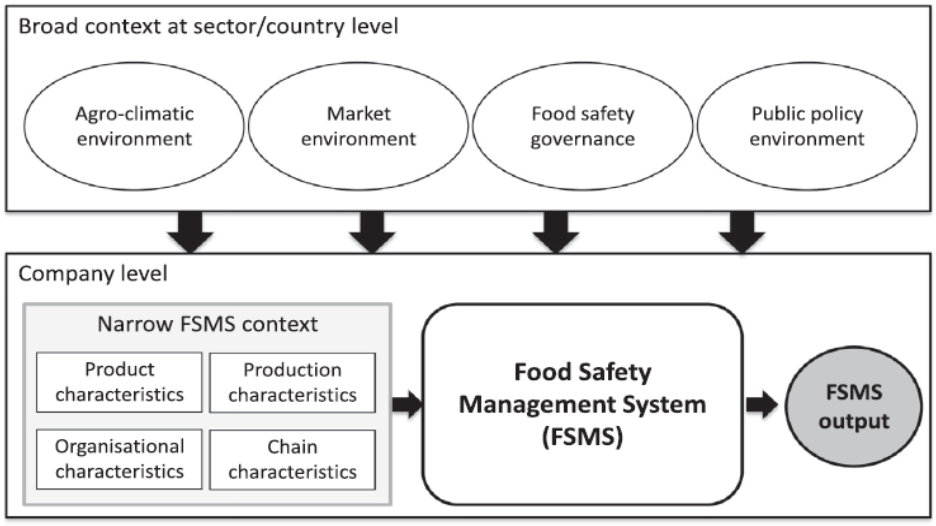

Figure 1.1. The hierarchy of the relationships between the broad context, narrow FSMS context, FSMS and FSMS output

(adapted from Kirezieva, Jacxsens, et al., 2015)

The first is the organisation consisting of sufficient resources in each firm. The second is the market in which the organisation has an interactive relationship with others within the food chain. The last is the 'broad context' as defined in the research of Kirezieva, Jacxsens, et al. (2015) that could influence on FSMS performance including food-safety governance, agro-climatic (for the case of leafy green) and public policy environment, especially in the context of global supply chains. Nevertheless, researches on CSFs in FSMS implementation has been mostly restricted to confirmation of CSFs' existence and focused only on one level in each study (e.g. Fotopoulos, Kafetzopoulos and Psomas, 2009; van Asselt *et al.*, 2010; Fotopoulos, Kafetzopoulos and Gotzamani, 2011; Kafetzopoulos and Gotzamani, 2014). In the context of the global food supply chains, food firms cannot operate on their owns. On the contrary, they need to co-operate with suppliers, service providers, certificate bodies, authorities and so on. CSFs from the level of the organisation receive most of the researchers' attention while those from the broader levels such as the level of market or governance, which affect food firms in term of how they compliance, collaborate, support, interact to ensure

food safety, remains unknown. Therefore, one level is not sufficient to understand how CSFs from these levels impact on firm's FSMS implementation.

Furthermore, the crucial role of successful FSMS implementation is well established in the food industry. Food manufacturers and exporters operate in a diverse business environment with different field pressures and manufacture characteristics, legal requirements, and institutional settings. Much uncertainty still exists about the interaction between CSFs and FSMS implementation, considering the dynamics and differences among enterprises. These variables follow the contingency argument, which states that there is no best way to lead a firm or a process; instead, the best solution is contingencies that reflect the situation of each organisation (Donaldson, 1995, 2006; Kirezieva, Jacxsens, *et al.*, 2015). In particular, the previous studies on CSFs of FSMS implementation fail to point out the difference in each firm's practice and identify which area is more critical to improve or give priority based on their status. As examples, some studies (Fotopoulos, Kafetzopoulos and Psomas, 2009; Habibah Abdul Talib, Anuar Mohd Ali and Idris, 2014; Kafetzopoulos and Gotzamani, 2014; Xiong *et al.*, 2017; Shukla, Singh and Shankar, 2018) have identified numerous critical factors of both quality and food safety management systems having the positive impact on business performance. Unfortunately, such approaches are limited to the confirmation of CSFs' presences regardless of the differences among enterprises.

Lastly, none of these studies directly focus on the relationship between FSMS implementation and business performance despite the ultimate goal of business is to improve overall performance, and FSMS is a critical part of TQM in the food industry (Figure 1.2). Also, there is no free safe lunch due to the high cost of development and implementation FSMS in the food industry (Macheka *et al.*, 2013; Qijun and Batt, 2016). Many studies are exploring the relationship between the quality management system and business performance (e.g. Lakhal, Pasin and Limam, 2006; Clegg, Gholami and Omurgonulsen, 2013; Kafetzopoulos and Gotzamani, 2014). No single existing study investigates a direct positive relationship between the extent to which companies implement FSMS and business performance. It is necessary to

assess the degree to which the implementation of FSMS impacts on business performance through available data at their firms such as financial performance, and operational performance. For the reason that it would be more practical to encourage firms to review and update their FSMS implementation continuously when they recognise the link between FSMS and business performance.

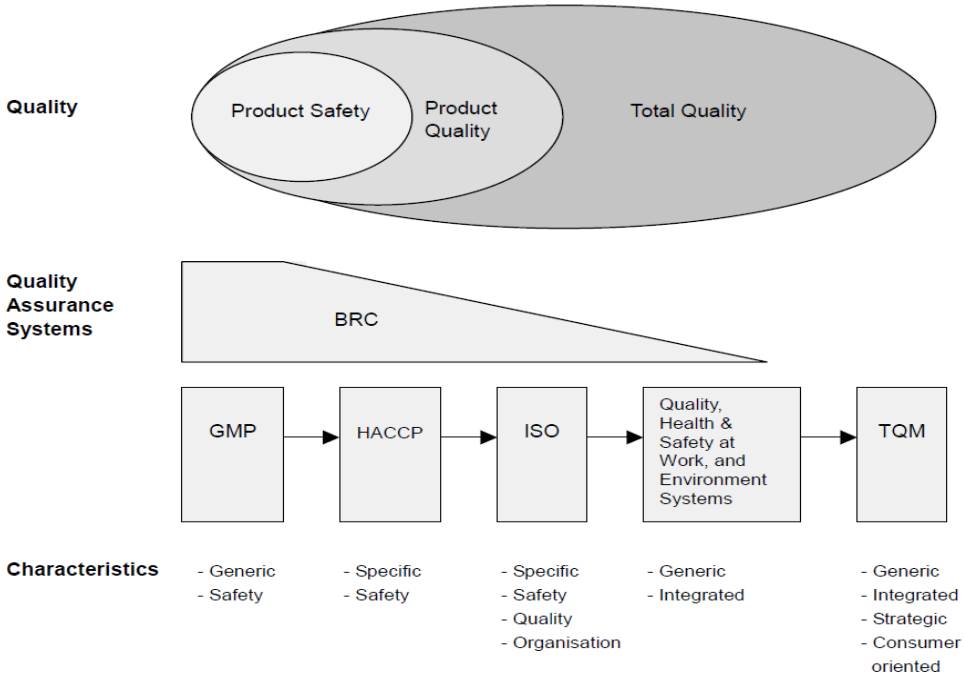

Figure 1.2 QA system in the food industry in relation to quality aspects

(Adopted from Hoogland, Jellema and Jongen, 1998)

1.4 Research objective and questions

With the aforementioned issues, to enhance the understanding of food safety management in the global supply chains as well as facilitate managers in improving the implementation of FSMS at food firms, this thesis aims to:

- Give a systematic review of the literature in food safety management in the global supply chains to identify research gaps in the area.
- Qualitatively investigate CSFs for FSMS implementation in a specific context of the food industry to understand the reasons underlying each CSF.

- Propose a model for measuring the FSMS implementation based on their regulatory requirements and standards.
- Empirically test the proposed hypotheses to identify CSFs, the relationship between them and FSMS implementation as well as the relationship between FSMS implementation and business performance.
- Identify Best practice among the studied firms and explore the differences among them in term of CSFs, criteria of supplier selection and supply chain relationship to inform the optimal strategy of FSMS implementation. Then, suggest potential improvement areas where the studied firms could pay more attention to improve the implementation of FSMS.

Therefore, the research questions generated to accomplish these research objectives, which will be answered at the end of the thesis can be listed as follows:

RQ1: With the complexity of the global supply chains, how do food manufacturers manage and improve the implementation of FSMS based on CSFs leading to safer food production?

RQ2: Why is a factor considered as a critical success factor to FSMS implementation, and what is the priority order of these CSFs to improve the current practice based on the perception of experienced managers in the food industry?

RQ3: Whether and to what degree do CSFs influence FSMS implementation at firms in the context of the global supply chains?

RQ4: Whether and to what degree does the implementation of FSMS affect business performance?

RQ5: Do the CSFs vary significantly across food firms depending on their different FSMS implementation?

RQ6: Whether the groups that have better FSMS implementation pay more attention to safety criteria than others and are in better SC relationship than their counterparts?

1.5 Research scope

The scope of the study helps to delineate clearly the extent of content that will be covered by means of the research in order to generate more logical conclusions and give conclusive and satisfactory answers to the research questions. Hence, it is fundamental to clarify the research scope at the early stage for the purpose of developing valuable insights. Managing the implementation of FSMS has long been a question of great interest in a wide range of research fields such as Food Science, Operation Management and Supply Chain. This thesis positions under the umbrella of Operation Management and Supply Chain disciplines.

Not to mention, the global food supply chains comprise all supply chain activities (i.e. farming, processing, distributing, storing, packaging and so on) within the interactions of different parties in association with the material, products, finance and information flow from farm/water to fork from every corner of the globe. This thesis spotlights on food manufacturing and exporting sector in developing countries. The reason for focusing on this sector is that they highly interact and are in a vertical relationship with other stakeholders in the supply chains as illustrated in Figure 1.3, from regulatory authorities, importers, distributors to service providers and sometimes directly to consumers. Additionally, they are in charge of transforming raw material from farm/water into consumable food products.

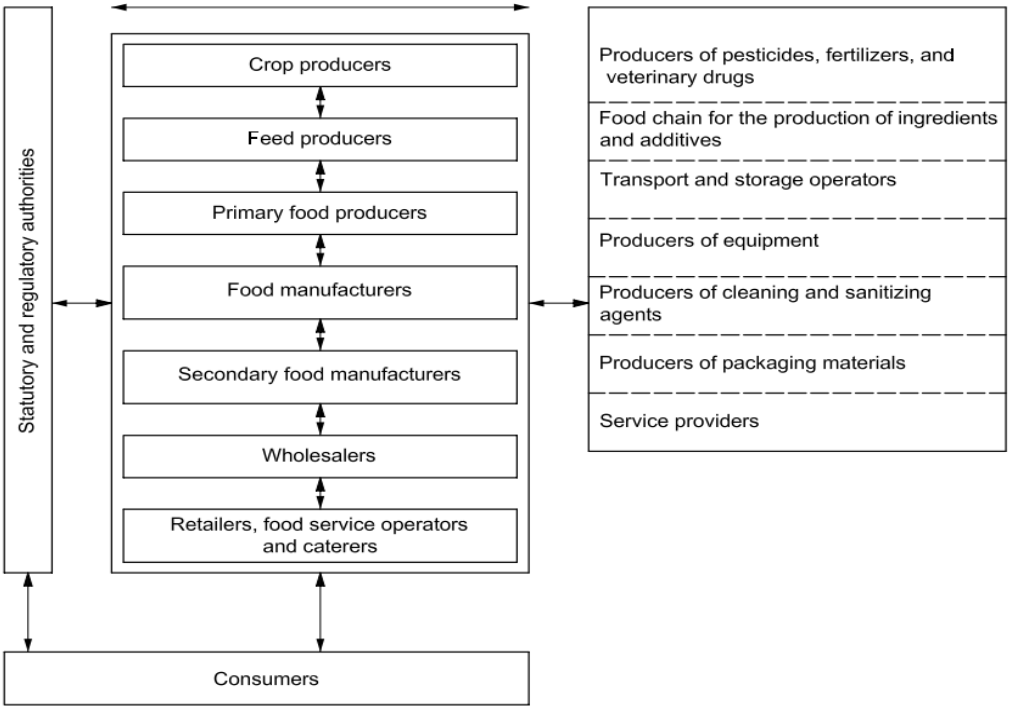

Figure 1.3 Example of interaction within the food supply chains

(Adopted from ISO, 2005)

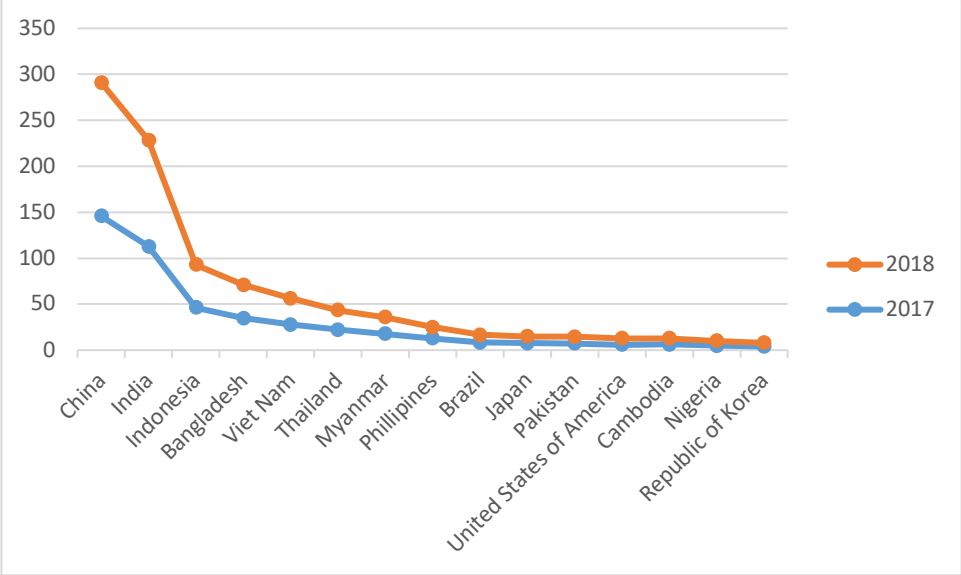

Figure 1.4 Leading rice producers in the world

(countries listed according to their position in global production - million tons, sourced from FAO, 2019)

Also, according to reports of FAO (2016) and FAO (2019), there are many leading food producers and exporters in developing countries, namely rice (Figure 1.4), fish and fishery, agricultural products. Therefore, how these

organisations manage their FSMS implementation, and ongoing improve practices to fulfil the stringent requirements is very critical to the worldwide food supply chains.

1.6 Structure of the thesis

The thesis consists of six chapters as the followings.

Chapter One – Introduction: This chapter states a general overview of the research background, needs, the generated research questions, the scope and contributions of research, and the structure of this thesis. It briefly outlines the incentives for this research.

Chapter Two – Systematic literature review: Using systematic literature review (SLR) method, this chapter aims to provide the theoretical background for the thesis, discuss the current challenges to enhance the understanding of FSMS in the global supply chains as well as the approach using CSFs as a dynamic strategy to identify improvement opportunities. In detail, a comprehensive representation of current knowledge is generated and critically evaluated as well as analysed based on the objectives of this chapter. Moreover, it is both explicitly focused on CSFs of FSMS implementation and sufficiently broad to capture their interactive from the organisational to the boarder environments in which food firms operate.

Chapter Three – Research methodology: This chapter explains the methodology, philosophy, approach, strategies and choices that established the foundation for the research works in this thesis. After defining the overall research design, the chapter looks for justifying the methodological choices to meet the research objectives by outlining the application of data collection and analysis methods.

Chapter Four – A qualitative study of Chinese and Vietnamese exporters' perspective on critical success factors for FSMS: grounded on the research challenges identified in Chapter Two, this chapter takes a closer look at the fishery exporting industry in China and Vietnam to investigate what are the CSFs and why they contribute to the success of FSMS implementation by

examining the chain in its entirety and by explicitly exploring at the organisation, market and governance levels in the global supply chains.

Chapter Five – An empirical investigation of critical successful factors for FSMS and business performance: while the qualitative study focuses on 'why' the experienced exporters consider some factors are more important than others in FSMS implementation, this chapter further investigate whether and to what degree identified CSFs influence FSMS implementation among not only fishery exporters but also other types of food exporters in China and Vietnam. The research from the case study presented in Chapter Four – The qualitative (QUAL) phase helps to develop better measurements with specific samples of populations and to see if data from a few individuals can be generalised to a large sample of a population in the quantitative (QUAN) phase. In addition, whether and to what degree FSMS affect business performance at firms are also analysed. After that, Best practice is identified based on two-step cluster analysis to explore whether their CSFs and practices related to supplier selection and SC relationship vary significantly across food firms depending on their different FSMS implementation to suggest areas in which firms should pay attention and give priority to improving.

Chapter Six – Conclusion: This chapter addresses the findings on CSFs, the relationship between FSMS implementation and business performance, the practices related to supplier selection and SC relationship along with improving suggestions for the studied firms. It also suggests the limitations of this thesis and provides the directions as well as recommendations for further research agenda for researchers and several practical implications for practitioners of the food industry in managing and improving FSMS implementation to guarantee food safety in the global food supply chains. Figure 1.5 illustrates how each chapter is related to the others from Chapter Two to Chapter Five.

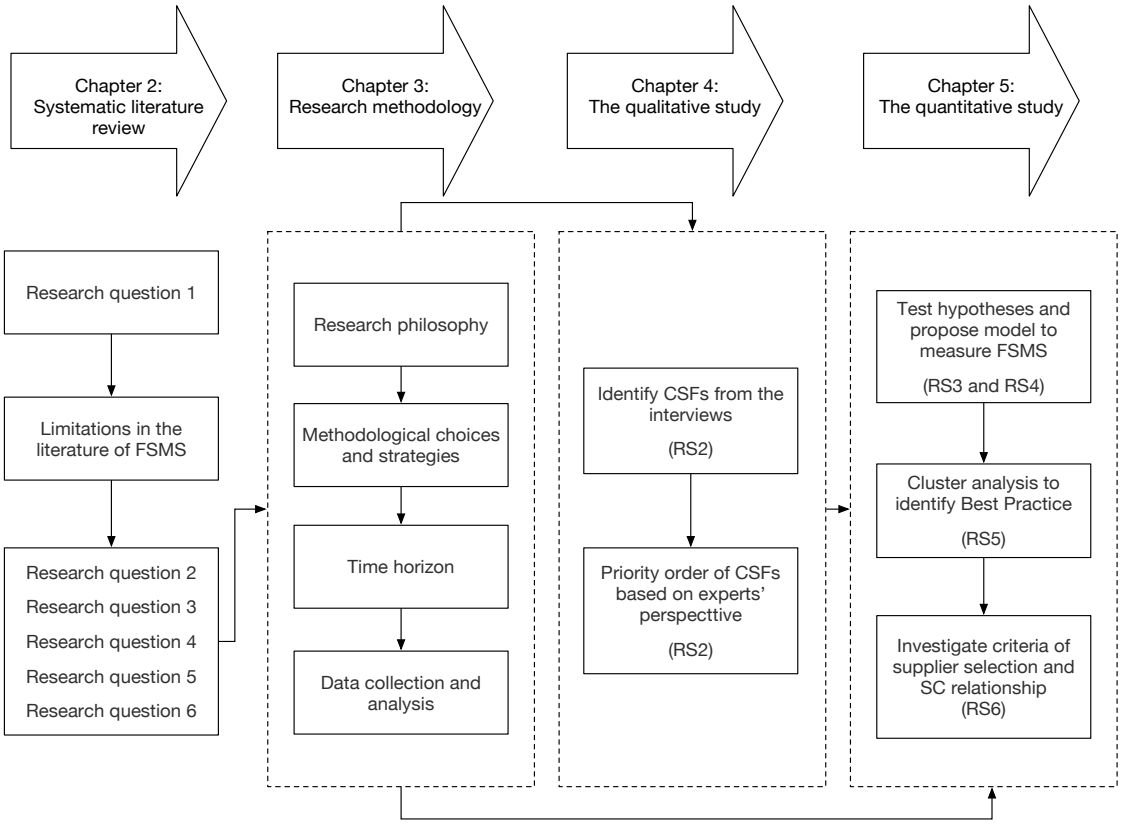

Figure 1.5 The structure of the thesis

CHAPTER 2 SYSTEMATIC LITERATURE REVIEW

2.1 Chapter introduction

This chapter presents the systematic literature review to investigate and summarise the latest findings on CSFs for FSMS implementation. It provides the theoretical background for the study and identifies the gaps of the literature that need to be filled in order to enhance the understanding of FSMS in the context of the global food supply chains. In detail, a comprehensive representation of current knowledge is generated and critically evaluated as well as analysed based on the review questions. Moreover, the review is both explicitly focused on CSFs of FSMS implementation and sufficiently broad to capture their interactive from the organisation to the boarder environment in which food firms operate. This SLR, therefore, sets out to:

- Clarify FSMS definition and summarise the managerial requirements of FSMS from the existing research.
- Review the measurements of FSMS implementation in the global food supply chains.
- Extract the existing CSFs leading successful FSMS implementation from the previously published studies.
- Identify research gaps in managing FSMS implementation and seeking continuous improvement opportunities.

The rest of the chapter is structured as the followings. The next section describes the methodology of the review that is followed. Section 2.3 presents the findings organised by the first three research objectives above. In Section 2.4, the known and unknown about CSFs of FSMS implementation in the context of global food supply chains are identified to establish the theoretical background as well as the research needs for the following chapters of the thesis. Finally, it is a brief conclusion restating the answer to the research question of SLR and summarising the value of the chapter in Section 2.5.

2.2 SLR methodology

As Cochrane Collaboration defined, a systematic review is a review of a clearly formulated question that uses systematic, reproducible and explicit methods to identify, select, and critically appraise relevant research, and to

collect and analyse data from the studies that are included in the review (Higgins and Green, 2011). Given the critical role of literature reviews in creating and building bodies of knowledge and informing policy and practice, Denyer and Tranfield (2009) provide the guidance of five steps to conduct a systematic literature review (SLR) in the field of management and organisation studies. Durach, Kembro and Wieland (2017) also suggest these steps of SLRs as a new paradigm accounting for the ontological and epistemological foundations of supply chain management research in their reviews. In the same manner, Thomé, Scavarda and Scavarda (2016) offer an SLR guideline for operation management scholars including eight steps by slitting the last steps and adding 'updating the review'. In this chapter, these SLR guidelines are combined, and then a five-step SLR is applied to answer the research question related to the CSFs of FSMS implementation in the global food supply chains as illustrated in Figure 2.1.

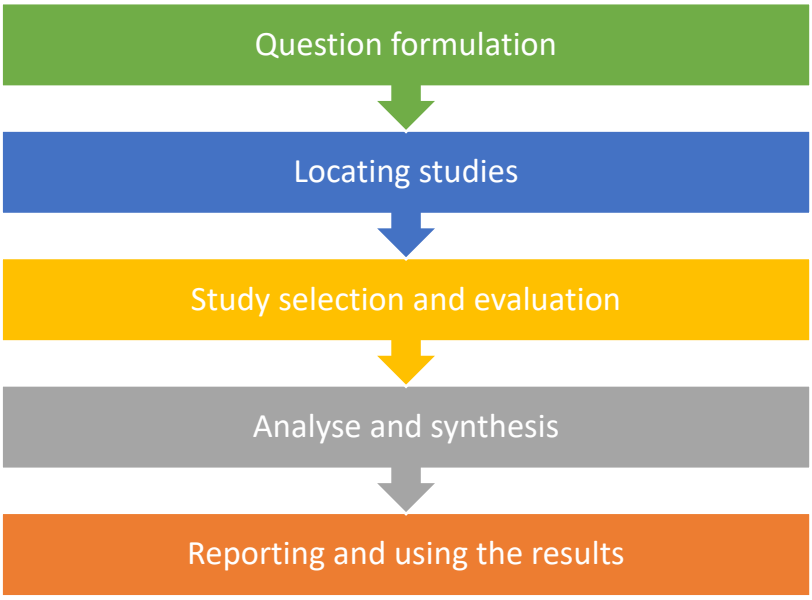

Figure 2.1. Systematic review methodology

(adapted from Denyer and Tranfield, 2009; Durach, Kembro and Wieland, 2017)

2.2.1 Question formulation and locating studies

In order to have a comprehensive search strategy, the first step is to formulate a clear research question that establishes the focus and criteria of the review (Denyer and Tranfield, 2009). The CIMO-logic (Context,

Intervention, Mechanisms and Outcomes) is obtained to specify the four critical parts to be investigated in a well-built systematic review. It is constructed as 'in this class of problematic Contexts, use this Intervention type to invoke these generative Mechanism(s), to deliver these Outcome(s)' (Denyer, Tranfield and van Aken, 2008; Denyer and Tranfield, 2009). Using this logic to the study, it emerges that the management of FSMS implementation has gained increasing attention in the global supply chain context due to the enormous negative impacts of food safety incidents on human heaths, society, economics, and environment. In this context, characterised by increasing level of global complexity and stringent food safety requirements, FSMS implementation is required to be successfully managed and improved by food manufacturers in order to ensure food safety. Hence, the main question of this study is: with the complexity of the global supply chains (Context), how do food manufacturers manage and improve (Intervention) the implementation of FSMS based on CSFs (Mechanism) leading to safer food production (Outcome)?

A set of keywords connected to the above question of the study is derived based on a brainstorming process. The search commerce with an investigation of citation databases using the string keywords by combining Boolean operators with parentheses complex search (Denyer and Tranfield, 2009). Data is collected from the Science Citation Index (SCI) compiled by the Institute for Scientific Information (ISI) from 2003 to 2018. Web of Science, which is a web-based user interface of Thomson Reuters ISI Databases, is used in this review to search for keywords within all databases such as WOS, BCI, BIOSIS, CCC, DRCI, DIIDW, KJD, MEDLINE, RSCI, SCIELO, and ZOOREC. The reason for this selection is that the ISI Citation Databases is 'the most used sources for facilitating a researcher's access to high-quality, latter-day research' (Papavlasopoulos *et al.*, 2010). Moreover, the results retrieved from these databases can be easily accessed, well-organised and accurately analysed thanks to the available functions of the Citation Report.

2.2.2 Search strategy

The complex string of keywords is constructed to reduce too generic and broad results instead of using keywords or simple string of keywords. For

instance, the string ‘food safety management’ generates 4869 records, then ‘implement* food safety management’ generates 953 records. However, this search strategy would create a lot of duplications. Therefore, the complex string of keywords is used for searching as the following: [‘Critical success factor’ OR ‘Critical success factors’ OR ‘Critical factor’ OR ‘Critical factors’] AND [‘Food safety’ OR ‘Food safety management’ OR ‘Food safety management system’] AND [‘Supply chains’ OR ‘Global supply chains’] AND [‘Management’] AND [‘Implementation’].

The SLR flow diagram is in Figure 2.2. There are 198,630 records generated based on this complex string instead of using separated keywords. Then, the research results are refined by Web of Science Categories including only Business, Economics, Food Science Technology, Management and Operation Research Management Science, remaining 6,506 records. Also, only English articles selected, the number of records is narrowed down to 3,343. There are 67 pages with 50 articles per page listed on Web of Science. At this stage, the author read page by page to ensure substantive relevance by requiring that selected articles contain at least one keyword in their title or abstract as the suggestion of Newbert (2007).

After this process, there are 1,075 records chosen. Besides the ISI database, other sources containing 50 documents are used such as records identified from Google Scholar, published theses from previous PhD students who share the same research interests as well as reports, publications and working papers from BS EN ISO, WHO, FAO, Codex. In total, 1125 documents are further investigated by reading abstracts to eliminate irrelevant records regarding the SLR research question. After this process, there are only 457 records remaining. Among the remaining records, after further ensuring substantive relevance by reading all remaining articles in their entirety, there are only 122 articles related to the research context – the global food supply chain. These articles are full text accessed to finalise the studies for the synthesis stage. More than 40 papers have been eliminated during this process. In the end, there are 71 papers qualified to be reviewed.

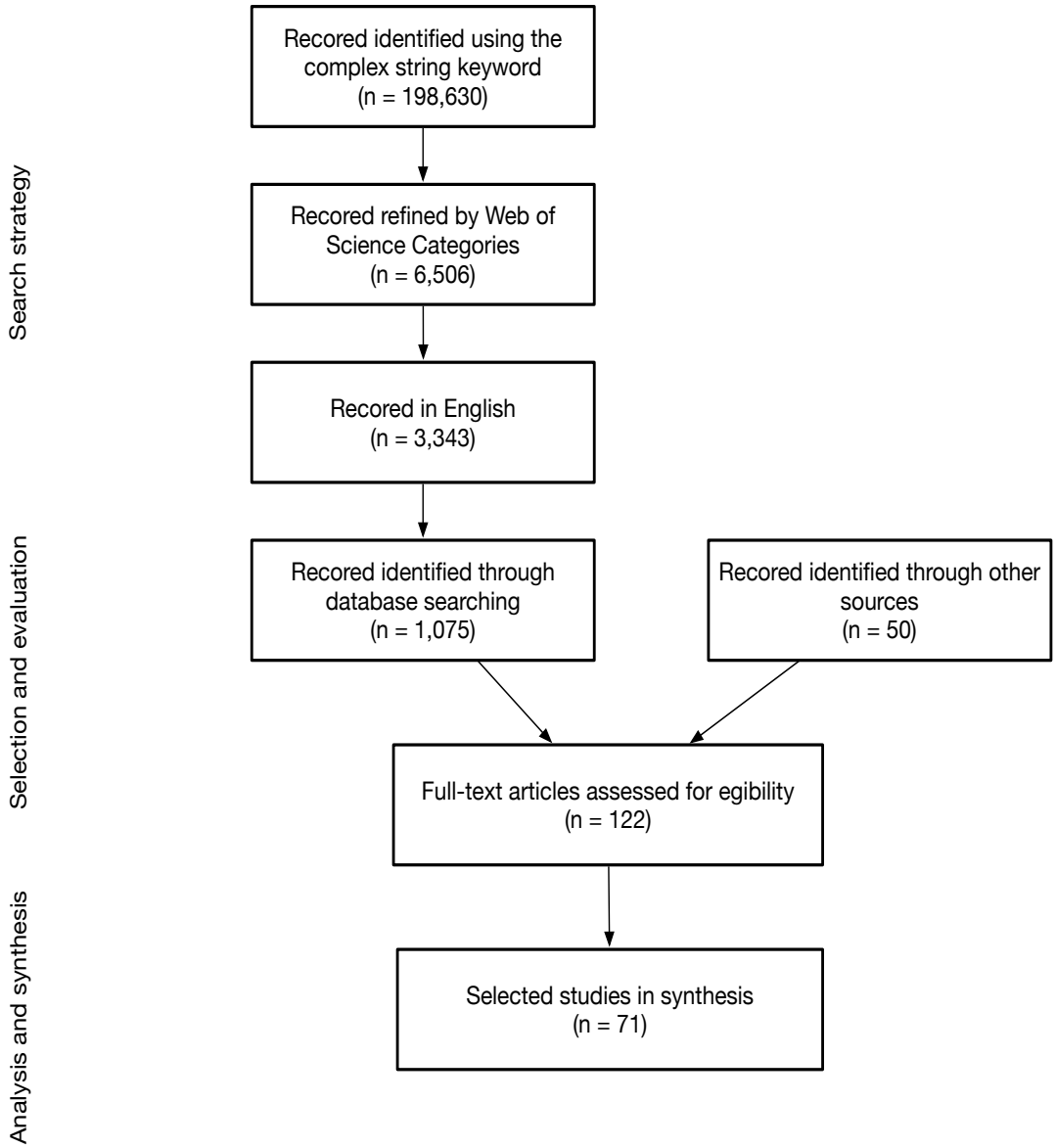

Figure 2.2. The SLR flow diagram

(adapted from *Moher* et al.*, 2009; Saunders, Lewis and Thornhill, 2015)*

2.2.3 Study selection and evaluation

A structured extraction procedure is created to capture the critical elements of each study, including purpose, design/methodology/approach, contribution and paper type. The purpose of using a set of explicit selection criteria is to assess the relevance of each study whether they do address the review question (Denyer and Tranfield, 2009).

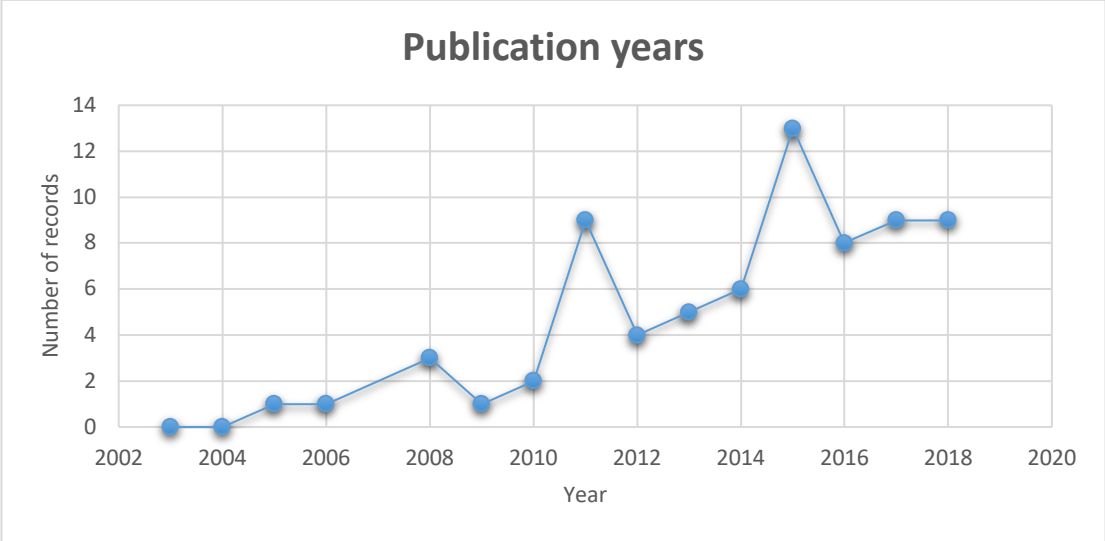

Figure 2.3. Total publication by year of the selected papers

After this procedure, there are 71 selected records including 59 articles, seven reviews, and six proceeding papers relevant to the research questions and need to be further examined from 2003 to September 2018 (Figure 2.3). These papers have been cited 1331 times, and average citations per item are 18.75 and h-index of 21. Figure 2.4 shows the frequency of articles being cited by year. Food Control journal dominates in this research area having the most cited articles within the review list accounting for six papers (Table 2.1). The most cited study is the work of Roth *et al.*, (2008) on Journal of Supply Chain with 180 times cited since 2003 to 2018 and it is the highest average cited with 16.36 times per year (

Figure 2.5). The descriptive analysis of the 71 sources revealed that 45% of the total were published in Food Control with 32 papers, 4% from Trends in Food Science Technology, 3% from Journal of Food Protection (Figure 2.6).

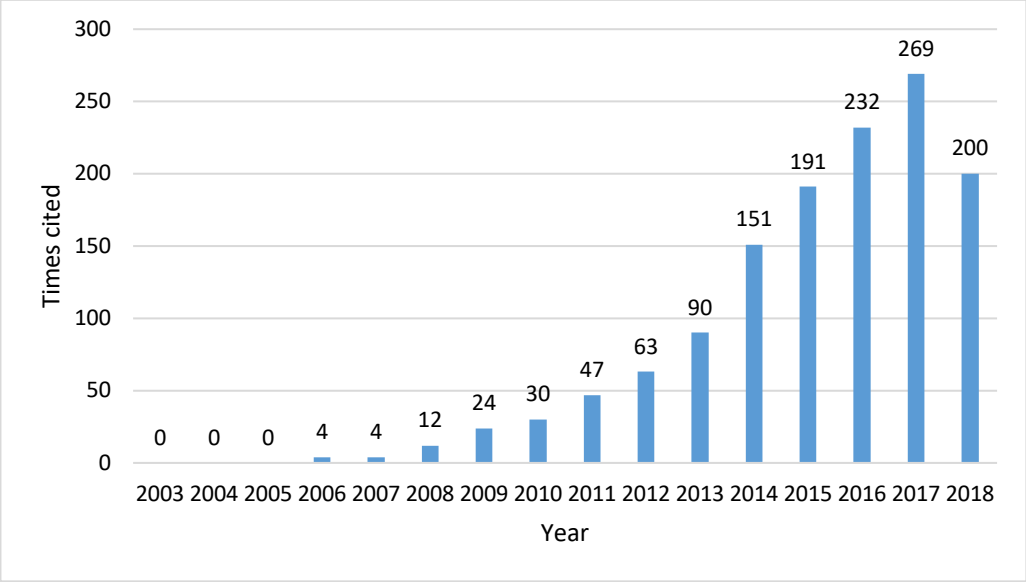

Figure 2.4. Sum of times cited by year from 2003 to 2018

Table 2.1. Information of top 10 cited articles in the review list

No.	Title	Authors	Source title	Publication year
1	Unravelling the food supply chain: strategic insights from China and the 2007 recalls	Roth et al.	Journal of Supply Chain Management	2008
2	Product safety and security in the global supply chain: Issues, challenges and research opportunities	Marucheck et al.	Journal of Operations Management	2011
3	Food safety knowledge and practices among food handlers in Slovenia	Jevsnik et al.	Food Control	2008
4	Implementation of food safety management systems in the UK	Mensah and Julien	Food Control	2011
5	Food safety objective: An integral part of food chain management	Gorris	Food Control	2005
6	Adoption of HACCP system in the Chinese food industry: A comparative analysis	Jin, Zhou and Ye	Food Control	2008
7	Barriers and benefits of the implementation of food safety management systems among the Turkish dairy industry: A case study	Karaman et al.	Food Control	2012
8	Food safety performance indicators to benchmark food safety output of food	Jacxsens et al.	International Journal of Food Microbiology	2010

	safety management systems			
9	Semi-quantitative study to evaluate the performance of a HACCP-based food safety management system in Japanese milk processing plants	Sampers et al.	Food Control	2012
10	A tool to diagnose context riskiness in view of food safety activities and microbiological safety output	Luning et al.	Trends in Food Science and Technology	2011

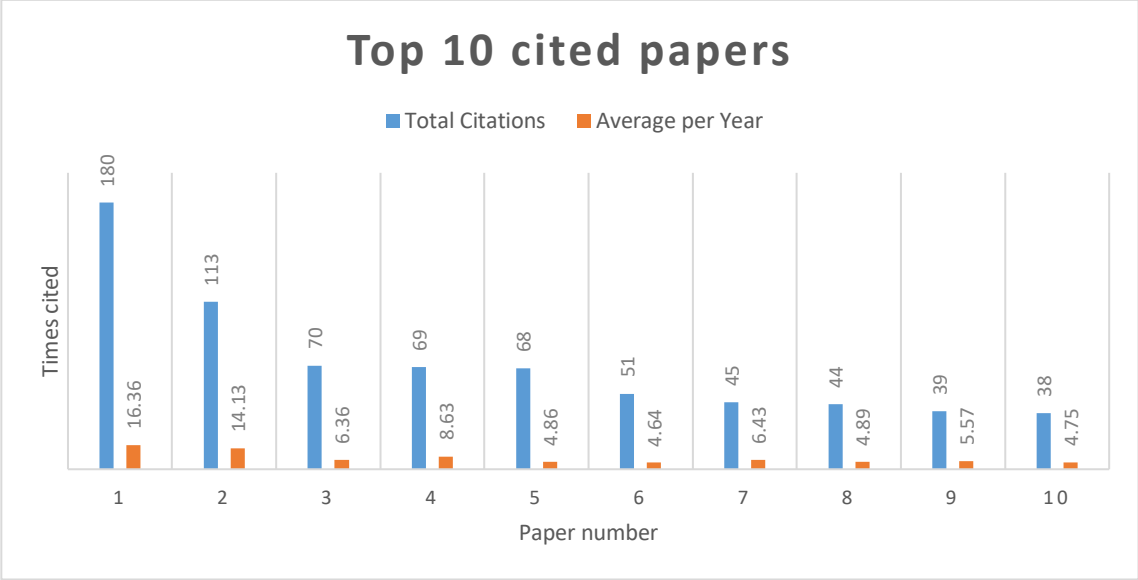

Figure 2.5. Citation of top 10 cited papers in the review list

The rest 33% are from several journals, namely Journal of Supply Chain Management, Journal of Operations Management, Global Food Security, Food Research International, and so on. These journals have high Journal Impact Factor (JIF 2017/2018) in the research area, namely Trend in Food Science Technology (6.609), Journal of Supply Chain Management (6.105), Journal of Production Economics (4.407), Food Control (3.667) and Food Research International (3.52).

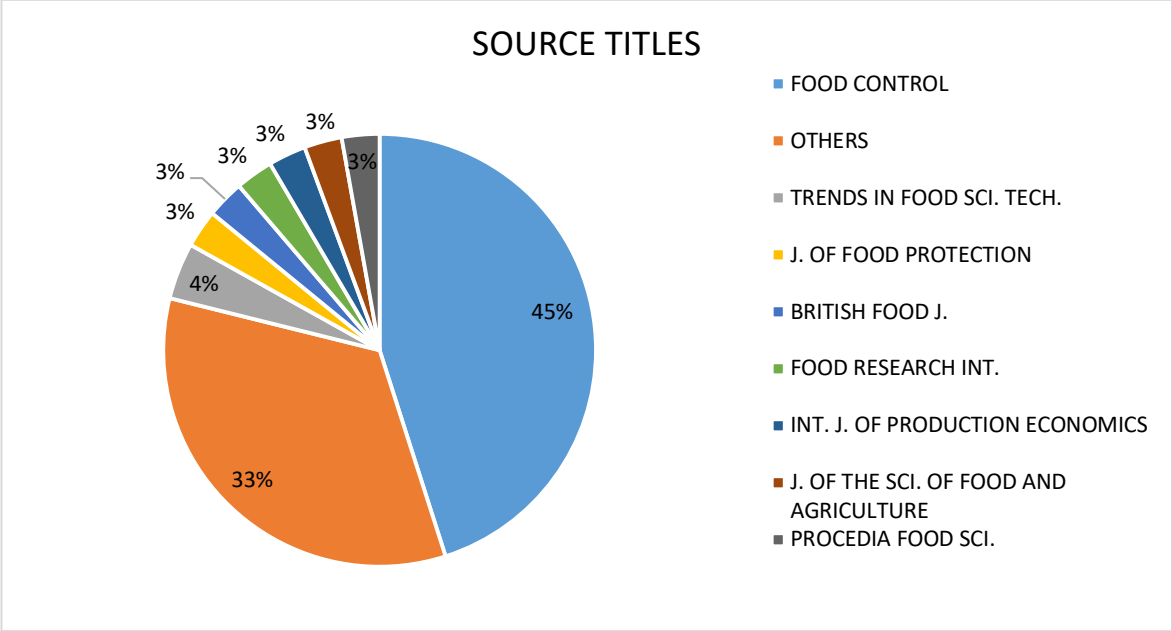

Figure 2.6. Source titles of selected papers

Ghent University and Wageningen University are the leading institutions in this field, accounting for 40 records. These papers are mainly from the research areas of Food Science Technology, Business Economics and Agriculture (Figure 2.7).

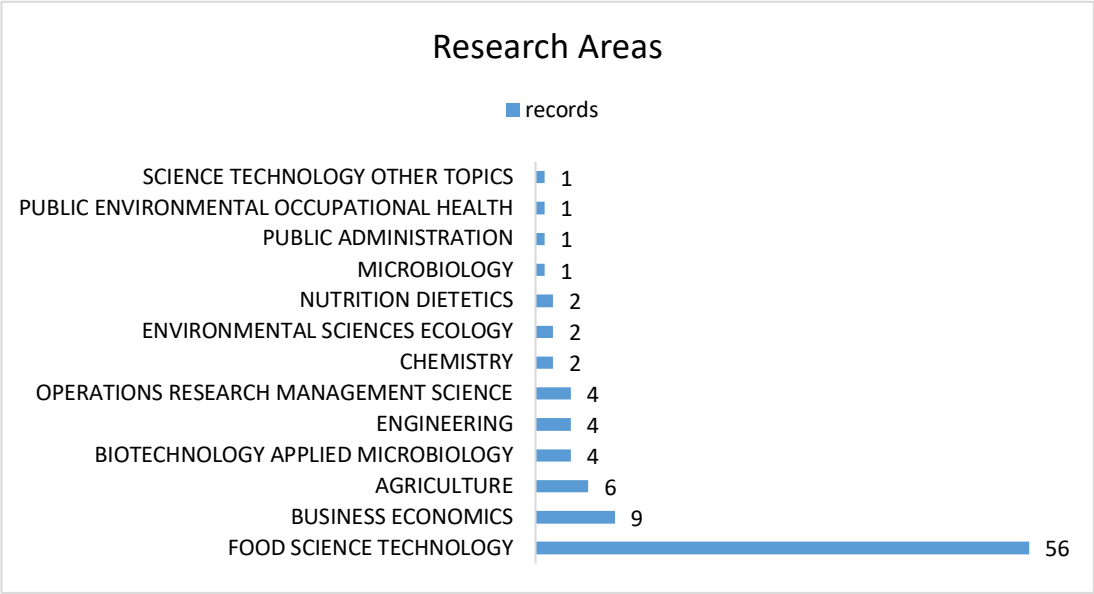

Figure 2.7. Research areas of the reviewed papers

2.2.4 Analysis and synthesis

In this stage, the reviewed papers are analysed by breaking down individual studies into constituent parts, then synthesis by making associations between

elements. This work aims to develop and reorganise knowledge that is not apparent from reading the individual studies independently into a new arrangement (Denyer and Tranfield, 2009). The rationales used to extract, synthesise, and interpret the findings are in the below classification framework.

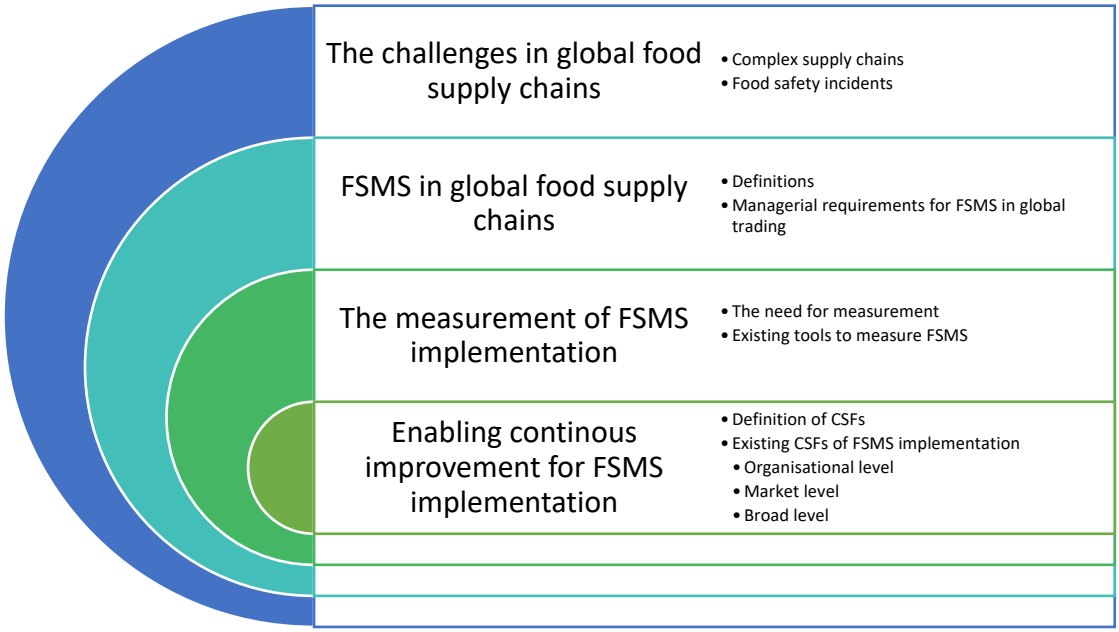

Figure 2.8. The framework of literature review classification

As Figure 2.8 shows, it is structured to enable a holistic research analysis of this review. The first group presents the challenges associated with global food supply chains. The second group provides a recap of the managerial requirements of FSMS to deal with these challenges from the trends in the literature. The third group summaries the need and existing tools to measure FSMS implementation applied in the previous studies within 15 years. Finally, the last group unify the definition and extract the existing critical success factors (CSFs) of FSMS implementation as an enabling mechanism for continuous improvement from previously published research. Collectively, they cover critical concerns of the paramount issues in measuring and improving the FSMS implementation of food manufacturers in global trading. The next section presents these four groups of content.

2.3 The findings of SLR

2.3.1 Global food supply chains

Food is increasingly produced, traded and consumed in worldwide dynamics. Globalisation is considered as the source of competitive advantage in all industries, and the food industry is no exception. On the one hand, it could bring many benefits to organisations in term of cheap labour and materials, better financing opportunities, larger product markets, arbitrage opportunities, and additional inducements offered by host governments to attract foreign capital (Manuj and Mentzer, 2008; Roth *et al.*, 2008; Marucheck *et al.*, 2011). On the other hand, globalisation of the food industry increases the level of complexity involving the high level of risks and vulnerabilities (Whipple, Voss and Closs, 2009). First, food supply chains deal with natural products, most of them are perishable and could become harmful to consumers if not managed in a timely and safe manner (Akkerman, Farahani and Grunow, 2010). Second, it is likely to be long and highly interconnected in which products exposed move along the supply chain continuum from planting, raising, catching and sourcing to manufacture, transportation, distribution, and final sale to the consumer (Trienekens and Zuurbier, 2008; Henson *et al.*, 2010; Unnevehr, 2015). Moreover, supply networks, including firms from a multitude of countries with considerable differences in production systems, infrastructure, regulatory frameworks and technical capacities, are complicated (Marucheck *et al.*, 2011). Finally, food safety risk, which means a function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard, may occur and can be compromised at any point of the food chain from farm to fork (EC, 2002). Therefore, the need for food safety presents an enormous challenge for the global food trade since safe food is the essential requirement regardless of its origin from around the world. The management of food safety refers to the development of actions to reduce the likelihood of food contamination and prevent the resulting harmful consequences of unsafe food, such as illness, death or adverse consequences to people (Akkerman, Farahani and Grunow, 2010).

Furthermore, food safety concerns have been dramatically increasing over the past century as the results of several high-profile food scares from all over the world, namely Melamine in Chinese milk products (Roth *et al.*, 2008), Salmonella-contaminated peanuts in the U.S (Leighton, 2016), dioxins in the Republic of Ireland (Bánáti, 2011), E.coli contamination of bean sprouts in Germany and France (Soon, Seaman and Baines, 2013), Tesco horse meat scandals in the UK (Sarpong, 2014) and so on. These food scandals led to severe impacts not only on human health but also on social and economic aspects. For instance, in the case of Chinese milk products, an estimated death of some children and 54,000 babies being hospitalised from kidney stones and kidney damage. The responsible companies have been closed down due to bankruptcy. Not to mention, the general manager and several company officials in the Chinese case are in jail, and two have been sentenced to death (Marucheck *et al.*, 2011). In the case of the massive distribution of salmonella-contaminated peanuts in 2008–2009 in the U.S that caused nine deaths, 11,000–20,000 illnesses and the recall of 4000 products (Leighton, 2016). For that reason, these anxieties have led consumers to be more sensitive to food safety issues and all relevant sectors to develop and strengthen a more effective food safety system to moderate food safety risks.

As an illustration of Table 2.2, reviewing several high-profile food scares from all over the world reveals that the performance of food safety management of the whole supply chain could be limited by the strength of the weakest link. These weakest links could be the inadequate manufacturing capacity in the case of peanut butter, input materials had been contaminated and adulterated in the event of horse meat scandal or deceitful behaviour of the managers in the case of milk product.

Table 2.2. Reasons behind high-profile food safety incidents

References	Incidents	Year	Reasons
Qiao, Guo and Klein (2010)	Melamine in Chinese milk products	2008	Milk products were contaminated by melamine on purpose to fool food quality inspectors
Bánáti, (2011)	Dioxins in the Irish pork	2008	The animals may have eaten contaminated dioxin feed

Basu, (2015)	Salmonella outbreak in peanut butter paste in U.S	2008-2009	Filthy conditions at the plant where federal inspectors found roaches, rats, mould, dirt, accumulated grease and bird droppings during their raid. They also found a leaky roof.
Sample, (2011)	E. coli contamination of bean sprouts in Germany and France	2011	The outbreak strain in a package of sprouts from the suspect farm
Laurence, (2013)	Horse meat scandals in EU	2013	Three factories two in Ireland and one in Yorkshire as the source of beef products that had been contaminated or adulterated.

Food safety is, therefore, a responsibility that is shared by regulators, producers, processors, distributors, retailers, and even consumers. Under these demands on food safety, the firms in global food supply chains have paid more attention to food safety management such as complying with regulatory frameworks which include both of international and national standards, reforming of institutional structures and responsibilities, strengthening capacities for inspection and conformity assessment, etc. (Marucheck *et al.*, 2011). However, it is difficult to control the risk of food products through their transference and transformation through numerous links interconnecting a worldwide network of firms. That explains why food scandals still happen on a regular basis, and in many cases, the source of contamination was never identified (Sarpong, 2014). All things considered, the assurance of food safety management is a crucial concern in the global food trading.

2.3.2 FSMS in global food supply chains

2.3.2.1 Definitions of FSMS and FSMS related-standards

According to CAC (2009), people have the right to expect the food they eat to be safe and suitable for consumption and all the sectors in the food supply chains have share responsibility to guarantee and tackle food safety risks (FAO/WHO, 2001). Firms in global food chains need to establish food safety management systems (FSMS) as regulatory demands such as requirements in the Regulation (CE) 852/2004, CAC (2009), and international standards namely the British Retail Consortium's global food safety standard (BRC), the International Food Standard (IFS), the Safe Quality Food (SQF) 2000 Level 2,

and the ISO 22000:2005. The international standards that are common among food producers in global supply chains are (Tzamalis, Panagiotakos and Drosinos, 2016):

- ISO 22000 is a standard containing requirements for the food safety management systems relating to the entire food supply chain (ISO, 2005).
- BRC Global Standard for Food Safety has been developed to specify the safety, quality and operational criteria required to be in place within a food manufacturing organisation to fulfil obligations concerning legal compliance and protection of the consumer (BRC, 2015)
- HACCP (Hazard Analysis and Critical Control Points) is a system that identifies, evaluates and controls hazards that are significant for food safety (CAC, 2009).
- IFS International Food Standard is a quality and food safety standard for retailer (and wholesaler) branded food products, which is intended to assess suppliers' food safety and quality systems, with a consistent approach that harmonises both elements (IFS, 2014).
- The SQF Code is a HACCP-based supplier assurance code for the food industry from farm to fork (SQFI, 2014).

There are many definitions in the literature that clarifying the characteristics and key elements of FSMS as illustrations in Table 2.3. Likewise, Mensah and Julien (2011) summary and compare the vital common requirements for food safety management among the international standards (Table 2.4).

Table 2.3 Definitions of FSMS

References	Definitions
ISO (2005)	A combined of the recognised key elements to ensure food safety along the food chain: interactive communication, system management, prerequisite programmes, HACCP principles.
Luning *et al.* (2008)	A system consists of (1) control activities including all strategies aimed at keeping product and process conditions within acceptable safety limits and (2) assurance activities aimed at setting systems requirements, evaluating system performance and organising necessary changes.

Scott and Chen (2010)	A group of interacting or interdependent elements forming a network to ensure that food presents minimal risk to consumers.
Jacxsens *et al.* (2011)	A highly custom-made system as a result of the implementation of various quality assurance and legal requirements into each company's production, organisation and environment.

Table 2.4 Key common requirement for food safety standards

(Adopted from Mensah and Julien, 2011)

FSMS elements	BRC	HACCP	ISO 22000	SQF	IFS
Management system	✓	✓	✓	✓	✓
Prerequisite programs	✓	✓	✓	✓	✓
HACCP	✓	✓	✓	✓	✓
Validation & verification	✓	✓	✓	✓	✓
Emergency preparedness/crisis management	✓		✓		
Quality management	✓			✓	✓

These prior studies have indicated the main activities of an FSMS, including management system, HACCP, validation, crisis management or correction actions. The installation of these requirements into a company forms an interacting and dynamic system that is highly customised based on differently organisation's characteristic due to the different processes (i.e. slaughtering, butcher shops) and type of companies (i.e. industrial operations versus SMEs) along the food chains. There are various levels of FSMS from the perspective of the government to the industrial level. Scott and Chen (2010) state that there could be a horizontal FSMS that extends from farm to fork, but in practice, food safety efforts are segmented into multiple systems which are tailored to specific types of operations of each sector in the food industry, such as farmers, slaughterers, manufacturers, retailers or restaurants. However, no matter how different these FSMSs are, the ultimate purpose is to ensure that foods are safe with respect to foodborne hazards.

2.3.2.2 Managerial requirements for FSMS in the context of global supply chains

Given the vital role of FSMS in the food industry and the need to manage it properly, reviewing all the relevant papers is undertaken to summarise the managerial requirements for an FSMS. First, regulations and standards compliance is the essential element of all FSMS. This is the results of extensive global sourcing of food products accompanied by (1) additional costs for oversight, logistics, pipeline inventory and quality management, (2) heightened vulnerability and higher supply risks stemming from potential supply disruptions, lack of accountability, lower visibility and quality failures, (3) issues concerning global financing and funds transfer, and (4) lower responsiveness due to longer lead times (Roth *et al.*, 2008). Moreover, the whole supply chain which includes the series of processes, operations, and entities that help to take the food from its raw material state to our plates. If there is one node of these series breached or contaminated, it can result in unsafe food that is hazardous to human health. In other words, the safety of the whole food chain is the safety of each link. As a result, there is a significant evolution toward tougher requirements and more stringent food-safety governance since 1990s thanks to advances in hazard detection and epidemiology. In order to assure food safety globally, scientific and regulatory consensus on best approaches to risk management (Mensah and Julien, 2011; Unnevehr, 2015). For instance, there has been an increase in the number of standards that seek to enhance food safety such as HACCP, the BRC, IFS, SQF, and the ISO 22000:2005. The harmonious objective of these standards is to protect consumer health through an integrated process-based food safety management based on the basic minimum requirements acceptable for food safety, and third-party audits (Mensah and Julien, 2011). Previously, these standards were considered voluntary for food operators to apply and there is a stream in the literature discussing how these stringent standards impact on food producers, especially SMEs and family businesses in developing countries (e.g. Henson and Reardon, 2005; Henson and Humphrey, 2010; Schuster and Maertens, 2013). Currently, the global recognition of these standards is performing the task of a framework for

uniformity in requirements, mutual acceptance of audit procedures and audits as well as reassurance in the capability and competence of suppliers as Mensah and Julien (2011) discuss. Some of them have become commonly mandatory in most of the countries such as the case of HACCP principles.

Second, food safety is required to be grounded on scientific evidence and assessment of the risk to the population, and this risk assessment should be quantitative where feasible (FAO/WHO, 1997). It is challenging to determine safety risks before consumption associated with the potentially devastating effects of food safety incidents on human health. Hence, in food production, end product testing is not an efficient approach to ensure food safety. The risk-based preventive approach is implied in FSMS through specifying the necessary minimum requirements acceptable for food safety. Based on these requirements, food manufacturers proactively prevent food safety incidents from occurring due to various types of hazards in any food chain stages that can cause the end product to be unsafe, rather than just reacting to the incidents. In particular, taking necessary actions to manage and allowing the highest priority regarding resources and activities to be placed on the risks deemed to have the most significant potential impact. Thus, there are much research using different approaches to assess food safety risks such as the study of Gkogka *et al.*, (2013) shows two different risk assessment approaches to derive the potential appropriate level of protection (ALOP) for Salmonella in chicken meat in the Netherlands. One is a 'top-down' approach, based on epidemiological data, and the second is a 'bottom-up' approach, based on food supply chain data. Wang, Li and Shi (2012) and Chan and Wang (2013) also propose integrated risk assessment approaches to perform structured analysis of aggregative food safety risk in the food supply chain by using the concepts of fuzzy set theory and analytical hierarchy process. They provide structured risk assessment and establish aggregative food safety risk indicator as a practical tool which can be effectively employed in incorporating the safety objectives into operations planning. Furthermore, food safety assurance is based on the establishment of appropriate control measures and operational food safety management throughout the food supply chain, which form a comprehensive system as the organising framework. One critical characteristic

of any system is that it cannot be fully explained or understood by merely studying each of its components individually. Instead, it must be explained by understanding how each part or component interacts and influences other components (Yiannas, 2009).

Last but not least, it is proven that none of FSMS is perfect even that system had certificated and well audited and inspected in the past. Cormier *et al.* (2007) argue that the audits, which include a visit to the facility and review of records, can only confirm that the procedures and processes of the manufacturing system are being implemented as planned. Later, Powell *et al.*, (2013) express some criticisms on the (third party) audits and inspections, and state that they are not enough to guarantee food safety due to the fact that they reflect only a snapshot in time and cannot guarantee future performance. The authors also give many examples of foodborne illness outbreaks from commercial food operators that had a high score of audits or inspections. The existing body of research on FSMS suggests that fundamentally fulfilling the minimal requirements of regulations and standards are not sufficient (Kok, 2009; Kafetzopoulos, Psomas and Kafetzopoulos, 2013). Therefore, it is essential to strengthening FSMS and ongoing compliance with regulations and standards by continuous improvement approach that enables companies to achieve both operational and business objectives sustainably. FSMS is an integrated process management system including a variety of procedures based on Deming's cycle from planning of the steps (Plan), implementation day-to-day operations (Do), verification (Check) of PRPs, control measures and system performance, and improvement (Act) by reviewing the overall system performance (ISO, 2005). As a result, FSMS is underpinned by the continual improvement that is an integrative management philosophy means 'is a recurring activity to increase the ability to fulfil requirements' (ISO 9000:2000). Specifically, this paradigm seeks the continual improvement of machinery, materials, labour utilisation, product quality and safety, and production methods through the application of suggestions and ideas of team members. In simple words, managers should continually seek to improve the effectiveness and efficiency of the processes of the organisation, rather than wait for a problem to reveal opportunities for improvement.

2.3.3 The measurement of FSMS implementation

Certifying an FSMS is a must in international trading, but it does not guarantee the optimum level of managing food safety hazards, consequently absolute food safety, and the quality of the end products (Fotopoulos, Kafetzopoulos and Psomas, 2009; Kok, 2009; Kafetzopoulos, Psomas and Kafetzopoulos, 2013). Most of the studies concerning the management of FSMS are related to the measurement that Lord Kelvin (1824 -1907) once said, 'if you cannot measure it, it does not exist'. Neely, Gregory and Platts (1995) emphasise that the results of measurement could support organisations in term of resource allocating, work structuring, management information, reward and sanction in addition to technical or operational activities. Likewise, FSMS implementation must be assessed regularly to ensure that the goals are achieved. In the literature, several suggestions have been made with regard to the measurement of FSMS implementation. Many authors (Fotopoulos, Kafetzopoulos and Psomas, 2009; Luning *et al.*, 2008) indicated that the availability of a diagnostic instrument to assess the implementation of FSMS was rather restricted. As a result, Luning *et al.*, (2008) and Jacxsens *et al.* (2010) were the pioneers in building the measurement system of FSMS implementation based on the diagnostic instrument (FSMS-DI) and microbial assessment scheme (MAS) to assess a company's FSMS; including control, preventative and core assurance activities, as well as their contributions to the system, outputs under impact of the riskiness of contextual factors.

The measurement gives insight into the level of implementation of the different activities in the current FSMS. The actual microbial performance and the food safety output in these studies can be used by food business operators in firms' internal auditing process and provide evidence about major factors affecting the status of FSMS. It is designed to identify the bottlenecks in the current practice and where improvements are necessary. Within a decade, these approaches have been widely adopted by many researchers for a variety kinds of food supply chains, namely fresh produce (Luning *et al.*, 2008; Klementina Kirezieva *et al.*, 2013; Sawe *et al.*, 2014; Nanyunja *et al.*, 2015), animal-based processing (Jacxsens *et al.*, 2010; Luning *et al.*, 2015), meat and dairy (Jacxsens *et al.*, 2011; Njage *et al.*, 2018), lamb (Osés *et al.*, 2012),

fish processing (Kusaga *et al.*, 2014), raspberries chain (Rajkovic *et al.*, 2017) to evaluate status of FSMS based on the system output and the insight that a company has on its implementation (e.g. results of external inspections or audits, results of sampling). However, most of the research above focus on those activities that specifically aim at controlling and assuring microbiological food safety, leaving chemical and physical hazards out of the scope (Jacxsens *et al.*, 2010; Luning *et al.*, 2011). Also, this diagnostic tool is not simple to be widely applied due to the requirement of experts' or researchers' participation in organising workshops to explain and train managers to identify the level of all indicators. Especially, some part of the assessments demand to test microbiological samples (Kirezieva, Jacxsens, *et al.*, 2015). Therefore, due to these limitations, food firm managers cannot use this tool as a daily basis to continuously assess and improve their current practices.

Using different approach and research method, Kafetzopoulos, Psomas and Kafetzopoulos (2013) develop an instrument for measuring the effectiveness of the HACCP-based FSMS and its critical objectives including identification, assessment and control of foodborne hazards. They affirm the effectiveness of FSMS in connection with the extent to which its prescribed safety targets are met and the validation of this instrument in the food manufacturing sector. The simple instrument of this study contributes to encourage, facilitate and improve the food companies' self-assessment process. It helps to guild them in adopting the proper manufacturing practices concerning food safety, leading to the achievement of aims and consequently enhanced business performance. Though this study does not take into account determinant factors that influence FSMS implementation. To fill this gap, Kafetzopoulos and Gotzamani (2014) further develop this approach to propose a more systematic model for measuring the effectiveness of quality (ISO 9001) and HACCP-based FSMS thanks to their stated objectives when these systems are jointly implemented in a food company. They also investigate the critical factors for effective implementation of the ISO 9001 and HACCP systems and examine the degree to which the combined application of ISO 9001 and HACCP influences the overall performance of the certified firms. This HACCP-based

FSMS emphasises on hazard analysis as the key requirement of an effective FSMS (ISO 22000, 2005). One major drawback of this approach is that it does not give sufficient consideration to other vital elements such as prerequisite programmes, communication and system management as requirements of many standards and regulations (i.e. ISO 22000, BRC, SFQ, IFS). As Mortimore and Wallace (2013) confirm the needs of many prerequisites and other management support activities since HACCP by itself cannot control food safety even though it is the centre in the way that risk-based program requires hazard analysis and risk evaluation skills. Moreover, these approaches are very promising thanks to its simplicity, but it requires more evaluation due to possible bias from the subjective perspectives of quality managers or top managers within studied firms.

2.3.4 Enabling continuous improvement for FSMS implementation

2.3.4.1 Definition of CSFs for FSMS implementation

To reduce the failure of FSMS and to respond to the needs for continuous improvement, identifying and evaluating CSFs for the successful implementation is vital (Roth *et al.*, 2008; Mensah and Julien, 2011; Wilcock, Ball and Fajumo, 2011; Kafetzopoulos and Gotzamani, 2014; De Boeck *et al.*, 2018). In the literature of food safety management, CSFs is interchangeably used as 'enablers', 'successful implementation factors' or 'key success factors' and categorised in 'critical factors' in many studies on FSMSs (e.g. van Asselt *et al.*, 2010; Mensah and Julien, 2011; Kafetzopoulos and Gotzamani, 2014; Taylor and Taylor, 2015; Xiong *et al.*, 2017; Walsh and Leva, 2018). Nevertheless, in their studies, few writers have clarified the definition of CSFs in FSMS implementation, or there is no separation in categorisation both barriers and enablers in the same group of 'critical factors'. An example of this is the study carried out by Fotopoulos, Kafetzopoulos and Psomas (2009) in which indicate 'the CFs of an effective HACCP system can be viewed as those factors that should effectively be managed in order to ensure the system's successful implementation and consequently food safety'. In other study, Kafetzopoulos and Gotzamani, (2014) suggest 'in order to detect Critical Factors for Effective Implementation of quality and FSSs, one should identify:

a) the usual barriers/difficulties/limitations faced in their implementation, as well as b) the true motives for their implementation, since it has widely been supported in literature that these motives are critical to their overall success and contribution to performance improvement'. These unclear viewpoints could lead to misunderstand the impact of CSFs and influence the way practisers apply the research findings, which are the primary objective of FSMS studies. Hence, based on the discussion of CSFs in the literature, this study uses the definition of CSFs for FSMS implementation are *those few things that must be taken into sufficient consideration by food firms to ensure success for FSMS implementation*.

2.3.4.2 Existing CSFs of FSMS implementation

Once an FSMS has been developed, no doubt that it will interact with its surrounding environments. At any scale (regional, national, local, and organisational), FSMS implementation could be influenced by many factors because global food supply chains are complicated by a large number of stakeholders are involved with an enormous variety of structures, logistics, and chain participants will undoubtedly change rapidly, scale-up and diversify continuously (Gorris, 2005). In the light of searching for improvement opportunities of FSMS implementation, researchers and consultants have suggested various factors that lead to successful FSMS from different perspectives in the context of complex global supply chains to assist food companies. Prior studies that have examined the three fundamental levels in which FSMS implementation are influenced (Kirezieva, Jacxsens, *et al.*, 2015). The first is the organisation consisting of sufficient resources in each firm. The second is the market in which the organisation has an interactive relationship with others within the food chains. The last is the 'broad context' as defined in the research of Kirezieva, Jacxsens, et al. (2015) that could influence on FSMS implementation including food-safety governance, agro-climatic (for the case of leafy green) and public policy environment, especially in the context of global supply chains. These identified CSFs from those three levels are discussed in the following subsections.

2.3.4.2.1 Organisational level

According to ISO 22000 (2005), to fulfil food safety objectives, 'the organisation should provide adequate resources for the establishment, implementation, maintenance and update FSMS'. These resources include human resources, infrastructure, and work environment. A great deal of previous research has focused on the impact of the organisational environment on FSMS performance. For example, human resource or employee characteristic is considered as the topmost challenge in implementing FSMS, and it could attribute as determinant factors of quality and food safety effectiveness (Fotopoulos, Kafetzopoulos and Psomas, 2009; Kafetzopoulos and Gotzamani, 2014). Nyarugwe *et al.* (2016) state that employee characteristics describe an individual's attitudes, knowledge and perceptions of food safety and hygiene control. Particularly, other authors suggest it also consists of the degree of employee involvement (Luning *et al.*, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; Fotopoulos, Kafetzopoulos and Gotzamani, 2011; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Luning, *et al.*, 2015), their efficient knowledge and skills to ensure food safety (Kafetzopoulos and Gotzamani, 2014), awareness of the relevance and importance of their activities in contributing to food safety (ISO, 2005; Yiannas, 2009; Nyarugwe *et al.*, 2018), training programs for employees to improve current level of the above requirements related to food safety (Singh and Smith, 2006; Kafetzopoulos and Gotzamani, 2014; Xiong *et al.*, 2017).

Likewise, Trienekens and Zuurbier (2008) state that an essential factor for developing country producers to take part in international chains and implement standards required in Western markets is the enabling business environment such as institutional and infrastructure facilities. In addition, management or leadership in the firms plays a key roles in providing commitment to support food safety objectives and ensuring the availability of required resources and adequately trained staff (Luning *et al.*, 2008; Trienekens and Zuurbier, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; Fotopoulos, Kafetzopoulos and Gotzamani, 2011; Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Jacxsens, *et al.*, 2015) as well as establishing the food safety policy and culture within organization (Yiannas,

2009). Managers are also in charge of updating the system continually (ISO 22000:2005). Together, there is a large volume of published studies indicating that the organisational environment highly interacts with FSMS and affect its effectiveness. However, the previous studies have not dealt with other environments of FSMS, such as the levels of market and governance that are discussed in the next sections.

2.3.4.2.2 Market level

Kirezieva, Jacxsens, et al., (2015) define the market level as the structure of the market and supply chain, interactive relationship between organisations within the food chain that could affect FSMS performance. In support of this, the study of Kirezieva, Luning, *et al.* (2015) confirmed that collaborative/supportive supply chains contribute to more advanced FSMS and sound system output as firms demonstrated advanced knowledge and expertise about safety and quality management. These factors are adopted as chain characteristics in the group of the context factors (product, production, organisational and chain characteristics) affecting the design and operation of activities in the FSMS from several studies (Luning and Marcelis, 2007, 2009; Luning et al., 2011; Kirezieva et al., 2013; Kirezieva, Luning, *et al.*, 2015) that refer to the conditions during supply and relationships with other organizations in the chain. It is noticed that in this study, the researchers have not treated the definition of a collaborative/supportive supply chain in much detail with limited information such as the severity of stakeholder requirements, the extent of power in supplier relationships, the degree of information exchange in supply chain and so on. Their provided information cannot reflect the relationships in the chain as well as the degree to which the organisations collaborate with others. Also, one question that needs to be asked is whether the impact from other parties such as government, non-profit organisations (NGOs), business associations and financial institutes are significant on a firm's FSMS implementation. Many authors point out that implementing FSMS requires not only regulatory and market opportunities information but also technical and financial support from these parties (Kirezieva, Luning, *et al.*, 2015; Qijun and Batt, 2016). Additionally, Qijun and Batt (2016) confirm that difficulty in obtaining external funds is perceived as a significant financial

barrier to adopting a certificated FSMS. Nonetheless, no attempt was made to confirm or quantify the degree to which these factors of the market environment, including support from other parties and collaborative activities in the supply chains influencing FSMS implementation.

2.3.4.2.3 Food-safety governance

The level of 'broad context' in the research of Kirezieva, Jacxsens, et al. (2015) could influence on food firms' FSMS are food-safety governance, agro-climatic and public policy environment. They define agro-climatic environment is climate zone and production season. While public policy environment is subsidies and other policy measures aimed at influencing the market, quality and safety of food products (Kirezieva, Jacxsens, et al., 2015). In this study, agro-climatic and public policy environment are out of the research scope. They are assumed to change relatively small and slow, and only food-safety governance is analysed in depth. In the case of food safety, governance is aimed at assuring compliance of food companies to the food safety standards and regulations (Rouvière and Caswell, 2012). Food-safety governance, like any other governance, is the result of public and or private enforcement (Kirezieva, Jacxsens, *et al.*, 2015). The enforcement strategy consists of different practices; commonly used ones for the enforcement of food safety are: audits and inspections, incentives (sanctions and stimuli), information and education, and sampling/monitoring (Yapp and Fairman, 2006; García Martinez and Poole, 2004; Garcia Martinez *et al.*, 2007; Rouvière and Caswell, 2012; Kirezieva, Jacxsens, *et al.*, 2015). In the global food trading, there are significant variations in food-safety governance across countries and among value chains, which increase the burden of auditing costs and certifications on food manufacturers, as retailers require different certification frameworks to qualify suppliers (Mensah and Julien, 2011). Only a few previous research pay attention to investigate the impact of food-safety governance and FSMS implementation (e.g. Rouvière and Caswell, 2012; Richards et al., 2013). Nevertheless, these studies concentrate on the context of FSMS at the company level; the broad environment of the country and sector have not been considered. For instance, the study of Luning *et al.* (2015) investigates the influence of a public standard on the FSMS without analysing the underlying

governance mechanisms. Kirezieva, Jacxsens, et al., (2015) realise the gap and suggest further research concerning how food-safety governance as the sub-systems of the 'broad environment' influence FSMS implemented at firms.

To sum up the existing CSFs of FSMS implementation, a summary of existing CSFs extracted from the emerging discussion as an approach to increase the effectiveness of FSMS implementation excluding the review papers is presented in Table 2.5. It is noticed that CSFs from the organisational level tend to be more concerned by many researchers, whereas the others are mainly distributed by Kirezieva, Jacxsens, *et al.*, (2015). Among the organisational level, it is evident that standardised food safety procedure, leadership and human resource related factors are affirmed as the top most important factors to FSMS implementation in these studies. Many authors argue that this is the way food enterprises responding to the requirement of stricter food-safety governance to assure food safety globally as the discussion in the above section. In the market environment, establishing collaboration and developing a more integrated relationship among the parties within the supply chain are essential to unify food safety assurance in the food supply chain as suggestions of these studies. Also, external supports in term of the finance to be able to invest in structure, equipment and staff training, information to expand the market and update FSMS, industry associations and non-governmental organisations are examined (Fotopoulos et al., 2009; Mensah and Julien, 2011).

These practices are essential to FSMS due to the burden and costs of more stringent food safety monitoring have a growing tendency of being shifted from importing countries to exporting countries, from developed countries to developing countries, from retailers to suppliers (Liu, 2009; Henson and Humphrey, 2009; Clarke, 2010). In the broader environment, these studies are likely to emphasise the existence of the broad context on FSMS performance without measuring their level of impacts (Mensah and Julien, 2011; Kirezieva, Luning, *et al.*, 2015). In term of the methods that these studies use, the above table is colour-coded following their research methods, in particular, quantitative (blue), qualitative (green), case study (orange) and mixed method (red). It is realised that the research stream on CSFs for FSMS has been

mostly restricted to the confirmation of their presences by empirical studies or qualitative analyses. A possible explanation for this might be that most researchers want to simplify the investigated factors and variables in the previous researches.

Table 2.5. Existing CSFs in FSMS implementation

			Roth *et al.*	Fotopoulos, Kafetzopoulos & Psomas	Wilcock, Ball & Fajumo	Mensah & Julien	Kafetzopoulos & Gotzamani	Kirezieva, Luning, *et al.*	Kirezieva, Jacxsens, *et al.*	Xiong *et al.*
Authors										
Year			2008	2009	2011	2011	2014	2015	2015	2017
Sample country			USA	Greece	Canada	UK	Greece	12 countries	Spain, Belgium & Norway	China
Organisational level	Leadership	Managers' commitment								
		Awareness								
		Food safety culture								
	Human resource	Communication								
		Commitment								
		Training								
		Awareness								
		Involvement								
	Equipment									
	Technology									
	Standardised procedure									
Market level	Trust in relationships									
	Collaborative supply chains									
	Target market (export or domestic)									
	External support									
Broad environment	Food-safety governance									
	Agro-climatic									
	Public policy environment									

2.4 The identified gaps in the literature

The review of research evidence in the field of food safety management, derived from the urgent need for safer food supply chains, provides some insights highlighting gaps and incongruent findings in the existing literature.

2.4.1 The management of FSMS implementation in global supply chains

The research findings presented in the previous section point out the vital role of FSMS and introduce many realistic approaches to manage and measure it by the existing researches on FSMS (e.g. Fotopoulos, Kafetzopoulos and Psomas, 2009; Luning *et al.*, 2011; Mensah and Julien, 2011; Klementina Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Xiong *et al.*, 2017). It is interesting to note that these authors have successfully created and verified many useful and practical tools in evaluating FSMS implementation, which is applied and tested in various kinds of food supply chains concerning food safety objective. Then, their analyses reveal the performance of the different activities in the current FSMS along with the actual microbial performance, and the food safety output that could be used by food business operators in firms' internal auditing process. Moreover, they also provide evidence about major factors affecting the status of FSMS. Applying firms' self-assessment process as a different approach, some studies measure FSMS to encourage, facilitate and guide food companies in improving and adopting a better manufacturing practice aiming food safety (Kafetzopoulos, Psomas and Kafetzopoulos, 2013; Kafetzopoulos and Gotzamani, 2014). The previous researchers have confirmed that the assessment of FSMS implementation is needed for the firms to control the efficiency and effectiveness of the system as well as ensure that the goals are achieved. *Moreover, these authors call for further study on FSMS assessment and identifying the mechanisms to encourage firms to update their practices continuously.*

In particular, there are two important requirements for assessing FSMS implementation. First, measuring instruments are required to be easy-to-use for managers and food safety teams as daily basis tools. Since preventative approach in FSMS requires them to be quick responding and take necessary actions as well as allow the highest priority regarding resources and activities to be placed on the risks deemed to have the most significant potential impact. Second, this review also indicates many demanding requirements for FSMS in the food industry and the critical role of well-performed FSMS towards a safer global food supply chain, which requires food manufacturers to improve their current practices continuously. Thus, the outcomes of these measurements should be able to reflect the status of the system and produce noticeable improvement opportunities for firms' current practices to fulfil the stringent requirements of FSMS in global supply chains. *From the literature, there is a notable lack of convincing decision-making tools to assist food enterprises in assessing FSMS implementation. This assessment must lead to identify improvement opportunities and prioritise which area managers should pay attention to enhance and update the current practices, especially in the case of firms with limited resources.*

In term of managing the performance of a system, Neely, Gregory and Platts, (1995) suggest that performance measurement is the process of quantifying the efficiency and effectiveness of action. Hence, in the case of measuring FSMS, effectiveness refers to the extent to which food safety requirements are met, while efficiency should be a measure of how economically the firm's resources are utilised. It is interesting and somewhat surprising that current studies have only focused on the effectiveness of FSMS, whereas efficiency perspective receives little attention. Despite the fact that the ultimate goal of any business is to improve overall performance and seek for the maximisation of profit. *Consequently, researches on the management of FSMS would have been more realistic if they had focused on how such tools may indeed facilitate decision-making for food enterprises regarding the harmonisation of both food safety and business objectives.* Exploring the relationship between the implementation of FSMS and business performance as well as assessing the degree to which FSMS impact on

business performance using available data at their firms such as financial performance and operational performance would be more realistic to encourage firms to review and update their FSMS continuously.

Moreover, food safety is unnegotiable due to its enormous negative impacts on human health, society and economics. Most of the current studies on FSMS usually pay attention to HACCP principles or consider FSMS as a part of quality management (e.g. Cormier *et al.*, 2007; Sheriff, 2013; Green and Kane, 2014; Kafetzopoulos and Gotzamani, 2014; Al-Busaidi, Jukes and Bose, 2017). *There are little published studies focusing directly on FSMS, which wholly consist of the key elements, as discussed in the definitions of FSMS. FSMS must include not only the objective of hazard analysis but also other requirements such as prerequisite programs and other control activities.* Apart from that gap of the literature, *each firm is unique in production, organisation and the context in which it is operating, therefore, FSMS is highly customised resulting no 'one best way' for all food manufacturers.* Managing FSMS implementation should be a more practical approach regarding the differences between firms that is, therefore, recommended. For instance, benchmarking and best practice could be useful and practical ways in the management of FSMS implementation. The key strategy when applying best practice to organisations is the ability to balance the unique qualities of an organisation with the practices that it has in common with others. This approach shows its effective and practical application in the study of Tzamalis, Panagiotakos and Drosinos (2016). They apply FSMS-DI in combination with the 'Best Practice Score' in order to assess the performance of an SME as well as benchmarking practices and scores between firms. However, few authors have been able to interfuse this approach in the literature of FSMS implementation.

Last but not least, in their papers, Gorris (2005), Roth *et al.*, (2008) and Marucheck *et al.*, (2011) emphasise the field of operations management can provide fresh perspectives and insights in addressing the challenges of product safety and security in the complex context of global supply chains. Nevertheless, it is interesting that the development of conceptual works on measuring FSMS performance seems to be led by research in Food Science. Statistically, there are 56 records in this research field over 71 reviewed papers

in this SLR (Figure 2.7). Although most of the studies in FSMS implementation analyse based on the perspective of food supply chains or global supply chains, there are only eight records from Business Economics and four from Operation Management. Despite the limited in number, these records are in the top five of the highly cited papers within fifteen years of this review (see Table 2.1 and

Figure 2.5), which shows the qualified importance of their contributions within this research field. Moreover, performance measurement has been well-developed for decades in Operation Management discipline (Melnyk, Stewart and Swink, 2004). *Combining Food Science and Operation Management could help to build a multidiscipline construct to measure FSMS implementation based on multiple perspectives of stakeholders from farm to forks such as suppliers, manufacturers, distributors, and retailers.*

2.4.2 CSFs for FSMS implementation

Thus far, the above section has discussed that the identification of enabling a mechanism for the success of FSMS is critical to reduce the failure of FSMS implementation and to respond to the needs for continuous improvement of firms in global food supply chains. There is a growing body of literature that recognises CSFs in facilitating food manufacturers to focus only on the most important factors that lead to the achievement of their desired food safety level (Mensah and Julien, 2011; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Luning, *et al.*, 2015). There are many potential factors related to an organisation such as technology, strategy, market, and environment that affect FSMS failure and success (Fotopoulos, Kafetzopoulos and Psomas, 2009; Macheka *et al.*, 2013; Qijun and Batt, 2016). Narrowing down this set to those factors that are most critical is very helpful for managers to provide the necessary resources and support as well as develop the necessary policies, practices and procedures in time to increase the effectiveness of FSMS implementation. Also, other researchers draw meticulous attention to the interactions and relationships between and within the FSMS as well as the context in which they operate (Luning *et al.*, 2011; Kirezieva, Jacxsens, *et al.*, 2015).

Nevertheless, these studies have not attempted to address the concern about factors related to the broader environment of FSMS. *The evidence from this chapter suggests that the most crucial limitation lies in the insufficient understanding of CSFs in the market level and food-safety governance*. Also, the FSMS analysis from a systematic perspective requires interactions and relationships between and within firms as well as the context in which they are operating. Thus, further studies on defining the direct and indirect influences along with their possible magnitude on FSMS are needed. There are only a few works investigated these environments, such as the study of Nanyunja *et al.* (2016) demonstrates how other stakeholders of supply chains influence on FSMS in Kenya and Uganda. There is an apparent shift in more advanced FSMS and higher system output between farms and trade companies in Kenya to respond to the demand of strict voluntary food safety standards from large retailers supplying the EU premium market. While traders in Uganda only have basic FSMS and low system output present with both farmers and traders due to the less demanding EU wholesale markets such as ethnic speciality shops. Another example of the influence of the market and food-safety governance on FSMS performance is the results from the work of Kirezieva, Luning, *et al.* (2015). They indicate that several factors have the dominating effect on the status of FSMSs in the global fresh produce chain. International export supply chains promote building capacity within companies in the chain to answer the stringent requirements of private brand standards. However, local institutional environments and the legislative framework in developing countries has negative consequences for the FSMSs in companies supplying the local markets. Additionally, standards play the role of an essential tool to trigger the maturation of the systems because some companies were lacking of motivations to comply with requirements. These findings, while preliminary, suggest that FSMS implementation cannot be investigated separated from its environments, especially CSFs within these environments.

Moreover, *none of the studies is able to suggest improvement opportunities as a result of assessing FSMS implementation considering the impact of CSFs contingent on the current situation of each enterprise*. Contingency theories suggest that there is a fit between the organisational structures and

contingency that has a positive effect on performance. As a result, maximum performance comes from the appropriate level of a structural variable that fits the contingency (Donaldson, 2001). In addition, it is evident that managing FSMS implementation is deeply contextual, divergent, and practice-related. Therefore, each firm will have different critical point needed to improve following their current practices. Up to now, the research stream on CSFs of FSMS implementation has been mostly restricted to the confirmation of their presences by empirical studies or qualitative analyses. There is a need to understand how and why a factor is considered as CSF and the degree to which they affect FSMS implementation. Constructed on that result, identifying improvement opportunities for FSMS could assist food firms' managers effectively in managing by prioritising CSFs to optimise available resources. Without this information, all factors seem important to FSMS implementation. Hence, firms' managers have no idea where to make a change or update first. This is exemplified in works undertaken by Kafetzopoulos and Gotzamani (2014) and Kirezieva, Luning *et al.* (2015) in which point out many critical factors without considering their interactions with each other and prioritising which factors should be improved or changed first. For large firms with potential financial and technological capabilities as well as years of global trading experiences, this approach could be easily done, but it is impossible for SMEs with limited capabilities (Luning *et al.*, 2015). Consequently, a much more comprehensive approach would evaluate and suggest a prioritising order of CSFs for FSMS implementation that could be a more realistic decision-making tool to facilitate food firms' managers in improving FSMS.

2.5 Summary

In this chapter, a systematic review of the literature following the research methodology of Denyer and Tranfield (2009) has been undertaken to identify the knowledge gaps in the research of FSMS implementation - concerning the need to understand how firms measure, manage, and improve their current FSMS in the global food supplying. There are 71 papers published within 15 years that are analysed and synthesised. Based on that, the challenges in managing FSMS and its managerial requirements are summarised as well as a set of the practices for food manufacturers measuring and improving FSMS

are reviewed and provided through a comprehensive analytical lens. The findings reported here emphasise the essential role of the FSMS implementation in global supply chains and point out the main gaps in measuring FSMS, the relationship between it and business performance, and identifying improvement opportunities for firms enhancing the level of safety guarantee from food production to final consumption grounded on the feasible application of CSFs theory. These identified gaps are summarised as the followings:

- Lacking assessment tools for food enterprises to identify improvement opportunities and prioritise which area managers should pay attention to improve FSMS implementation.
- The need of motivation for encouraging food firms to improve FSMS by exploring the relationship between the implementation of FSMS and business performance using their available data such as financial performance and operational performance.
- FSMS implementation is limited to the objective of hazard analysis excluding other requirements such as prerequisite programs and other control activities namely traceability, control of nonconformity, validation, verification, and continuous improvement.
- Most researches on CSFs for FSMS implementation has been mostly restricted to confirmation of CSFs' presents and focused only one level in each study.
- The lack of studies examining the interaction between CSFs and FSMS considering the differences among enterprises regardless the diverse business and operational environments of food manufacturers and exporters.

In the chapter that follows, the research methodology is presented to establish the research framework from broad philosophical assumptions to specific methods of data collection, analysis, and interpretation to tackle these research gaps identified in this chapter.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Chapter introduction

Creswell (2013) suggests in a study that it is essential for researchers to think through the philosophical worldview assumptions brought to the study, the research design related to this worldview, and the specific methods of research translating the approach into practice. Responding to the needs for a coherence philosophy throughout the thesis with the intention of addressing the research questions in the previous chapter adequately, this chapter aims to clarify the research methodology that establishes the research framework. It is expected to explain the philosophical strand, the research approach, the methodological choices, and the strategies as well as data collection techniques applied in this thesis following the research onion (Figure 3.1) developed by Saunders, Lewis and Thornhill (2015). In details, the aims of this chapter are as follows.

- Reflecting the epistemological, ontological and axiological stance of the philosophical assumption underlined in the study. Also, the research paradigm through the philosophical orientation about the world and the nature of research is revealed.
- Explaining the choices between deductive, inductive, and abductive approaches to theory development.
- Stating the importance of designing research, explaining the chosen research methods and strategies to answer the research questions and achieve coherence throughout the research design.
- Discussing the selected techniques and procedures to collect and analyse data.

This chapter is structured as the followings. Metaphorically, the first two layers of the onion will be presented in the next section that describes the research philosophy and approach to theory development. Section 3.3 sets out the next two layers of the choices in research methods and strategies. Time horizon is stated in section 3.4, while specific techniques and procedures are discussed in section 3.5 to clarify the protocol of data collection and analysis. In the end, section 3.6 is a summary recapping the research methodology of the thesis.

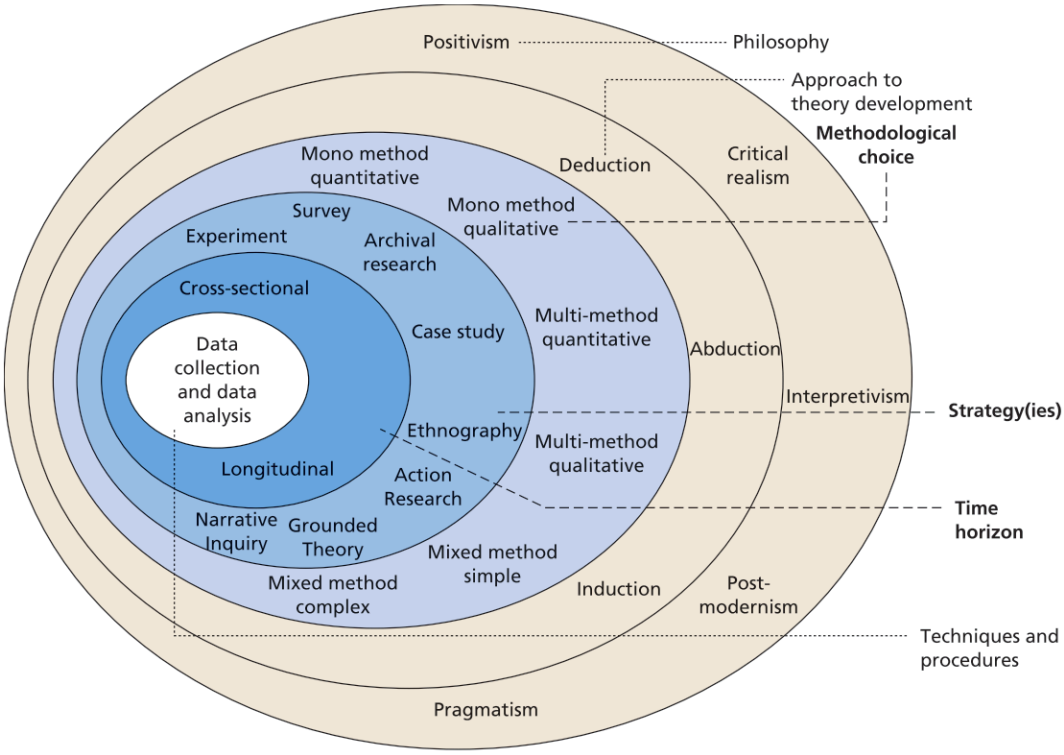

Figure 3.1. The research 'onion'

(adopted from Saunders, Lewis and Thornhill, 2015)

3.2 Research philosophy and approach

3.2.1 Research philosophy

Research philosophy is a system of beliefs and assumptions about the development of knowledge (Saunders, Lewis and Thornhill, 2015). It influences the practice of research and needs to be identified as ‘a basic set of beliefs that guide action’ (Creswell, 2013). At every stage in the research, there are a number of types of assumption including the epistemological assumptions about human knowledge, the ontological assumptions about the realities, and the axiological assumptions as to the extent and ways the researchers’ values influence the research process (Burrell and Morgan, 1979). These assumptions ineluctably form how researchers understand research questions, choose the methods, and how they interpret the findings (Crotty, 1998). A credible research philosophy will be constituted by a well-thought-out and consistent set of assumptions, which will strengthen the methodological choice, research strategy, data collection techniques, and

analysis procedures (Saunders, Lewis and Thornhill, 2015). There are five major philosophies in business and management research including positivism, critical realism, interpretivism, postmodernism, and pragmatism; which are different in ontological, epistemological, axiological assumptions, and typical methods according to Saunders, Lewis and Thornhill (2015).

Although the history shows that there are many extensive arguments among business and management researchers on what the best philosophy is and whether this discipline requires a multiplicity of research philosophies, paradigms, and methodologies; there is no agreement up till now. In lieu, Morgan (2006) argues that each research philosophy and paradigm make an exclusive and valuable contribution to the business and management research, indicating a distinctive 'way of seeing' organisational realities. Taking this pluralist approach, the primary concern of this research is investigating critical success factors for FSMS in global food supply chains to suggest potential improvement areas for the studied firms. Instead of focusing on methods, the central point of this study is to emphasise the research problems stated in the previous chapters and use all available approaches to understand and derive knowledge about them. In other words, the most crucial determinant for this research design and strategy is the research problems and the addressed research questions. Moreover, the main research object in this study is each firm's FSMS that is a highly customised system as a result of implementing various quality assurance and legal requirements into a company's unique production, organisation, and environment (Jacxsens et al., 2011). Numerous stakeholders are involved in FSMS, namely food firms, suppliers, importers, certificate bodies, governments and authorities, and end users. As a result, managing the implementation of FSMS is deeply divergent, contextual and practice-related upon each firm.

Consequently, no single point of view can ever give the entire picture of the research context, and there may be multiple realities leading to various ways of interpreting the observed premises and undertaking research. The truth, in this case, are practical effects of ideas and knowledge, which is valued for enabling actions to be undertaken effectively. The study begins with stated problems and aims to propose practical solutions that inform potentially

improved practices in FSMS implementation. In that sense, theories, concepts, hypotheses and research findings are not in an abstract form, but they play the roles as instruments of thought and action and concerning their practical consequences in the specific context of the investigation (Saunders, Lewis and Thornhill, 2015). Apart from the contributions to the body of knowledge in the food safety and supply chain management theory, this study is expected to support food manufacturers in the developing countries to improve their current FSMS implementation by practical solutions based on CSFs as a more practical approach than the previous studies. In particular, the outcomes should lead to clear improvement opportunities for firms' FSMS current practices to ensure safe food to final consumption. Upon the reflection of these viewpoints and the discussion by many scholars about research philosophies in business and management (e.g. Kelemen and Rumens, 2008; Bryman, 2012; Creswell, 2013; Saunders, Lewis and Thornhill, 2015), this research is positioned toward the philosophy of pragmatism.

3.2.2 Approach to develop theory

Regarding the approach to developing theory, there are two contrasting approaches for researchers in theory development: deduction and induction (Ketokivi and Mantere, 2010). In deduction, the conclusion is derived logically from a set of general premises, the conclusion is true when all the premises are analytically true and logical coherence. On the contrary, induction is in the opposite direction, from particulars to generalisations. Inductive conclusions are generalised from data and also contain knowledge not analytically implied by the premises. This explains why induction sometimes 'amplifies' knowledge because the conclusion is beyond a restatement of the premises (Ketokivi and Mantere, 2010). There is also a third approach to theory development that is common in business and management research. Abduction, which begins with a 'surprising fact' being observed, leads to the conclusion instead of a premise. Accordingly, a set of possible premises is determined, which is considered sufficient or nearly sufficient to explain the conclusion (Saunders, Lewis and Thornhill, 2015). To clarify these approaches, the comparison of these types is shown in term of logic, generalisability, use of data and theory in Table 3.1.

Table 3.1. Three types of approaches to develop theory

	Deduction	Induction	Adduction
Logic	When the premises are true, the conclusion must also be true	Known premises are used to generate untested conclusions	Known premises are used to generate testable conclusions
Generalisability	From the general to the specific	From the specific to the general	From the interactions between the specific and the general
Use of data	To evaluate propositions or hypotheses related to an existing theory	To explore a phenomenon, identify themes and patterns and create a conceptual framework	To explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory falsification or verification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build a new theory or modify existing theory

(adapted from Saunders, Lewis and Thornhill, 2015)

In the literature, many debates are surrounding whether reasoning will be predominantly deductive, inductive, or abductive. It is not surprising when the answer is that it is up to the characteristics of the research such as the emphasis of the research, the nature of the research topic, available time, researchers' preferences, and the audience(s) of the research (Creswell, 2013; Saunders, Lewis and Thornhill, 2015). These factors are also considered to adopt suitable approaches in undertaking this research. However, there are some factors in priority based on the requirements of PhD study, namely the emphasis of the research, the nature of the research topic, and time constraint.

First, the emphasis of the whole study is improving FSMS implementation at food manufacturers in global supply chains using the approach of CSFs. The discussion of the SLR chapter suggests that there are gaps in the existing streams of the management of FSMS implementation and the feasible application of CSFs to seek for improvement opportunities of FSMS actively.

On the one hand, it suggests that the most crucial limitation lies in the insufficient understanding of CSFs in the broader environments of FSMS, including the market level and food-safety governance. How each CSF affects FSMS implementation in a specific context needs to be explored and understood since little research has been done on them. In this sense, the study will need to explore the in-depth understanding of FSMS implementation in their natural setting where practitioners have different viewpoints about CSFs that influence the success of FSMS implementation in global supply chains. This contributes to providing fresher and more practical thoughts of CSFs for FSMS implementation. As a result, it is appropriate to work inductively by generating, analysing data and reflecting upon what existing theoretical themes the data are suggesting.

On the other hand, many works have been done in this research area, especially the evaluation of FSMS performance based on diagnostic tools are wealth in the literature that has been adopted to measure FSMS implementation within food firms around the world (e.g. Luning *et al.*, 2008; Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Luning, *et al.*, 2015; Nanyunja *et al.*, 2015; Njage *et al.*, 2018). Researchers also identify many critical factors that influence FSMS implementation within food firms in many countries (Fotopoulos, Kafetzopoulos and Gotzamani, 2011; Mensah and Julien, 2011; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Luning, *et al.*, 2015). This study proposes a model for measuring the FSMS implementation based on their regulatory requirements and empirically test the proposed hypotheses to identify whether and to what extent CSFs impact on the firm's FSMS in global food supply chains. So, it lends itself more readily to deductive approach from which helps to establish a theoretical framework and deduces hypotheses that must then be subjected to empirical scrutiny to confirm the factors that may lead to the success of FSMS implementation in the chosen research context.

In addition, the available time is also an issue for doctoral research. Within an amount of four years, all works have to be done. Saunders, Lewis and Thornhill, (2015) suggest that it is quicker to complete deductive research, notwithstanding it takes a considerable amount of time setting up the study

prior to data collection and analysis. It is possible to predict the time schedules accurately since data collection is often based on 'one take'. Meanwhile, inductive research can be much more prolonged due to a much longer period of data collection and analysis emerging gradually. Furthermore, each approach associates with different kinds of risk. The deduction can be a lower-risk strategy, although there are risks, such as the low response rate and uncompleted questionnaires. With induction, the most significant risk is that no useful data patterns and theory will not be emerged (Ketokivi and Mantere, 2010; Saunders, Lewis and Thornhill, 2015).

Considering the above factors, the aims of this thesis are both generalising the findings and developing a comprehensive solution for applying CSFs as a strategy to identify improvement opportunities for FSMS implementation for each food manufacturer. Therefore, the researcher first explores to learn what variables to study in a small sample and then studies those variables in a larger sample of food enterprises in developing countries. In simple words, this thesis uses the inductive and deductive approach in combination. For a reason, this choice is especially suitable to the considerations above, and it enables more credible, well-founded, reliable, and relevant data to be collected, which advances the research (Kelemen and Rumens, 2008). The methodological choices and strategies that reflect the pragmatic philosophy and these combined approaches to develop theory in this thesis will be discussed in the next section.

3.3 Methodological choices and strategies

The research philosophy and approach to theory development consequently influence the next three layers of the research onion, including methodological choice, research strategies and the time horizon that are discussed in this section.

3.3.1 Methodological choices

Research design or strategies of inquiry (Denzin and Lincoln, 2011) is the general plan that provides specific direction for researchers to answer the research question(s) (Creswell, 2013). Saunders, Lewis and Thornhill (2015)

suggest that it contains clear objectives derived from the research question(s), specifies the sources from which and how to collect and analyse data. There are two typical methodological paths, including mono-method and multiple methods research design (Figure 3.2).

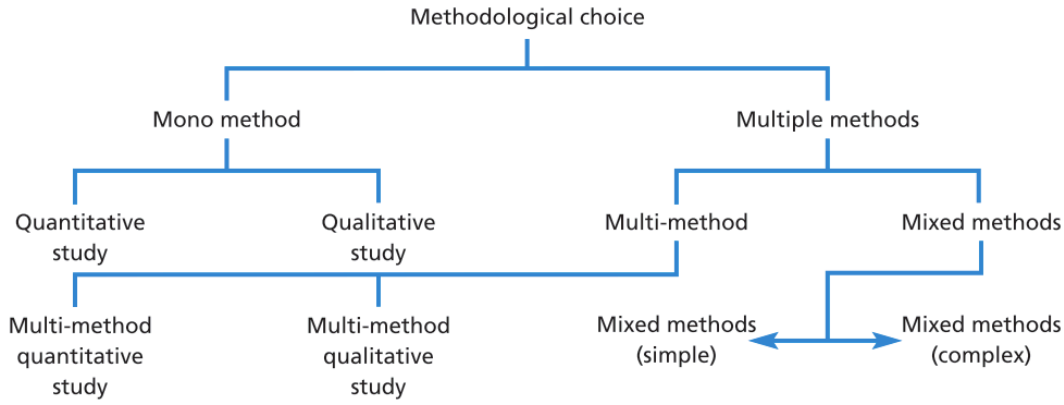

Figure 3.2. Methodological choices

(source from Saunders, Lewis and Thornhill, 2015)

As stated in the previous section, the nature of the research questions, the research contexts and research consequences are driving forces determining the appropriate methodological choice for this thesis. In other words, the 'what' and 'how' to research based on the intended consequences - where to go with it are the determinants for this pragmatic study (Creswell, 2013). In addition, the research occurs in the complex contexts of global supply chains involving many stakeholders. It is also suggested that the pragmatist's view encourages researchers to work with various types of knowledge and methods (Bryman, 2012; Creswell, 2013; Saunders, Lewis and Thornhill, 2015). Thus, mixed methods in the path of multiple methods support pragmatism for the access to dissimilar worldviews, and non-identical assumptions; as well as different forms of data collection and analysis (Tashakkori and Teddlie, 2010). The rationales behind the mixed method design are outlined in Table 3.2. In mixed methods research, investigators combine the use of quantitative and qualitative data collection techniques and analytical procedures to provide the best understanding of a research problem (Creswell, 2013). There are a number of variations of mixed methods research grounded on various combinations of quantitative and qualitative research (Creswell and Clark, 2011).

Table 3.2. The rationales about the usage of mixed method design

Reason	Explanation
Initiation	• To define the nature and scope of sequential quantitative or qualitative research • To provide contextual background and to better understand the research problem • To formulate or redraft research questions, interview questions and questionnaire items and to select samples, cases and participants
Facilitation	One method may result in the discovery of new insights which inform and are followed up through the use of the other method
Complementarity	To allow meanings and findings to be elaborated, enhanced, clarified, confirmed, illustrated or linked
Interpretation	One method (e.g. qualitative) may be used to help to explain relationships between variables emerging from the other (e.g. quantitative)
Generalisability	To establish the generalisability of a study or its relative importance. Similarly, the use of mixed methods may help to establish the credibility of a study or to produce complete knowledge
Diversity	To allow for a greater diversity of views to inform and be reflected in the study
Problem-solving	Use of an alternative method may help when the initial method identifies unexplainable results or insufficient data
Focus	One method may be used to focus on one attribute (e.g. quantitative on macro aspects), while the other method may be used to focus on another attribute (e.g. qualitative on micro aspects)
Triangulation	To combine data to ascertain if the findings from one method mutually confirm the findings from the other method
Confidence	Findings may be affected by the method used. Use of a single method will make it impossible to ascertain the nature of that effect. To seek to cancel out this 'method effect', it is advisable to use mixed methods. This should lead to greater confidence in conclusions

(Adopted from Bryman, 2012; Saunders, Lewis and Thornhill, 2015)

This thesis involving the use of one method with others is to elaborate on the initial set of findings, then to generalise findings in the larger sample. Hence, there is more than one phase of data collection and analysis, which is well suited to sequential mixed methods research. In specific, a sequential exploratory research design that has two phases including exploring qualitative data and analysis, then using the findings in a second quantitative phase (Creswell and Clark, 2011) is applied in this thesis. First, the qualitative (QUAL) approach is used to gain insight into why an identified factor from the findings of the SLR chapter is perceived as CSF that influences the success of FSMS

implementation in the context of global supply chains. This stage also helps to provide contextual background and to better understand the research problem in a specific context. Second, the QUAL phase helps to develop better measurements with specific samples of populations and to see if data from a few individuals can be generalised to a large sample of a population in the quantitative (QUAN) phase as illustrated in Figure 3.3.

Figure 3.3. Mixed methods design

(adopted from Creswell, 2013 and modified by the researcher)

3.3.2 Methodological strategies

Saunders, Lewis and Thornhill (2015) define a research strategy as a plan of how researchers will go about answering their research questions. It plays the role of the methodological link between the research philosophy and subsequent choice of methods to collect and analyse data (Denzin and Lincoln, 2011). In this thesis, there are two strategies, including case study for the first phase and survey for the second phase.

3.3.2.1 Case study

According to Yin (2014), a case study that is an in-depth inquiry into a topic or phenomenon in a holistic and real-world perspective arising out of the desire to understand complex social phenomena. The case study strategy is suitable for this study because it can provide valuable insights from intensive and in-depth research considering the interaction between a phenomenon and its contextual conditions, leading to rich, empirical descriptions and the development of theory (Eisenhardt, 1989; Dubois and Gadde, 2002; Eisenhardt and Graebner, 2007; Yin, 2014). As any research strategies, the case study research is challenging because of its intensive and in-depth nature and the approaching ability of researchers to identify, define and gain access to a case study setting (Saunders, Lewis and Thornhill, 2015). In case study research, the ‘case’ may refer to ‘individuals’, ‘organisations’, ‘processes’, ‘programs’, ‘neighbourhoods’, ‘institutions’, and even ‘events’ (Yin, 2014).

In this research, the ‘case’ refers to the FSMS of each food manufacturer which is a customised-process, including many assurance and prevention activities in a complex context of manufacturing and exporting in Asian developing countries. Given the choice of sequential mixed methods research, the case study strategy is structured as multiple cases. The use of multiple cases aims to provide more evidence, and it focuses on whether findings can be replicated across cases as literal replication at the suggestion of Yin (2014). Nevertheless, the number of cases to use should be manageable and able to encourage the researcher to observe and analyse the FSMS of each particular organisation closely. As a result, it is applied to gain multiple insights of CSFs in FSMS implementation and examine across cases in a specific research context to confirm which factors are critical and rank them in priority based on practitioners’ perspectives.

3.3.2.2 Survey

The survey strategy offers the use of quantitative data by means of descriptive and inferential statistics to suggest possible reasons for particular relationships between variables and to produce models of these relationships (Saunders, Lewis and Thornhill, 2015). Moreover, it is easier for researchers to establish control over the research process because the probability sampling is used to generate findings that are statistically representative of the whole population at a lower cost than collecting the data for the whole population. In this research, a survey will be used for the QUAN phase as a tool to propose a model for measuring the FSMS implementation based on their regulatory requirements and empirically test the proposed hypotheses. The purpose of a survey is to generalise the findings from a few cases in the previous QUAL phase (Figure 3.3) to a larger sample of food manufacturing and exporting companies in Asian developing countries. However, there are some difficulties along with this strategy, including time-consuming and the accuracy in the sampling process, designing, piloting data collection instrument and administrating response.

3.4 Time horizon

An important question to be asked in designing the research is time horizon. Cross-sectional, which is a 'snapshot' taken at a particular time (Saunders, Lewis and Thornhill, 2015), is chosen for this study for two following reasons. First, this study is the mixed methods research containing both QUAL and QUAN phases. All of them are conducted over a short period of time. The QUAL phase is carried out as a multiple case study based on interviews at each participant's company. Also, the QUAN phases are undertaken by a survey based on structured questionnaires. Second, most research projects undertaken for the doctoral degree are necessarily time-constrained. This thesis is no exception which requires all works done within four years. Amount of time for data collection, therefore, is restricted.

3.5 Data collection and analysis

With regard to the research methods for data collection and analysis, this section focuses on the appropriate techniques and procedures related to the above methodological selections to answer the research questions. The below table is a summary of the research methods involved in this study (Table 3.3).

Table 3.3. Summary of research methods

Research questions	Research stages	Data collection	Data analysis
What and how?	Literature review	Systematic review	Synthesis and analysis
Why and what?	Multiple case study	• Face-to-face interview • Onsite observation • Public and provided documents	• Theme analysis • Qualitative assessment
Whether and to what extent?	Survey	• Questionnaire using Likert scale	• Structural equation modelling • Cluster analysis

3.5.1 Data collection

There are four techniques used in the data collection of this thesis. Each technique has its advantages and limitations that could influence the quality of

the research data, as illustrated in Table 3.4. Moreover, various difficulties associated with the processes of data collection that the researcher has encountered are also discussed in this section.

Table 3.4. Advantages and disadvantages of each data collection technique

Data collection types	Advantages	Limitations
Interview	• Interact with participants • Provide historical information • Allow control over the line of questioning	• Researcher's presence may bias responses. • Provide information in a designated place rather than the natural field setting. • Provide indirect information filtered through the views of the interviewees • Not all people are equally articulate and perceptive.
Observation	• Interact with participants • Record information as it occurs • Unusual aspects can be noticed during an observation • Useful in exploring topics that may be uncomfortable for participants to discuss	• The researcher may be as seen as intrusive • Private information may be observed that the researcher cannot report • The researcher may not have good attending and observing skills
Documents	• Enable researcher to obtain the language and words of participants • Time convenient to the researcher as written evidence • Represent data to which participants have given attention	• Not all people are equally articulate and perceptive • Protected information unavailable to public access • Researcher search out the information in hard-to-find places • Require transcribing or optically scanning for computer entry

		• Materials may be incomplete • The documents may not be authentic or accurate
Structured questionnaire	• Collect responses from a large sample • Each respondent is asked to respond to the same standardised set of questions	• No interaction with responders • Problems with response rate, the validity of data collected, reliability of data, can occur. • Only one opportunity to collect the data, respondents could remain anonymous.

(source from Creswell, 2013; Saunders, Lewis and Thornhill, 2015)

The first phase aims to enrich the understanding of factors leading to the success of FSMS implementation focusing on 'why' a factor is considered as critical factor to FSMS implementation (RQ2) and the priority ranking of these factors to assist food managers in improving their current practice. Interview is a data collection technique allowing the individual to talk openly about a topic and describe his or her experience (Creswell, 2013). It also allows additional information to emerge from participants in the research project. Therefore, in this research context, it is the most suitable technique to collect data from food firms.

In addition, the technique of observation and document will be conducted by for the purpose of 'triangulation' of data from different sources (Creswell, 2013; Yin, 2014). These types of techniques allow the researcher to gather multiple forms of data rather than rely on a single data source. At the end, the researcher could review all of the data, make sense of them, and organize them into categories or themes that cut across all of the data sources (Creswell, 2013). During the interviews, the researcher will also be conducted field observations at these companies, especially paying attention to their employees, managers, factories, and facilities. Apart from the primary data, the secondary data as documents are also taken from these companies'

websites such as their public information, annual reports and industrial associations' reports.

3.5.1.1 QUAL data collection

The face-to-face interviews with participants involve semi-structured and generally open-ended questions that are few in number and intended to elicit views and opinions from the participants. Participants in the QUAL study are senior managers, quality control managers who are experts in their field, and they are currently in charge of FSMS implementation at the interviewed firms. Semi-structured interviews are used to generate practical knowledge, critically evaluate and analyse the result grounded on the CSFs from the findings of the SLR chapter. These firms should diverse in scale and have years of experience in manufacturing and exporting fish and fisheries products all over the world. In detail, the key focus of the QUAL study is to investigate and understand why a factor is perceived as CSF and how they contribute to the success of FSMS by examining the chain in its entirety, by explicitly examining at the organisational, market and food-safety governance levels based on the practitioners' views. The interview protocol and questions in three languages - English, Chinese and Vietnamese is used to collect qualitative data in Appendix I.

Furthermore, the use of multiple data collection is implemented for the purpose of 'triangulation' of data from different sources (Creswell, 2013; Yin, 2014). Observations are also carried out while doing interviews at these firms. The researcher has visited these factories and explored the manufacturing process of each firm onsite. However, the language difference and the collection of the study evidence are the main challenges while conducting the QUAL study. The language barrier is the topmost challenge in China. Fortunately, the researcher has received enthusiastic support from both Professors and PhD students of Beijing Jiaotong University in contacting these firms and translating Chinese to English or vice versa. While in Vietnam, many colleagues at Ho Chi Minh City Open University have helped to introduce and provide useful contacts to recruit the participated companies.

Moreover, collecting research evidence is quite limited due to the restriction in recording interviews. Although the researcher has been granted access to all of the firms but limited only to visit and take personal notes without recording any types of media such as pictures, voice memo or video. The interviewed experts explained these restrictions are their company policies. On the other hand, the observations supported the researcher in asking general questions of the participants and allowing the participants to provide their opinions freely. To overcome the limitation of lacking evidence, the investigator also collected documents during the process of research. These are public documents from the interviewed firms such as printed brochures, official reports, news, and public information from their websites.

This thesis involving the use of both QUAL and QUAN data is to elaborate on the initial set of findings in the QUAL stage, then to generalise findings in the larger sample in the QUAN stage following the design of sequential mixed methods. Therefore, stratification of the population for QUAN data collection is the same as the qualitative study; the snowball sampling method is continuously used to recruit voluntary firms that meet the similar of key criteria as the QUAL stage. However, the sample number of the QUAN must be higher than the QUAL. Therefore, the technique to collect data in QUAN stage is the last one in Table 3.4 - structured questionnaire. This technique provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Creswell, 2013). In this case, it provides the managers' perspectives on CSFs, FSMS implementation, and their business performance. This technique could help the researcher to collect a larger number of respond within shorter time than QUAL research. The QUAN data collection is described in the below subsection.

3.5.1.2 QUAN data collection

In the second phase of the research, QUAN data collection is conducted by distributing structured questionnaires to the respondents who work at the food manufacturing and exporting firms as the QUAL participants. Prior to the distribution, pilot testing has been conducted to evaluate individual questionnaire items, revise and delete questions that are wordy and unclear in

the meaning. Snowball sampling method is used to recruit volunteered respondents who are in charge of FSMS at food manufacturing and exporting firms in China and Vietnam. Recruiting letters in three languages English, Chinese and Vietnamese are sent to food firms in Appendix II. The questionnaire in three languages English, Chinese and Vietnamese along with the measurement items used in the survey are listed in Appendix III.

Like the qualitative study, there is considerable support from both Professors and PhD students of Beijing Jiaotong University and Zhejiang University in contacting firms and translating the questionnaire from English to Chinese or vice versa. While in Vietnam, many colleagues at Ho Chi Minh City Open University and Industry University of Ho Chi Minh City have helped to introduce and provide useful contacts to the targeted companies. In the QUAL stage, the sample is the fish and fishery industry. In the QUAN stage, all kind of food is included for the purpose of generalising the findings to the larger sample. However, the samples in the qualitative phase is not be included in the quantitative phase as this would introduce unnecessary duplication of responses, as Creswell (2013) suggests.

There are many difficulties emerged in collecting response, especially the issue of low response rate at the beginning of the QUAN phase. Therefore, multi-mode administration methods are implemented to collect data in the two countries. Each type of questionnaire administration has its pros and cons as illustrated in Table 3.5, only door-to-door (structured interview) and internet survey are satisfactorily adopted in this study. A door-to-door survey is very efficient in term of getting valid responses, but it is expensive due to the high cost of travelling to the respondents' companies. The rest is collected via internet survey using email, Google Form in Vietnam, and the website wjx.com, which is also a survey platform similar to Google Form, to collect online response in China. Internet survey is a cost-saving and convenient method of data collection, but respond rate and speed are relatively low, which require the researcher to keep chasing the available contacts to collect their responses.

Table 3.5. Main attribute of the questionnaire

Attribute	Web and mobile	Postal	Delivery and collection	Telephone	Structured interview
Population's characteristics for which suitable	Individuals with access to the Internet, often contacted by email	Literate individuals who can be contacted by post; selected by name, household, organisation, etc.		Individuals who can be telephoned; selected by name, household, organisation, etc.	Any; selected by name, household, organisation, in the street etc.
Confidence that right person has responded	High with email	Low	Low but can be checked at collection	High	
Likelihood of contamination or distortion of respondent's answer	Low	May be contaminated by consultation with others		Occasionally distorted or invented by interviewer	Occasionally contaminated by consultation or distorted/ invented by interviewer
Size of sample	Large, can be geographically dispersed		Dependent on number of field workers	Dependent on number of interviewers	
Likely response rate[a]	Variable to low, 30–50% reasonable for web within organisations, otherwise 10% or even lower	Variable, 30–50% reasonable		High, 50–70% reasonable	
Feasible length of questionnaire	Equivalent of 6–8 A4 pages, minimise scrolling down	6–8 A4 pages		Up to half an hour	Variable depending on location
Suitable types of question	Closed questions but not too complex; complicated sequencing fine if uses software; must be of interest to respondent	Closed questions but not too complex; simple sequencing only; must be of interest to respondent		Open and closed questions, including complicated questions; complicated sequencing feasible	
Time taken to complete collection	2–6 weeks from distribution (dependent on number of follow-ups)	4–8 weeks from posting (dependent on number of follow-ups)	Dependent on sample size, number of field workers, etc.	Dependent on sample size, number of interviewers, etc., but slower than self-completed for same sample size	
Main financial resource implications	Cost of online survey tool, purchase of list of respondents' email addresses	Outward and return postage, photocopying, clerical support, data entry	Field workers, travel, photocopying, clerical support, data entry	Interviewers, telephone calls, clerical support; photocopying and data entry if not using CATI[b]; survey tool if using CATI	Interviewers, travel, clerical support; photocopying and data entry if not using CAPI[c]; survey tool if using CAPI
Role of the interviewer/ field worker	None		Delivery and collection of questionnaires; enhancing respondent participation	Enhancing respondent participation; guiding the respondent through the questionnaire and recording responses; answering respondents' questions	
Data input[d]	Automated	Closed questions can be designed so that responses may be entered using optical mark readers after questionnaire has been returned		Response to all questions entered at time of collection using CATI[c]	Response to all questions can be entered at time of collection using CAPI[d]

(source from Saunders, Lewis and Thornhill, 2015)

3.5.2 Data analysis

From the process of data collection, there are two data sets needed to analyse separately. The findings from the initial exploratory database (QUAL) are used to build into quantitative measures (QUAN). The QUAN data set is to test the generated theoretical model of CSFs that initially investigated in the previous phase. Therefore, there is no comparison between the two data sets since they are typically drawn from different samples as above noted in the data collection discussion and the intent of the strategy is to determine if the qualitative results can be generalised to a larger sample (Creswell, 2013).

3.5.2.1 QUAL data analysis

The QUAL data analysis procedure is as the followings (Figure 3.4). First, raw data that are field notes and documents have been hand-written, organised and prepared for data analysis right after each interview when they

were still fresh and well memorised to overcome the restriction of research evidence as mentioned above. When all the data have been collected, they are coded into three categories following the aims of the study to understand why a factor is considered as a critical success factor based on expert's listing and reasoning to answer RQ2. Lastly, these CSFs are ranked based on their impacts on the success of FSMS implementation grounded on the experts' qualitative assessment to identify their priority order.

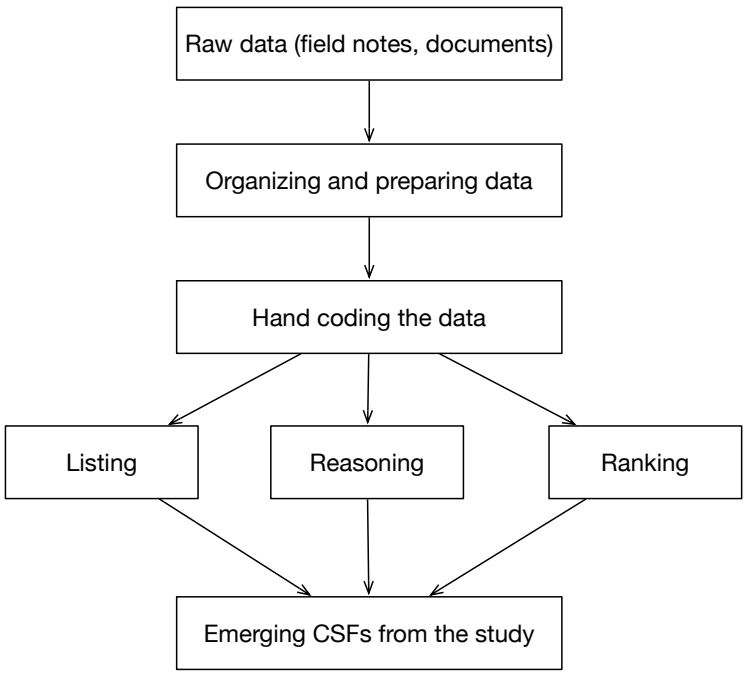

Figure 3.4 The process of QUAL data analysis

3.5.2.2 QUAN data analysis

The process of the QUAN data analysis is more complicated than the QUAL data analysis. Since the aims of the QUAN study are not only to propose a model for measuring the effectiveness of the FSMS implementation based on their regulatory requirements but also empirically test the proposed hypotheses to investigate whether and to what extent CSFs impact on FSMS implementation as well as FSMS impact on business performance. Moreover, the identification of Best practice and the differences among the identified groups of the study are carried out in the QUAN analysis.

Although there are many methods to analyse CSFs such as grey-DEMATEL model in the study of Bai and Sarkis (2013), Analytic Process Hierarchy (AHP)

in the research of (Chin, Chan and Lam, 2008) or combining EFA and Total Interpretive Structural Modelling (TISM) in the work of Shankar, Gupta and Pathak (2018). Each method has its strengths and weaknesses. In the literature, the determination of antecedents to success (CSFs) of programs and practices, in organisation and management research has utilised statistically robust, multivariate regression analysis and structural equation modelling (e.g. Dinter, 2013; Stankovic *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Netland, 2016). Statistical techniques typically require specific parametric assumptions for their data and results to be considered valid (Bai and Sarkis, 2013). Moreover, the limitation of the QUAL study is the limited sample size. Statistical techniques usually require a large number of studied firms, which helps to overcome the QUAL limitation. SEM could provide insight into the causal ordering of variables and the structural relationship among CSFs, FSMS implementation, and business performance.

Grounded on this study's objectives and followed the most popular method of data analysis in the literature, the QUAN study applies structural equation modelling. In detail, IBM® SPSS® Amos, which is the powerful structural equation modelling software, is appropriate to model and test the proposed hypotheses in this study by its functions of extending standard multivariate analysis methods, including regression, factor analysis, correlation, and analysis of variance. It helps to reflect complex relationships more accurately than with standard multivariate statistics techniques. The procedure of QUAN analysis is presented in Figure 3.5. The codebook for variables used in this analysis is listed in Appendix IV.

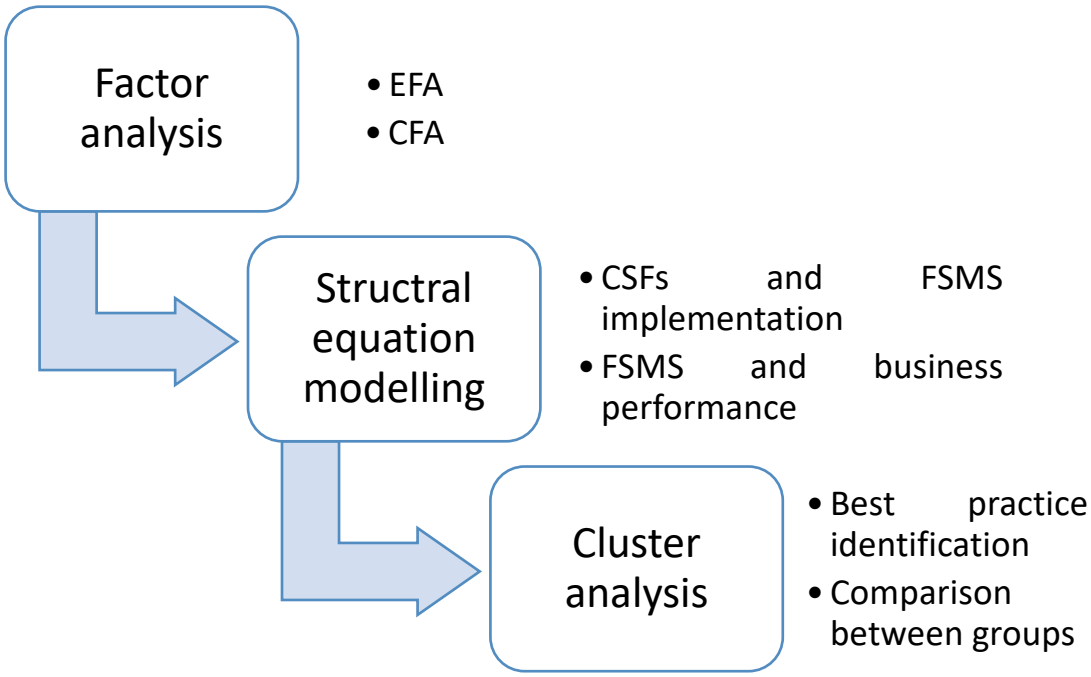

Figure 3.5 The process of QUAN analysis

First, there is a need to reduce original variables into a smaller set of new, composite dimensions with a minimum loss of information. For instance, in the study, the managers mention human resources in the organisation which include many related perspectives such as employee's awareness, skill and involvement in FSMS implementation. However, in analysis, it is impossible to include all original data. They need to be used collectively in term of identifying their impact on FSMS implementation. Thus, factor analysis is the most suitable analysis technique in the first stage of QUAN analysis, which provides the two distinct, but interrelated, features: data summarisation and data reduction (Hair *et al.*, 2014). In summarising the data, factor analysis derives underlying dimensions that, when interpreted and understood, describe the data in a much smaller number of concepts than the original individual variables. Data reduction extends this process by deriving an empirical value (factor score) for each dimension (factor) and then substituting this value for the original values. Factor analysis includes both an initial Exploratory Factor Analysis - EFA (Principal component extraction method with Varimax orthogonal rotation) and Confirmatory Factor Analysis – CFA. EFA is a multivariate statistical technique is used to lessen the higher number of measured variables (items) into a smaller set of hidden constructs (latent factors) to determine the essential dimensions between them (Tabachnick and

Fidell, 2013). In this study, EFA is used to uncover the underlying structure of the variables. Then, CFA is adopted to refine the resulting scales in EFA as well as to determine if the number of factors and the loadings of the measured variables on them conforms to what is expected based on pre-established theory. Factor analysis is an excellent starting point for many other multivariate techniques thanks to its ability in providing insight into the interrelationships among variables and the underlying structure of the data (Hair *et al.*, 2014). In addition, multi-collinearity, uni-dimensionality, scale reliability and construct validity are conducted for the study variables as suggested by Tabachnick and Fidell (2013) and Hair *et al.*, (2014). After that, the model and the hypotheses are tested using SEM via path analysis, as it is a multivariate analytic methodology that address some essential issues of this QUAN stage including (1) specifying relationships that define the model (2) establishing causation and (3) the development of a modeling strategy (Hair *et al.*, 2014). In this study, it is suitable to explore the causal ordering of variables and the structural relationship among CSFs, FSMS implementation and business performance.

In the end, the final research objective is to identify Best practice among the studied firms and explore the differences among them in terms of CSFs, criteria of supplier selection and supply chain relationship to inform the optimal strategy of FSMS implementation. Then, suggest potential improvement areas where the studied firms could pay more attention to improve the implementation of FSMS. As a result, cluster analysis is a group of multivariate techniques whose primary purpose is to group objects based on the characteristics they possess. In other words, cluster analysis, which is the classification of data as suggested by natural groupings of the data themselves, is appropriate method to analyse the data for this study. In particular, there are two popular methods to use in cluster analysis: hierarchical or non-hierarchical methods. Each method has its pros and cons. Hence, several researchers recommend the combination approach using both methods to compensate for the weaknesses of the other (Milligan, 1980; Hair *et al.*, 2014). This study adopts two-step cluster analysis, which includes two steps allowing the advantages of the hierarchical method is complemented by the ability of the non-hierarchical method. First, a hierarchical technique is

applied as the partitioning stage to produce a complete set of cluster solutions, establish the appropriate cluster solutions and the appropriate number of clusters. Then, a non-hierarchical method follows to refine the results by allowing the switching of cluster membership and validate the final cluster solution (Hair *et al.*, 2014).

3.6 Ethical issues in doing research

In doing research, there are plenty of requirements for researchers in terms of ethical aspects. While collecting data from people and about people, researchers need to protect their research participants, develop a trust with them, promote the integrity of research, guard against misconduct and impropriety that might reflect on their organizations or institutions, and cope with new, challenging problems (Israel and Hay, 2006). All the researches in this study have been also complied with both the standard and University of Liverpool's ethical policy. For the standard ethical requirements, the researcher has read and complied with many ethical reference sources from British Academy of Management's Code of Ethics and Best Practice, Association of Business Schools' Ethics Guide and European Union's Respect Code of Practice for Socio-Economic Research. In addition, as a PhD student at University of Liverpool, the researcher also attended many research ethics training sections, got an online ethical training certificate and gained ethical approvals from the Management School's Research Ethics Committees prior to conducting the QUAL and QUAN studies.

In detail, research activities in this thesis present no more than minimal potential physical or psychological adverse effects, risks of involvement to the participants since they have been conducted of the least potentially-harmful research environment, onsite interviews and onsite and online surveys. The researcher recruits participants for the QUAL and QUAN studies based on their volunteer and gains their informed consent by oral or written forms. In the QUAL data collection, the research involves passive observation of behavior without the collection of identifiers at the visited companies. The interview and survey of the study do not involve asking questions that are likely to embarrass the participants or cause sensitively psychological disturbance. In both stages

of data collection, the identities of interviewees and responders are anonymous. All anonymised data collected from the researches must only be stored on the University's secure server with password protected. There are only the supervisors and the researcher who have control of and act as the primary custodian for the data generated by the studies.

3.7 Summary

This chapter has briefly demonstrated the research onion of the thesis which modifies the philosophical worldview assumptions, the research design related to this worldview, and the specific methods of research translating the approach into practice to answer the research questions adequately. The truths, in this research, are practical effects of ideas and knowledge is valued for enabling actions to be undertaken effectively. Therefore, no single point of view can ever give the entire picture of the research context, and there may be multiple realities leading to various ways of interpreting the observed premises and undertaking research. In specific, underpinned by pragmatic philosophy and the combination of inductive and deductive approaches, sequential exploratory mixed methods are used to explore what and why various factors are perceived as CSFs of FSMS implementation, investigate their impacts on FSMS along with the relationship between FSMS and business performance. In addition, Best Practice and the comparison among the identified groups are explored to assist food-firms' managers in making decisions toward continuously improving FSMS. Many techniques of the QUAL and QUAN data collections and analyses are used to enhance the validity and reliability of the research. Overall, this chapter provides the general framework of methodology for the thesis, especially for Chapter Four - the QUAL study and Chapter Five - the QUAN study.

CHAPTER 4 A QUALITATIVE STUDY OF CHINESE AND VIETNAMESE EXPORTERS' PERSPECTIVE ON CRITICAL SUCCESS FACTORS FOR FSMS

4.1 Chapter introduction

Extensive research has shown that the identification of an enabling mechanism for the success of FSMS is critical to reduce the failure of FSMS implementation and respond to the need for continuous improvement of firms in global food supply chains. The previously published studies contribute to assist food firms' manager's direction on which they should focus in order to increase the effectiveness of FSMS implementation, providing the necessary resources and support as well as developing the necessary policies, practices and procedures (Kafetzopoulos and Gotzamani, 2014). Also, they draw meticulous attention to the interactions and relationships between and within the FSMS and the context in which they operate (Kirezieva, Jacxsens, *et al.*, 2015). The SLR chapter has pointed out many existing CSFs related to organisation, technology, strategy, market and environment that could affect the success of FSMS implementation (Fotopoulos, Kafetzopoulos and Psomas, 2009; Macheka *et al.*, 2013; Qijun and Batt, 2016).

Nevertheless, from the existing literature, researches on CSFs in FSMS has been mostly restricted to empirical confirmation of their existence and focused only on the organisational level (e.g. Fotopoulos, Kafetzopoulos and Psomas, 2009; Fotopoulos, Kafetzopoulos and Gotzamani, 2011; Kafetzopoulos and Gotzamani, 2014), leaving the market and food-safety governance of the broad environment restricted. Moreover, the reasons why factors are perceived as CSFs on the implementation of FSMS are limited. Much uncertainty still exists about how to assist firms in prioritising CSFs and identifying improvement opportunities for FSMS. Therefore, the objectives of this chapter are threefold:

- Investigate whether the identified CSFs of the literature are in accordance with reality within a particular context of global food supply chains
- Explain why a factor is perceived critical to the success of FSMS by examining the chain in its entirety, by explicitly examining at the organisational, market and governance levels in global supply chains based on practitioners' experiences

- Identify the ranking order of CSFs according to the qualitative assessments of the research participants to assist managers in prioritising the potential areas for improvement opportunities.

This chapter aims to enrich the understanding of CSFs for the success of FSMS implementation by conducting a qualitative method. Semi-structured in-depth interviews have been used to investigate this topic among fish and fisheries processors as well as exporters in China and Vietnam to generate practical knowledge, critically evaluate and analyse the results. The rest of the chapter is organised as followings. The next section describes the context of the study. It will then go to the specific methodology to conduct the study in section 4.3. The results and analysis in section 4.4, which is presented to explore the reasons why each factor is perceived as critical to the success of FSMS implementation based on the experts' opinions. Section 4.5 is the priority rank of CSFs, thanks to the qualitative assessments of the research participants. In the discussion, the results of research and the implications of these are considered before concluding. Finally, it is a brief conclusion for the above research objectives and explaining the value of the chapter.

4.2 Research context

To explore the in-depth understanding of FSMS implementation among firms in food chains, the global fish and fishery supply chain is used as a focal context to conduct case studies since fish and fishery products are the most traded food commodities worldwide. According to the Food and Agriculture Organisation (FAO) (2016), total fishery export value in developing Asian economies such as China, Vietnam, Thailand, and Indonesia, which was just 37% of world trade in 1976, rose sharply to 54%, with 60% quantity (live weight) by 2014. On the demand side, developed countries, which dominate world fishery imports, accounted for 73% of total world imports in 2014. International trade, therefore, is vital to economic growth and development in the fisheries sector as well as food and nutrition security.

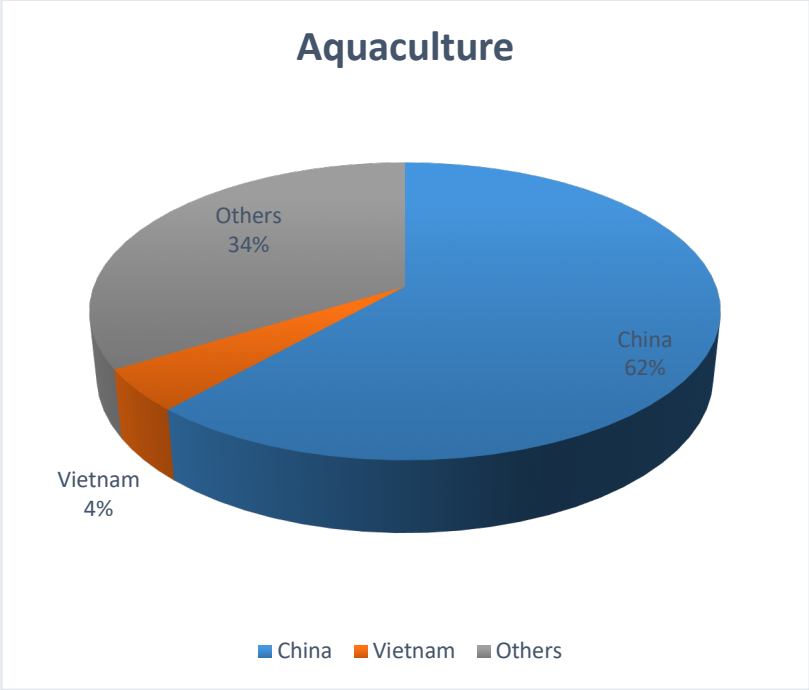

Figure 4.1 Aquaculture production of China and Vietnam compared to the world in 2014

(Adopted from FAO, 2016)

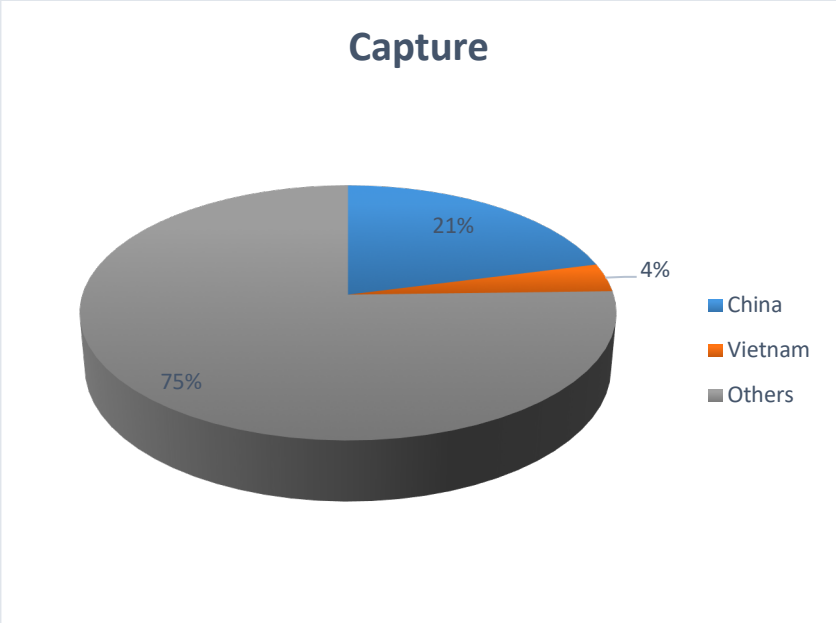

Figure 4.2 Fishery capture amount of China and Vietnam compared to the world in 2014

(Adopted from FAO, 2016)

The case of fishery supply chains is interesting and relevant as several significant safety risks exists because of the rapid increase in international

contamination incidents – for example, microbiologic contaminants from the lack of hygiene in production and residues from the use of prohibited antibiotics, metal contaminants, parasites, and thermal abuse (Thomas and Vaduva, 2015; Alam, 2016). Particularly, the study of Jetzkowitz, Henson and Olale, (2010) on food import rejection using EU and US Data during 2002-2008 confirm that fish and fisheries product is one of the top four types of rejected food by EU and US from third countries. Likewise, Wen *et al.* (2018) analyse 4047 cases of rejection by FDA (Food and Drug Administration) of the United States for Chinese food imports from February 2011 to July 2017. They conclude the same rejection ranking for fish and fishery products due to food safety concerns, namely (1) the food contained filth, decay, decomposition or other substances, (2) the food contained toxic and harmful substances (e.g. suspected melamine, chemical insecticides, or lead) and (3) the food contained agricultural and veterinary drugs. These commonly reported problems resulted in rejecting, destroying, or returning the traded products to the country of origin, severely influencing the value chain in the loss of foreign currency earnings for several developing countries, reputation damage, and the erosion of consumers' confidence.

To provide detailed information of the study context, a detailed description of the cases and their setting are made by remapping the fish and fishery supply chain from raw material to final products that are distributed to consumers based on information provided by the interviewees as seen in Figure 4.3. The fish and fishery supply chains start from various small farmers who do breeding, hatchery and aquaculture at farms or fishers who catch fisheries products from the sea. Then, they sell directly to firms or via numerous agents as intermediators operating at various scales to collect raw products. The agents, in turn, sell the products in large quantities to firms who process and package them into final products such as processed, dried or frozen seafood. These can be sold via wholesalers in the domestic market or export in other countries.

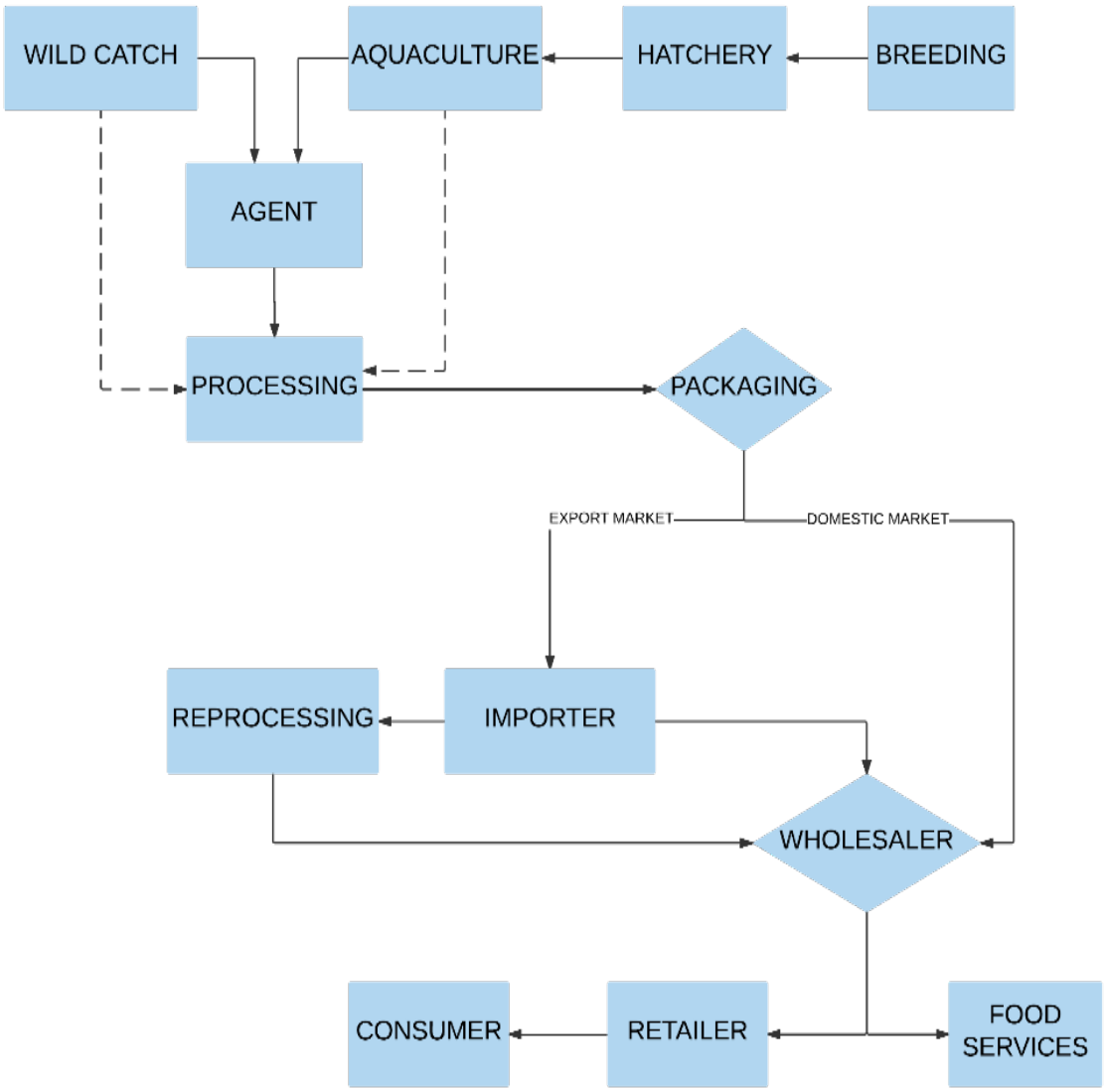

Figure 4.3 The global fishery supply chain

In some cases, firms possess farms and only hire local farmers to do the cultivation of aquatic animals. Therefore, their raw products do not primarily come from agents. Besides these main stakeholders, the supply chains also include service providers such as feed, veterinary medicine suppliers, ice and package providers, local transporters, and so on. In import countries, importers will sell large quantities to wholesalers who will reprocess and repack (if needed) to sell them to retailers or food services such as restaurants, caterings, and so on. The global fish and fishery supply chains are complicated as a large number of stakeholders are involved, including farmers/fishers, agents, processors or exporters, transport operators, importers, wholesalers/distributors who operate in different trade

environments with several local and international trade regulations, complex logistic networks, and differing levels of competency and technology.

4.3 Research methodology

As discussed in the section of the methodological choices and strategies, this thesis applies the sequential mixed method. The QUAL phase is used to gain insight into why the identified factors grounded on the findings of SLR is perceived as CSF that influences the success of FSMS implementation in the context of global supply chains. Then, these results are grounded on to identify the areas that are needed to receive more attention in FSMS implementation. The case study procedure is identified, as illustrated in Figure 4.4. There are three stages including define and design the study, then prepare and collect the data, analyse and conclude is the last stage.

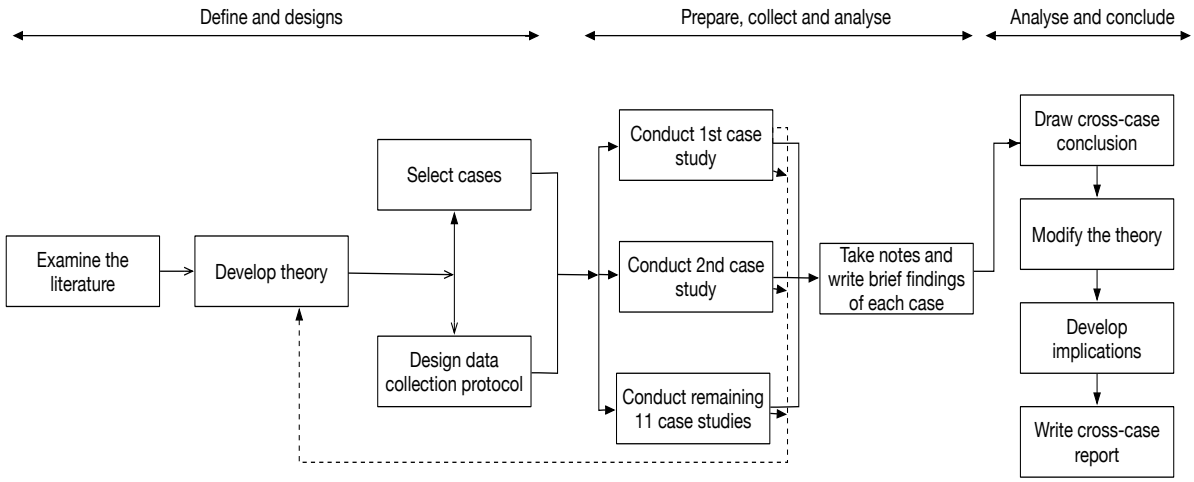

Figure 4.4. Case study procedure

(adopted from Yin (2014) and modified by the researcher)

4.3.1 The definition stage

In the definition stage, sampling method, criteria to select cases and data collection protocol are designed based on the literature review and the research needs. In this study, the snowball sampling method is used to recruit voluntary firms that meet key criteria, including:

- Firm size from small (11-50 employees), medium (51-250 employees) to large (> 250 employees) companies according to the definitions of European Commission (2003) for enterprises sizes.
- Current processing and trading fish and fishery products globally.
- Participants in the case study are senior and quality-control managers who are experts in their field and currently in charge of FSMS implementation.

Two developing Asian countries are chosen – China and Vietnam – which are ranked as the first and fourth, respectively, in the top ten aquaculture producers and exporters of fish and fishery products, such as shrimp, prawn, tuna, pangasius, squid, clams, and molluscs in a considerable volume (FAO, 2016). These firms are diverse in scale, from 48 to 2,000 employees, and have years of experience in processing and trading fish and fishery products worldwide. For the number of cases to use, Yin (2014) suggest that the number should be appropriate for the researcher to capture the complexity of the real world and process the information cognitively. Therefore, the number of firms from each country for the study is limited from four to ten.

4.3.2 The stage of data collection

In the collection stage, the use of multiple investigators and methods has been implemented for the purpose of 'triangulation' of data from different sources (Creswell, 2013; Yin, 2014). During the interviews, the researcher also conducted field observations at these companies. Apart from the primary data, the secondary data are also taken from these companies' websites such as their public information, annual reports and industrial associations' reports. The interview protocol includes three steps. Step one is to start a conversation, gain oral consent prior to each interview introduce each other as well as ask general information about the interviewees. Step two is to ask interviewees' opinion on each CSF and their perceptions about the impacts of CSFs on FSMS implementation. The final step is a closing conversation to express a thankful attitude to the interviewees. The interview time lasted from 60 to 90 minutes; the maximum was 120 minutes at the participants' companies within six months of 2017. During this stage, the interview questions are continuously

modified and updated based on the results of each previous interview to use for the next one.

The data in this study came primarily from thirteen firms (five Chinese and eight Vietnamese firms) using in-depth semi-structured interview questions. Profiles of firms that participated in the study are coded as Table 4.1. Data collection tools are the interview questions and public documents provided by the interviewees. A list of questions is constructed on the list of CSFs in the literature review and the requirements for FSMS by ISO 22000 for organisations in food chains.

Table 4.1. Description of the organisations participated in the study

Case	Size/Ownership	Product	Main markets
VN1	Large/Private	▪ Frozen & dried fish and shrimp ▪ Pond processing: salmon, pangasius fish, scallop, whelk, king crab meat ▪ Grape seaweed ▪ Anchovy, squid, clam meat (for the domestic market only)	Europe, Japan, US, Korea, Middle East, Africa, Taiwan, Malaysia, Singapore, Australia
VN2	Large/Private	▪ Pangasius fish	Japan, USA, EU, Canada, Australia, Middle East, North Africa, and Asia
VN3	Large/Private	▪ Tiger shrimp ▪ Prawn	Japan, USA, EU, Canada, Australia, New Zealand, Middle East, North Africa, Singapore, China, Lebanon, UAE and Korea
CN1	Large/Private	▪ Pangasius fish ▪ White and yellow clams	Japan, USA, EU, Canada, Australia, Middle East, North Africa, Singapore, and Korea
VN4	Medium/Private	▪ Salmon ▪ Pangasius fish ▪ Fish ▪ Whelk ▪ King crab meat	Japan, USA, EU, Canada, Australia, New Zealand, Middle East, North Africa, Singapore, China, Lebanon, UAE and Korea
VN5	Medium/Private	▪ Tiger shrimp ▪ Prawn	USA, EU and Asian countries
CN2	Medium/State-owned	▪ Frozen & dried fish ▪ Frozen & dried shrimp	EU, North Africa and Asian countries
CN3	Medium/Private	▪ Salmon ▪ Pangasius fish ▪ Whelk ▪ King crab meat	Japan, USA, EU, Canada, Australia, New Zealand, Middle East, North Africa, Singapore, China, Lebanon, UAE and Korea

VN6	Small/State-owned	▪ Freshwater, marine and tropical fish ▪ Cooked shrimp ▪ Crab meat	Asia countries
VN7	Small/Private	▪ Crab meat ▪ Prawn ▪ Shrimp ▪ Squid ▪ Fish	USA, EU and Asian countries
CN4	Small/State-owned	▪ Fish ▪ Crab meat	Asia countries Domestic market
CN5	Small/Private	▪ Pawn ▪ Shrimps	Asian countries
VN8	Small/Private	▪ Pangasius fish	Asian countries Domestic market

4.3.3 The analyse and conclude stage

In analyse and conclude stage, collected data that are field notes and documents have been hand-written, organised and prepared for data analysis right after each interview when they were still fresh and well memorised to overcome the restriction of research evidence as mentioned in the research methodology chapter. In detail, after the data of each case has been collected, a brief report is written, the findings are coded into three categories following the aims of the study to understand why a factor is perceived as a critical success factor based on expert's listing and reasoning. Comparisons among the case's finding are made to draw the cross-case conclusion and modify the theory (delete factors that were not mentioned in the interviews). In the end, these CSFs are ranked according to their impacts on the success of FSMS implementation using the scaling technique grounded on the experts' qualitative assessment.

4.4 CSFs from the interviews

After identifying the existing CSFs in the literature, a semi-constructed list of the interview questions for Chinese and Vietnamese fisheries processors and exporters is used to ask what and why a factor is perceived as CSF of FSMS implementation in their context. Since the interview questions are designed grounded on factors identified in the literature review (see Table 2.5),

in this stage, factors mentioned by less than half of the interviewees would be eliminated. On the contrary, emerging factors suggested by more than a half of interviewees were added into the final list of CSFs.

4.4.1 The organisational level

4.4.1.1 Human resource

In the category of organisational factors, people-related issues within the firm emerged and received much attention as a prevailing view among the interviewees. VN4 stated, 'Human resource is considered a key role in our FSMS. Their knowledge, awareness, and commitments are fundamental to the success of the whole system because of their direct involvement in FSMS.' During the interviews and field trips at these firms, this statement was confirmed by the managers numerous times. Given the context of processing fishery products, each company has a significant number of employees who work directly in transforming and handling raw materials into exporting products daily (Figure 4.5). For instance, according to the manager of VN6, a special feature of the fishery industry is the use of intensive labour in peeling and removing shellfish, crab, shrimp, or prawn shells, bones, and skin. During this process, sharp objects such as shells or bones could easily tear workers' gloves and lead to contamination. Under this circumstance, only the employee who is peeling shellfish could know and report to the manager to prevent food-safety risks. If that person is irresponsible and ignores the food safety objective, there is no way to figure out the problem.

Figure 4.5 Inside a fish-processing plant

(Interviewee provided)

CN1 emphasised the dimension of human resource in FSMS because it is essential for each person to have a shared perception of the importance and understand the food safety expectation of their job. On the same point of view, the manager of VN2 concerned with the level of consistency in personnel awareness said, ‘To follow HACCP principles and prerequisite programmes, employees are required to be trained and pass several tests, but after the training program, some of them still complain, such as why there are so many steps and too-complicated procedures for a simple action like washing hands after using the toilet . . . we have to supervise them strictly, and periodic training is a must.’ In the case of VN7, the manager added, ‘Some employees are very well experienced since they earn for living by catching and processing seafood, but these experiences are completely different compared to the requirements of HACCP or PRPs, so we have to train them from fundamental steps.’ Currently, common methods these firms use to raise awareness, knowledge, or commitment to food safety are periodic and on-site supervision, inspections as well as training. However, these methods are certainly not enough to improve food safety performance with regard to the human-resource aspect in FSMS, CN4 stressed, ‘It is obvious that the supervisor cannot watch each person make sure they are doing right. The organisation must change the way people think and behave toward the food-safety objective.’

4.4.1.2 Management responsibility

Most international food-safety standards or regulations state that at each food-chain organisation, the top managers are responsible for having clear commitments and establishing the organisation's food-safety policy as well as the food-safety team with a designated leader (e.g. ISO 22000, 2005). Hence, with firms as links in the chains, managers must devote considerable efforts to strengthen several protocols, programs, practices, training, and testing based on an inspectional approach to manage risks toward the food-safety objective. During the interviews, management responsibility was recognised as a critical factor in firms' FSMS implementation because of several difficulties in the current practice, notwithstanding firm sizes. VN1 said, 'At our firm, the board of directors have strong commitments in the food-safety objective, and we recognise the importance of food safety as the core of final products' quality ... We think management responsibility is one of the most important factors in implementing FSMS because it consists of the perceptions and viewpoints of the managers or food-safety team, but we struggle with how to spread and transform them into food-safety culture, policy, and objectives to all employees within the firm and other involved stakeholders such as farmers/fishers and service providers for packing materials and equipment in the supply chain.'

Management responsibility also involves establishing the organisation's commitment via vision, mission, and value toward the food-safety policy. The policy must be developed to ensure compliance with all requirements to promote food safety as well as consumer protection. As an overall response to this question, the interviewees emphasised that the policy is perceived as a 'generic' requirement. For example, the researcher compared and picked the most popular contents on food safety from these firms: 'follow the principles of HACCP', 'identify the potential food hazards in our business operation', 'implement effective control and monitoring procedures at those points deemed critical to food safety', 'establish operating procedures and guidelines that minimise the risk to food safety', 'provide a comprehensive training plan for all food handlers, supervisors, and managers', 'monitor standards of compliance with this policy and promote standards and maintenance of premises and equipment', 'review systems and procedures to enable

continuous improvement', and so on. When visiting these firms, the food-safety policy can be seen as written statements on paper or on boards hanging on the wall in meeting rooms or managers' offices. Except for VN1 and VN3, the interviewees accounted for the food-safety policy as their competitive advantage in both national and international markets. These companies actively look forward to continuous improvements with the objective of manufacturing and providing products with a low level of non-conformities. For example, they issue their own 'stamps' on their products as food-safety commitments to their consumers, showing the tightened link among input agents, factories, and consumers. The firms are determined in continuously improving FSMS to guarantee food safety by encouraging the participation and promotion of safety responsibilities among all employees and third parties continuously. Although operational costs for enhancing FSMS are higher compared to other competitors in the market, the manager of VN3 indicated, 'Consumers get what they pay for so that if we have higher standard products, we could sell with higher prices under more rigorous food-safety guarantees.' To achieve this, VN3 explained, 'The food-safety policy is long-established and widely accepted between firms and our partners, not only documents that we keep in the record to get FSMS certificates.'

4.4.1.3 The facility, working environment and financial abilities

In this research context, the facilities and work environments at the participated firms are operations, testing, transport, storage equipment, factory conditions, and so on to assure food safety through the journey of raw materials from seas/ponds to final products. The majority of the managers agreed that facilities, equipment, and work environments are essential to FSMS implementation, as most food safety standards require. However, there is a difference between large firms with substantial financial ability that could invest and possess more advanced facilities and provide better work environments compared to SMEs with limited finances as well as manufacturing facilities. Based on evidence from the interviews and observations at the organisations, this difference creates a gap between large firms and SMEs. Large firms' operational and testing resources are

sophisticated and in excellent condition, thanks to years of experience in this industry, working with large-scale clients such as Tesco (cases VN1, VN2, VN3, and CN1). In particular, all processing plants, packaging factories, and associated equipment are built and constructed under EU code and stringently comply with several food-safety standards such as HACCP, ISO, Global GAP, and BRC.

Furthermore, these firms also focus on the supply of additives, processing aids, packaging material, and food-contact material. To follow prerequisite programs and HACCP, these companies provide all high-quality equipment such as laundry, sterilising services for working and protecting clothes, caps, gloves, glasses, boots and face masks for their direct workers. They invest in manufacturing resources that are not requirements of the standards, but these products' quality could directly affect the food safety of exports such as ice and package factories and advanced thermal-control systems for warehouses, storages, and vehicles. For testing equipment, large firms tend to own private and professional laboratories along with experienced scientific staffs and FSMS teams, while SMEs may send samples to the accredited laboratories in their local areas. Apart from self-supply, large firms also provide these services for other smaller local firms. Moreover, a new trend toward safer raw-material supply at large firms is observed from the interviews. They aim for 'a closed chain' as the managers in cases VN2 and CN1 explained that they had developed a fully integrated fish-production system, from the hatchery to aquaculture and processing through the finished product. These integrated systems are 100% financed and controlled by the company instead of cooperating with different parties in the supply chain. For instance, firms possess farms and only hire local farmers to do the cultivation of aquatic animals. Therefore, they do not rely on agents for raw-material supply. These firms invested in recirculating aquaculture systems (RAS) technology that is used in home aquaria and for fish production where water exchange is limited and the use of bio-filtration is required to reduce ammonia toxicity. Although RAS can help them achieve better control of food-safety risks from the beginning of the chain, it requires a financial capacity for upfront investment in facilities, high operating costs mostly from

electricity usage, and system maintenance as well as well-trained staff to monitor and operate. In simple words, they want to shorten the chains to control food safety strictly from the beginning of the chains without involving too many stakeholders.

Nevertheless, shortening the chains could raise several arguable issues such as the exclusion of small-scale, more impoverished stakeholders (farmers, fishers, and family businesses), and large companies with strong financial ability could dominate the market. Large corporations are strongly capable of complying with any standards as long as importers require and hence could assess most worldwide markets. Meanwhile, SMEs could only approach less stringent ones. For instance, VN7, as a small firm, said, 'We are unable to export products to high-value markets such as the USA, Japan, or EU since requirements are stringent and our facility, as well as financial ability, are not enough, so we aim at Asia or South East Asia or domestic markets. In turn, surplus value for these markets is not enough to invest in a sophisticated facility to improve food safety, such as a private laboratory.'

4.4.2 The market level

4.4.2.1 Supply chain relationship

The supply chain relationship emerges from the study through supplier management and collaboration among stakeholders in global supply chains to ensure food safety management. First, to manage suppliers, supplier selection is perceived as vital by the managers in the study since fishery supply chains consist of several small-scale farmers/fishers/agents that directly affect the safety of final products. It is obvious that more than one available supplier improves supply chain continuity, and suppliers are a crucial part of firms' success. No food-safety control system is perfect; supplier selection, therefore, has become more and more critical to these firms to consider and evaluate several tangible and intangible factors in selecting and monitoring their suppliers. Under the strong impact of food-safety standards, supplier-selection criteria in the food industry are not only defined by price, quality, delivery performance, and service but also related to food-safety management, such

as suppliers' certificates and inspection results to ensure input safety. Currently, the interviewed firms require several safety-related criteria for supplier selection and undertake additional audits, testing, and inspections by their laboratories or personnel to monitor their suppliers. VN5 stated, 'We use HACCP protocol, sensory testing and monitoring, random and periodic testing for specific heavy metals, histamine testing, CAP antibiotics, etc. At the point of purchasing raw material, we send our employees to work on-site at farms or agents. For other service providers, we select suppliers by recognised safety and quality standards.' Second, collaboration activities in supply chains help control food safety management in food firms via food-safety information exchange, joint solving, establishing continuous improvement program, planning and goal setting among stakeholders. For example, under the firms' policy, fishers/agents/suppliers have to share information related to food safety such as the information of the raw material area, amount and what type of breed, feed and veterinary drugs they use, and so on. In some cases, firms also provide loans for feed and veterinary drugs if they have agreements with farmers in selling prices prior to the harvesting period.

Two different practices in terms of supplier management and collaboration exist based on the interview results. On the one hand, large firms in this study manage and collaborate with their local suppliers and sign contracts with rigorous supply policies containing agreements on specifications (e.g. microbiological and hygiene assurance, precise kind of feed for fishes, specifying the approved area of aquaculture, providing feed and veterinary drugs to use) and certifications related to safety criteria. VN2 said, 'Farmers/fishers and agents who are under the close monitoring of the processors could provide better and safer input supply than independent firms thanks to close collaborating and stricter managing of suppliers.' Likewise, some suggested that this is the same trend between exporters and importers. In the case of VN5, their import partners 'invest in the facility for manufactures and inspection from raw material to final products'. In the case of VN1, their clients 'send technical experts to work in our processing factories to monitor and enhance improvement in FSMS'.

On the other hand, firms mainly manage their suppliers based on supplier-selection criteria, and no further collaboration exists between them and their stakeholders, as the manager of VN4 stated – 'Collaboration is not common. Buyers usually sign contracts in the quest of food safety certification terms in the contract. Most of the importers decide to import as long as firms show certificated standards.' This statement is confirmed by VN8 – 'Most of our consumers only concern what standards we have so they could get through the border inspection.' CN5 specified, 'Some clients come to visit our plants and check what standards and regulations we comply with to decide to buy or not – no further collaboration between us.' Although collaboration aims are to guarantee food safety, improve management efficiency, and support firms in compliance with more stringent standards in international trading, the managers of VN4 and VN6 mentioned these practices are 'costly' and 'time-consuming' processes and 'rely heavily on suppliers' objective and incentive to collaborate' because some local fishers/farmers/agents resist changing their current practices.

4.4.2.2 External supports

Several interviewees mentioned that some SMEs in their local areas had become bankrupt because of intense price competitions, failing to meet exporting requirements and continuously changing operating environments. Therefore, firms in the fishery industry need to support and receive support from other organisations to develop and meet increasing demands in international trading. According to the interviewees, four sources of support enhance FSMS: stakeholders in supply chains, government and authorities, business associations, and financial institutions. The means of support vary depending on each firm's need from tangible to intangible elements, such as 'operational and testing equipment', 'fishery seeds and feed', 'skilful and experienced human resource', 'finance', 'market opportunities and food safety information', 'standards requirement', 'pre-agreement contracts', and so on. For instance, the large firms confirmed that they usually receive supports from their stakeholders, such as importers and wholesalers in terms of updated technology and information to comply with rapidly changing standards and

requirements in developed countries. In turn, they support their local suppliers, such as in the case of VN2 closely working with their upstream suppliers through 'upfront loans, facility investment such as 30–50% of the total contract value, and detailed processes of feeding, nurturing fish/shrimp for fishers, agents, or suppliers, and sending employees to work frequently on site to control food safety from raw material'. The level of support from the government, authorities, and business associations are considered from medium to high impact to FSMS among participant firms. While the government and authorities mainly provide legal information and FSMS training, business associations (namely China Fisheries Association in China and VASEP in Vietnam) usually provide FSMS guidance, market-opportunities information, and food-safety training course for firms. Financial institutions such as banks and industrial investments contribute financial support to firms. Another reported problem is a paradox in this type of support because large firms could easily approach these financial sources while SMEs struggle to acquire loans to purchase safe raw material and new machinery. For instance, there is a lot of procedures required from the banks as evidence that firms are able to pay back the money, which SMEs might find difficult to fulfil.

4.4.3 Food-safety governance

The most popular practices of food-safety governance found at the interviewed firms include inspections and audits, sampling, regulatory sanctions, stimuli, and education. Most of the informants agreed that inspections, audits, and sampling are necessary to assure and provide evidence to authorities that firms comply with regulations. Official inspections, audits, and sampling can be random or periodically performed before or after releasing products at firms, retail places (e.g. showrooms, flea markets, and supermarkets), or exporting points by regulatory authorities. These practices focus on product or process. Product-focused practices concern the safety level of the product, such as the level of antibiotics in the raw material, while process-focused practices pay attention to whether firms establish the correct food-safety management procedures. These practices of food-safety governance play the roles of framing, guiding and checking FSMS implementation at these firms. On the other hand, they also cause difficulties

for food firms in implementing FSMS; the manager of VN4 expressed, ‘Inspections, audits, and sampling are necessary for the fishery industry, but the current system is duplicated in terms and requirements. For example, in our national regulation, a type of fish is under the supervision of three ministries, including the Ministry of Health, the Ministry of Agriculture and Rural Development, and the Ministry of Industry and Trade. Therefore, our firm is subject to be inspected by all three ministries several times throughout a year, generating more costs and time because of these inspections’.

From the results of regulatory inspections, audits, and sampling, regulatory sanctions such as fines, penalties, prosecution, and recalls will be conducted to punish firms for committing offences or repeatedly breaching food-safety regulations. The most popular form of sanction, according to the interviewees, is fines. It is obvious that no firm wants to be punished since sanctions will damage their reputation and opportunities to further develop in the industry. From the viewpoints of the majority of the managers, the FSMS-related requirements are described as ‘not steady’. As a result, a minor requirement change could make firms deal with several issues to adapt and avoid sanctions because of the complexity of the whole system involved with several stakeholders. These businesses need ‘pending time’ to adjust their current practices along with training progresses for handling food, directing workers, and changing contracts with suppliers like farmers/fishers, agents, and local service providers, not to mention the changes in food-safety requirements extend inspection time at the ports for cargos both before shipping at exporting countries and after arriving at importing destinations. They also raise several associated costs, such as testing and certification fees.

On the contrary, stimuli such as awards, labels, and tax reduction from regulatory agencies encourage compliance with food-safety management. The manager of VN2 mentioned a particular case of one well-known firm in the area as an interesting example of a stimulus. The USA imposed new anti-dumping duties on Vietnamese fishery exporters ranging from 3.87 to 7.74 USD per kilogram, much higher than the initial results. Only two companies are allowed to retain or reduce their tax because these firms could guarantee a high level of FSMS by strictly controlling the quality and traceability of breeds,

ensuring food hygiene and limiting antibiotic residues. Even their average selling price increased by 10–15% compared to the market because of their strict FSMS policy, which is especially advantageous for the company. The average export price of pangasius to the U.S. market is about 3.87 USD/kg; with the above tax rates, none of the businesses would be able to continue exporting to the U.S. market. Accordingly, the company in the area accounts for 43.5% of total catfish imported into the USA from Vietnam, and their products are sold in well-known retail chains such as Walmart, Target, Trader Joe's, and Kroger. For the EU market, their products are sold at Tesco, Casino, and Metro supermarkets and occupied 15.1% of the market share of Vietnamese pangasius by the end of 2017 (Ba Uoc, 2018).

Also, information and education, such as guidelines, training, and advice from regulatory agencies to food firms, enhance the knowledge of food-safety management. These activities are conducted monthly or quarterly, according to the interviewed firms. Firms usually send quality-control managers or food-safety teams to attend these sessions, most of which are compulsory. VN5 stated, 'In these training, the participants gain knowledge on food safety in production and processing or update relevant legal documents to further raise the awareness and responsibility of managers and direct workers. Normally, at the end of each session, the participants receive certifications for attending or have some tests indicated, passing all the requirements.' After being trained, the participants are in charge of training for others in their company, such as direct workers and line managers, to update new FSMS-related knowledge, protocols, or legal information. Nonetheless, some limitations of information and education include 'inconsistent training', time consumption, and the 'lack of following up and evaluating the effectiveness and impact', as said by CN4.

4.5 Priority order of CSFs for FSMS implementation

To identify the priority order of CSFs, there are two involved techniques including measuring or quantifying and comparative scaling the qualitative assessment of the interviewed managers. In comparative scaling technique, there are various types of scaling including paired comparison, rank order,

constant sum, Q-sort and other procedures (Malhotra and Birks, 2018). In this study, there is a need to rank order of CSFs based on the level of their perceived impacts on the success of FSMS implementation. First, to measure or quantify the qualitative assessment of the interviewed managers, the interviewees were asked to attempt to qualitatively assess the impact degree of these CSFs following three levels – high, medium, and low – at the end of each interview. Then, following the procedure of rank order scaling, the respondents were presented with several CSFs simultaneously and asked to order or rank them according to their impact on FSMS implementation. As shown in Table 4.2, the results are in the above matrix columned by the sizes of the participated firms (large, medium, and small) and colour coded as a high impact in blue columns, medium impact in orange, and low impact in grey.

In order to compare and rank those CSFs, there is a need to calculate the cumulative occurrence of each CSF to understand the total impact assessment from all the interviewees and find their ranking order. The approach of quantifying qualitative assessment has been applied in several previous studies. To quantify qualitative assessment, each statement or criteria is assigned a numerical score, ranging either from –2 to +2 or from 1 to 3 or 1 to 5 (Malhotra and Birks, 2018). For example, van Asselt *et al.* (2010) use scale from -2 to +2 (Substantially declined food safety risk (-2), declined risk (-1), no impact (0), increased risk (+1) substantially increased risk (+2)) to identify CSFs for pasteurised milk and Valess (a vegetarian product prepared from algae and curdled milk). Based on the experts' cumulative assessments in Table 4.2, the cumulative occurrence is quantified to have the same measurement for the assessment by assuming that the constant distance among the three levels of impact is fixed and each level is assigned to interval scale from low to high impact from 1 to 3. In particular, low impact is 1, medium impact is 2 and high impact is 3. For example, the cumulative concurrence of 'information and education' is 3H 4M 6L. According to qualitative assessments, its total impact value would be equal to $3 \times 3 + 4 \times 2 + 6 \times 1 = 23$. The cumulative occurrence of each CSF is calculated in the last column. After quantifying, all factors based on total impact value are sorted to provide a

ranking view of identified CSFs in prioritising, which CSFs should receive more attention than others.

Table 4.2 CSFs Ranking Based on Their Perceived Impacts

Group	Factors	CSF Ranking									Cumulative Occurrence
		Large Firm (4 firms)			*Medium Firm (4 firms)*			*Small Firm (5 firms)*			
(1) HR	Commitment and awareness	4	0	0	4	0	0	5	0	0	13H
	Involvement	4	0	0	4	0	0	5	0	0	13H
	Knowledge	3	1	0	4	0	0	5	0	0	12H 1M
(2) MR	Managers' commitment	4	0	0	4	0	0	5	0	0	13H
	Responsibilities and authorities	3	1	0	3	1	0	5	0	0	11H 2M
	Food-safety policy and culture	3	1	0	3	1	0	3	2	0	9H 4M
(3) OR	Facilities and equipment	2	2	0	2	2	0	3	2	0	7H 6M
	Financial condition	1	3	0	1	3	0	3	2	0	5H 8M
	Technological condition	0	2	2	1	2	1	1	3	1	2H 7M 4L
(4) SCR	Supplier management	4	0	0	3	1	0	5	0	0	12H 1M
	Collaboration	3	1	0	3	1	0	3	2	0	9H 4M
(5) ES	Stakeholders in supply chains	4	0	0	3	1	0	4	1	0	11H 2M
	Government and authorities	1	3	0	2	2	0	3	2	0	6H 7M
	Business associations	3	1	0	2	2	0	4	1	0	9H 4M
	Financial institutions	0	3	1	0	3	1	3	2	0	3H 8M 2L
(6) FSG	Audits and inspections	3	1	0	2	2	0	4	1	0	9H 4M
	Incentives (sanctions and stimuli)	2	2	0	3	1	0	0	3	2	5H 6M 2L
	Information and education	1	1	2	1	1	2	1	2	2	3H 4M 6L

****Note:*

H: high impact; M: medium impact; L: low impact.

HR: human-resource factors; MR: management responsibility factors; OR: Organisational resources, SCR: supply chain relationship, ES: external support, FSG: food safety governance.

As illustrated in Table 4.3, each CSF is sorted and ranked by the total level of their perceived impact on the success of FSMS implementation through cumulative experts' assessments. It is unfeasible for food manufacturers to devote efforts to address and improve all CSFs of FSMS implementation concurrently owing to finite resources. Developing the ranking of CSFs can enable organisations to recognise the potential area to pay attention and to

improve their FSMS continuously. Therefore, based on the total points of each CSF in this study, managers could use as order ranking reference to identify which CSFs should receive more attention. For instance, the top three of the perceived factors leading to the success of FSMS within the interviewed firms are employees' commitment and awareness, knowledge, and employee's involvement having the highest scores. It is suggested that they should be determined as the highest priority group. Then, employees' knowledge and supplier management rank the second place compared to the rest in term of priority order. The other factors, which have lower points, could be sorted into the lower priority group.

Table 4.3. The assessment of CSFs Impact Based on Quantifying the Cumulative Occurrence

No.	Factors	Total Points	Priority order ranking
1	Employees' commitment and awareness to food safety	39	1
2	Employees' involvement	39	1
3	Managers' commitment	39	1
4	Employees' knowledge	38	2
5	Supplier management	38	2
6	Clear responsibilities and authorities	37	3
7	Support from stakeholders in supply chains	37	3
8	Food-safety policy and culture within the organisation	35	4
9	Collaboration in the supply chain	35	4
10	Support from business associations	35	4
11	Audits and inspections	35	4
12	Qualified facilities and equipment	33	5
13	Support from government and authorities	32	6
14	Organisation's financial condition	31	7
15	Incentives (sanctions and stimuli)	29	8
16	Support from financial institutions	27	9
17	Organisation's technological condition	24	10
18	Information and education	23	11

4.6 Discussion

The increasing stringency of food-safety requirements and the growing complexity of global food-supply chains pose a significant challenge for firms to manage food safety from raw material to final products effectively. As a result, enterprises have responded by complying with international food-safety standards through process-based, integrated food safety management approaches and being audited by third-party auditing institutions to verify specific FSMS levels (Mensah and Julien, 2011). Thus, organisations that participate in global trading with differences in resources, firm sizes, and trading environments could experience several factors that affect FSMS implementation. Despite their contributions to the success of FSMS implementation, CSFs have not received enough attention since most of the studies in the literature adopted a quantitative approach to confirm their presences without considering the reasons why they are perceived as CSFs in their complicated natural settings. Moreover, the priority order of CSFs that could act as decision-making tools in what and where to improve to create the highest impact on FSMS implementation remains unknown. Hence, this study addresses these gaps and presents a set of identified and ranked CSFs based on practical experts' viewpoints and field observations and then weaves it into the existing literature.

From the study findings, it is evident that in international trading, firms deal with several CSFs at three levels, including the organisation, the market, and food-safety governance of the broad environment in FSMS implementation. Compared to CSFs in the literature, there are many factors eliminated based on the study findings, these factors are in italic fonts in the column 'CSFs in the literature' in Table 4.4. These factors were eliminated due to changing in FSMS implementation, for instance, standardised procedure is regulatory requirements for food manufacturers and exporters in global supply chains. If they did not have standardised procedure such as HACCP, ISO 22000, etc, it is impossible to export or even sell their food products in domestic markets. On the contrary, factors in the italic fonts in the column 'CSFs from this study' in Table 4.4 are emerging from the interviews. The reasoning for identified CSFs in this study is summarised in Table 4.5.

Table 4.4 Comparison between CSFs from the literature and this study

Group	CSFs in the literature	CSFs from this study
Human Resources	• *Communication* • Commitment • Training • Awareness • Involvement	• Commitment • Awareness • Knowledge • Involvement
Management responsibility	• Managers' commitment • Awareness • Food safety culture	• Managers' commitment • Food-safety policy and culture in the organisation • *Clear responsibilities and authorities*
Other organisational resources	• Equipment • Technology • *Standardised procedure*	• Qualified facilities and equipment • Financial condition • Technological condition
Supply Chain Relationships	• Trust in relationships • Collaborative supply chains • *Target market (export or domestic)*	• *Supplier management* • Collaboration
Support	• External support	• *Stakeholders in supply chains* • *Government and authorities* • *Business associations* • *Financial institutions*
Food-Safety Governance	• Food-safety governance	• Food-safety audits and inspections • Incentives (sanctions and stimuli) • Information and education

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Table 4.5 Summary of the justifications for identified CSFs in the study

Level	Group	Factors	Reasons
Organisational Level	Human Resources	• Commitment • Awareness • Knowledge • Involvement	• 'Fundamental to the success of the whole system [because of] direct involvement.' • A significant number of employees involved in FSMS • The need for a shared perception of the importance and expectation of food safety • A required for a certain level of consistency in personnel awareness
	Management responsibility	• Managers' commitment • Food-safety policy and culture in the organisation • Clear responsibilities and authorities	• Demanded by the law and standards • 'It consists of the perceptions and viewpoints of the managers or food-safety team.' • Firms 'struggle with how to spread and transform them into food-safety culture, policy, and objectives to all employees within the firm and other involved stakeholders' • A well-established food-safety policy is considered as a competitive advantage in global trading
	Other organisational resources	• Qualified facilities and equipment • Financial condition • Technological condition	• The more advanced and sophisticated the facility and work environment in food manufacture are, the higher the guarantee of food safety management could be at the interviewed firms • These facilities and equipment directly affect the food safety of exporting products • Reflect abilities in complying with any standards as long as importers require
Market Level	Supply Chain Relationships	• Supplier management • Collaboration	• Fishery supply chains consist of several involved small-scale farmers/fishers/agents whose activities directly affect the safety of raw material to final products • The interviewed firms require several safety criteria for supplier selection and undertake additional audits, testing and inspections by their laboratories or personnel to monitor their suppliers • 'Farmers/fishers and agents who are under the close monitoring of the processors could provide better and safer input supply than independent firms thanks to close collaborating and stricter managing of suppliers' • Activities of collaboration in the supply chain contribute to elevating the level of controlling food-safety management in food firms • Difficulties in these practices are 'costly' and 'time-consuming' processes that 'rely heavily on suppliers' objective and incentive to collaborate' because some local fishers/farmers/agents resist changing their current practices

	Supports	• Stakeholders in supply chains • Government and authorities • Business associations • Financial institutions	• Support one another to update technology and information to comply with rapidly changing standards and requirements in international trading • Means of supports vary, such as 'operational and testing equipment', 'fishery seed and feed', 'skillful and experienced human resource', 'finance', 'market opportunities and information', 'standards requirement', and 'pre-agreement contracts' • SMEs receive less support compared to large firms
Broad Level	Food-Safety Governance	• Food-safety audits and inspections • Incentives (sanctions and stimuli) • Information and education	• Food-safety inspections and audits are necessary to assure and provide evidence to authorities that firms are complying with regulations • They play the roles of framing, guiding and checking FSMS implementation • Could create a huge advantage for firms in international trading • 'In these training, the participants gain knowledge on food safety in production and processing or update relevant legal documents to further raise the awareness and responsibility of managers and direct workers' • Difficulties: o Duplicated in terms and requirements o 'Not steady.' o Raising costs o 'Training is not consistent' and is 'time-consuming.' o 'Lack of following up and evaluating the effectiveness and impact.'

4.6.1 The organisational level

At the organisational level, the literature suggests standardised food-safety procedure is the most mentioned factor among CSFs. In this case study, all the participated firms are certificated as they are currently processing and trading their products across the globe. In addition, it is obvious that without certificated FSMS, firms are unable to participate in global food supply chains. Therefore, standardised FSMS is no longer a factor; it becomes a condition to be a part of global suppliers.

In this study, people-related factors within the firm emerge from all the interviewed experts. In particular, awareness, commitment, and behaviour not only from personnel who directly handle food products but also from managers and supervisors who establish responsibilities and authorities within firms, monitor food-safety management activities, and develop food-safety policy and culture contribute significantly to FSMS success. People-related factors are perceived as high-priority CSFs since firms find them challenging to establish, control, and measure. Therefore, they should be in the high-priority group of CSFs, as expressed by Yiannas (2009): 'You can have the best-documented food-safety processes and standards in the world, but if they are not consistently put into practice by people, they are useless.' From this finding, it is interesting to note that except for training-skills requirements, current FSMSs lack emphasis on the human aspect of firms in terms of employees' awareness, commitment, and behaviour and management responsibility in food safety management. This finding harmonises with several prior studies' results in the literature that people-related factors are the first challenge that enterprises face in their quest for successful FSMS implementation (e.g. Fotopoulos, Kafetzopoulos, and Psomas, 2009; Mensah and Julien, 2011; Kafetzopoulos and Gotzamani, 2014). Xiong et al. (2017) also mentioned several weak indicators of FSMS performance related to people, such as qualified personnel, personal hygiene, lack of competent persons, and so on. These issues are critical to FSMS implementation because each employee within an organisation has a shared responsibility for preventing food-safety risks, and the sum of food-safety efforts within an organisation is critically dependent on its parts, especially in the context of

using intensive labour at fishery manufacturing and exporting firms in Asia. This finding has important implications for the practical suggestion that firms in food supply chains would not only rely on training and audits or acquire complied standards to improve these factors. On the contrary, food firms should consider food safety as a leading KPI (key performance indicator) and establish and reinforce it as a vital culture with shared values by the managers and direct workers (Yiannas, 2009).

Furthermore, the more advanced and sophisticated the facility and work environment, as well as sustainable financial conditions in food manufacturers, the higher the abilities of food-safety management, according to the observation and interviews. Consequently, these factors are considered as CSFs of FSMS implementation besides people-related factors at the organisational level. Moreover, SMEs have the tendency to perceive these aspects as more critical and with higher impact to FSMS implementation than large firms do since the interviews reveal that it leads to the gap between them in international trading. This result is in accord with the stream of literature indicating that stringent standards cause an unequal distribution of the gains from trade and lead to the exclusion of the least developed countries and the most impoverished farmers who are unable to comply because of a lack of technical and financial capacity (Henson and Reardon, 2005; Schuster and Maertens, 2013). In this study, it is proven that even in the same country where firms are in the same context, a significant gap between SMEs and large firms exists because of the trend toward the ‘closed chains’ of large firms. On the one hand, this trend assists these firms to absolutely control food safety and sell their products at higher prices. On the other hand, SMEs are likely to be eliminated in the race for more stringent FSMSs and demanding market segments since they are only able to supply ‘lower quality’ markets with their current levels of the facility, work environment, technological and financial ability.

4.6.2 The market level

At the market level, relationships and interactions between firms and other organisations within a sector with the aim of guaranteeing food safety are

explored in this research. In detail, the roles of supplier management and support from stakeholders in the supply chains in implementing FSMS are perceived as critical and need to be prioritised than several CSFs among the food exporters for two reasons (see Table 4.3). First, these factors are used as multi-purpose tools by the firms to control and manage their suppliers. Second, they facilitate and affect the status of FSMS toward continuous improvement through collaboration and support among stakeholders, especially for SMEs. In the context of increasing food-safety standards and requirements, these factors help bring several advantages for firms in global supply chains, including more reliable inputs and better food safety and quality control. These findings further support the highlighted role of supplier management practices and supportive relationships in supply chains, including contributing to more advanced FSMSs and good system output as firms demonstrate advanced knowledge and expertise about safety and quality management (Kirezieva, Luning, *et al.*, 2015), leading to improving product quality (Fynes, Voss, and Burca, 2005), lowering costs, and enhancing reliable delivery (Goffin, Lemke and Szwejczewski, 2006).

Another important finding is that creating and maintaining such collaborative relationships not only requires intensive resources but also is influenced strongly by stakeholders' awareness and incentives according to the experts' experience. Therefore, collaboration in the supply chains ranks lower than supplier management and supportive relationships. These findings raise intriguing questions regarding the nature and extent of why and how to motivate firms to support and collaborate with one another to enhance food safety management in global supply chains. While the support of stakeholders in the supply chains is in the centre of the interviewees' attention, support from business associations, the public sector, and financial institutions receives less consideration. This result is rather disappointing because these organisations are supposed to facilitate the proper functioning of food chains and open up space for better bargaining for local actors in global value chains (Jespersen et al., 2014), and managing food safety is a shared responsibility of all actors in the food chain, including governments, the industry, and consumers (FAO/WHO, 2001).

4.6.3 Food-safety governance

In this research, it is demonstrated that implemented FSMSs are impacted by the 'broad context' shaped by food-safety governance, corroborating the findings of Kirezieva, Jacxsens, et al. (2015) and Kirezieva, Luning, et al. (2015). Inspections, audits, and sampling are periodically or randomly used as tools to examine non-conformity products or processes by regulatory authorities. Afterwards, sanctions can be imposed upon non-compliant activities, and stimuli are used to encourage compliance incentives. In addition, information and education (such as guidelines, training, and advice) are applied to broaden and update knowledge of food-safety management. The ultimate objectives of food-safety governance encourage compliant and proactive FSMS improvement; as Rouvière and Caswell (2012) suggest, the enforcement of safety regulations focuses more on prevention rather than on punishment and deterrence. Nonetheless, in practice, the emerging finding from the interviews is that these practices generate extra costs, are time-consuming, and are considered as bureaucratic protocols for firms to follow, lack adequate evaluation for each practice. The practices of food-safety governance in the studied countries cause some emerging issues to the interviewed firms because of the lack of consistency, stability, and transparency. Therefore, although these factors contribute to the success of FSMS implementation by encouraging firms to update their FSMS and guaranteeing continuous compliance, they have not adequately performed their vital roles in supporting, encouraging, and enforcing food-safety governance.

4.7 Conclusion

These research findings, while preliminary and qualitative, provide a closer look at the FSMS practices of firms in the fish and fishery industry. A set of the most critical factors related to the organisations, market, and environment is determined that affect the success of FSMS. Moreover, it provides a detailed explanation for each perceived CSF in three analysis levels based on the practical and valuable experience of Asian fishery exporters in China and Vietnam. Besides contributing to the existing literature of FSMS

implementation grounded on CSF theory, several practical implications exist, especially for manufacturers and exporters in the fish and fishery industry in developing countries.

First, to successfully and effectively manage FSMS, managers should fully understand and be aware of the above CSFs because certifying an FSMS does not guarantee a high degree of identification, assessment, and control of hazards in food-supply chains (Fotopoulos, Kafetzopoulos, and Psomas, 2009). Hence, food businesses can apply the viewpoint of the CSF as a more proactive approach to identify the mechanism enabling continuous improvement strategies for the current FSMS implementation, particularly for SMEs with finite resources, as not all factors are important and contribute to the system success. Focusing on the wrong CSFs or even not knowing their existence influences FSMS implementation and might hamper businesses from making more profit.

Second, each FSMS is highly customised, resulting in no 'one best way' applied for all food manufacturers; maximum performance comes from the appropriate level of a structural variable that fits the contingency (Donaldson, 2001). There are different reasons and perceptions of the interviewed experts from various-sized organisations. Some CSFs are perceived and assessed more critically to the success of FSMS implementation, given the situational differences of each enterprise. Therefore, firms should pay attention to these CSFs contingent on their situation.

Finally, notwithstanding the priority of CSFs developed simply according to the ranking of the experts' assessments (see Table 4.2), the study suggests that there are three groups of CSFs in FSMS implementation, classified as high, intermediate, and low priority. This suggestive priority order can be used as a realistic decision-making tool to assist food firms' managers in allocating adequate resources as well as raise their attention to specific factors in ensuring and improving the current FSMS implementation. Moreover, food firms could apply the methodology of this study to identify their list of CSFs and rank them to examine a new priority order of CSFs on demand. Especially, the finding's significance from this research provides critical and practical insights for fishery companies from Vietnam and China. Practitioners in the fishery

industry seeking improvement of FSMS implementation would be served well by the analysis in this study on a CSF-based approach to identify improvement areas as a useful reference tool.

CHAPTER 5 AN EMPIRICAL INVESTIGATION OF CRITICAL SUCCESSFUL FACTORS FOR FSMS AND BUSINESS PERFORMANCE

5.1 Chapter introduction

To meet both market demands and regulations, stakeholders in global food supply chains are progressively increasing food safety management within their organisations and throughout the chains to demonstrate their abilities in controlling food safety hazards to ensure that food is safe at the time of human consumption (Mensah and Julien, 2011). However, this is a difficult task since the success of FSMS in preventing foodborne hazards depends on its correct implementation and application (Kok, 2009; Kafetzopoulos, Psomas and Kafetzopoulos, 2013). As a result, the identification of a mechanism enabling for FSMS success is increasingly critical to assist food firms in recognising and understanding these critical points and consequently contributes to guaranteeing food safety.

In this thesis, the SLR chapter has addressed the main gaps in the literature. Although FSMS implementation has been thoroughly investigated with both positive and negative reviews, causal factors leading to effective FSMS implementation and its consequences on business performance remain speculative. In detail, the systematic analysis and assessment of FSMS regarding their CSFs and the degree to which their effective implementation impact on business performance remains unknown. The ultimate goal of the effective implementation of FSMS is to improve food safety. Uup to now, far too little attention has been paid to whether FSMS impacts on overall business performance even though optimising business performance is the primary objective of any firms in global food supply chains. When companies adopt FSMS, they expect that besides compliance with regulations to ensure food safety, FSMS would have positive impacts on their business performance in term of finance and operation (Kafetzopoulos and Gotzamani, 2014). Thus, many authors (Kafetzopoulos, Psomas and Kafetzopoulos, 2013; Kafetzopoulos and Gotzamani, 2014) suggest that future research would evaluate the relationship between CSFs, FSMS and business performance.

In addition, food manufacturers and exporters operate in a diverse business environment with different field pressures and manufacture characteristics, legal requirements, and institutional settings. Despite the growing importance

of FSMS in the food industry, there remains a paucity of evidence on improvement opportunities as a result of assessing FSMS implementation considering the impact of CSFs contingent on the current situation of each enterprise. These variables follow the contingency argument, which states that there is no best way to lead a firm or a process; instead, the best solution is contingencies that reflect the situation of the organisation (Donaldson, 1995, 2006; Kirezieva, Jacxsens, *et al.*, 2015). Consequently, it explains that the performance of a system and its optimal course of action are dependent on the internal and external situation. Therefore, identifying improvement areas for FSMS must be investigated contingent on firm's situation matching their structures and processes to their environment in order to maximise the performance. Consequently, food firms' managers could effectively manage FSMS implementation by focusing on prioritised CSFs to optimise all resources.

In Chapter Four, it is proven that a set of CSFs related to the organisations, market, and environment affecting the success of FSMS based on the perspective of Asian fishery manufacturers and exporters in China and Vietnam. It provides the explanations for several CSFs of FSMS that firms deal with at three levels in international trading and suggest the CSFs ranking to assist managers in decision-making. The research from the case study presented in Chapter Four is the initial set of findings to gain insight into why and how an identified factor grounded on the findings of SLR is perceived as CSF that influences the success of FSMS implementation in the context of global supply chains. It is expected to develop better measurements with specific samples of populations and to see if data from a few individuals can be generalised to a large sample of a population in the QUAN phase. The results also intrigue a question related to the differences in the practices of supplier selection and the management of SC relationship among firms, and whether the differences affect the implementation of FSMSs. Thus, a quantitative approach is needed to generalise its results and quantify to what the degree these CSFs impact FSMS implementation and also explore the relationship between FSMS implementation and business performance. Moreover, the sampling strategy of the qualitative study is designed to capture

the common patterns in developing countries where the dominant fishery-production processes in the world are located. Hence, there is a need for further investigation on different kinds of food supply chains such as grains, vegetable, and dairy because each kind of food has unique characteristics and might require different customisations of FSMS implementation.

Responding to the identified gaps in the literature and the need for further research on the qualitative results, this study aims to:

- Research objective 1: Investigate whether and to what degree CSFs influence FSMS implementation at firms in the context of global supply chains
- Research objective 2: Search the evidence concerning whether and to what degree FSMS implementation affect business performance.
- Research objective 3: Examine whether the groups that have better FSMS implementation pay more attention to safety criteria in supplier selection and are in better SC relationship than their counterparts
- Research objective 4: Identify the potential areas for improvement opportunities depending on their different FSMS implementation to inform the effective strategies of FSMS implementation.

The rest of the chapter is structured as follows. The next section presents the research framework and hypotheses development of the study. The research methodology is presented in section 5.3. The data analysis includes two separate sections 5.4 and 5.5. In section 5.4, factor analysis consisting of EFA and CFA is conducted to uncover the underlying structure of the variables emerging from the qualitative study and conform to what is expected based on pre-established theory. Then, SEM is undertaken to test the proposed hypotheses, following by two-step clustering analysis. Cluster analysis is conducted in section 5.5 to identify Best practice and classify the sample into distinctive groups, explore how these groups manage their suppliers, examine differences in CSFs and other practices that impact on and correlate to FSMS implementation. In the discussion, the research results and implications are considered before reaching the conclusion of the study in the end.

5.2 Research framework and hypotheses development

Given the limited amount of literature on the research questions investigated in this thesis and the above-stated objectives of the quantitative study, the hypotheses about the relationships suggested in the research model are drawn in Figure 5.1. Grounded on the findings of the previous studies and the results of Chapter Two and Four, the purpose to develop the hypotheses in this section is to theoretically identify the critical relationships between CSFs and FSMS implementation as well as between FSMS and two aspects of business performance. Each path in Figure 5.1 is labelled with the associated hypothesis, along with their theoretical backgrounds, which is discussed in the below sections. At the end of this section, the research instrumentation is presented.

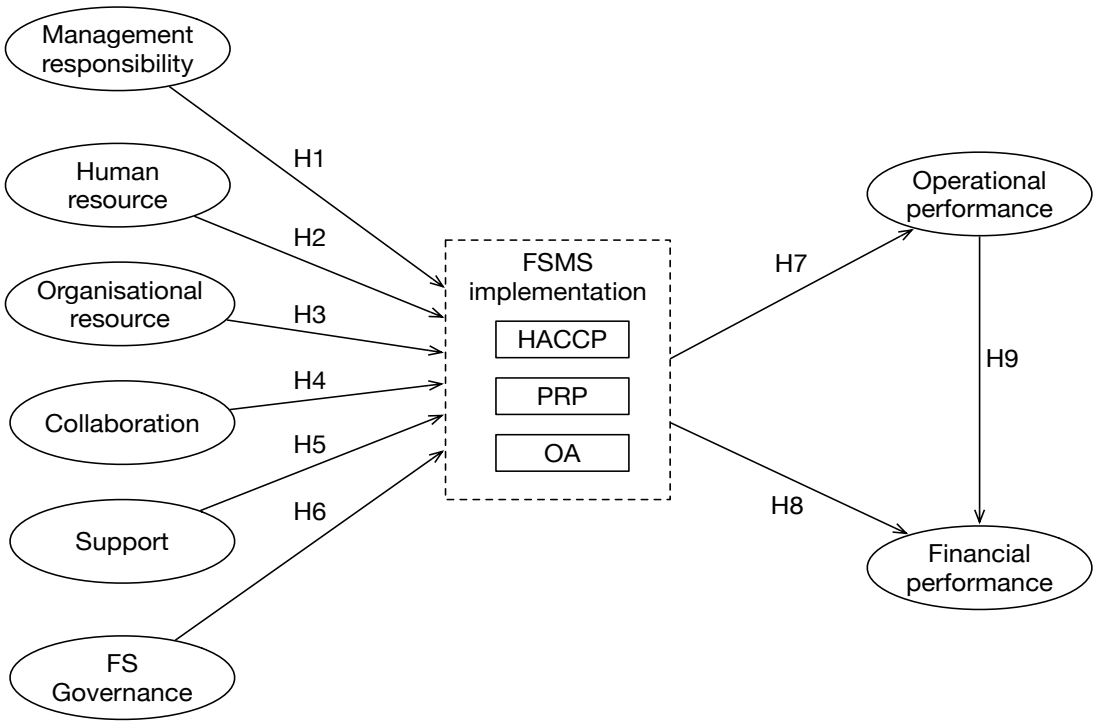

Figure 5.1. The research model

5.2.1 Critical success factors

The theoretical background of CSFs for FSMS is established in the discussion and findings of Chapter Two. Then, these factors have been investigated and narrowed down to six CSFs, including management

responsibility, human resource, organisational resources, collaboration, and support and FS governance in Chapter Four. Conjunctively, these CSFs from three analysis levels are selected to further investigate in this chapter.

5.2.1.1 The organisational level

As documented by food safety regulations, standards and many studies, management responsibility should be an important factor in FSMS since supervisors and top managers are responsible for the development and implementation of the effective FSMS and continually improving its effectiveness. The management provides commitment to support food safety objectives (Luning *et al.*, 2008; Trienekens and Zuurbier, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Jacxsens, *et al.*, 2015) and ensures the availability of required resources and adequately trained staff (Fotopoulos, Kafetzopoulos and Psomas, 2009; Kafetzopoulos and Gotzamani, 2014), establishes the food safety policy and culture within organization as well as updates the system continually (ISO, 2005; Yiannas, 2009; Nyarugwe *et al.*, 2018). Moreover, managers also must define clear responsibilities and authorities for involved personnel from food safety to food handling workers within our organisation to ensure efficient operation and maintenance of the FSMS (ISO, 2005).

According to ISO 22000:2005, to fulfil food safety objectives, 'the organisation should provide adequate resources for the establishment, implementation, maintenance and update FSMS'. These resources include human resources, infrastructure and work environment. Human resource or employee relation is considered as the topmost challenge in implementing FSMS, but it could attribute as the determinant factors of quality and food safety effectiveness (Fotopoulos, Kafetzopoulos and Psomas, 2009; Kafetzopoulos, Psomas and Kafetzopoulos, 2013; Kafetzopoulos and Gotzamani, 2014). The level of the FSMS implementation could be impacted by the degree of employee involvement (Luning *et al.*, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; Kirezieva, Luning, *et al.*, 2015), their efficient knowledge and skills to ensure food safety (Kafetzopoulos and

Gotzamani, 2014; Nyarugwe *et al.*, 2016), awareness of the relevance and importance of their activities in contributing to food safety (ISO, 2005; Yiannas, 2009; Powell *et al.*, 2013), training programs for employees to improve the current level of the above requirements related to food safety (Singh and Smith, 2006; Mensah and Julien, 2011).

Likewise, Trienekens and Zuurbier (2008) state that institutional and infrastructure facilities are essential factors for developing country producers to take part in international chains and implement standards required in Western markets. Many authors namely Luning *et al.* (2008), Fotopoulos, Kafetzopoulos and Psomas (2009), K. Kirezieva *et al.* (2013), Kafetzopoulos and Gotzamani, (2014), Kirezieva, Jacxsens, *et al.*, (2015) and Kirezieva, Luning, *et al.*, (2015) also consider that infrastructure and work environment are the basic operating characteristics of companies that may affect effective FSMS implementation. Furthermore, the other two aspects related to organisational resources that have not taken into account in ISO 22000:2005 are financial and technological conditions of the firm. Nevertheless, they are mentioned as barriers to FSMS implementation in the previous studies since their impacts could be significant if they are not sufficient for the system (Macheka *et al.*, 2013; Qijun and Batt, 2016; Xiong *et al.*, 2017). These aspects are investigated in the qualitative study and confirmed that they have impacts on FSMS implementation at the interviewed firms.

In summary, management responsibilities, human resources and organisational resources have been separately studied in the literature. They also have been qualitatively confirmed in Chapter Four. However, they have not been empirically tested in a model that shows their positive impact on FSMS implementation. Therefore, the following research hypotheses are proposed:

H1. Management responsibilities have a significant positive impact on the implementation of the FSMS.

H2. Human resources have a significant positive impact on the implementation of the FSMS.

H3. Organisational resources, including facilities, technology and finance condition of the firm, have significant positive impacts on the implementation of FSMS.

5.2.1.2 The market level

Collaboration

As mentioned above, the scope of this study concentrates on the impacts of supply chain collaboration and external supports on the implementation of FSMS at the level of the market environment. Supply chain collaboration, which is defined as two or more independent firms that form long-term relationships, work closely to plan and execute supply chain operations toward common goals, thereby achieving more benefits than acting independently (Simatupang and Sridharan, 2002), is a well-developed topic for many businesses. However, among all, the supply chain of food production needs to be paid more attention than others because of the nature of food, the difficulty associated with determining its safety risks before consumption (Mensah and Julien, 2011). Establishing collaboration and developing a more integrated relationship among the parties within the supply chain are essential to avoid corrupted connections in the food supply chain.

Additionally, Fynes, Voss and de Búrca (2005) suggest that supply chain collaboration create opportunities for firms to experience improved quality performance. As the same manner, Goffin et al. (2006) confirm that 'closer' relationships between manufacturers and their suppliers bring many advantages for firms, including better quality, lower costs and reliable delivery. Kirezieva, Luning, *et al.* (2015) confirm that collaborative supply chains contribute to more advanced FSMS and better system output as companies demonstrated advanced knowledge and expertise about safety and quality management. They specify collaborative supply chain related to a high level of severe stakeholder requirement, power in supplier relationship and degree of information exchange in the supply chains. In the same manner, to identify the degree to which a company collaborates with its partners in a supply chain, many previous studies propose to measure collaboration through information

sharing, joined problem solving, continuous improvement, planning and goal-setting activities, information exchange (Simatupang and Sridharan, 2008; Cao *et al.*, 2010; K. Kirezieva *et al.*, 2013; Macheka *et al.*, 2017).

In the qualitative study, the results show that collaborative activities related to food safety management in the supply chains help control FSMS better in food firms via information exchange, establishing continuous improvement program, joint emerging-problem solving, planning and goal setting among stakeholders. Therefore, these activities are used as well to explore the level of collaboration among the surveyed firms in this quantitative study. Although there are contradictory opinions toward practising collaboration in the supply chains among the interviewed companies as mentioned in Chapter Four, collaboration still plays a key role in managing FSMS. In the light of evidence from the qualitative research, they contribute to elevating the level of controlling food-safety management in food firms since farmers/fishers and agents who are in collaboration with firms could provide better and safer input supply than independent firms.

Support

Under pressure of more and more stringent market demands and regulatory requirements for food safety management, FSMS at firms within the international food supply chains need to be continuously improved. However, firms could deal with many difficulties in improving FSMS implementation since the burden and costs of more stringent food safety monitoring have a growing tendency of being shifted from importing countries to exporting countries, from developed countries to developing countries, from retailers to suppliers (Liu, 2009; Henson and Humphrey, 2009; Clarke, 2010). Retailers would be able to demand that their suppliers comply with new standards without compensating them adequately for the extra costs incurred even though most of exporting firms from developing countries often lack the infrastructure, equipment and trained personnel to meet the additional requirements of food safety standards. During the interviews of the qualitative study, these difficulties have been confirmed by the fact that some SMEs had become bankrupt because of intense price competitions, failing to meet exporting requirements and

continuously changing operating environments according to the managers of fishery exporting companies.

As a result, food manufacturers from developing countries search for external supports in term of finance to be able to invest in structure, equipment and staff training (Qijun and Batt, 2016), information to expand the market as long as update their FSMS to compliance with changed requirements from other stakeholders in supply chain, industry associations and non-governmental organizations (Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011). The findings of the qualitative research also point out that there are four primary sources of support enhancing the implementation of FSMS: stakeholders in supply chains, government and authorities, business associations, and financial institutions. In addition, from the literature NGOs show their critical roles in developing private regulatory/certification systems to support and encourage food firms to address food safety as well as social and environmental responsibility, using third-party certification rather than self-reports or certification by business partners (Mensah and Julien, 2011; Tran *et al.*, 2013). Combined with the suggestion of the literature, there are five sources of external support need to be tested in this quantitative research to investigate their impact on FSMS implementation, including support from stakeholders in supply chains, government and authorities, business associations, financial institutions and NGOs. Therefore, the following hypotheses are proposed:

H4. Collaborative activities concerning food safety in the supply chains have a significant positive impact on the FSMS implementation.

H5. Support related to food safety management has a significant positive impact on firms' FSMS implementation.

5.2.1.3 Food-safety governance

Stringent regulations and standards compliance is an essential element of all FSMS. Food-safety governance is usually used to induce compliance by the companies and is enforced by food safety authorities and relevant parties such as certificate bodies. They not only can be direct – via visits, random or

scheduled but also be indirect – through monitoring companies' records or third-party audits (Rouvière and Caswell, 2012). In the context of global supply chains, food-safety governance is extremely complicated due to many national and international actors involved in governance. This is evident in the study of Tran *et al.* (2013) in which they investigate the governance of the shrimp supply chain in Vietnam. Figure 5.2 integrates the public and private regulatory networks affecting the organisation and governance of shrimp supply chains. It consists of four quadrants divided by two red dotted lines. The two upper quadrants clarify public (governmental) and private (non-governmental) regulatory networks operating in the country (upper left quadrant) and foreign countries (upper right quadrant) importing Vietnamese shrimp.

As Kirezieva, Jacxsens et al. (2015) suggest, there are some existing enforcement practices and strategies by these key actors in food-safety governance. Their impacts on the FSMS implementation are receiving more attention to be investigated thoroughly. In detail, audits and inspections can be random or periodically performed before or after releasing products at firms, retail places (e.g. showrooms, flea markets, and supermarkets), or at exporting points by these actors (Rouvière and Caswell, 2012; Kirezieva, Jacxsens, *et al.*, 2015). From the results of regulatory inspections, audits, and sampling, regulatory sanctions such as fines, penalties, prosecution, and recalls will be conducted to punish firms for committing offences, non-compliance or repeatedly breaching food-safety regulations. They can be repressive (e.g., fines, prosecution, recall, closure of facilities, seizure of products, disqualification from the market), informative – requiring corrective actions, and 'naming and shaming' – providing negative information to the consumers (Rouvière and Caswell, 2012). Stimuli such as awards, labels, tax reduction, can also be employed to encourage compliance (Kirezieva, Luning, *et al.*, 2015).

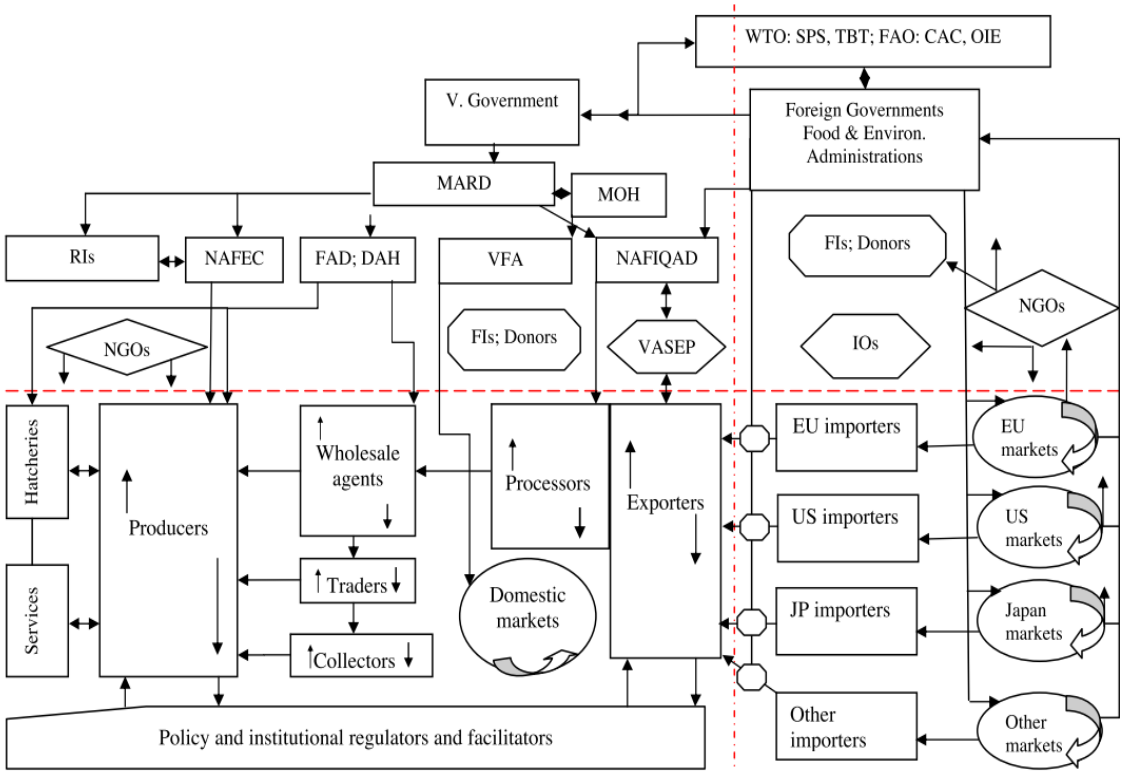

Figure 5.2 Key actors in governance for shrimp supply chains in Vietnam

(adopted from Tran *et al.*, 2013)

Additionally, information and education (such as guidelines, training, advice) are used to support companies, especially in the case of small and medium enterprises (Fairman and Yapp, 2005; Garcia Martinez *et al.*, 2007). In the qualitative study, these activities of food-safety governance are found at the interviewed firms, including inspections and audits, sampling, sanctions, stimuli, and education. In the analysis of food-safety governance, it is noted that the impact of food-safety governance is perceived by the firms participating in global food supply chains. Despite the difficulties associated with these practices in reality mentioned by the interviewed managers of the qualitative study, their impacts reflect on the roles of framing, guiding and checking FSMS implementation for the purpose of assurance for governance actors that firms are complying with regulations and standards. It is interesting that in some cases, food-safety governance could create a huge advantage for firms in international trading. As a result, the following hypothesis is

proposed to test whether and to what extent food-safety governance impacts on FSMS implementation:

H6. Food-safety governance has a significant positive impact on firms' FSMS.

5.2.2 FSMS implementation

In international food trading, food safety regulations and standards have became essential frameworks to control and enhance food safety management (FAO, 2011), namely BRC, IFS, HACCP, the Safe Quality Food (SQF) 2000 Level 2, and the ISO 22000:2005. Underpinned by these standards and regulations, FSMS provides a framework for uniformity in requirements, audit procedures and mutual acceptance of audits, and reassure retailers and branded manufacturers of the capability and competence of suppliers (Mensah and Julien, 2011). FSMS is highly customised for each firm based on a result of the implementation of various quality assurance and legal requirements into its unique production, organisation and environment (Jacxsens et al., 2011). However, there are key elements of FSMS extracted as food safety requirements of EU legislation (EC, 2002), Code of Federal Regulation (FDA, 2001), Codex (CAC, 2009), ISO 22000 (ISO, 2005) including prerequisite programmes, HACCP principles, and other components of FSMS such as traceability, control of nonconformity, validation, verification, and improvement that are adopted to construct measurement indicators of FSMS implementation in this study.

5.2.2.1 PRPs

PRPs are defined as 'Basic conditions and activities that are necessary to maintain a hygienic environment throughout the food chain suitable for the production, handling and provision of safe end products and safe food for human consumption' (ISO, 2005). PRPs play essential roles in the context of supporting HACCP for effective FSMS, and they are as crucial as HACCP in term of safe food assurance. HACCP focuses on raw materials, the product, and the manufacturing process, whilst PRPs tend to focus on the hygienic operating environment and quality assurance support programs managed by

people who are knowledgeable and exhibit a supportive attitude towards food safety (Mortimore and Wallace, 2013), namely Good Manufacturing Practice (GMP), Good Hygiene Practice (GHP), Sanitation Standard Operating Procedures (SSOPs). For food manufacturing in general, there are specifies detailed requirements adopted from BSI EN ISO22002-1 (ISO, 2009) as the following:

- Construction and layout of buildings and associated utilities
- The layout of premises, including workspace, employee facilities, laboratory facilities, storage and warehouse
- Supplies of air, water, energy and other utilities
- Supporting services, including waste and sewage disposal
- Suitability of equipment and its accessibility for cleaning, maintenance and preventive maintenance
- Management of purchased materials
- Measures for the prevention of physical, allergen and microbiological cross-contamination
- Cleaning and sanitising programmes are established to ensure that the food-processing equipment and environment are maintained in a hygienic condition

5.2.2.2 Principles of HACCP

The HACCP system is a science-based system created to identify specific hazards and actions to control them in order to ensure food safety and quality (Arvanitoyiannis, 2009). Preventing problems from occurring is the desired goal underlying in any HACCP system. The HACCP consists of seven principles that outline how to establish a HACCP plan for each operation to reduce the risk of a food safety failure established by Codex (CAC, 2009). Seven fundamental principles are employed in the development of HACCP plans that include hazard analysis (including hazard analysis, identification and assessment), Critical Control Points (CCPs) identification, establishing critical limits, monitoring procedures, corrective actions, verification procedures, and record-keeping and documentation. These principles as the

Codex standard have become the reference for international food safety and identified as the baseline for consumer protection. HACCP is a critical part of any FSMS, widely acknowledged as the best method of assuring product safety while becoming recognised internationally as a mandatory tool for controlling foodborne hazards in the food industry (Khandke and Mayes, 1998; Mortimore and Wallace, 2013). The significant benefit of the HACCP system is that it focuses attention on areas where problems potentially may occur and require that food service facilities be prepared to deal with problems immediately if they arise. The success and effectiveness of the HACCP plan in preventing foodborne diseases and reducing food safety risks to an acceptable level depending on its correct implementation and application (FAO/WHO, 2001; Kok, 2009).

5.2.2.3 Other activities

Besides PRPs and HACCP principles as the basic elements, FSMS is also formed by other activities that are regulatory and standardised requirements, including traceability, control of nonconformity, validation, verification, and improved ability.

Traceability

The European Union (EU) regulation 178/2002 (EC, 2002) defines traceability as the ability to trace and follow food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution. Codex (CAC, 2005) defines traceability as the ability to follow the movement of food through the specified stage(s) of production, processing and distribution. ISO 22000:2005 suggests 'the organisation shall establish and apply a traceability system that enables the identification of product lots and their relation to batches of raw materials, processing and delivery records'. Food Standard Agency (FSA, 2002) identifies three primary characteristics for traceability systems: (1) identification of units/batches of all ingredients and products, (2) information on when and where they are moved and transformed, and (3) a system linking these data.

Control of nonconformity

Control of nonconformity is defined as the act of identification and control potential unsafe products that are affected because critical limits for CCP(s) are exceeded, or there is a loss of control of operational PRP(s) with regard to their use and release to ensure safety (ISO 22000:2005). A documented procedure shall be established and maintained defining a) the identification and assessment of affected end products to determine their proper handling, and b) a review of the corrections carried out. Therefore, food manufacturers need to ensure corrective actions to be initiated and have a proper procedure to handle potentially unsafe products, for instance, re-processing or further processing within or outside the organization to ensure that the food safety hazard is eliminated or reduced to acceptable levels; destruction and/or disposal as waste; withdraw/recall.

Validation

According to Codex (CAC, 2009), validation is 'obtaining evidence that a control measure or combination of control measures, if properly implemented, is capable of controlling the hazard to a specified outcome'. The food safety team shall plan and implement the processes needed to validate control measures are competent and capable of ensuring control of the identified food safety hazards and provide sufficient evidence that the specified monitoring and measuring methods and equipment are adequate to ensure the implementation of the monitoring and measuring procedures (ISO22000: 2005).

Verification

Verification is 'the application of methods, procedures, tests and other evaluations, in addition to monitoring, to determine whether a control measure is or has been operating as intended' (CAC, 2009). The fundamental role of verification is to ensure that the FSMS is functioning as designed and is effective. The organisation shall conduct internal audits at planned intervals to determine whether the food safety management system is implemented efficiently and updated based on evaluation and analysis of the result of verification activities and all records and documents required by the food safety

management system are controlled adequately at food company (ISO 22000: 2005).

Improvement

FSMS is required to be improved and continually updated and firm actively seek certification or registration of their FSMS by an external organisation, or make a self-assessment or self-declaration of conformity (ISO 22000:2005).

5.2.3 Business performance

The ultimate goal of business is to improve overall performance. Besides food safety objectives, FSMSs are applied in the expectation that it could help to increase positive impacts on business performance. Data from several studies suggest that a strong FSMS is supposed to deliver several advantages for firms that go well beyond food safety objectives. For example, increasing sales revenue thanks to rising consumer confidence in the safety of the purchased food (Javee and Masakure, 2005) and obtaining a ticket for accessing global food value chains (Mensah and Julien, 2011; Macheka *et al.*, 2013), reducing operating cost and lower insurance charges for avoided costs such as food safety incidents, recalls and complaints (Whipple, Voss and Closs, 2009), satisfying the need of stakeholders/customer (Thomsen and McKenzie, 2001; Fotopoulos, Kafetzopoulos and Gotzamani, 2011), improving efficiency and process control (Escanciano and Santos-Vijande, 2014) and so on. Also, extensive research has shown the influence of quality and food safety management systems on business performance of certified food manufacturing companies. For instance, Kafetzopoulos, Gotzamani and Psomas (2013) highlight the value of the combined effective implementation of ISO 22000 and ISO 9001:2000 systems have a favourable effect on companies' performance. Likewise, the empirical research of Kafetzopoulos and Gotzamani (2014) has revealed the positive impact of the effective implementation of both systems ISO 9001 and HACCP on food product quality and operational performance, as well as the positive impact of operational performance on food product quality and financial performance. Some other studies demonstrate that companies that efficiently implement food safety systems improve their quality and have a positive and significant effect on

operational performance and increase competitive advantage (Singh and Smith, 2006; Feng, Terziovski and Samson, 2007; Mensah and Julien, 2011; Ding *et al.*, 2014; Qijun and Batt, 2016). In their study, Sampaio, Saraiva and Guimarães Rodrigues (2011) prove that companies present a greater propensity to implement and certify their quality management system with higher financial performance. However, in these studies, FSMS is HACCP-based, leaving other food safety activities unexamined, and food safety is considered as a part of quality management.

Regarding the measurement of business performance, there are many proposed tools to measure business performance using sub-dimensions such as financial performance, non-financial performance, innovation performance, operational performance and quality performance in the literature. Koh *et al.* (2007) measure total business performance in two dimensions: operational and financial performance. Lakhal, Pasin and Limam (2006), Kafetzopoulos, Psomas and Kafetzopoulos, (2013), Kafetzopoulos and Gotzamani, (2014) also assess organisational performance regarding financial performance and operational performance along with product/service quality. Consistent with the prior researches, two sub-dimensions have been adopted to reflect business performance in this study, namely operational performance - reflecting the performance of internal operations of an organization on an ongoing basis such as cost, flexibility and productivity of facilities (Clegg, Gholami and Omurgonulsen, 2013) and financial performance - the achievement of financial and market-related objectives (Kafetzopoulos and Gotzamani, 2014). In their studies, these two aspects of business performance also have a direct relationship. Based on the discussion above, this study develops the following three hypotheses to investigate whether and to what extent the implementation of FSMS directly influences the business performance of food firms:

H7. FSMS implementation has a significant positive impact on operational performance.

H8. FSMS implementation has a significant positive impact on financial performance.

H9. Operational performance has a significant positive impact on financial performance.

5.2.4 Criteria of supplier selection and the SC relationship

In their review, Marucheck *et al.* (2011) raise the issue of the management of supplier relationships potentially leading to safety problems since companies have outsourced manufacturing to developing countries around the world under pressures for lower costs combined with the additional complexity of the supply chain. Fynes, Voss and Burca (2005) and Whipple, Voss and Closs (2009) also identify the role of supplier selection and relationship in the food supply chain.

5.2.4.1 Criteria of suppliers selection

Whether to make or buy a new product or service is the first decision that must be made in managing the supply chain, which determines where and how the supply chain will be managed following by other steps such as purchase, movement, and storage of raw materials (Schoenfeldt, 2008). The characteristics of food supply chains are exceptional due to the continuous change in the quality of raw materials. The shelf-lives of raw, intermediate and final goods together with the strong uncertainties in the whole chain is a significant challenge for proper supply chain management and planning (Ahumada, Villalobos and Mason, 2012). Therefore, it requires firms to consider various aspects to make the decision; for instance, the quality and price are assumed higher for fresher raw materials from the local area. In contrast, a similar product with a low remaining shelf-life and produced with mainstream raw materials have a lower quality and price (Oberholtzer, Dimitri and Jaenicke, 2014). Given the significance of managing the supply chain and input purchasing in FSMS, food firms need to decide which suppliers to collaborate with and how to select suppliers is a very crucial decision for FSMS.

In the qualitative study, it is proven that the interviewed firms require several safety criteria for supplier selection. In details, they require relevant certificates, reliability of the suppliers to select providers. They also undertake

additional audits, testing and inspections by suddenly visiting or sending samples to their laboratories or personnel to work on-site to monitor their suppliers. As a result, in the quantitative study, these criteria are used to examine how surveyed firms choose their key suppliers. In addition, other criteria that are not related to food safety requirements are selected as a result of the literature review (Table 5.1) in the research context of global food supply chains. They are price as the presentative for financial perspective, after-sale service (i.e. policy, quality assurance, and damage ratings), order flexibility (i.e. payment, freight, order frequency and amount), and distance (local or not).

Table 5.1 Criteria of supplier selection in the literature

References	**Criteria for supplier selection**
Weber, Current and Benton, (1991)	Price, delivery, facilities and capacity, geographic location, technology capability
Cheraghi, Dadashzadeh and Subramanian, (2004)	Quality, delivery, price, repair service, technical capability
Ho, Xu and Dey, (2010)	Quality, delivery, price/cost, manufacturing capability, service, management, technology
Thiruchelvam and Tookey, (2011)	Quality, delivery, price
Banaeian *et al.*, (2015)	Finance, delivery & service, quality, environment management system

5.2.4.2 Supply chain relationship

Matopoulos *et al.*, (2007) propose that two pillars of the framework for supply chain collaboration are the design and the government of supply chain activities accompanied with the establishment and the maintenance of supply chain relationships. Mutual trust, long-term commitment and interdependency are characteristics of a successful relationship that are needed to maintain among supply chain partners. In a supply chain context, trust is 'the degree to which the channel member perceives that its relationship with the supplier is based upon mutual trust and thus is willing to accept short-term dislocation because it is confident that such dislocation will balance out in the long-run' (Anderson, Lodish and Weitz, 1987). Commitment can be defined as the willingness of each partner to exert effort on behalf of the relationship and firms' attempt to build a relationship that can be sustained in the face of

unanticipated problems (Gundlach and Cadotte, 1994). Interdependency reflects the firm's need to maintain a relationship with the partner to achieve its goals and the firm's inability to replace a partner (Kumar, Scheer and Steenkamp, 1995).

Altogether, these dimensions establish a business relationship in which determine the degree to which each party perceives they can depend on the integrity of the promise offered by the other (Fynes, Voss and de Búrca, 2005; Ding *et al.*, 2014). There are many studies on the SC relationship and quality management. For example, Fynes, Voss and de Búrca (2005) study the impact of the various dimensions of SC relationships (such as trust, commitment, adaptation, communication and collaboration) SC relationships on quality performance and conclude that by focussing on the management of SC relationships organisations can also improve product quality. In the same manner, Ding *et al.*, (2014) confirm strategic alliance, information quality and trust and commitment are significantly related to food quality. Although the aspect of FSMS implementation and SC relationship remains restricted, this study is grounded on the previous studies considering the correlation and relationship among these dimensions of a business relationship and FSMS implementation. The above hypotheses (H1-H9) help to determine Best practice and the differences among the analysed firms in FSMS implementation while this hypothesis concentrates on how firms with a better degree of FSMS implementation select their suppliers and their supply chains relationship. The proposed hypothesis related to supplier selection and SC relationship is the following:

H10. The groups of firms that have better FSMS implementation pay more attention to food safety criteria than others and are in better SC relationship than their counterparts.

5.2.5 Research instrumentation

As part of rigorous data collection, research instrument plays an important role in establishing the study's validity and reliability (Creswell, 2013). Grounded on the above hypotheses development, the research instrumentation used to design the survey questionnaire is presented in Table

5.2. The survey questionnaire in three languages – English, Vietnamese and Chinese is in the Appendix III.

Table 5.2 Construct, measurement item and support references

Construct	Measurement item	References
Management responsibilities	Managers' commitments to food safety management	(ISO, 2005; Luning *et al.*, 2008; Trienekens and Zuurbier, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; K. Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Macheka *et al.*, 2017)
	Responsibilities and authorities are defined for each person such as food safety team, team leader, direct workers within the organisation to ensure efficient operation and maintenance of FSMS	(ISO, 2005; Fotopoulos, Kafetzopoulos and Psomas, 2009; Kafetzopoulos and Gotzamani, 2014)
	Food safety culture is established within the organisation	(ISO, 2005; Yiannas, 2009; Nyarugwe *et al.*, 2016, 2018)
	Food safety policy is established as the guiding principles to implement FSMS	(Yiannas, 2009; Nyarugwe *et al.*, 2016, 2018)
Human resources	Knowledge and skills of the employees	(ISO, 2005; Fotopoulos, Kafetzopoulos and Psomas, 2009; K. Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014)
	Awareness of the personnel in the relevance and importance of their activities contributing to food safety management	(ISO, 2005; Yiannas, 2009; Powell *et al.*, 2013)
	Training programs related to food safety for the employee	(Lakhal, Pasin and Limam, 2006; Singh and Smith, 2006; Mensah and Julien, 2011)
	Employee's involvement in food safety management activities	(Luning *et al.*, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; Kirezieva, Luning, *et al.*, 2015; Macheka *et al.*, 2017)
Organisational resources	Qualified facilities and equipment to ensure food safety management	(Luning *et al.*, 2008; Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011; K. Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Jacxsens, *et al.*, 2015; Kirezieva, Luning, *et al.*, 2015)
	The company's financial condition	(Macheka *et al.*, 2013; Qijun and Batt, 2016; Xiong *et al.*, 2017)

	The company's technological condition	(Macheka *et al.*, 2013; Qijun and Batt, 2016; Xiong *et al.*, 2017)
Collaborative activities related to FSMS	Solving emerging problems related to product safety	(ISO, 2005; Simatupang and Sridharan, 2005, 2008; Cao *et al.*, 2010)
	Having continuous improvement programs for food safety	(ISO, 2005; Simatupang and Sridharan, 2005, 2008; Cao *et al.*, 2010)
	Planning and goal-setting activities	(Simatupang and Sridharan, 2005, 2008; Cao *et al.*, 2010)
	Communicating and exchanging information related to food safety management	(Fynes, Voss and de Búrca, 2005; Simatupang and Sridharan, 2005, 2008; Cao *et al.*, 2010; Ding *et al.*, 2014; Luning *et al.*, 2015)
External support to enhance food safety management from:	Other stakeholders in our supply chains (such as suppliers, contractors, buyers, etc.)	(Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011; Qijun and Batt, 2016; Macheka *et al.*, 2017)
	Government and authorities	(Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011; Tran *et al.*, 2013; Qijun and Batt, 2016; Macheka *et al.*, 2017)
	Financial institutions (banks)	(Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011; Tran *et al.*, 2013; Qijun and Batt, 2016; Macheka *et al.*, 2017)
	Business associations (such as NAFIDAD, VASEP in Vietnam)	(Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011; Tran *et al.*, 2013; Qijun and Batt, 2016; Macheka *et al.*, 2017)
	Non-governmental organisations	(Fotopoulos, Kafetzopoulos and Psomas, 2009; Mensah and Julien, 2011; Tran *et al.*, 2013; Qijun and Batt, 2016; Macheka *et al.*, 2017)
FS governance	Food safety audits and inspections by regulatory agencies to induce compliance by the company	(Yapp and Fairman, 2006; Rouvière and Caswell, 2012; K. Kirezieva *et al.*, 2013; Kirezieva, 2015; Kirezieva, Jacxsens, *et al.*, 2015)
	Sanctions such as penalties, prosecution, and recalls to punish for committing an offence or repeatedly breaching regulations	(Rouvière and Caswell, 2012; K. Kirezieva *et al.*, 2013; Kirezieva, 2015; Kirezieva, Jacxsens, *et al.*, 2015)
	Stimulus such as awards, labels, tax reduction from regulatory agencies to encourage food safety management compliance	(Rouvière and Caswell, 2012; K. Kirezieva *et al.*, 2013; Kirezieva, 2015; Kirezieva, Jacxsens, *et al.*, 2015)
	Information and education such as guidelines, training, advice from	(Garcia Martinez *et al.*, 2007; Rouvière and Caswell, 2012; K.

	regulatory agencies to support company in food safety management	Kirezieva *et al.*, 2013; Kirezieva, 2015; Kirezieva, Jacxsens, *et al.*, 2015)
HACCP	Hazards that need to be prevented, eliminated, or reduced to acceptable levels are well identified at each step from incoming raw materials to finished product.	(ISO, 2005; Cormier *et al.*, 2007; Scott and Chen, 2010; Raspor and Ambrožic, 2012; Mortimore and Wallace, 2013)
	The points where control is critical to assuring the safety of the product are established by HACCP team	
	Level of efficiency in establishing critical limits at critical control points that separate acceptability from unacceptability for the prevention, elimination or reduction of identified hazards.	
	Monitoring procedures and systems at critical control points are established and implemented	
	Corrective actions are installed when monitoring indicates that a critical control point is not under control.	
	Validation procedures are carried out to assure that the critical control points will control the hazards of concern and verify that the system is working day-to-day as planned.	
	The ability to provide efficient documents and records that demonstrates HACCP system is operating under control, and that appropriate corrective action has been taken for any deviations from the critical limits.	
Prerequisite programs	Construction and layout of buildings and associated utilities	(ISO, 2005, 2009; Cormier *et al.*, 2007; Scott and Chen, 2010; Raspor and Ambrožic, 2012; Mortimore and Wallace, 2013)
	The layout of premises, including workspace, employee facilities, laboratory facilities, storage and warehouse	
	Supplies of air, water, energy and other utilities	
	Supporting services, including waste and sewage disposal	
	Suitability of equipment and its accessibility for cleaning, maintenance and preventive maintenance	
	Management of purchased materials	

	Measures for the prevention of physical, allergen and microbiological cross-contamination	
	Cleaning and sanitising programs are established to ensure that the food-processing equipment and environment are maintained in a hygienic condition	
Other activities of FSMS	Traceability system is effective to identify incoming material from the immediate suppliers and the initial distribution route of the end product	(ISO, 2005; Cormier *et al.*, 2007; Scott and Chen, 2010; Mortimore and Wallace, 2013)
	Corrective actions are guaranteed to be initiated when critical limits are exceeded or when there is a lack of conformity with operational prerequisite programs	
	Proper procedures to handle potentially unsafe products	
	Control measures are effective and capable of ensuring control of the identified food safety hazards	
	The ability to provide sufficient evidence that the specified monitoring and measuring methods and equipment are adequate to ensure the performance of the monitoring and measuring procedures.	
	Internal audits are conducted to determine whether the food safety management system is effectively implemented and updated based on evaluation and analysis of the result of verification activities.	
	All records and documents required by the food safety management system are properly controlled	
	Internal communication is efficient in exchange information concerning food safety throughout the organisation	
	External communication is efficient in exchange information concerning food safety throughout the food chain such as suppliers and contractors, customers, statutory and regulatory authorities, and other organisations	
	The ability to improve and continually update food safety management system.	

	The active in seeking certification or registration of our food safety management system by an external organisation or make a self-assessment or self-declaration of conformity	
Operational performance	Company's productivity	(Lakhal, Pasin and Limam, 2006; Singh, 2008; Dora *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014)
	Company's efficiency	(Lakhal, Pasin and Limam, 2006; Aramyan *et al.*, 2007; Singh, 2008; Kafetzopoulos and Gotzamani, 2014)
	Company's process effectiveness	(Feng, Terziovski and Samson, 2007; Cai *et al.*, 2009; Kafetzopoulos and Gotzamani, 2014)
	Level of employees' satisfaction	(Feng, Terziovski and Samson, 2007; Kafetzopoulos and Gotzamani, 2014)
	Building positive image for the company in food safety assurance	(Kafetzopoulos and Gotzamani, 2014)
	Delivery ability	(Cai *et al.*, 2009; Kafetzopoulos and Gotzamani, 2014)
Financial performance	Company's operational costs of the previous year	(Singh, 2008; Kafetzopoulos and Gotzamani, 2014)
	Company's profitability of the previous year	(Feng, Terziovski and Samson, 2007; Kafetzopoulos and Gotzamani, 2014)
	Financial results of the previous year	(Kafetzopoulos and Gotzamani, 2014)
	Net profit margin of the previous year	(Kafetzopoulos and Gotzamani, 2014)
	Sales growth of the last year	(Sampaio, Saraiva and Guimarães Rodrigues, 2011; Kafetzopoulos and Gotzamani, 2014)
	Cash flow of the previous year	(Kafetzopoulos and Gotzamani, 2014)
Criteria to select suppliers	Lower price	(Weber, Current and Benton, 1991; Cheraghi, Dadashzadeh and Subramanian, 2004; Burke, Carrillo and Vakharia, 2009; Ho, Xu and Dey, 2010)
	Certificates fulfilment	(ISO, 2005; Russo, Perito and Di Fonzo, 2014; Xiong *et al.*, 2017)
	Distance	(Weber, Current and Benton, 1991)

	Reliability	(ISO, 2005; Burke, Carrillo and Vakharia, 2009)
	Good self-inspection results	(ISO, 2005; Tran *et al.*, 2013)
	Order flexibility	(Verma and Pullman, 1998)
	After-sale service	(Banaeian *et al.*, 2015)
Supply chain relationship	Trust	(Anderson, Lodish and Weitz, 1987; Fynes, Voss and de Búrca, 2005; Matopoulos *et al.*, 2007; Whipple, Voss and Closs, 2009; Ding *et al.*, 2014)
	Commitment	(Gundlach and Cadotte, 1994; Fynes, Voss and de Búrca, 2005; Whipple, Voss and Closs, 2009; Ding *et al.*, 2014)
	Interdependency	(Kumar, Scheer and Steenkamp, 1995; Fynes, Voss and de Búrca, 2005).

5.3 Research methodology

5.3.1 Research population and sample

The population that is chosen for this study is food manufacturing and exporting companies in Asian developing countries. The reasons for focusing on this sector are two folds. Firstly, the food industry in Asia has emerged as a leading sector given the percentage of global markets served by these countries such as China and Vietnam in which top fishery, agriculture food products exporters locate (FAO, 2016). Secondly, this thesis involving the use of one method with others is to elaborate on the initial set of findings, then to generalise findings in the larger sample following sequential mixed methods. Therefore, stratification of the population for this study is the same as the qualitative study; the snowball sampling method is continuously used to recruit voluntary firms that meet the similar of key criteria, including:

- Firm size from small (11-50 employees), medium (51-250 employees) to large (> 250 employees) companies according to the definitions of European Commission (2003) for enterprises sizes.
- Current processing and trading food products globally, not limited to fisheries products as the qualitative study.

- Respondents are required to be senior and quality-control managers who are experts in their field and currently in charge of FSMS implementation.

Regarding the number of firms as the sample for the research, it depends on many factors such as multivariate normality of the data, estimation technique, model complexity, the amount of missing data, and the average error variance among the reflective indicators (Tabachnick and Fidell, 2013; Hair *et al.*, 2014). It is obvious that the larger the sample size is, the more trustworthy the results are since SEM is more sensitive to sample size than other multivariate approaches (Hair *et al.*, 2014). However, it is usually more time-consuming and expensive to obtain larger samples. Hair *et al.* (2014) suggest a minimum of 300 cases is needed to produce reliable results for models with seven or fewer constructs, lower communalities (below .45), and/or multiple under-identified (fewer than three) constructs. A widely accepted rule of thumb is five to ten cases/observations per indicator variable in setting a lower bound of adequate sample size (Nunnally, 1978; Bentler and Chou, 1987). Considering all the suggestions, there are nearly 30 indicators in this study, 300 cases are the appropriate minimum cut-off value for the sample size.

The surveys containing structured questionnaires as the data collection method were distributed to 1000 food firms' managers of Chinese and Vietnamese food manufacturing and exporting sector. Questionnaires were translated into Chinese and Vietnamese by the researcher, who is one Vietnamese and two PhD Chinese researchers of food safety in supply chains. The questionnaires were sent through both online platforms such as email, survey portals (Weixin in China and Google Form in Vietnam) as well as the door-to-door distribution method by the researcher. All participants responded on a voluntary basis and were assured that their individual responses would remain confidential. Finally, a total of 324 food companies responded, giving a response rate equal to 32.4%. Although there were a lot of difficulties in collecting data as mentioned in Section 3.5.1, the response rate is considered high thanks to the door-to-door distribution method. The responders were more willing to answer the survey questionnaire when the researcher visited

their companies. However, there is not an equal number in terms of responding from two countries. There are 252 valid responses from Vietnam, meanwhile, only 72 responses from China.

Responding companies belong to the fishery (48.7%), agricultural (41%) and beverages (6.8%) and other (3.5%) sub-sectors. They are mainly SMEs (71.6%), only 17.1% of them are large firms (companies with more than 250 employees), and the rest (11.3%) are micro firms (less than ten employees). Regarding exporting capacity, there are 13.2% of firms could export more than 3000 tons per year, 49.4% export less than 500 tons/year and the rest exports from 500 to under 3000 tons/year. Respondents are primarily Quality control (QC) managers (29.7%), supply chain managers (29.4%) and others (40.9%) are CEO/directors/trading managers.

5.3.2 Construction of the instrument and measures

All measuring variables, based upon the above theoretical model, were defined and narrowed down to the most representative indicators, both through literature review and reliability and validity testing. The five-point Likert scale questionnaire (from 1- not important to 5 - very important or 1 - low level to 5 - high level) was thoroughly examined and improved by (1) a team of experts consisting of four academics and three business executives with years-experience in food manufacturing and (2) two pilot studies, the first through personal interviews with five top management executives and the second through a pilot online survey of 50 food enterprises. The results of the pilot studies helped to reduce the number of questions and wordy questions. The distributed questionnaire consisted of four parts: (1) General information about the companies' profile (6 questions), (2) CSFs of FSMS (23 questions) and practices with suppliers (2 questions), (3) FSMS implementation (27 questions), (4) Business performance (12 questions).

5.3.3 Data preparation

All respondents completed the survey instrument individually and independently. Fourteen observations were deleted from the analysis because they were extreme observations with a threshold value of a standard score up

to 3 (Hair *et al.*, 2014). Consequently, calculating the Mahalanobis d-squared distance, no observations exceeded the threshold value of 3 and so, no more data points were deleted from the analysis. Regarding the normality of the data, all measured variables in this study exhibited univariate normality and did not suffer from Skew and Kurtosis (< ±1), indicating, but not guaranteeing, multivariate normality (Hair *et al.*, 2014). In addition, the scatter plot showed the constant variance of error terms (Homoscedasticity), while the histogram and Normal Q-Q plots of the standardised residuals indicated normality of the error terms. To test the presence of non-response bias, responses to a randomly selected set of questions and firm characteristics were compared for early versus late returned responses, the latterly considered representative of non-respondents. No significant differences between the two groups suggested the absence of non-response bias in the data.

5.3.4 Method of data analysis

This study aims to propose a model for measuring the FSMS implementation based on their regulatory requirements, empirically testing the proposed hypotheses to confirm CSFs and investigating the extent to what CSFs impact on FSMS implementation as well as the extent to what FSMS impact on business performance. First, factor analysis is conducted to define the underlying structure among the variables in the analysis for the purpose of either exploration or confirmation (Hair *et al.*, 2014). It includes an initial Exploratory Factor Analysis - EFA (Principal component extraction method with Varimax orthogonal rotation) to uncover the underlying structure of the variables which have not been tested before for reliability and validity (Henson and Roberts, 2006). Then, Confirmatory Factor Analysis - CFA is used to refine the resulting scales in EFA and to determine if the number of factors and the loadings of the measured variables (i.e. indicators) on them conforms to what is expected based on pre-established theory in prior research (Hair et al., 2014).

It is advisable to use the different sample for scale development and for assessing construct validity to avoid potentially biased results (Donaldson, 1987; Hinkin, 1995). EFA is conducted on the 50% randomised sample (n =

161), while CFA is undertaken on the whole sample (n = 310) in the aim of providing an application of the measure in a substantive context to enhance the generalizability of the new measures. Multi-collinearity, uni-dimensionality, scale reliability and construct validity are undertaken for the study variables as suggested by Pallant (2013), Tabachnick and Fidell (2013), and Hair *et al.* (2014). The model and the hypotheses are tested using SEM via path analysis, as it is a multivariate analytic methodology that gives insights into the causal ordering of variables in a system of relationships (Anderson and Gerbing, 1988; Tabachnick and Fidell, 2013; Hair *et al.*, 2014). In the end, two-step cluster analysis is conducted to identify the groups based on their FSMS implementation and closely examine each group's practices on CSFs, supplier selection and SC relationship. The statistical analysis software IBM SPSS (Statistical Package for Social Sciences) and AMOS 25.0 (Analysis of Moment Structures) are used for the statistical processing of the data.

5.4 Factor analysis and structural equation modelling

5.4.1 Exploratory factor analysis

EFA is applied in order to extract the latent constructs of CSFs on a random haft of the research sample (161 observations). The 24 items of the CSFs are subjected to principal components analysis (PCA). Prior to performing PCA, the suitability of data for factor analysis are assessed. Inspection of the correlation matrix revealed the presence of many coefficients of 0.3 and above. Six constructs (latent factors) are established (Kaiser-Meyer-Olkin 0.874, Bartlett's test of Sphericity 1804.313, p = 0.00, Eigen-value > 1, MSA > 0.747, factor loadings > 0.535), explaining 66.897% of the total variance. However, the rotated component matrix suggested that two items 'Support from non-governmental organisations' and 'Support from financial institutions' should be deleted from the construct. After the deletion, 69.605% of the total variance is explained with Kaiser-Meyer-Olkin 0.872, Bartlett's test of Sphericity 1685.232, p = 0.00, Eigen-value > 1, MSA > 0.743, factor loadings > 0.6. Six constructs are named after the items that are loaded on them, as follows: 'Human resource', 'Management responsibility', 'Collaboration', 'FS

governance', 'Support' and 'Organisational resources' arranged in descending coefficient size as illustrated in Table 5.3.

Table 5.3. Exploratory factor analysis

Constructs	Rotated Component Matrix[a]							
	Code	Items	Component					
			1	2	3	4	5	6
Management responsibility (MR)	MR1	Managers commitments	0.825					
	MR2	Food safety policy	0.812					
	MR3	Responsibilities and authorities	0.744					
	MR4	Food safety culture	0.672					
Collaboration (C)	C2	Emerging problems		0.806				
	C3	Planning and goal-setting activities		0.784				
	C4	Continuous improvement programs		0.762				
	C1	Information exchange		0.694				
Human resources (HR)	HR4	Employees' involvement			0.777			
	HR2	Personnel awareness			0.769			
	HR3	Training programs			0.748			
	HR1	Employees' knowledge and skills			0.729			
FS Governance (G)	G4	Information and education				0.785		
	G3	Stimulus				0.703		
	G2	Sanctions				0.702		
	G1	Audits and inspections				0.613		
Organisational resource (OR)	OR2	Financial condition					0.865	
	OR3	Technological condition					0.790	
	OR1	Qualified facilities and equipment					0.760	
Support (S)	S2	Business associations						0.847
	S3	Stakeholders in supply chains						0.778
	S4	Government and authorities						0.603

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Similar to the above process, the suitability of data for factor analysis is assessed and EFA is applied to extract the latent constructs of the business performance (Table 5.4). Two constructs are established (Kaiser-Meyer-Olkin = 0.9, Bartlett's test of Sphericity = 1301.248, p = 0.00, Eigen-value > 1, MSA > 0.815, factor loadings > 0.633), explaining 66.983% of the total variance. The item 'Company's operational costs of the previous year' is dropped from the construct because it does not provide pure measures of a specific factor. After the deletion, 72.707% of the total variance is explained with Kaiser-Meyer-Olkin = 0.901, Bartlett's test of Sphericity = 1297.143, p = 0.00, Eigen-value > 1, MSA > 0.815, factor loadings > 0.653. They are named after 11 items that are loaded on them, namely 'Operational Performance' and 'Financial performance'.

Table 5.4. EFA for business performance

Constructs	**Rotated Component Matrix[a]**			
	Code	Items	Component	
			1	2
Operational performance (OP)	OP5	Building positive image	0.847	
	OP4	Level of employees' satisfaction	0.830	
	OP2	Company's efficiency	0.815	
	OP6	Delivery ability	0.802	
	OP3	Company's process effectiveness	0.792	
	OP1	Company's productivity	0.778	
Financial performance (FIN)	FIN4	Net profit margin of the previous year		0.894
	FIN2	Company's profitability of the previous year		0.867
	FIN3	Financial results of the previous year		0.815
	FIN5	Sales growth during the last three years		0.666
	FIN6	Cash flow of the previous year		0.653

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

5.4.2 Construct reliability and validity

The reliability of all FSMS implementation items is confirmed through Cronbach's alpha coefficients that are higher than 0.750 (Hair *et al.*, 2014)

indicating that all factors are measured by reasonably reliable items and the mean inter-item correlations are above 0.6 suggesting quite a strong relationship among the items (Pallant, 2013).

Table 5.5. Reliability check for FSMS implementation

FSMS implementation	Cronbach's alpha	N of items	Item Mean	Inter-Item correlations (Minimum-Maximum)	Mean of Item-Total Correlation
HACCP	0.940	7	3.566	0.638 – 0.744	0.693
Prerequisite programs (PRPs)	0.931	8	3.540	0.499 – 0.728	0.627
Other activities (OA)	0.955	11	3.521	0.549 – 0.747	0.658

The reliability of all the extracted factors of CSFs and business performance are confirmed through Cronbach's alpha coefficients that are higher than 0.75, indicating that all factors are measured by reasonably reliable items (Table 5.5). In order to determine whether the extracted latent factors show acceptable fit to the empirical data, the CFA (Maximum likelihood estimation technique) is also applied in each of the sub-models (CSFs, FSMS implementation model). Thus, a series of tests are performed to further determine the construct validity of the latent factors. The extracted latent factors show an acceptable fit to the empirical data (Table 5.6).

In terms of other diagnostic measures, the standardised residuals are examined that are less than |2.5|. Then, the modification index (M.I.) associated with each of the loadings of the indicators are examined. Some of M.I. are high indicating cross-loading such as the covariance error terms between C4 and S4 (20.997), FIN2 and OP3 (17.236). These high values indicate a high degree of covariance between these two items that are not captured by the construct. Nevertheless, given the high loading estimates for each indicator (FIN2, OP3, C4) and the variable deletion leading to violating the three-indicator rule (S4) so they are retained. Finally, construct, convergent, discriminant and nomological validity are confirmed, indicating strong evidence that the proposed latent factors meet rigorous tests of these types of validities.

Table 5.6. Validity check

Constructs	Items	Factor loading	Cronbach's alpha	AVE [a]	CR [b]	(Corr)^2 [c]
Human resources (HR)	HR1	0.810	0.842	0.570	0.841	0.373
	HR2	0.775				
	HR3	0.695				
	HR4	0.736				
Management responsibility (MR)	MR1	0.844	0.859	0.612	0.862	0.476
	MR2	0.845				
	MR3	0.731				
	MR4	0.698				
Organisational resources (OR)	OR1	0.777	0.834	0.627	0.834	0.370
	OR2	0.751				
	OR3	0.844				
Collaboration (C)	C1	0.723	0.820	0.500	0.799	0.440
	C2	0.773				
	C3	0.660				
	C4	0.666				
FS Governance (G)	G1	0.754	0.796	0.541	0.824	0.476
	G2	0.762				
	G3	0.774				
	G4	0.645				
Support (S)	S2	0.778	0.762	0.521	0.762	0.335
	S3	0.788				
	S4	0.580				
FSMS implementation (PER)	HACCP	0.942	0.948	0.860	0.949	0.489
	PRP	0.901				
	OA	0.935				
Operational performance (OP)	OP1	0.827	0.925	0.676	0.926	0.537
	OP2	0.878				
	OP3	0.785				
	OP4	0.794				
	OP5	0.852				
	OP6	0.791				
Financial performance (FIN)	FIN2	0.825	0.894	0.631	0.895	0.537
	FIN3	0.814				
	FIN4	0.792				
	FIN5	0.776				

	FIN6	0.764

a. AVE = $\sum\lambda_i^2/n$ (number of items i = 1,…, n; λ_i: standardized factor loading).

b. CR = $(\sum\lambda_i)^2/ [(\sum\lambda_i)^2+ (\sum\delta_i)^2]$ (number of items i = 1,…, n; λ_i: standardized factor loading; δ_i: error term).

c. The highest squared correlation between the factor of interest and the remaining factors.

5.4.3 Model estimation

According to Hair et al. (2014) and Anderson and Gerbing (1988), a two-step SEM process consisting of one measurement model fit and one structural theory is appropriate for testing the hypothesised structural model.

Table 5.7. Model fit indices

Fit indices	CSFs model	Implementation model	Measurement model	Structural model	Acceptable fit indices*
Absolute fit indices					
Chi-square (χ2)	285	348.377	892.411	962.223	0 ≤ χ2 ≤ 2df
Degrees of freedom (df)	194	254	558	571	
Probability level	0.000	0.000	0.000	0.000	p < 0.05
Root Mean Square Residual (RMR)	0.041	0.038	0.042	0.058	< 0.08
Root Mean Square of Approximation (RMSEA)	0.039	0.035	0.044	0.047	< 0.07
Normed chi-square (χ2/df)	1.469	1.372	1.599	1.685	< 3
Incremental fit indices					
Incremental Fit Index (IFI)	0.970	0.978	0.953	0.944	> 0.90
Tucker-Lewis coefficient (TLI)	0.964	0.973	0.946	0.938	> 0.90
Comparative Fit Index (CFI)	0.970	0.977	0.952	0.944	> 0.90
Parsimonious fit indices					
Parsimonious Normed Fit Index (PNFI)	0.766	0.922	0.782	0.792	> 0.5
Goodness of Fit Index (GFI)	0.923	0.918	0.866	0.863	> 0.5

**Acceptable when N > 250, the number of the measured variables ≥ 30 (Hair et al., 2014)*

Following this suggestion, first, CFA is conducted, then the hypothesised model is tested. The fit indices of both the measurement and structural model fit the data satisfactorily and suggest that the theoretical model has an adequate level of empirical support (Tabachnick and Fidell, 2013; Hair *et al.*, 2014) (Table 5.7).

Following the above tests, the SEM procedures are applied to estimate the causal relations between the constructs to test the previously stated hypotheses (H1-H9). Most of the hypotheses are significantly supported at the 0.05 and 0.001 level (two-tailed); there is only one hypothesis rejected (H8) (Table 5.8). The rejection of H8 means there is no direct effect of FSMS implementation on financial performance, only have an indirect effect between them. The indirect effect measures the extent to which financial performance changes when FSMS implementation is held fixed and the mediator variable, in this case - operation performance changes by the amount it would have changed had FSMS performance increased by one unit. This phenomenon called 'partial mediation' which is popular in statistics (Baron and Kenny, 1986; Andrews *et al.*, 2004).

Table 5.8. Hypotheses testing results

Relationships	Standardised regression weights	SE	p-Value	Hypothesis test results
H1: Management responsibility → FSMS implementation	0.187	0.08	0.006	Accept
H2: Human resource → FSMS implementation	0.126	0.063	0.033	Accept
H3: Organisational resources → FSMS implementation	0.147	0.066	0.013	Accept
H4: Collaboration → FSMS implementation	0.259	0.08	0.000	Accept
H5: Support → FSMS implementation	0.209	0.102	0.000	Accept
H6: FS Governance → FSMS implementation	0.160	0.086	0.037	Accept
H7: FSMS implementation → Operational performance	0.714	0.051	0.000	Accept
H8: FSMS implementation → Financial performance	-0.103	0.066	0.142	Reject
H9: Operational performance → Financial performance	0.806	0.084	0.000	Accept

The results of the hypothesised structural model are depicted in the following figure (Figure 5.3).

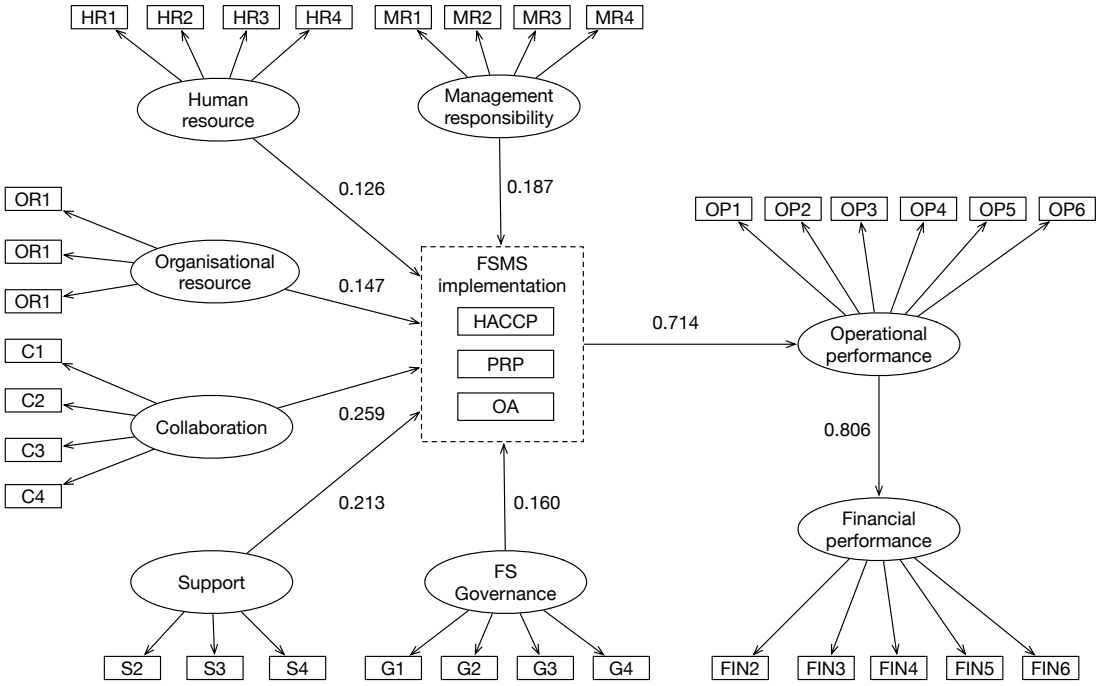

Figure 5.3. The hypothesised structural model

5.5 Cluster analysis

In the last stage of data analysis, cluster analysis is applied for data simplification, taxonomy description and relationship identification (Hair *et al.*, 2014) among the studied firms regarding their status of FSMS implementation. In detail, the objectives of cluster analysis are to (1) identify the best practice, (2) explore the differences in their CSFs that affect FSMS implementation, and (3) investigate the practices showing how these firms manage their suppliers. This approach has been applied in many previous studies to analyse the difference among various groups of respondents (e.g. Kirezieva *et al.*, 2013; Kirezieva, Luning, *et al.*, 2015; Macheka *et al.*, 2017; Nguyen and Li, 2018). In this section, 310 observations are classified into manageable groups based on their FSMS implementation. After that, the similarities and differences among them are analysed to further examine their characteristics and CSFs for FSMS.

5.5.1 Identifying cluster solution

Several researchers recommend the combination approach using two-step cluster analysis to compensate for the weaknesses of both hierarchical and non-hierarchical cluster analyses (Milligan, 1980; Hair *et al.*, 2014). First, a hierarchical technique is applied as the partitioning stage to produce a complete set of cluster solutions, establish the appropriate cluster solutions and the appropriate number of clusters. Then, a non-hierarchical method follows to refine the results by allowing the switching of cluster membership and validate the final cluster solution (Hair *et al.*, 2014).

5.5.1.1 Hierarchical clustering analysis

Hierarchical procedures involve a series of $n - 1$ clustering decisions (where n equals the number of observations) that combine observations into a hierarchy or a tree-like structure based on the similarity among members (Hair *et al.*, 2014). Given the need of repetitive clustering process combined with a clustering algorithm to define the similarity between clusters with multiple members and the moderate sample size (under 400 observations in this study), hierarchical clustering procedure is suitable to apply using the Ward Linkage and Squared Euclidean distance measure (Hair *et al.*, 2014) with FSMS implementation as the clustering criteria variable. The score of FSMS implementation is constructed as a weighted factor-based scale using all of the variables and taking their factor loadings into account instead of simply adding up all scores as the suggestion of de Vaus (2002). The use of a weighted factor-based score reflects a natural relationship in the scaling of the variables. In this study, FSMS implementation is constructed by the mean of HACCP, PRP and OA variables. Instead of simply adding up all the scores, a weighted factor-based FSMS implementation uses all of the variables and takes their factor loadings into account. Therefore, grounded on the factor loading column in the results of CFA (Table 5.6), the equation used to compute the variable 'FSMS implementation' is as the following:

$$\text{FSMS Implementation} = 0.942\text{HACCP} + 0.901\text{PRP} + 0.935\text{OA}$$

Considering a natural increase in heterogeneity comes from the reduction in the number of clusters along with one-member or extremely small clusters are not acceptable and should be eliminated. The results of Dendrogram suggest that four or five clusters are the possible outcome according to the grouping branches in Figure 5.4 (four-cluster solution numbered in red and five-cluster solution numbered in blue). Also, the changes in agglomeration coefficient (Table 5.10) indicate that moderately homogeneous clusters are being merged with small coefficients, whereas joining two very different clusters results in a large coefficient (Hair *et al.*, 2014). In addition, the membership distribution (Table 5.9) shows that the solutions of four or five clusters having a more reasonable number of firms in each cluster.

Table 5.9. Cluster membership distribution

Cluster	**6 Clusters**	**5 Clusters**	**4 Clusters**	**3 Clusters**	**2 Clusters**
1	55	55	55	55	177
2	51	51	122	122	133
3	71	71	83	133	
4	83	83	50		
5	36	50			
6	14				

Table 5.10 Agglomeration schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
300	2	4	23.991	287	289	306
301	6	134	29.324	292	279	305
302	8	30	37.564	295	288	306
303	1	21	48.651	297	294	308
304	3	13	62.567	298	296	307
305	6	140	**90.005**	301	299	307
306	2	8	**139.845**	300	302	308
307	3	6	322.617	304	305	309
308	1	2	518.063	303	306	309
309	1	3	1596.816	308	307	0

****Note: Stage 1-299 have been omitted from the table*

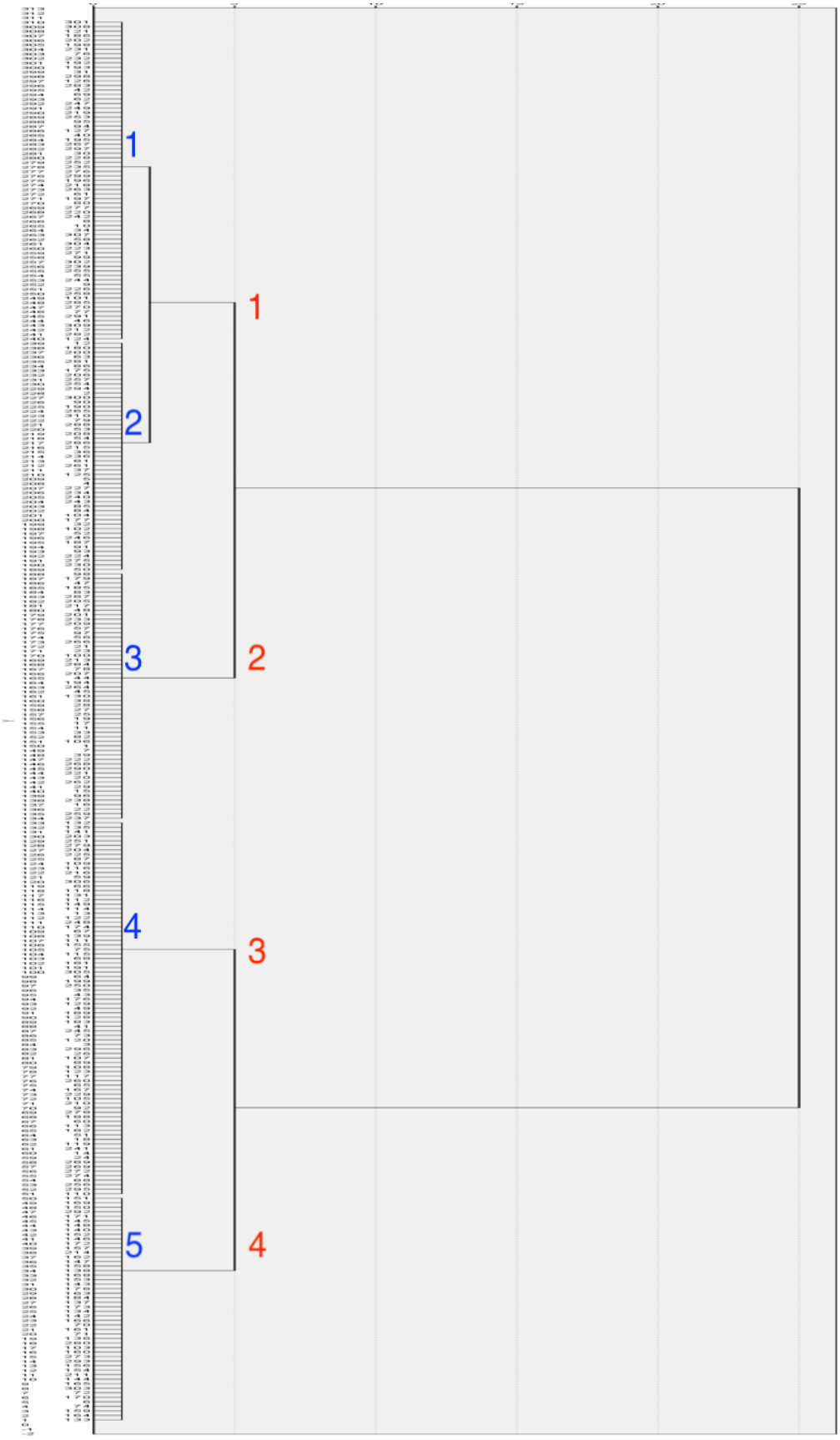

Figure 5.4 Dendrogram using Ward Linkage

5.5.1.2 Non-hierarchical clustering analysis and the validation

In this step, four-cluster and five-cluster solutions, which are the specified cluster seed points as the result of the hierarchical process are used to execute non-hierarchical clustering in K-mean cluster. In the case of the five-cluster solution, cluster 5 has a cluster containing a quite small number of members (14) compared to the rest. Therefore, the four-cluster solution is the most suitable solution in this study. Comparing two steps, there is the same number of cases in cluster 3 and 4 while there are significant changes in cluster 1 and 2 in the four-cluster solution (Table 5.11).

Table 5.11 Comparing number of cases in each cluster in two steps

Cluster	Hierarchical cluster (First step)		K-mean (Second step)	
	5 clusters solution	4 clusters solution	5 clusters solution	4 clusters solution
1	55	55	62	81
2	51	122	89	96
3	71	83	99	83
4	83	50	46	50
5	50		**14**	

Turning now to the validation, two tests are conducted to confirm the validity of the four-cluster solution while also ensuring it has practical significance following the suggestions of Hair *et al.* (2014). First, the stability of the cluster solution is assessed by sorting the observations in a different order and then, the cluster analysis is performed once again with the same number of clusters specified. The results reveal mostly matches between the two solutions. Second, criteria validation is also assessed to test predictive validity by using variables that have a theoretically based relationship to the clustering variables but were not included in the cluster solution. A one-way between-groups multivariate analysis of variance (MANOVA) is conducted to verify the clustering result using three FSMS-related variables including the means of HACCP, PRP and OA and one independent variable (K-mean cluster membership). The overall F-statistic for the MANOVA ($F(3, 306) = 1166.243$, $p = 0.000$; Wilks' Lambda = 0.08; partial eta squared = 0.92), as well as the

univariate F-statistics, are all significant, thus providing evidence of criterion validity in the four-cluster solution (Table 5.12).

Table 5.12 Univariate F-statistics results assessing cluster solution criterion validity

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
HACCP	1514.269	1	1514.269	13730.910	.000	.978
PRP	1363.448	1	1363.448	8859.056	.000	.966
OA	1424.193	1	1424.193	13165.750	.000	.977

5.5.2 Best practice identification

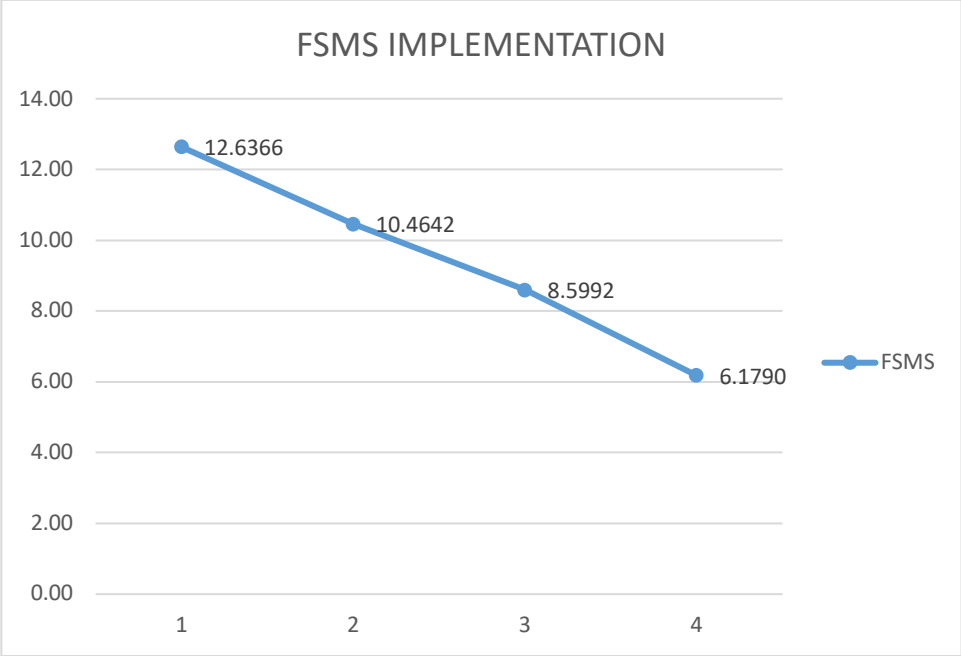

Figure 5.5. Comparing the FSMS Implementation between clusters

In order to identify Best practice, an inspection of the mean scores of FSMS implementation and HACCP, PRP and OA indicates that cluster 1 reports the highest level of FSMS implementation (M = 12.6366, SD = 0.72) as well as the mean of HACCP, PRP, OA than other clusters (Figure 5.5 and Figure 5.6). The mean of FSMS implementation of cluster 2, 3 range from 10.46 to 6.179 and cluster 4 has the lowest mean – 6.179. The mean scores of HACCP, PRP and OA of each cluster are displayed in Figure 5.6.

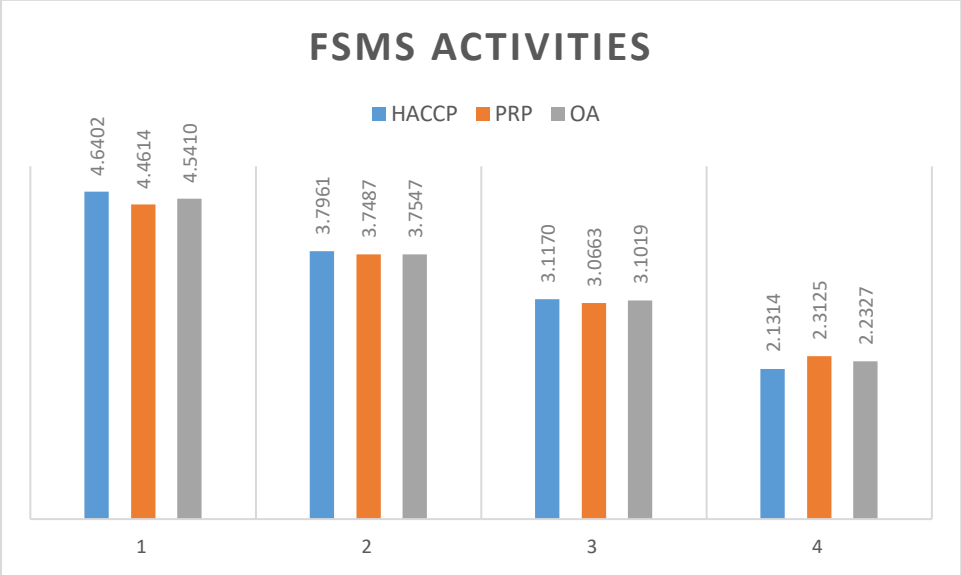

Figure 5.6. Comparing the means of HACCP, PRP, OA between clusters

In addition, the aspects of business performance are checked among the clusters. MANOVA is conducted on financial and operational performance as the dependent variables. Similar to the equation of FSMS implementation, the equations for OP and FIN variables are computed based on the factor loading results of CFA (see Table 5.6) as the followings:

OP = 0.827OP1 + 0.878OP2 + 0.785OP3 + 0.794OP4 + 0.852OP5 + 0.791OP6

FIN = 0.825FIN2 + 0.814FIN3 + 0.792FIN4 + 0.776FIN5 + 0.764FIN6

There is a statistically significant difference between the clusters, both for the multivariate with F (6, 610) = 39.093, p = 0.000; Wilks' Lambda = 0.522; partial eta squared = 0.278), as well as the univariate F-statistics as seen in Table 5.13.

Table 5.13. MANOVA for business performance

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Operational performance	2610.340	3	870.113	93.094	.000	.477
Financial performance	665.963	3	221.988	28.545	.000	.219

From Figure 5.7 below, it can be seen that cluster 1 has the highest score of operational performance (M = 21.4856, SD = 2.375) and cluster 4 is the lowest one (M = 12.85, SD = 4.72). The same in the financial performance, cluster 1 (M = 15.487, SD = 2.7) has the highest mean compared to the rest.

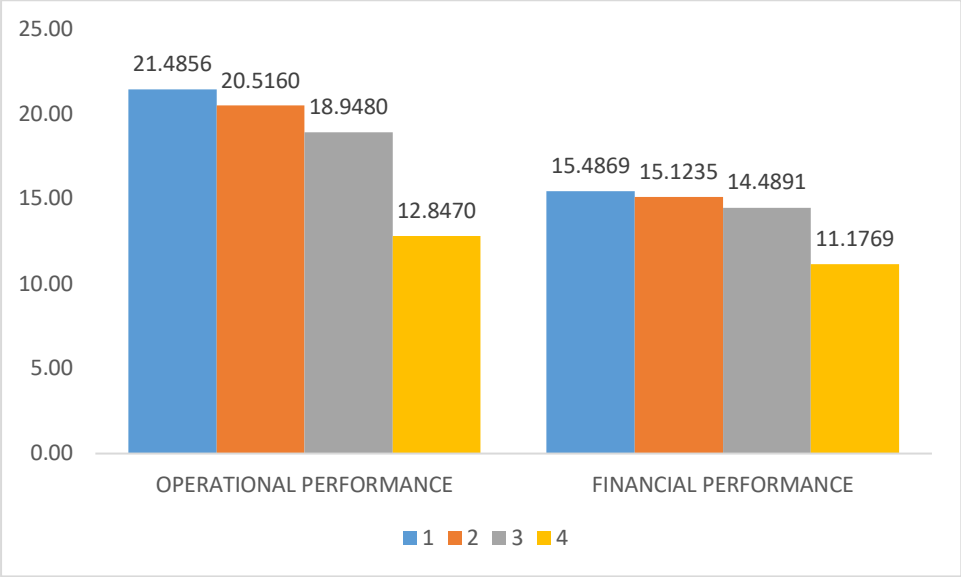

Figure 5.7. Business performance of the clusters

Therefore, based on the score of FSMS implementation, operational and financial performance, four clusters are classified as the followings: Cluster 1 – 'Best practice' group (81 firms), Cluster 2 – 'Good practice' (96 firms), Cluster 3 – 'Average' (83 firms), Cluster 4 – 'Poor Practice' (50 firms). The next task is to profile the four clusters to determine the characteristics of each cluster.

5.5.3 Profiling the identified groups

To clarify the differences between the groups, MANOVA is conducted on their profile variables. Significant chi-square values are observed for three of four profile variables except for the variable 'kind of exporting food' (Table 5.14).

Table 5.14. Multivariate F results for profile variables

Variable	*Cluster number*	*Cluster mean*	*Multivariate F**	*Univariate F**	*Sig.*
			4.611		0.000
Size	1	2.68		7.352	0.000
	2	2.55			
	3	2.25			

	4	2.96		
Ownership structure	1	1.90	4.175	0.006
	2	1.94		
	3	2.17		
	4	2.54		
Average exporting/year	1	2.72	8.693	0.000
	2	2.21		
	3	2.41		
	4	2.84		
Kind of exporting food	1	2.59	2.003	0.114
	2	1.82		
	3	1.67		
	4	2.42		

* *Multivariate F has 12 degrees of freedom and univariate Fs each has 3 degrees of freedom*

The results of the cross-classification are provided in Table 5.15. The 'Best practice' group is mainly including large firms with limited liability (Ltd.) and joint stock structure. The most popular type of food supply among groups are fisheries, fresh fruit and vegetable. In this group, there are 37 fishery firms and 14 fresh products firms. The exporting capabilities of 'Best practice' firms are remarkable since 24 firms are exporting more than 3000 tons per year, accounting 58.54% of the sample are able to export at that amount. Meanwhile, 40 small and 38 medium firms primarily construct the 'Good practice' group. There are 45 firms are Ltd., and 30 firms are private enterprises. The exporting capabilities of this group are mainly below 1000 tons per year, accounting for 78 firms over 96 firms in this group. The Average group consists of 64 SMEs, while there are only eight large and five micro firms. The dominant owner structure of this group is Ltd. (37 firms), and there are 13 firms exporting more than 1000 tons per year. Similarly, the Poor Practice group consists of 79 SMEs, but the number of micro firms accounting for 16 firms is the highest number among the groups. For the owner structure, this group is mainly private enterprises and has four cooperatives, which are the highest number for this type of ownership among the groups. The exporting capabilities of this group are the same as the Average group, mainly below 1000 tons per year. Surprisingly, the Poor practice group has 13 large firms

which are higher than the Good and Average groups. Private enterprise and ltd. are the most popular structures of this group.

Table 5.15. Cross-classifications from five-cluster solution

Firm characteristics		Cluster				Total
		1	2	3	4	
Size	1-10 employees	11	7	16	1	35
	11- 50 employees	29	40	34	13	116
	51 - 250 employees	16	38	29	23	106
	>250 employees	25	11	4	13	53
	Total	81	96	83	50	310
Ownership structure	Limited liability company	33	45	33	17	128
	Joint stock company	28	18	11	7	64
	Private enterprise	16	30	35	18	99
	State-owned enterprise	3	1	0	2	6
	Cooperatives	1	1	4	2	8
	Others	0	1	0	4	5
	Total	81	96	83	50	310
Average exporting tons/year	<500 tons	33	54	54	12	153
	500 -1000 tons	16	24	15	18	73
	1000 – 2000 tons	7	7	6	11	31
	2000 – 3000 tons	1	3	3	5	12
	> 3000 tons	24	8	5	4	41
	Total	81	96	83	50	310
Kind of exporting food	Fishery	37	58	43	13	151
	Poultry	7	5	6	10	28
	Dairy	8	6	7	8	29
	Fresh fruit and vegetables	14	18	18	11	61
	Drinks and beverage	5	4	5	7	21
	Rice and grains	6	1	1	1	9
	Other	4	4	3	0	11
	Total	81	96	83	50	310

5.5.4 Examining the CSFs of each group

To clarify differences among identified groups, MANOVA is conducted on their CSFs variables. The overall F-statistic for the MANOVA, as well as the

univariate F-statistics (Table 5.16), are all significant on all clusters' CSFs variables with F (66, 851.947) = 6.013, p = 0.000; Wilks' Lambda = 0. 319; partial eta squared = 0.317. The mean score of each cluster is also displayed in the below table.

Table 5.16. MANOVA results for all CSF indicators

Variable	Cluster number	Cluster mean	Univariate F*	Sig.
Managers commitments	1	4.06	31.416	0.000
	2	3.69		
	3	3.43		
	4	2.52		
Food safety policy	1	4.16	44.917	0.000
	2	3.60		
	3	3.33		
	4	2.26		
Responsibilities and authorities	1	3.98	25.899	0.000
	2	3.71		
	3	3.34		
	4	2.70		
Food safety culture	1	4.02	24.348	0.000
	2	3.52		
	3	3.43		
	4	2.60		
Employees' knowledge and skills	1	3.91	31.978	0.000
	2	3.85		
	3	3.37		
	4	2.40		
Awareness of the personnel	1	3.77	26.514	0.000
	2	3.76		
	3	3.30		
	4	2.34		
Training programs for employee	1	3.88	26.468	0.000
	2	3.85		
	3	3.29		
	4	2.58		
Employees' involvement	1	3.78	22.547	0.000

	2	3.77		
	3	3.20		
	4	2.54		
Qualified facilities and equipment	1	3.90	26.151	0.000
	2	3.70		
	3	3.43		
	4	2.58		
Financial condition	1	3.96	20.132	0.000
	2	3.73		
	3	3.61		
	4	2.88		
Technological condition	1	3.94	39.406	0.000
	2	3.77		
	3	3.43		
	4	2.40		
Food safety audits and inspections	1	3.94	54.899	0.000
	2	3.82		
	3	3.27		
	4	2.24		
Regulatory sanctions	1	3.85	39.770	0.000
	2	3.67		
	3	3.33		
	4	2.32		
Regulatory stimulus	1	3.79	36.283	0.000
	2	3.65		
	3	3.14		
	4	2.52		
Regulatory information and education	1	3.69	16.780	0.000
	2	3.45		
	3	3.02		
	4	2.62		
Support from business associations	1	3.56	22.583	0.000
	2	3.32		
	3	2.99		
	4	2.40		
Support from stakeholders in supply chains	1	3.41	19.883	0.000

	2	3.14		
	3	2.77		
	4	2.36		
Support from government and authorities	1	3.88	27.809	0.000
	2	3.60		
	3	3.28		
	4	2.74		
Information exchange	1	3.47	29.142	0.000
	2	3.16		
	3	3.01		
	4	2.30		
Emerging problems	1	3.21	19.249	0.000
	2	3.03		
	3	2.84		
	4	2.22		
Planning and goal-setting activities	1	3.32	15.314	0.000
	2	3.13		
	3	3.08		
	4	2.40		
Continuous improvement programs	1	3.25	18.250	0.000
	2	3.12		
	3	3.07		
	4	2.28		

A one-way between-groups MANOVA is performed to investigate each indicator of CSFs differences among the four groups. It can be seen that for most of indicators, Best practice has the highest mean score among four groups, following by Good practice. The lowest mean scores for most of indicators belong to Poor practice group. From the mean score of each cluster presented in Table 5.16, internal CSFs and external CSFs will be discussed in detail in the below subsections.

5.5.4.1 Internal CSFs

First, all internal CSFs are examined. The differences between the four groups are illustrated in Figure 5.8. As can be seen from the below figure,

overall, the highest mean score of all CSFs belong to Best practice group and the lowest belong to Poor practice group. The ranges of the internal CSFs for each group are from 3.77 to 4.16 for Best practice, from 3.52 to 3.85 for Good practice, from 3.2 to 3.61 for Average and from 2.26 to 2.88 for the last group. In detail, the mean score factor 'Management responsibility' of Best practice significantly stands out among all factors and groups, ranging from 3.98 to 4.16. Meanwhile, the factor of Human resource and Organisational resources only show a slightly different among the groups of Best, Good and Average practice, ranging from 3.77 to 3.96. The mean score of Poor practice groups in all CSFs is far behind the rest in all indicators of the internal CSFs.

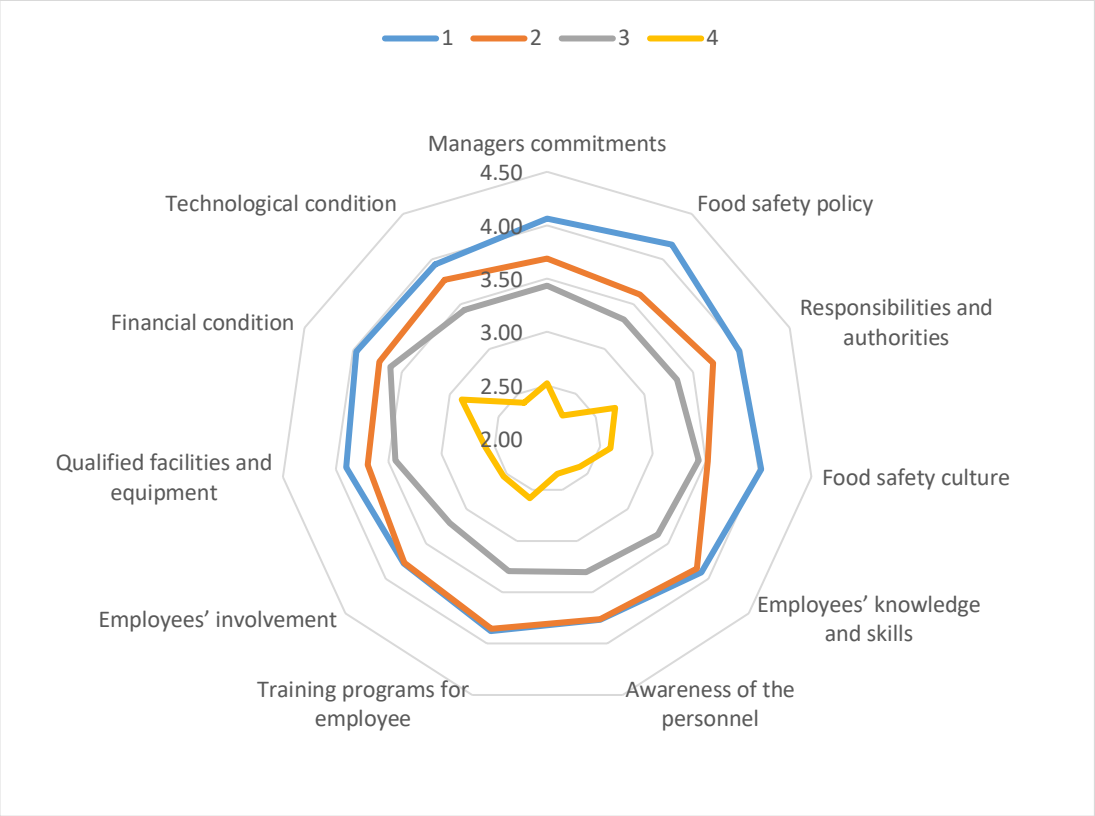

Figure 5.8. Internal CSFs among the groups

5.5.4.2 External CSFs

In the food-safety government, Figure 5.9 demonstrates that the different gaps among the first three groups (lowest mean from 3.02 to highest mean 3.94) are relative while the last group is far behind compared to the others. The mean score of the last group ranging from 2.24 to 2.62. Interestingly, while the first two groups agree that audits and inspections are the most impact

indicator of food-safety governance on FSMS implementation, they have different opinions on the lowest impact. According to Best practice, the lowest impact is information and education while the Good practice considers stimulus as the lowest one. Average group agrees with Best practice on both the most and the least impact activities of food-safety governance. The Poor practice group show different ranking perspectives on all four activities compared to the other groups, information and education is the most critical impact indicator while audits and inspects is the least critical to their FSMS implementation.

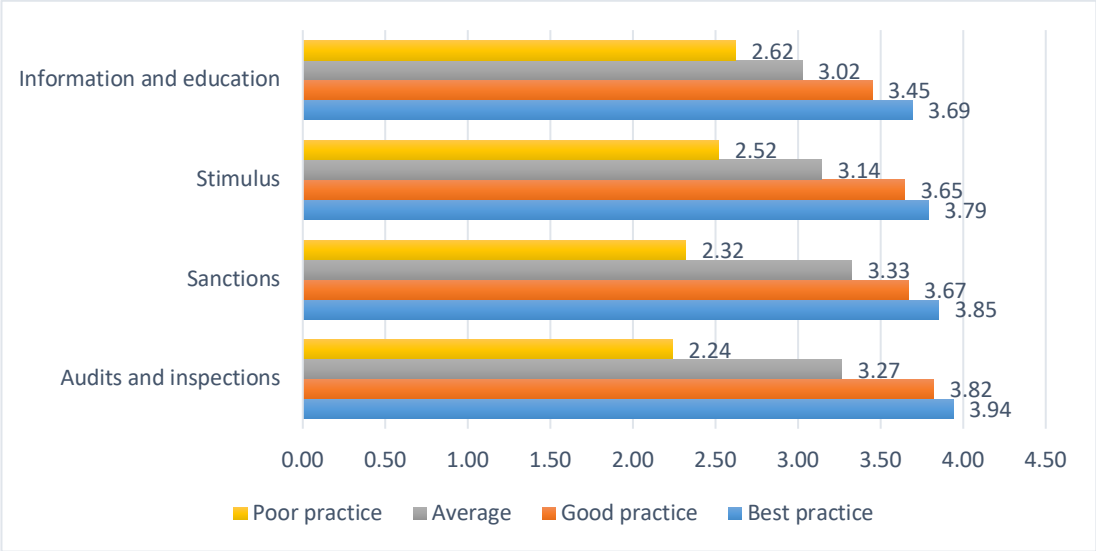

Figure 5.9. Food-safety governance

Figure 5.10. Support

Regarding support to FSMS, from Figure 5.10, all the groups share the same point of view in emphasising the role of support from government and authorities on FSMS implementation despite the difference in its mean scores across the groups. Support from business associations is perceived as the second among three sources of support. Although support from stakeholders in the supply chain significantly impacts on FSMS in the previous SEM analysis, it is the lowest impact factor among support factors.

The level of collaboration in the supply chain is highest for the Best Practice group in all activities, especially in information exchange with the highest mean score of 3.47 (Figure 5.11). It also determines solving emerging problems related to food safety is the lowest on among four indicators by the surveyed firms. The groups of Best and Good practice share the same choice of the lowest indicator. While Average and Poor practice make the same selections as they pay the most attention to the impact of planning and setting goals with their stakeholders on FSMS implementation than other activities.

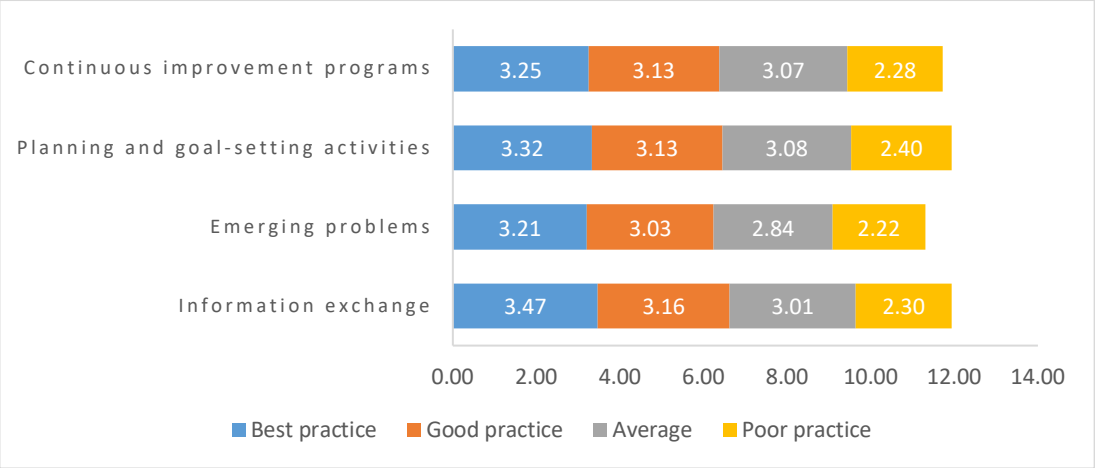

Figure 5.11. Level of collaboration in the supply chain

5.5.5 Exploring the aspect of supplier selection and SC relationship

In this section, the practices of supplier selection and the quality of SC relationship are explored to investigate their relationships with FSMS implementation as well as the differences between groups to test H10. First, Pearson product-moment correlation coefficient is undertaken for the variables of FSMS implementation and the variable group of supplier selection and the quality of SC relationship. Generally, there are significant positive correlations

between the variables at the 0.01 and 0.05 level. The strength of correlations between FSMS implementation and the variables vary from weak to strong in Table 5.17. Cohen (1988) suggests r is weak if it is below 0.3; medium r ranges from 0.3 to 0.49 and r more than 0.5 means strong relationship.

The correlational analysis indicates that certificates, reliability, self-inspection results are strongly correlated to FSMS implementation, with high levels of selecting suppliers using these criteria associated with higher levels of FSMS implementation. Criteria such as flexibility and after-sale services are medium (r = 0.441 and r = 0.467) correlated to FSMS implementation while price and distance are the weakest criteria that are correlated to FSMS implementation, r = 0.124 and r = 0.202 respectively. In term of SC relationship, commitment is the strongest element (r = 0.555) related to high FSMS implementation. Trust is medium (r = 0.483) and interdependency shows the weakest correlation to FSMS implementation (r = 0.288).

Table 5.17. Correlations

No	Correlations											
	Items	1	2	3	4	5	6	7	8	9	10	11
1	FSMS Perform	-										
2	Price	.124*	-									
3	Certificates	.573**	.326**	-								
4	Distance	.202**	.381**	.271**	-							
5	Reliability	.604**	.196**	.761**	.278**	-						
6	Self-inspection	.618**	.211**	.733**	.200**	.706**	-					
7	Flexibility	.441**	.392**	.479**	.372**	.452**	.433**	-				
8	After-sale	.467**	.308**	.520**	.362**	.555**	.595**	.515**	-			
9	Trust	.483**	.165**	.548**	.144*	.536**	.610**	.333**	.447**	-		
10	Commitment	.555**	.182**	.621**	.199**	.613**	.577**	.383**	.465**	.747**	-	
11	Interdependency	.288**	.174**	.287**	.186**	.372**	.412**	.383**	.394**	.590**	.535**	-

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Then, a MANOVA model is also conducted to investigate the differences between groups considering the criteria of supplier selection and SC relationship. MANOVA model is selected because the dependent variables are

known to correlate with each other. The overall MANOVA model is significant (F (30, 872.43) = 10.581, P = 0.000, Wilks' Lambda = 0.402, partial eta squared = 0.262) and the individual univariate F-statistics are also significant as the results in *Table 5.18*. Based on the MANOVA results, the differences between the groups considering the practices of supplier selection and the quality of SC relationship are revealed in the below table and figure.

Table 5.18. Multivariate F Results

Dimensions	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Criteria of supplier selection	Price	4225.318	1	4225.318	4671.019	.000	.939
	Certificates	4170.308	1	4170.308	5581.100	.000	.948
	Distance	4135.818	1	4135.818	6341.139	.000	.954
	Reliability	4094.023	1	4094.023	6150.068	.000	.953
	Self-inspection results	4117.774	1	4117.774	6092.257	.000	.952
	Flexibility	3801.903	1	3801.903	5976.445	.000	.951
	After-sale service	3284.783	1	3284.783	4590.697	.000	.938
SC relationship	Trust	4148.278	1	4148.278	5334.242	.000	.946
	Commitment	3851.060	1	3851.060	4541.829	.000	.937
	Interdependency	3192.707	1	3192.707	3058.959	.000	.909

Table 5.19. The differences between the groups in supplier selection

Group	Price	Certificates	Distance	Reliability	Self-inspection	Flexibility	After-sale
Best practice	3.79	4.41	3.95	4.43	4.44	4.06	3.84
Good practice	4.10	4.32	3.85	4.19	4.27	3.88	3.66
Average practice	3.96	4.11	3.83	4.06	3.99	3.70	3.54
Poor practice	3.36	2.28	3.42	2.30	2.32	2.80	2.38

The group of Best practice select their suppliers based on the reliability and the result of the inspections that they examined themselves first as well as certificates that suppliers possess. The Good practice group is likely to select suppliers based on self-inspection results. The group of Good and Average practice prioritise certificates to select suppliers. The most striking result to

emerge from the data is that the Poor practice prefers local and cheaper suppliers than the other selection criteria.

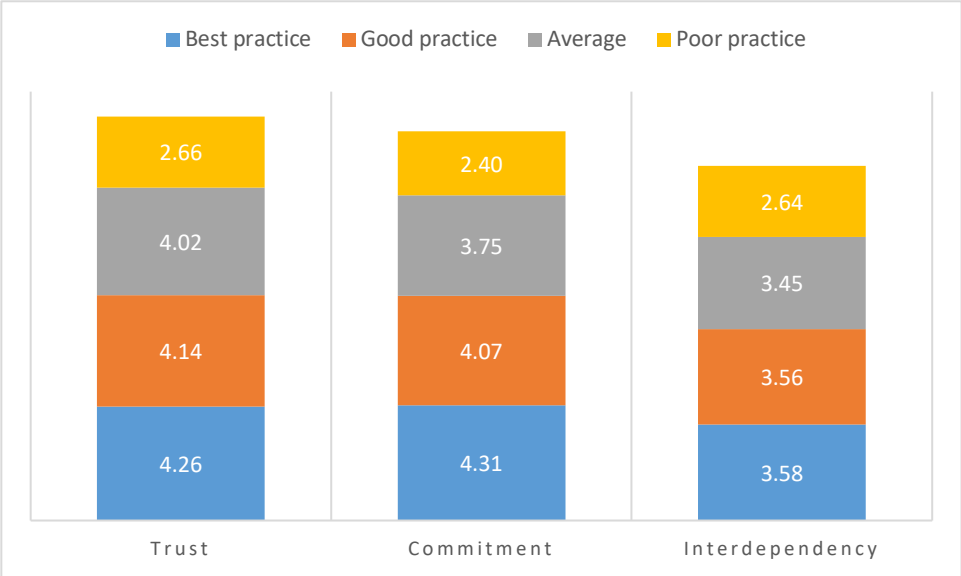

Figure 5.12 SC relationship among the groups

Moreover, the SC relationship of Best practice has the highest mean score with a high level of commitment (Figure 5.12). While the other groups have a higher level of trust than commitment and the interdependency is the lowest score across the groups. Both commitment and trust are strongly correlated to FSMS implementation as the above results of the correlational analysis. Poor practice has the lowest score of all SC relationship indicators. It shows a different pattern in their SC relationship compared to the rest because its interdependency has a higher score than commitment. Also, the mean gap between each indicator is relatively narrower than the other groups, about 0.2. In conclusion, H10 is confirmed considering the correlation, the mean score and comparisons among the groups of this study in term of criteria to select suppliers and their SC relationship.

5.6 Discussion

5.6.1 Impact of CSFs on FSMS implementation

The first objective of this study, which sought to determine the impact of CSFs on FSMS implementation consisting of HACCP, prerequisite programs and other activities related to food safety guarantee at food production, is

identified by the empirical evidence. In detail, 22 indicators of six CSFs are investigated and identified from the three levels of the organisation, market, and governance. The hypotheses testing reveals that internal CSFs such as 'management responsibility' (managers' commitment, responsibilities and authorities, FS policy, FS culture), 'Human resource' (employees' involvement, training programs, personnel's awareness, employees' knowledge and skills) and 'other organisational resources' (qualified equipment and facilities, technological and financial conditions) make significant contributions to FSMS implementation of the firms. Among all internal indicators of CSFs, FS policy, employees' knowledge and skills, technological condition are taken into account as the most critical impact indicator in each construct. In addition, it is interesting to note that the construct 'Management responsibility' has the most significant impact on FSMS implementation, according to the SEM results. Contributing to the extensive research on CSFs, the finding of these internal CSFs further confirm the results of the previous studies identified by Fotopoulos, Kafetzopoulos and Psomas (2009), Mensah and Julien (2011), Kafetzopoulos and Gotzamani (2014), Kirezieva, Luning, *et al.*, (2015). Nonetheless, this study identifies additional latent constructs and clarifies the critical roles of each factor instead of equally considering their importance in the implementation of FSMS. The above results provide a vital managerial message to those who want to improve FSMS within their firms by paying more attention and give priority in improving these internal factors first.

Regarding the group of external CSFs, 'Support' (from government and authorities, business associations and stakeholders in SC), 'FS governance' (audits and inspections, stimulus, sanction, education and information), and 'Collaboration' (information exchange, solving emerging problems, setting plan and goal, continuous improvement program) significantly show their critical contributions to FSMS implementation. Regarding the combined impacts of those CSFs of the same level, grounded on SEM results (see Figure 5.3), the value of each level can be estimated using the following equations :

CSFs' impact of the organisational level = 0.187 Management responsibility + 0,126 Human resource + 0.147 Organisational resources

CSFs' impact of the market level = 0.259 Collaboration + 0.213 Support

CSFs' impact of FS governance = 0.160 FS Governance

Contrary to expectations, this study confirms a larger contribution of the market factors including Collaboration and Support to FSMS implementation than the organisational factors according to SEM results at the surveyed firms. This outcome is contrary to the work of Kafetzopoulos and Gotzamani (2014) that found the organisational attributes greatly contributing to the effective of ISO 9001 and HACPP system while the external environment did not. On the other hand, it is consistent with the study of Kirezieva, Luning *et al.*, (2015) who confirmed collaborative/supportive supply chains and the roles of sector organisations and non-governmental organisations (NGOs) that contribute to more advanced FSMS and good system output. Likewise, Nanyunja *et al.* (2016) demonstrate how other stakeholders of supply chains influence on FSMS in Kenya and Uganda. There is an apparent shift in more advanced FSMS and higher system output between farms and trade companies in Kenya to respond to the demand of strict voluntary food safety standards from large retailers supplying the EU premium market. Apart from these studies, most of the existing studies are limited to the impact of CSFs in the organisational environment on FSMS implementation leaving the other two environments of FSMS insufficient understanding (Mensah and Julien, 2011). This is the first study to lay stress on the vital impact of the external factors to FSMS implementation while considering all levels of organisation, sector and governance simultaneously. Also, it clarifies the level of these firms collaborate with their stakeholders and what sources of support critically impact on FSMS implementation. Therefore, these findings have important implications for food firms to increase their concentration on working with their stakeholders in the SC toward food safety issues and other parties. Also, the results suggest that government and authorities and business associations should enhance their activities in supporting firms and governing FSMS implementation. It represents the major contribution of this study to the existing literature in the area.

5.6.2 The relationship between FSMS implementation and business performance

The second research objective is set based on reviewing the literature that has shown insufficient empirical research concerning the impact of FSMS implementation on the business dimensions of companies in the food industry. The study addresses it through two main findings. First, companies' business performance is investigated. Data analysis extracts two main factors of business performance, which are: 'operational performance', and 'financial performance'. Second, the hypotheses testing shows that the FSMS implementation makes a significant contribution to firms' 'operational performance' but a non-significant direct contribution to 'financial performance'. Instead, it is proven that 'operational performance' makes a significant positive contribution to 'financial performance'. The conclusion that operational performance is a determinant of financial performance corroborates these earlier findings, such as the works of Kafetzopoulos and Gotzamani (2014).

It is somewhat surprising that there is no direct relationship between FSMS implementation and financial performance, only an indirect relationship through operational performance. It is difficult to explain this result, but it might be related to the following explanations. Firstly, in other researches, FSMS is examined in combination with a quality management system such as ISO 9001 or only HACCP system is representative for FSMS (Sampaio, Saraiva and Guimarães Rodrigues, 2011; Kafetzopoulos and Gotzamani, 2014). Secondly, this possible explanation intrigue a further research direction, whether investigating the relationship between FSMS and financial performance need an intermediate variable in the research model? This is exemplified in the works undertaken by Jacxsens *et al.* (2010), Klementina Kirezieva *et al.* (2013) and Luning *et al.*, (2015), the authors use system output including information from external (i.e. audits, consumer complaints) and internal activities (i.e. sampling information, non-conformity) as the outcomes of FSMS. Unfortunately, they have not empirically tested these indicators in their studies, which requires future works on developing instrumentation for system output

as an intermediate variable among FSMS implementation and financial performance. Thirdly, there is another explanation for this result from a different perspective on the relationship between FSMS implementation and financial performance involving the cost of FSMS implementation. Chen, Wilson and Otsuki (2008) present useful firm-level empirical analyses of food safety regulations on manufacturing firms. They prove that a 1% increase in initial investment to meet compliance costs raises variable costs by between 0.06 and 0.13% and fixed costs of compliance are non-trivial, averaging about 4.7% of annual variable costs. This estimation is much smaller compared to the finding of Ragasa, Thornsbury and Joshi, (2011) which focused on the seafood sector whose assurance of food safety (under the requirement for HACCP) far more costly. Their results point to a significant underestimation of reported HACCP costs by an average of US$1.10 for a dollar of reported expenditure. In this study, the item 'Company's operational costs of the previous year' has been dropped from the construct in the factor analysis because it does not provide pure measures of a specific factor. Accordingly, there is no indicator in the research model reflecting the cost of operation at firms, which might result in no significant relationship between FSMS implementation and financial performance.

Furthermore, food safety management is considered as the burden for businesses due to high cost of standards compliance and proper testing processes in production as mentioned in the previous studies, namely the works of Marucheck *et al.*, (2011), Mensah and Julien (2011), Macheka *et al.* (2013); Maskus, Otsuki and Wilson (2013), Keiichiro, Otsuki and Wilson (2015), Qijun and Batt (2016). Following the extensive literature review, it is obvious that this study represents the first research in the FSMS field that investigates the direct links as well as empirically tests the relationship between FSMS implementation and the two dimensions of business performance. This finding has a crucial implication for the food industry because it positively encourages firms to improve and update their FSMS continuously, which leads to better operational and financial performance for firms in global trading.

5.6.3 The measurement of FSMS implementation

Considering the important need of the measurement of FSMS, it is required that FSMS implementation must be assessed regularly to ensure the food-safety goals are achieved in global supply chains (Jacxsens *et al.*, 2011; Kafetzopoulos, Psomas and Kafetzopoulos, 2013; Klementina Kirezieva *et al.*, 2013). The measurement proposed in this study is constructed on the main activities of an FSMS, including management system, HACCP, validation, and correction actions. It is designed to identify potential restrictions in the determinant of FSMS implementation and where improvements are necessary for firms. This effort is in line with many prior studies (Luning *et al.*, 2008, 2015; Jacxsens *et al.*, 2010, 2011; Osés *et al.*, 2012; Klementina Kirezieva *et al.*, 2013; Sawe *et al.*, 2014; Kafetzopoulos and Gotzamani, 2014; Kusaga *et al.*, 2014; Nanyunja *et al.*, 2015; Rajkovic *et al.*, 2017; Njage *et al.*, 2018) in evaluating the status of FSMS based on the available data and insight that a company has on its implementation (e.g. results of external inspections or audits, sampling, self-assessment results). Additionally, FSMS implementation in this study is not limited to HACCP principles and is not only considered as a part of quality management as the previous studies (Cormier *et al.*, 2007; Sheriff, 2013; Green and Kane, 2014; Kafetzopoulos and Gotzamani, 2014; Al-Busaidi, Jukes and Bose, 2017). Instead, it fully consists of the key elements as discussed in the definition of FSMS including not only the objective of hazard analysis but also other requirements such as prerequisite programs and other safety-related control activities within food firms.

In other words, this study aims to propose a practical and straightforward approach to measure FSMS implementation based on the current practices of the firm considering their determinant CSFs. This measurement established in this study tackles two critical requirements for assessing FSMS implementation. First, it is easy-to-use for managers and food safety teams as daily basis tool which helps them to quickly respond and take necessary actions as well as allow the highest priority regarding resources and activities deemed to have the most significant impact. Second, the outcomes of these measurements are able to reflect the status of firms' FSMS implementation and produce recognisable improvement opportunities for their current

practices to fulfil increasing stringent requirements of FSMS in global supply chains. This assessment leads to identify improvement opportunities and prioritise which area food managers should pay attention to enhance and update the current practices, especially in the case of firms with limited resources. This is the contribution of the study in constructing decision-making tools to assist food enterprises in assessing FSMS implementation.

5.6.4 Identifying improvement opportunities for FSMS implementation

The research stream on CSFs of FSMS implementation has been mostly restricted to the confirmation of their presences by empirical studies or qualitative analyses. A possible explanation for this might be that most researchers want to simplify the investigated factors and variables in previous research. However, each FSMS is highly customised, resulting in no 'one best way' for all food manufacturers. Each firm's FSMS is unique in production, organisation and the context in which it is operating (Jacxsens *et al.*, 2010). Contingency theories suggest that there is a fit between the organisational structures and contingency that has a positive effect on performance. As a result, maximum performance comes from the appropriate level of a structural variable that fits the contingency (Donaldson, 2001). To the best of our knowledge, none of the studies is able to suggest potential improvement opportunities through assessing the impact of CSFs on FSMS implementation contingent on the system status of each enterprise. Respond to these needs, apart from SEM used to investigating the determinants; the cluster analysis is applied in this study to classify all the sampled companies into the distinctive groups based on their FSMS implementation. Then, the significant MANOVA on all clusters' CSFs variables confirms that the CSFs vary across food firms depending on their different FSMS implementation (Research objective 3). This work is associated with the study of Tzamalis, Panagiotakos and Drosinos, (2016) to develop a tool providing a 'best practice' among the studied firms based on factors influencing the FSMS implementation. It is particularly beneficial for pointing out the differences between firms of different

groups and identifying their potential improvement areas contingent on the status of FSMS implementation.

For example, Best practice group has the finest practice overall such as the factor 'Management responsibility' which is outstanding and has the highest internal impact on FSMS implementation. The comparison between Best practice and the others offers constructive suggestions regarding improvement opportunities in many aspects (Figure 5.13).

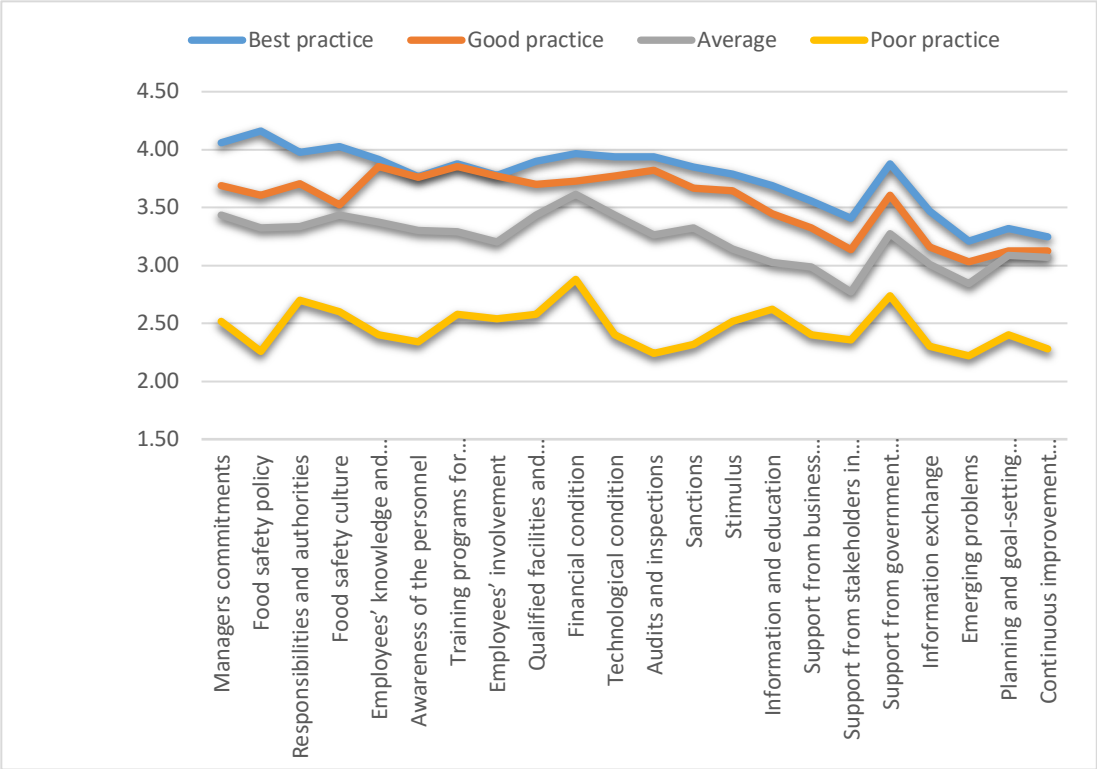

Figure 5.13. The overall mean score of all indicators

Closer inspection of the figure shows that the groups of Good and Average Practice should improve their Management responsibility since their gaps with the Good practice are apparent. For the group of Good practice, the gaps between it and the Average group indicate that human resource, in particular, more training programmes for employees should be in priority to improve by firms. The case of Poor practice is more complicated since it has the lowest score across all factors. However, this group is mainly private enterprises with low exporting capabilities, as mentioned in section 5.5.3. Therefore, it is impossible to improve everything at the same time. Alternately, these research results suggest that it should give priority to improving FS policy and

awareness of the personnel within the firm, which is more critical to their FSMS implementation.

Furthermore, it is interesting to note that a manager of the company in any group could identify which area to improve based on the comparison between its score and the mean score of the group root on the results of the cluster analysis. For instance, there are four firms randomly picked from each cluster in Table 5.20.

Table 5.20. Internal CSFs of five random firms in the research sample

Group	Firm	Management responsibility				Human resource				Other resources		
		Commitments	Policy	Responsibilities	Culture	Knowledge	Awareness	Training	Involvement	Facilities	Finance	Technology
1	VN169	5	5	3	5	4	4	4	4	4	4	4
	Mean	4.06	4.16	3.98	4.02	3.91	3.77	3.88	3.78	3.90	3.96	3.94
2	VN167	2	1	2	1	4	4	4	1	1	2	2
	Mean	3.69	3.60	3.71	3.52	3.85	3.76	3.85	3.77	3.70	3.73	3.77
3	VN175	3	3	4	3	5	4	4	4	4	4	4
	Mean	3.43	3.33	3.34	3.43	3.37	3.30	3.29	3.20	3.43	3.61	3.43
4	VN168	3	4	4	4	2	3	3	4	3	4	4
	Mean	2.52	2.26	2.70	2.60	2.40	2.34	2.58	2.54	2.58	2.88	2.40

Comparing them to the mean score of each cluster offers some practical suggestions. Overall, the firm VN169's practice is good compared to other firms in the same group. However, it should pay attention to setting up clear responsibilities and authorities in managing food safety in its company. Contrary to VN169, VN167 needs to make many efforts in management responsibility and increase employees' involvement since most of them are far lower than the average of the group. Moreover, its facilities, financial and technological condition are beneath compared to most firms in the group. However, these data must be interpreted with caution because of the possible bias in the managers' perceptiveness. The implication of these findings provides a novelty approach to identify potential factors to improve that directly impact on FSMS implementation. An implication of this is the possibility that

businesses apply the viewpoint of CSF as a more proactive approach to identify the mechanism enabling continuous improvement strategies for the current FSMS implementation, particularly for SMEs with finite resources. A further study with more focus on the different status of FSMS implementation is therefore suggested.

5.6.5 Criteria of supplier selection

With respect to the last research objective of this study, it is found that each group has different priority criteria and the level of trust, commitment and interdependence with their suppliers. A Pareto or sorted histogram chart that contains both the mean score columns sorted in descending order and a line representing the cumulative total percentage is conducted to highlight the most popular criteria that these firms used to choose suppliers (Figure 5.14). The Pareto chart shows that the studied firms primarily choose their suppliers based on reliability, certificates, self-inspection results, flexibility and distance, considering after-sale service and price as the least-wanted criteria. This finding provides empirical support for confirming that firms give priority to safety criteria more than the other criteria in selecting suppliers. On the other hand, comparing the groups shows the most interesting aspect that is the different selecting criteria. The group of Poor practice reveals its contrary trend in evaluating distance, price and flexibility to be more critical than the other groups. Whereas, the rest shares the same tendency in the selecting order of these criteria. A closer inspection shows that the Good practice is likely to choose their suppliers based on their inspection results and reliability; this mean score is the highest among the four groups. Overall, it is concluded that the groups that have better FSMS implementation pay more attention to safety criteria since their mean scores for these criteria are higher than others.

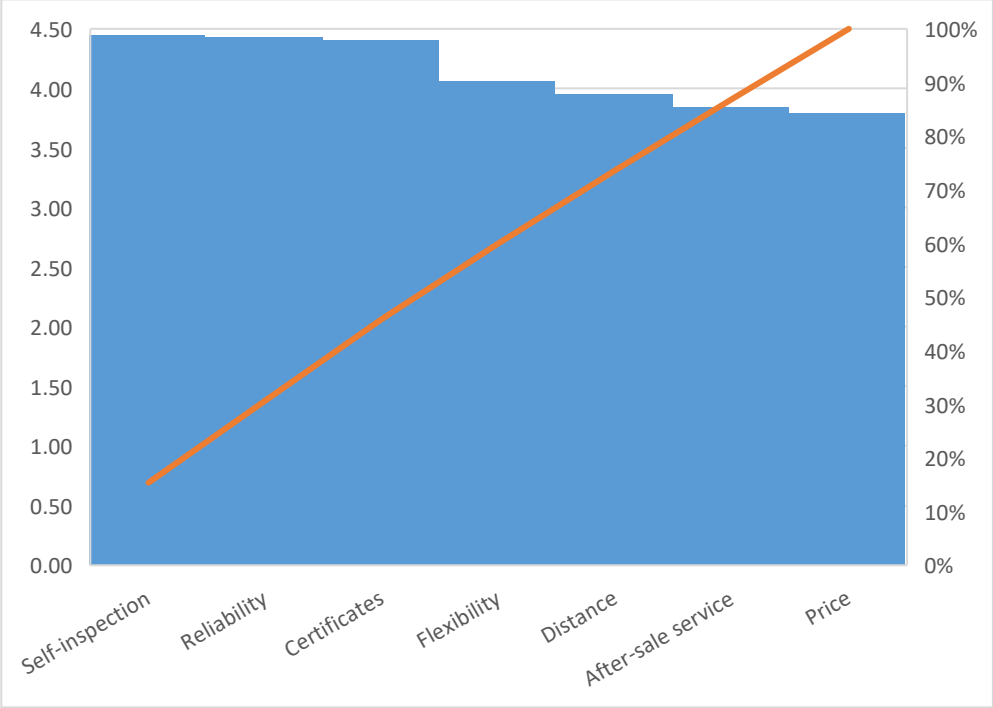

Figure 5.14. Pareto chart of supplier selecting criteria

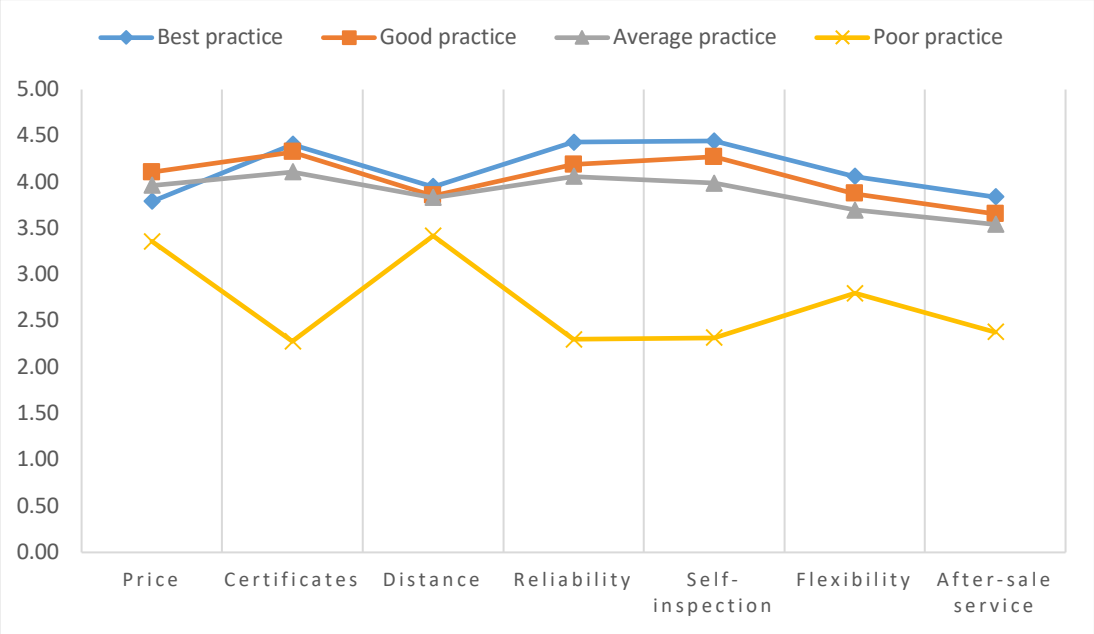

Figure 5.15 The different selecting criteria of five groups

5.6.6 The SC relationship

Regarding the SC relationship, the analysis shows that there are higher levels of trust and commitment than interdependency among the studied companies with their suppliers as a whole (Figure 5.16).

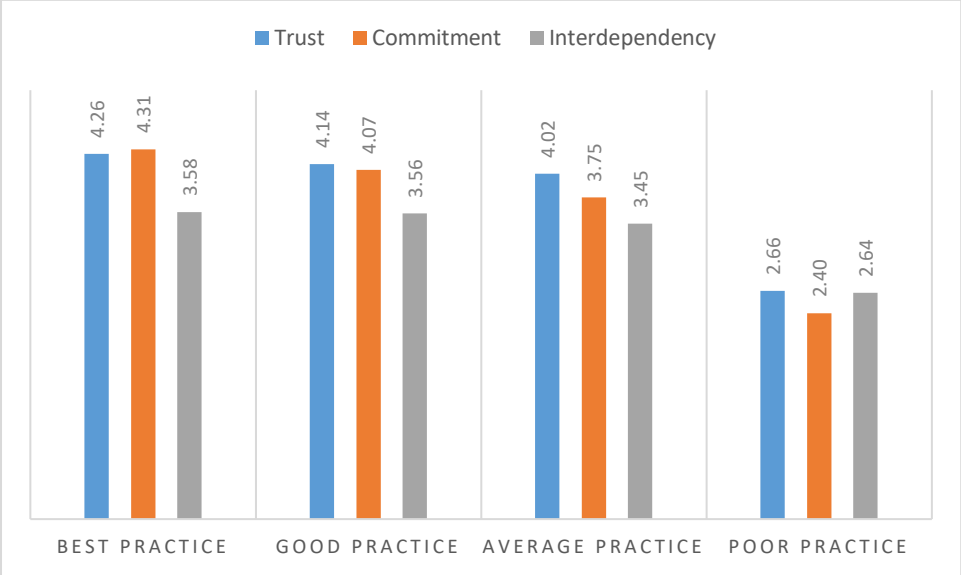

Figure 5.16 SC relationship between the groups

One interesting finding is the commitment from Best and Good practice that have a higher level of commitment than trust, which is different from the rest. It can be seen that the level of commitment, trust and interdependency are descending order following the score of FSMS implementation of each group. The correlational analysis also points out that commitment is the strongest element related to high FSMS implementation, whereas trust is medium, and interdependency shows the weakest correlation to FSMS implementation. These results provide a further answer for the last research question that the groups have better FSMS implementation in better SC relationship with their suppliers, especially in term of trust and commitment. This finding is in line with the study of Fynes, Voss and de Búrca (2005) emphasising the impact of SC relationship on product quality or the work of Ding *et al.* (2014) confirming that trust and commitment are significantly related to food quality of Australian beef supply chain. This study directs attention to SC relationship and FSMS implementation. It suggests that food firms should gain more commitment and develop mutual trust with their suppliers in term of food safety management.

5.7 Conclusion

The investigation of CSFs on FSMS implementation consisting of HACCP, prerequisite programs and other activities related to food safety guarantee at food production has shown that there are six critical areas that should be

carefully considered by food companies that seek to improve their current FSMS. These areas are constituted by management responsibility, human and other organisational resources, food-safety governance, external support and collaboration in the supply chains. The research findings provide the use of CSFs as a more proactive approach to identifying the mechanism enabling continuous improvement for the current FSMS contingent on each firm's status, particularly for SMEs with finite resources. Also, food firms should develop the necessary policies, practices, and procedures to follow food-safety governance as well as support and collaborate with their stakeholder in global supply chains since these activities significantly contributing to FSMS implementation. Likewise, they should require food safety criteria when selecting suppliers and develop a better relationship with their stakeholders in the SC toward food safety issues. Commitment and trust should be gained among the stakeholders in food supply chains since they are highly correlated to FSMS implementation. Moreover, the empirical research presented in this paper has revealed the positive impact of FSMS implementation on operational performance, as well as the positive impact of operational performance on financial performance. The findings suggest that effective implementation of FSMS can significantly contribute to the realisation of operational and financial improvements in food manufacturing in order to increase companies' competitiveness in the highly dynamic global marketplace. This study also raises the critical roles of other parties such as government, authorities, and business associations in global supply chains. Greater efforts are needed to enhance their activities in supporting and governing food firms' FSMS implementation.

The discussion of insights into managing FSMS implementation by more effective mechanism enabling continuous improvement opportunities for the current FSMS implementation based on the identification of CSFs presented in this study has specified several important future research directions for researchers. First, the findings and discussion of this study suggest that there are still gaps and many promising research directions needed in designing and establishing instruments for evaluating the implementation of FSMS. The most important requirement is that the outcomes of these measures should lead to

clear improvement areas for firms' current practices to ensure safe food to final consumption. Future work in this area can examine and construct more diagnostic tools to assess FSMS implementation. Second, more CSFs from all levels of organisation, sector and governance simultaneously should be identified to reduce the complexities of decision-making and managing FSMS to facilitate food firms' managers toward a safer global food supply chain. Third, the relationship between FSMS implementation and financial performance is needed to explore further and explain why there is no direct relation between them. Finally, the important contribution of external factors should be further investigated, especially the role of more supportive and collaborative supply chains to FSMS implementation.

CHAPTER 6 CONCLUSION

6.1 Chapter introduction

This concluding chapter presents the brief answers for the research questions, clarifies the contributions of this thesis and introduces future directions for developing the work. In detail, the chapter returns to the defined research objectives to address research questions through the research's key findings. This is followed by a description of the contribution to existing theories as well as the study's practical implications. Lastly, the future research direction arising from this research is explored in the last section.

6.2 Addressing the research questions of the thesis

The systematic literature review has identified the knowledge gaps in the research of FSMS implementation concerning the need for firms to measure and improve their current FSMS implementation toward a safer global food supply chain. The primary research gap was the need for a mechanism enabling successful FSMS implementation to assist food firms in recognising and understanding their critical points and consequently contributes to guaranteeing and improving food safety. The second one was that the research on the measurement of FSMS implementation focuses particularly on HACCP while other requirements and activities namely prerequisite programs, traceability, control of nonconformity, validation, verification, and continuous improvement remain limited. The third research gap was identified since most researches on CSFs in FSMS has been mostly restricted to confirmation of CSFs' presents and focused only one level in each study. The fourth identified research gap was the lack of studies examining the interaction between CSFs and FSMS considering the differences among enterprises even though food manufacturers and exporters operate in a diverse business environment with different field pressures and manufacture characteristics, legal requirements, and institutional settings. The final gap was no single existing study that investigates whether a direct relationship exists between the extent to which companies implement FSMS and business performance.

To tackle these gaps, a sequential exploratory research design consisting of both the qualitative and quantitative research approach was adopted to

answer the developed research questions of this thesis. RQ1 was established to identify the research gaps in managing FSMS implementation and seeking continuous improvement opportunities. RQ2 was concerned with the in-depth reasons why a factor considered as a critical success factor to FSMS implementation and what their priority order is based on the perception of experienced managers in a specific context. Meanwhile, RQ3 and RQ4 focused on to what degree CSFs are influencing FSMS implementation and to what degree FSMS affects business performance at firms in the context of global supply chains. RQ5 and RQ6 spotlighted the differences between Best practice and other groups of firms in the research sample to explore their CSFs, supplier selection criteria and relationship in supply chains rigorously. The findings to each particular research question are briefly provided in the below sections.

6.2.1 Research question 1

With the complexity of global supply chains, how do food manufacturers manage and improve the implementation of FSMS based on CSFs leading to safer food production?

A systematic literature review derived from the research methodology of Denyer and Tranfield (2009) has been conducted to identify the knowledge gaps in the research of FSMS implementation concerning the need to understand how firms measure and improve their current FSMS in the global food trading. A total of 71 papers published within 15 years (from 2003 to 2018) are analysed and synthesised to clarify the complex context of global food supply chains, summarise the managerial requirements of FSMS implementation, review available measurement tools and extract the existing CSFs leading successful FSMS implementation. In details, globalisation of food supply chains associated with the high level of risks and vulnerabilities and increasing food safety concerns as the results of several high-profile food incidents from all over the world complicate the management of food safety. As a result, food safety management is a system consisting of many crucial requirements from both international and national regulations and standards. A risk-based preventive approach proposed in the literature (see Section

2.3.3.2) is recommended for food firms' managers to manage FSMS through specifying the necessary acceptable requirements. Also, there is no absolute safe system in food safety management, which requires food firms to seek for continuous improvement in the effectiveness and efficiency of their FSMS implementation rather than waiting for a problem to reveal opportunities for improvement.

Therefore, food firms in global supply chains manage their FSMS based on measuring FSMS performance using many diagnose tools suggested by researchers (e.g. Jacxsens *et al.*, 2010; Luning *et al.*, 2011; Klementina Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Xiong *et al.*, 2017). They also identify a variety of barriers and enablers of FSMS that assist food firms in overcoming difficulties and strengthen FSMS implementation (Yapp and Fairman, 2006; Mensah and Julien, 2011; Macheka *et al.*, 2013; Sheriff, 2013; Kafetzopoulos and Gotzamani, 2014; Qijun and Batt, 2016; Xiong *et al.*, 2017; Jawad, Ledwith and Panahifar, 2018). Furthermore, the findings of this research question confirm the essential role of the measurement for FSMS implementation and the feasible application of CSF theory in identifying improvement opportunities for firms enhancing the level of safety guarantee from food production to final consumption. In addition, many identified research gaps have emerged from the SLR by reviewing existing measurement tools and CSFs for FSMS implementation, which is in need of studying.

6.2.2 Research question 2

Why is a factor considered as a critical success factor to FSMS implementation, and what is the priority order of these CSFs to improve the current practice based on the perception of experienced managers in the food industry?

To answer this research question, a qualitative approach using semi-structured interviews to enrich the understanding of CSFs for the FSMS implementation among fish and fisheries manufacturers and exporters in two Asian developing countries. The qualitative study explores the in-depth reasons why a factor is considered as a critical success factor to FSMS

implementation and the qualitative assessment the priority order of identified CSFs based on the opinions of 13 experienced managers in Chinese and Vietnamese fishery firms. A set of the most critical factors with a detailed explanation for each perceived CSF in three analysis levels is determined in the study based on the practical and valuable reasoning and listing. Although each factor has a different explanation according to the interviewed managers presented in the qualitative chapter, in general, the distinctive reasons behind a CSF deduced from the study are:

- These factors are fundamental to the success of the FSMS implementation thanks to their direct involvement.
- They are demanded by the law, regulations and standards in global supply chains.
- A well-established FSMS containing positive impacts from those CSFs is considered as a competitive advantage in the global trading.
- They are used as managing tools by firms to their stakeholders in the supply chains.

The exploratory study indicates that people-related factors of the organisation contribute significantly to FSMS success. In particular, awareness, commitment, and behaviour not only from personnel who directly handle food products but also from managers and supervisors who establish responsibilities and authorities within firms, monitor food-safety management activities as well as develop FS policy and culture. These factors are also perceived as high-priority CSFs since firms find them challenging to establish, control, and measure in practice. While the more advanced and sophisticated the facility and work environment as well as sustainable financial conditions in food manufacturers are, the higher in guarantee the abilities of food-safety management could be according to the observation on-site and the interviews. Consequently, these factors are considered as CSFs of FSMS implementation besides people-related factors at the organisational level. It is interesting that SMEs in this study have the tendency to perceive these aspects as more critical and with higher impact to FSMS implementation than large firms do since the interviews' results reveal that it could lead to the gap among them in international trading.

At the market level, the roles of supplier management, collaboration and support from stakeholder in supply chains in implementing FSMS are perceived as critical and need to be prioritised than other CSFs because they are used as multi-purpose tools by the firms to control and manage their suppliers. Additionally, they facilitate and affect the status of FSMS toward continuous improvement through collaboration and support among stakeholders, especially for SMEs. Another important finding of the qualitative study is that creating and maintaining such collaborative relationships not only requires intensive resources but also is influenced strongly by stakeholders' awareness and incentives according to the experts' experience. Consequently, collaboration in the supply chains is ranked lower than supplier management and supportive relationships. For that reason, regarding the nature and extent of why and how to motivate firms to support and collaborate with others to enhance food safety management is an interesting research inquiry. Also, while the support of stakeholders in the supply chains is in the centre of the interviewees' attention, support from business associations, the public sector, and financial institutions receives less consideration by the interviewees.

Implementing FSMSs are impacted by the 'broad context' shaped by food-safety governance, corroborating the findings of Kirezieva, Jacxsens, et al. (2015) and Kirezieva, Luning, et al. (2015). FS governance in the qualitative findings include inspections, audits, and sampling that are periodically or randomly used as tools to examine non-conformity products or processes by regulatory authorities. Afterwards, sanctions can be imposed upon non-compliant activities, and stimuli are used to encourage compliance incentives. In addition, information and education (such as guidelines, training, and advice) are applied to broaden and update knowledge of food-safety management. The vital roles of food-safety governance in support, encouragement, and enforcement contribute to the success of FSMS implementation by motivating firms to update their FSMS and guaranteeing continuous compliance. On the contrary, the practices of food-safety governance in the studied countries cause some emerging issues to the interviewed firms because of the lack of consistency, stability, and

transparency in enforcement. These issues demand more considerable efforts of relevant parties such as government and authorities, certificate bodies and business associations in FS governance to assure food safety objective.

6.2.3 Research question 3

Whether and to what degree are CSFs influencing FSMS at firms in the context of global supply chains?

The quantitative study is designed to fulfil the research gaps identified in the SLR and generalise the results of the qualitative study by answering research question 3, 4, 5 and 6 through four research objectives. A structural equation model for detecting factors that are most critical to FSMS implementation, their relationships and influences on business performance among more than 300 food manufacturers and exporters in the same sample countries as the qualitative study is developed and tested in the research. Regarding the research question 3, the investigation of CSFs on FSMS implementation consisting of HACCP, prerequisite programs and other activities related to food safety guarantee at food production has shown that there are six CSFs constituted by management responsibility, human and other organisational resources, food-safety governance, external support and collaboration in the supply chains. Among all internal indicators of CSFs, FS policy, employees' knowledge and skills, technological condition are proved as the most critical impact indicator in each construct and 'Management responsibility' has the most significant impact on FSMS implementation. In the midst of the external CSFs group, 'external support' (from government and authorities, business associations and stakeholders in SC), 'FS governance' (audits and inspections, stimulus, sanction, education and information) and 'collaboration' (information exchange, solving emerging problems, setting plan and goal, continuous improvement program) significantly show their critical contributions to FSMS implementation. It is unexpected that this study confirms a more considerable contribution of the external factors to FSMS implementation than the internal factors according to SEM results at the surveyed firms. Other than that, the level of these firms collaborating with their stakeholders and support

from stakeholders, government and authorities as well as business associations critically impact on firm's FSMS implementation.

6.2.4 Research question 4

Whether and to what degree does the implementation of FSMS affect business performance?

The empirical findings of the quantitative study suggest that the effective implementation of FSMS can significantly contribute to the realisation of operational and financial improvements in food manufacturing. Two aspects of companies' business performance, which are operational performance and financial performance is extracted by exploratory and confirmation factor analysis in the study. Then, the hypotheses testing results affirm that the FSMS implementation makes a significant contribution to firms' operational performance but a non-significant direct contribution to financial performance. Alternately, the operational performance makes a significant positive contribution to financial performance. The finding that there is no direct relationship between FSMS implementation and financial performance, only an indirect relationship through operational performance is very thought-provoking and intrigue several future research questions that will be discussed in Section 6.5.

6.2.5 Research question 5

Do the CSFs vary significantly across food firms depending on their different FSMS implementation?

The research stream on CSFs of FSMS implementation has been mostly restricted to the confirmation of their existence by empirical studies or qualitative analyses, apart from SEM used to investigating the determinants, the cluster analysis is applied in this study to classify all the sampled companies into the distinctive groups based on their FSMS implementation. For the purpose of identifying Best practice, the two-step cluster analysis - hierarchical and non-hierarchical clustering has been conducted to classify the surveyed firms into four distinctive groups. The significant MANOVA on all clusters' CSFs variables confirms that the CSFs vary across four groups

depending on their different FSMS implementation. This finding is particularly beneficial for pointing out the differences and gaps among firms from different groups leading to the identification of their potential improvement areas contingent on the status of each firm's FSMS implementation. This is associated with the effort of Tzamalis, Panagiotakos and Drosinos, (2016) to develop a tool locating a 'best practice' among the studied firms based on factors influencing the FSMS implementation. The study has illustrated many practical suggestions for the studied firms such as what CSFs need to be improved and paid attention.

6.2.6 Research question 6

Whether the groups that have better FSMS implementation pay more attention to safety criteria than others and are in better SC relationship than their counterparts?

Grounded on the results of the cluster analysis, the study explores further the aspects of supplier selection and supply chain relationship among the studied firms. It is found that each identified group has different priority criteria as well as the level of trust, commitment and interdependence with their suppliers. A Pareto analysis shows that the studied firms primarily choose their suppliers based on reliability, certificates, self-inspection results, flexibility and distance, considering after-sale service and price as the least-wanted criteria. This finding provides empirical support for confirming that firms give priory to safety criteria more than the other criteria in selecting suppliers. Comparing among the identified groups shows the most interesting aspect, the group of Poor practice reveals its contrary trend in evaluating distance, price and flexibility to be more critical than the other groups. Whereas, the rest share the same tendency in the selecting order of these criteria. Good practice is likely to choose their suppliers based on their inspection results and reliability because this mean score is the highest among the four groups. Overall, it is concluded that the groups that have better FSMS implementation pay more attention to safety criteria than their counterparts.

Regarding the SC relationship, the analysis shows that there are higher levels of trust and commitment than interdependency among the studied

companies with their suppliers as a whole. The groups of Best and Good practice have a higher level of commitment than trust, which is different from the rest. It can be seen that the level of commitment, trust and interdependency are descending order following the score of FSMS implementation of each group. The correlational analysis also points out that commitment is the strongest element related to high FSMS implementation, whereas trust is medium, and interdependency shows the weakest correlation to FSMS implementation. In conclusion, the groups have better FSMS implementation in better SC relationship with their suppliers, especially in term of trust and commitment. This study directs attention to SC relationship and FSMS implementation. It suggests that food firms should gain more commitment and develop mutual trust with their suppliers in term of food safety management.

6.3 Research contributions

In contrast to the increasing importance of FSMS success in the food industry, there is much less information about exploring continuous improvement strategies as a result of assessing FSMS implementation considering the impact of CSFs contingent on the current situation of each enterprise. Responding to the urgent need for strengthening the success of FSMS, this thesis provides the sequential mixed methods containing both qualitative and quantitative techniques for CSFs identification, assessment of FSMS implementation, and suggestion of improvement identifications in the global food supply chain setting. It contributes to the body of knowledge in the food safety management discipline and supply chain management by four major significances. First, a comprehensive review of the literature on FSMS in the context of global food supply chains shows several gaps and fruitful research directions in managing FSMS implementation, extracting existing CSFs and the feasible use of CSF approach to identify improvement opportunities. Second, it provides deep-contextual explanations from the practical experience of Chinese and Vietnamese fishery exporters to understand why a factor is considered critical to FSMS implementation. Consequently, a set of CSFs related to the organisations, market, and environment and affecting the success of FSMS in the research setting, where

the dominant fishery-production processes in the world are located, is identified and their priority ranking is specified. Third, the study also establishes a quantitative model for detecting factors that are most critical to FSMS implementation, their relationships, and influences on business performance. Fourth, Best Practice of the studied firms is revealed to compare the difference in their CSFs. Based on that, improvement suggestions are made to each specific group to improve their current practices. Finally, a closer look into the criteria of supplier selection and the quality of supply chain relationship between studied firms and their suppliers is explored to understand how firms that have better FSMS implementation practice toward food safety objective. Overall, the thesis has several theoretical and practical implications for both academic scholars and practitioners as discussed in the following subsections.

6.3.1 Theoretical implications

6.3.1.1 Understanding critical success factors for FSMS implementation

CSFs that are those few things that must be taken into sufficient consideration by food firms to ensure success for FSMS implementation have examined among food manufacturers and exporters in two Asian developing countries by a mixed research method in this thesis. It contributes to the knowledge and further develop the theory of critical success factors for the field of food safety management in the context of global supply chains. There is no perfect FSMS in reality due to globalised and complicated of food supply chains along with the fact that FSMS implementation is affected by many factors from the organisation, the market and the broad environment. This thesis is the first study in the field to consider the impact CSFs from these three levels to FSMS implementation. Six CSFs have been identified through qualitative and quantitative phases, namely management responsibility, human resource, organisational resources, external support, collaboration and food-safety governance.

Addressing the research gaps deriving from the systematic literature review, the qualitative study has explored why these factors are perceived as critical

to the success of FSMS implementation in the in-depth context of fish and fishery industry in China and Vietnam. It also provides a closer look and the detailed explanations for CSFs to understand how the studied firms implement FSMS and interact with other stakeholders in the food supply chains. While the quantitative study has proposed a structural equation model to detect the impact of these CSFs on FSMS implementation among the surveyed firms in the same countries. The results of the quantitative study help to generalise the qualitative findings to any kind of food, not limited to fish and fishery products. Despite the lack of the rich study context compared to the qualitative study, the quantitative phase shows its advantages in modelling the impact of CSFs on FSMS implementation, identifying Best practice and comparing firms to indicate which CSF food firms need to pay attention based on the results of cluster analysis.

Grounded on the findings of the sequential exploratory research, the thesis proves that management responsibility and human resource have the most significant impact among internal factors while collaboration related to food safety management is the most impact factor among external factors to FSMS implementation. Even though in most of the prior studies, internal factors have received more concentration of the researchers than external factors (Mensah and Julien, 2011; Kafetzopoulos and Gotzamani, 2014). The thesis takes into account the market and the environment in which companies operate and investigates their relationships with FSMS implementation. It is attentive to the vital impact of the external factors to FSMS implementation in global supply chains. Additionally, the empirical findings in this study provide a new understanding of the level of these firms collaborate with their stakeholders and what sources of external support critically impact on FSMS implementation. These results add to the rapidly expanding field of the pivotal role of supply chain management in food safety management, especially the vertical integration of food manufacturers. In addition, the activities of food-safety governance are investigated to comprehend their influences as well as underlying difficulties that firms are dealing with in practice. These findings represent the major contribution of this thesis to the existing literature in the

area and emphasise the role of related actors in food-safety governance, namely government, authorities and business associations.

6.3.1.2 An enabling mechanism for continuous improvement strategies

The measurement of FSMS status is vital for food manufacturers to address potential restrictions in the system involving the supply chain from primary production, through processing and trading. In harmony with many prior assessment tools (Luning *et al.*, 2008, 2015; Jacxsens *et al.*, 2010, 2011; Osés *et al.*, 2012; Klementina Kirezieva *et al.*, 2013; Sawe *et al.*, 2014; Kafetzopoulos and Gotzamani, 2014; Kusaga *et al.*, 2014; Nanyunja *et al.*, 2015; Rajkovic *et al.*, 2017; Njage *et al.*, 2018) root on the available data and insight that a company has on its implementation, this thesis has proposed the measurement of FSMS implementation constructed on the key required activities of an FSMS instead of being limited to HACCP principles or only considered FSMS as a part of quality management.

The innovation in the proposed measurement is the inclusion of the key elements of FSMS implementation that include not only the objective of hazard analysis but also other requirements such as prerequisites programmes, validation, correction actions and other safety-related control activities within food firms. The study is one of the first attempt to thoroughly examine these key requirements to construct the FSMS implementation in a research model. Furthermore, a practical and straightforward approach to measure FSMS implementation based on the available data and insights of the firm considering their determinant CSFs is the key contribution of this thesis bringing two distinct advantages for practitioners. First, the outcomes of these measurements are able to reflect the status of firms' FSMS implementation. Second, the measures proposed in this thesis are easy-to-use for managers and food safety teams as daily basis tool. It could help them to quickly respond and take necessary actions as well as allow the highest priority for essential resources and activities.

On top of that, an enabling mechanism for continuous improvement strategies of FSMS implementation is established in this thesis which produces

recognisable improvement opportunities for food firms to fulfil the increasingly stringent requirements of FSMS in global supply chains. The assessment leads to identify improvement opportunities and prioritise which area food managers should pay attention to enhance and update the current practices, especially for the case of firms with limited resources. This is another contribution of the study in establishing decision-making tools to assist food enterprises in FSMS implementation. It also confirms and lays the groundwork for future research into the feasible application of CSFs in identifying continuous improvement strategies for FSMS implementation to enhance food safety management and narrow the performance gaps among food firms in global supply chains.

6.3.1.3 Incentives to improve FSMS continuously in global trading

It is obvious that firms always want to minimise the cost and optimise the overall performance of doing business. FSMS improvement is associated with extra costs in investing and expanding firms' plants, facilities or equipment, re-designing products, hiring and training labour for production/testing (Keiichiro, Otsuki and Wilson, 2015). For the sake of food safety to human health, society and the economy, food firms need incentives to update and improve their FSMS continuously. The thesis provides key shreds of evidence in elevating the role of FSMS as important motivations for the manufacturing and exporting sector in developing countries. First, the impact of CSFs, which is determinant of FSMS implementation, is considered as a huge competitive advantage in the global trading. Apart from internal factors, a higher level of collaboration, support and stimulus from FS governance bring many advantages to firms in the global trading according to the interviewed firms. Second, the study raises the awareness of a successful FSMS implementation in doing business by emphasising the empirical relationship between it and business performance to motivate firms to upgrade their FSMS continuously. The higher level of FSMS implementation, the better level of operational performance, which leads to better financial performance. These findings corroborate the results of a great deal of the previous work in examining the impact of FSMS implementation (Javee and Masakure, 2005; Whipple, Voss and Closs, 2009;

Fotopoulos, Kafetzopoulos and Gotzamani, 2011; Mensah and Julien, 2011; Macheka *et al.*, 2013; Escanciano and Santos-Vijande, 2014; Qijun and Batt, 2016).

6.3.2 Practical implications

Besides numerous theoretical implications, there are many practical implications for industrials, especially the manufactures and exporters as well as FSMS-related parties in developing countries. The novelty of the research lies in the fact that it helps to reduce the complexities of decision-making and managing FSMS to facilitate food firms' managers in seeking improvement areas actively. Compared to other studies of CSFs for FSMS, this study not only applies CSFs as a more proactive approach to identify the mechanism enabling continuous improvement for the FSMS implementation but also provide dynamic suggestions based on the status of each firm's FSMS, which is particularly helpful for SMEs with finite resources. In addition, the study is one of the efforts contributing to the method of measuring FSMS implementation for food producers. Likewise, raising the awareness of the importance of successful FSMS implementation in doing business is to encourage firms in continuous improvement by showing the direct link between it and business performance. Many suggestions are made for practices related to supplier selection, collaboration in the food supply chains since they are highly correlated to FSMS implementation. Besides, greater efforts from other parties involved in global food supply chains such as government and authorities, and business associations are needed to enhance their activities in supporting and governing FSMS.

In detail, first, a set of critical success factors emerging from this research helps to reduce the complexities of decision-making and to manage FSMS to facilitate food firms' managers in seeking improvement opportunities for FSMS actively. Compared to other studies of CSFs for FSMS, this study not only applies CSFs as a more proactive approach to identify the mechanism enabling continuous improvement for the FSMS implementation but also provide flexible suggestions based on the status of each firm's FSMS. This suggestion is particularly helpful for SMEs with limited resources. Each FSMS

is highly customised, resulting in no ‘one best way’ applied for all food manufacturers; maximum performance comes from the appropriate level of a structural variable that fits the contingency (Donaldson, 2001). Some CSFs are perceived and assessed more critically to the success of FSMS implementation, given the situational differences of each enterprise. Therefore, firms should pay more attention to these CSFs contingent on their FSMS situation as a more proactive approach to identify the enabling continuous improvement strategies for the current FSMS implementation, particularly for SMEs with restricted resources.

Moreover, this new understanding should help to prevent possible failures of FSMS toward a safer food supply chain by proposing a self-assess tool for FSMS implementation. The proposed measurement of FSMS could be applied at firms thanks to its practical, easy-to-use and straightforward approach grounded on the available data and insights of the firm. The outcomes of this measurement reflect the status of firms’ FSMS implementation, which facilitates managers and food safety teams to quickly respond and take necessary actions in time. In this thesis, the priority order of CSFs is preliminarily developed according to the ranking of the experts’ assessments in the qualitative study and the comparison among the groups of firms in the quantitative study. Taken together, these findings suggest a role of prioritising CSFs for FSMS implementation, which should be classified as high, intermediate, and low priority by firms. For the reason that a priority order could be used as a realistic decision-making tool to assist food firms’ managers in allocating adequate resources as well as raising their attention to specific factors to ensure and improve the current FSMS implementation. Moreover, food firms could apply the methodology of this thesis to identify their own list of CSFs and rank them to examine a priority order of their CSFs on demand.

Likewise, in term of the practices related to supplier selection, the study suggests that food firms should require food safety criteria when selecting suppliers, increase their collaboration and build a better relationship with their stakeholders in the SC toward food safety issues. Especially commitment and trust because they are highly correlated to FSMS implementation. Furthermore, greater efforts from other parties, namely government and

authorities, and business associations, are needed to enhance their activities in supporting and governing FSMS at firms. In details, the thesis suggests that those activities related to the establishment of standards and guidelines, auditing and sampling provide information about the status of FSMS. These parties also empower companies with useful knowledge and skills to establish and improve their FSMS implementation by way of providing feedbacks of these activities to companies. At the same time, they should help to reduce the difficulties that firms are dealing with by taking the step forward the consistency, transparency and stability in regulatory requirements as well as in support to firms.

6.3.3 Publications

Research outcomes of this thesis have been presented at many conferences and written into journal articles for publication by the researcher in collaboration with other researchers as scientific contributions. Articles that derived from this research have been presented at conferences and submitted to the journal along with two papers and a book are in the working process listed as the followings:

- Nguyen, T. T. B. et al. (2017) 'Mitigating food safety risks in the global supply chain', 24th International EurOMA Conference, Heriot-Watt University, Edinburgh, UK, 1 – 5 July 2017.
- Nguyen, T. T. B. and Li, D. (2018) 'The impact of supply chain relationship on food safety management in global food supply chains', 25th International EurOMA Conference, Budapest, Hungary, 24-26 June 2018.
- Nguyen, T. T. B., Li, D. and Zhou, J. 'Critical success factors of food safety management in global supply chains: A qualitative study based on Chinese and Vietnamese fishery exporters' perspectives' (under review with *Production Planning & Control* journal)
- Nguyen, T. T. B. and Li, D. 'Food safety management system performance in global supply chains: A systematic literature review' (in editing)

- Nguyen, T. T. B. and Li, D. 'An empirical study on critical success factors for food safety management and business performance in the global supply chains' (in editing)
- The proposal of a book - '*Toward a safer global food supply chain*' based on this thesis is accepted by Palgrave Macmillan publisher.

6.4 Research limitation

Research limitation is discussed following the thesis's research design in the below sections.

6.4.1 Systematic literature review

There are numerous research gaps identified in the systematic literature review of 71 papers published from 2003 to 2018, and these findings help to form the research objectives and questions. On the other hand, they may be somewhat limited by two main limitations of the review chapter. First, the most critical limitation is that the defined search strategy, analysis, and synthesis might not have investigated some relevant articles. Second, articles in other languages such as Chinese, French, Spanish, Korean, etc. were also excluded that could have been omission their findings in this review. The validity of the findings presented in this review can be reaffirmed by future researchers who can independently classify the set of articles using different databases besides ISI research database and include papers that are not limited to the English language.

6.4.2 The qualitative study

Although the qualitative study contributes to identifying CSFs of FSMS implementation in complex global supply chains with reasoning and ranking based on the Chinese and Vietnamese experts' opinions, it has some limitations given the nature of qualitative research that requires for further study. First, in this research, the external validity of the study may need to be empirically tested in a much bigger sample because thirteen industrial experts in two developing Asian countries is relatively small. In addition, this study only uses a qualitative approach to understand why a factor is perceived critical

impact the success of FSMS by examining the chain in its entirety, by explicitly examining at the organisational, market and governance levels in global supply chains based on practitioners' experiences. Thus, further research could seek to use a quantitative approach to generalise these results and quantify to what the degree these CSFs impact FSMS. Second, the sampling strategy was designed to capture common patterns in developing countries where the dominant fishery-production processes in the world are located. Hence, there is a need for further investigation on different kinds of food supply chains such as grains, vegetable, and dairy because each kind of food has unique characteristics and might require different customisations of FSMS implementation. Third, identifying CSFs in FSMS, relying on the exporters' perceptions of analysis is also a limitation. Bias may exist on behalf of quality managers or top managers in answering the interview questions. This limitation suggests further investigation from diverse perspectives – for example, including food exporters' suppliers and importers in developed countries. Fourth, it highlights the gaps between SMEs and large firms as well as the trending toward 'closed chains' of large firms but it does not explore different weights to different-sized companies when ranking the factor priority. It is very interesting for further research into how firms of different sizes perceive CSFs and whether larger weights should be assigned for larger firms in ranking CSFs priority. Finally, this study does not take into account the evaluation of the relationships and interactions among the CSFs. An inter-relationship analysis or cognitive mapping of the CSFs of FSMS that could foster decision makers in what CSFs must be improved first to create the highest impact on FSMS remains unknown.

6.4.3 The quantitative study

While quantitative research has contributed to the body of knowledge in the food safety management discipline, it is limited by the nature of the quantitative study. First, there is a possible bias on behalf of the surveyed managers in answering the research questionnaire. Second, FSMS and business performance of food companies are qualitatively self-evaluated by the mean of Likert scale, which is a popular psychometric measurement of attitudes, beliefs and opinions. It helps to get the complexity of the concept, assist in

developing more stringent measures and increase reliability as well as precision (de Vaus, 2002). However, being limited to the perceptiveness of the managers, the interpreting results and suggestions of the study are needed to further test for a specific case in reality. Third, a further assessment FSMS implementation from diversity perspectives by recruiting multiple respondents such as food exporting firms' suppliers and importers in developed countries is needed. Fourth, the study suffers the limitation from the unequal number in responses from two countries. In Vietnam, there are 252 valid responses from Vietnam meanwhile only 72 responses from China. Therefore, there is no comparison analysis between two countries in this study. Last but not least, the limited sample from a moderate number of manufacturing and exporting companies in the only two developing countries is a notable limitation of this study.

6.5 Future research directions

The finding of the studies, in-depth discussion of the insights into managing FSMS implementation by more practical measuring and flexible continuous improvement based on the identification of CSFs along with the research limitation presented in this thesis have specified several important future research directions for researchers. First, the findings of this thesis suggest that there are still gaps and many promising research directions needed in designing and establishing instruments for evaluating the implementation of FSMS. Many works have been done in this research area that has been adopted to measure FSMS within food firms around the world (e.g. Luning *et al.*, 2008; Kirezieva *et al.*, 2013; Kafetzopoulos and Gotzamani, 2014; Kirezieva, Luning, *et al.*, 2015; Nanyunja *et al.*, 2015; Njage *et al.*, 2018). However, the measurement instruments in this thesis are regulatory and standard-related requirements aiming to easy-to-use and visible improvement approach. Future work in this area can examine and construct more diagnostic tools to assess FSMS implementation in a different approach. More in detail, the question raised by this research is whether we could measure multiple aspects of an FSMS combined with other critical elements of food manufacturing performance. Also, regarding the fundamental requirements of

FSMS, there would be many fruitful areas on how to build measurement metrics that must be highly customised based on the unique characteristics of each company production, market, and environment but still compliance with regulation and standards.

Besides the evaluation of FSMS implementation, identifying CSFs of FSMS implementation is vital to prevent possible failures and seek improvement opportunities of FSMS actively. The results of this thesis reaffirm the critical role of well-performed FSMS towards a safer global food supply chain and provide incentives that require food manufacturers to improve their current practices continuously. The evidence from this study suggests that the most crucial limitation lies in the insufficient understanding of CSFs in the broader environment of FSMS, including the market level and food-safety governance. In addition, the contingency of each firms' FSMS, as well as the evaluation of the relationships amongst the CSFs, have not been taken into the current research. It is evident that managing the implementation of FSMS is deeply contextual and practice-related, a greater focus on understanding how each CSF interact with others in a specific context and how these interactions affect FSMS implementation could produce interesting findings that account more for prioritising and maximising the benefits of identified improvement areas. Additionally, considerably more work will need to be done to determine what trade-offs are when food firms' managers decide to improve their FSMS practices. In this sense, further studies will need to provide fresher and more comprehensive decision-making tools to facilitate food firms' managers in improving FSMS implementation based on CSFs.

Furthermore, this study represents the first research in the FSMS field that investigates the direct link and empirically tests the relationship between FSMS implementation and the two dimensions of business performance. This finding has a crucial implication for the food industry since it positively encourages firms to improve and update their FSMS continuously, which leads to better operational and financial performance for firms in the global trading. On the other hand, the non-significant relationship between FSMS implementation and financial performance raises several unanswered questions in need of future works. Firstly, the cost of FSMS implementation

results in an increase in firms' operational cost due to firm's compliance with regulatory and standards requirements by expanding their plant or equipment, re-designing products, and hiring labour for production/testing (Keiichiro, Otsuki and Wilson, 2015). For instance, Ragasa, Thornsbury and Joshi (2011) calculate the expenditure to comply with HACCP using survey data from seafood production firms in the Philippines. The impact of compliance with HACCP on the firms' operational cost net of HACCP-related expenditure is estimated at approximately 1.6% of the total value of output. Secondly, although the advantages of compliant FSMS have been discussed in many previous studies (Mensah and Julien, 2011; Macheka *et al.*, 2013; Qijun and Batt, 2016), to understand the relationship between FSMS implementation and financial, the benefits, the cost of FSMS implementation and their trade-offs need to be studied at the same time. Thirdly, whether we need an intermediate variable in the measuring model? The works of Jacxsens *et al.* (2010), Klementina Kirezieva *et al.* (2013) and Luning *et al.*, (2015), in which system output including information from external and internal activities (i.e. audits, consumer complaints, sampling information, non-conformity) as the outcomes of FSMS is used, requires further studies on testing and developing instrumentation for an intermediate variable among FSMS implementation and financial performance.

The qualitative study also points out the gaps between SMEs and large firms as well as the trending toward 'closed chains' of large firms, which could lead to the exclusion of SMEs in global supply chains. The quantitative study confirms that the group of Best practice is primarily constructed by the firms which are capable of exporting more than 3000 tons per year. However, it does not explore different weights to different-sized companies when ranking the factor priority. Therefore, future works could pay attention to this issue to investigate how firms of different sizes perceive CSFs and whether larger weights should be assigned for larger firms in ranking CSFs priority. Moreover, in line with the suggestion of Marucheck *et al.* (2011), this thesis also raises the question in how to encourage food firms to collaborate and support each other in term of strengthening FSMS, especially from large firms to SMEs, as the global food supply chain is only as strong as its weakest link (Oglethorpe

and Heron, 2013). Another question is how to make firms pay more attention to safety criteria and develop better relationships in the supply chains since this thesis proves that these practices are highly related to the level of FSMS implementation. Future modelling work will need to be conducted in order to determine and measure the impact of supplier selection criteria and SC relationship on FSMS. More information on these issues from supply chain perspectives would help to establish a stronger and safer food supply chain in international trading.

Last but not least, the thesis is one of several efforts that have been put into implementation and improvements of FSMS in global food supply chains. The mixed research method in this thesis has helped to compare different perspectives drawn from quantitative and qualitative data as well as develop better measurement instruments by first collecting and analysing qualitative data then administrating the instruments to a sample as the suggestion of Creswell (2013). In other words, both inductive and deductive approaches have been used in this thesis. Nevertheless, other research approaches, frameworks and theories are still needed to measure FSMS implementation, identify CSFs and to generate continuous improvements at food firms. For instance, abductive reasoning approaches such as simulations in Bayesian belief networks, stochastic programming, and agent-based modelling could be very interesting. More in detail, the application of system dynamics which uses modelling approaches to predict future changes of systems can address the problems of simultaneous causation of several critical success factors and their change over time by updating all variables with positive and negative feedbacks and by including time delays on FSMS implementation (Sterman, 2002).

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Appendix I

Interview protocol and questions in three languages used in Chapter Four

Interviewing protocol and questions for:

Critical success factors in global fishery supply chains

To understand how manufacturing and exporting companies control their food safety management system in global supply chains, each interview follows the below protocol using semi-structured questions to interview the food managers at their companies.

Part A: Introduction

At the beginning of the interview, there are following steps undertaken before asking questions to the interviewees.

1. The researcher introduces herself and asks for general information related to the interviewees, including their name, position, how long they have worked for the company.
2. The interviewer explains the purpose of the interview, informs the interviewees all the content of the information sheet and obtains their consent.
3. Explaining the format of the interview and indicating how long the interview usually takes.
4. Giving the contact details of the researcher, so the interviewees could get in touch later if they want to ask any questions before conducting the interview.

Part B: Clarify the supply chains and identify critical success factors

1. Please kindly clarify the supply chain from breed/pond/sea to the export port.
2. What is the critical factor to food safety management system of the firm? And why?

2.1. Organisational factors

- What organisational factors are critical to the success of food safety management system at the firm? In particular:
  - Management responsibility such as commitment, responsibility, food safety culture and policy, etc.
  - Human resources namely involvement, awareness, commitment, knowledge and skill, etc.
  - Organisational resource such as facilities, finance, and technology.

  Why and how do factors of this group impact on food safety management at each below stage?

    - Cultivated process
    - Technology in processing
    - Testing equipment
    - Storage
    - Transportation
    - Traceability system
- Besides these factors, is there any other factor related to organisation?

2.2. Supply chain management

- What and why are factors related to supply chain management critical to the success of food safety management system at the firm? In particular:
  - Level of collaboration in the supply chain:
    - How could the company control its suppliers in term of ensuring food safety?
    - What kind of collaboration do they have with other stakeholders in the supply chain?
  - External support: does the firm receive any support from other parties in order to enhance food safety management system? For example:
    - Other stakeholders in the supply chain
    - Business associations

- Government and authorities
- Non-governmental organisations (WTO, FAO, CAC)
- Financial organisations (banks, export or fishery cooperative etc.)

- Besides these factors, is there any other factor related to supply chain management contributing to food safety management system?

2.3. Food-safety governance

- What kind of food safety standards and regulatory requirements does the company follow? Including:
    - International requirements and standards such as HACCP, ISO 22000 BRC, SQF, etc.
    - National requirements and standards
- What activities of food-safety governance impact on food safety management system at the firm? And why? For instance:
    - Audits
    - Sanctions
    - Stimuli
    - Education and information
- What is the level of compliance and how this compliance affect the firm's food safety management system?

Part C: Qualitatively assess and rank the impact of the aforementioned critical factors.

Please kindly attempt to qualitatively assess the impact degree of these factors on your company's food safety management system by marking X on the impact level within the corresponding table. Please keep in mind that each level has a constant and equal distance from each other in the ranking order.

Group	Factors	Impact level

		High	Medium	Low
Human resources	Commitment			
	Awareness			
	Knowledge and skill			
Management responsibility	Managers' commitment			
	Responsibilities and authorities			
	Food-safety policy and culture			
Organisational resource	Facilities and equipment			
	Financial condition			
	Technological condition			
Supply chain management	Supplier management			
	Collaboration			
External support from:	Stakeholders in supply chains			
	Government and authorities			
	Business associations			
	Financial institutions			
Food-safety governance	Audits and inspections			
	Incentives (sanctions and stimuli)			
	Information and education			

Part D: Thank and end the interview.

The interviewer closes the interview expressing thankful gratitude and the willingness to stay connected with the interviewee after the visit.

Giao thức phỏng vấn và câu hỏi cho:

Các yếu tố thành công quan trọng trong chuỗi cung ứng thủy sản toàn cầu

Nhằm hiểu cách các công ty sản xuất và xuất khẩu thuỷ hải sản kiểm soát hệ thống quản lý an toàn thực phẩm của họ trong chuỗi cung ứng toàn cầu, mỗi cuộc phỏng vấn tuân theo giao thức và sử dụng các câu hỏi bán cấu dưới đây trúc để phỏng vấn các nhà quản lý thực phẩm tại công ty của họ.

Phần A: Giới thiệu

Khi bắt đầu cuộc phỏng vấn, các bước sau đây được thực hiện trước khi đặt câu hỏi cho người được phỏng vấn.

1. Nhà nghiên cứu tự giới thiệu và hỏi về thông tin chung liên quan đến người được phỏng vấn, bao gồm tên, chức vụ của họ, thời gian họ đã làm việc cho công ty.

2. Người phỏng vấn giải thích mục đích của cuộc phỏng vấn, thông báo cho người được phỏng vấn tất cả nội dung của tờ thông tin đính kèm và hỏi để có được sự đồng thuận.

3. Giải thích định dạng của cuộc phỏng vấn và cho biết cuộc phỏng vấn thường kéo dài bao lâu

4. Cung cấp chi tiết liên lạc của nhà nghiên cứu để người được phỏng vấn có thể liên lạc lại này sau nếu họ muốn và hỏi họ nếu họ có bất kỳ câu hỏi nào trước khi tiến hành phỏng vấn.

Phần B: Làm rõ chuỗi cung ứng và xác định các yếu tố thành công quan trọng

1. Xin vui lòng làm rõ chuỗi cung ứng từ ao/biển đến cảng xuất khẩu.

2. Điều gì và tại sao một yếu tố được coi là quan trọng đối với hệ thống quản lý an toàn thực phẩm của công ty?

2.1. Yếu tố tổ chức

- Yếu tố thuộc tổ chức nào là quan trọng đối với sự thành công của hệ thống quản lý an toàn thực phẩm tại công ty? Đặc biệt các yếu tố sau:
    - Trách nhiệm quản lý như cam kết, trách nhiệm, văn hóa và chính sách an toàn thực phẩm, v.v.
    - Nguồn nhân lực như là sự tham gia của nhân viên, nhận thức, cam kết, kiến thức và kỹ năng của họ, v.v.
    - Nguồn lực tổ chức như cơ sở vật chất, tài chính, công nghệ của tổ chức
- Làm thế nào và tại sao các yếu tố của nhóm này ảnh hưởng đến quản lý an toàn thực phẩm ở mỗi giai đoạn dưới đây?
    - Quy trình nuôi cấy
    - Công nghệ xử lý
    - Thiết bị kiểm tra
    - Lưu trữ
    - Giao thông vận tải
    - Hệ thống truy xuất nguồn gốc
- Bên cạnh những yếu tố này, còn có yếu tố nào khác liên quan đến tổ chức không?

2.2. Quản lý chuỗi cung ứng

- Điều gì và tại sao các yếu tố liên quan đến quản lý chuỗi cung ứng lại quan trọng đối với sự thành công của hệ thống quản lý an toàn thực phẩm tại công ty? Đặc biệt đối với:
    - Mức độ hợp tác trong chuỗi cung ứng: Làm thế nào công ty có thể kiểm soát các nhà cung cấp của mình trong việc đảm bảo an toàn thực phẩm? Họ hợp tác như thế nào với những bên liên quan nào trong chuỗi cung ứng?

- Hỗ trợ bên ngoài: công ty có nhận được bất kỳ sự hỗ trợ nào từ các bên khác để tăng cường hệ thống quản lý an toàn thực phẩm không? Ví dụ:
  - Các bên liên quan khác trong chuỗi cung ứng
  - Hiệp hội doanh nghiệp
  - Chính phủ và chính quyền
  - Các tổ chức phi chính phủ (WTO, FAO, CAC)
  - Tổ chức tài chính (ngân hàng, hợp tác xã xuất khẩu hoặc thủy sản, v.v.)

- Bên cạnh những yếu tố này, còn có yếu tố nào khác liên quan đến quản lý chuỗi cung ứng góp phần vào hệ thống quản lý an toàn thực phẩm không?

2.3. Quản trị an toàn thực phẩm

- Những loại tiêu chuẩn an toàn thực phẩm và các yêu cầu quy định mà công ty tuân theo? Bao gồm:
  - Các yêu cầu và tiêu chuẩn quốc tế như HACCP, ISO 22000 BRC, SQF, v.v.
  - Yêu cầu và tiêu chuẩn quốc gia
- Những hoạt động nào của quản trị an toàn thực phẩm ảnh hưởng đến hệ thống quản lý an toàn thực phẩm tại công ty? Và tại sao? Ví dụ:
  - Kiểm toán
  - Xử phạt
  - Kích thích
  - Giáo dục và thông tin
- Mức độ tuân thủ là như thế nào và sự tuân thủ này ảnh hưởng đến hệ thống quản lý an toàn thực phẩm của hãng ra sao?

Phần C: Đánh giá định tính và xếp hạng tác động của các yếu tố quan trọng.

Quý Công ty vui lòng cố gắng đánh giá định tính mức độ ảnh hưởng của các yếu tố này đối với hệ thống quản lý an toàn thực phẩm của công ty bằng

cách đánh dấu X vào mức độ tác động phù hợp trong bảng dưới đây. Xin lưu ý rằng mỗi cấp độ có một khoảng cách như nhau và không đổi từ cấp độ tiếp theo cho giai đoạn xếp hạng.

Yếu tố	Thành phần	Mức độ tác động		
		Cao	Vừa	Thấp
Nguồn nhân lực	Cam kết			
	Nhận thức			
	Kiến thức và kĩ năng			
Trách nhiệm quản lý	Cam kết của quản lý			
	Trách nhiệm và quyền hạn			
	Chính sách và văn hoá an toàn thực phẩm			
Nguồn lực của Cty	Cơ sở và thiết bị			
	Điều kiện tài chính			
	Điều kiện kĩ thuật			
Quản lý chuỗi cung ứng	Quản lý nhà cung cấp			
	Hợp tác			
Hỗ trợ từ bên ngoài	Thành viên trong chuỗi cung ứng			
	Chính phủ và cơ quan chức năng			
	Hiệp hội doanh nghiệp			
	Các định chế tài chính			
Quản lý an toàn thực phẩm	Kiểm nghiệm và kiểm định			
	Khích lệ (thưởng và phạt)			
	Thông tin và giáo dục			

Phần D: Cảm ơn và kết thúc cuộc phỏng vấn.

Người phỏng vấn cảm ơn nhà quản lý và khuyến khích các ý định để duy trì kết nối hoặc tiếp tục theo dõi của người được phỏng vấn.

采访协议和问题：

全球渔业供应链中的关键成功因素

为了了解制造和出口公司如何控制其在全球供应链中的食品安全管理系统，每次访谈都遵循以下协议，使用半结构化问题来访问其公司的食品经理。

A部分:简介

在面试开始时，在向受访者提问之前，已经采取了以下步骤。

1.研究人员自我介绍并询问与受访者有关的一般信息，包括他们的姓名，职位，他们为公司工作多长时间。

2.面试官解释面试的目的，通知受访者信息表的所有内容并征得他们的同意。

3. 解释面试的形式，并说明面试通常需要多长时间

4.提供研究人员的详细联系方式，以便受访者可以在以后与他们联系，并在进行面试前询问他们是否有任何问题。

B部分:明确供应链并确定关键成功因素

1. 请务必澄清从池塘/海洋到出口港的供应链。

2.对公司食品安全管理体系至关重要的因素是什么？为什么？

2.1。组织因素

- 哪些组织因素对公司食品安全管理体系的成功至关重要？ 为什么？特别是:
  - 管理责任，如承诺，责任，食品安全文化和政策等。
  - 人力资源，即参与，意识，承诺，知识和技能等.
  - 组织资源，如设施，财务，技术

在下面的每个阶段，这个群体的因素如何以及为何会影响食品安全管理？

- 培养过程

- 加工技术
- 测试设备
- 存储
- 运输
- 可追溯性系统

- 除了这些因素外，还有其他与组织相关的因素吗？

2.2。供应链管理

- 在供应链管理相关的因素中与公司食品安全管理体系的成功关系至关重要的因素是什么？为什么？特别是：
  - 供应链中的协作水平：
    - 公司如何在确保食品安全方面控制供应商？
    - 他们与供应链中的其他利益相关者进行了哪些合作？
  - 外部支持：公司是否得到其他方面的支持，以加强食品安全管理体系？例如：
    - 供应链中的其他利益相关者
    - 商业协会
    - 政府和当局
    - 非政府组织（WTO，FAO，CAC）
    - 金融机构（银行，出口或渔业合作社等）
- 除了这些因素之外，还有与供应链管理相关的其他因素有助于食品安全管理体系吗？

2.3。食品安全治理

- 公司遵循什么样的食品安全标准和监管要求？包含：
  - 国际要求和标准，如HACCP，ISO 22000，BRC，SQF等。
  - 国家要求和标准

- 食品安全治理的哪些活动会对公司的食品安全管理体系产生影响？为什么？例如：
  - 审计
  - 制裁
  - 刺激
  - 教育和信息
- 合规程度如何以及合规性如何影响公司的食品安全管理体系？

C部分：定性评估和评定上述关键因素的影响。

请通过在下表中的影响级别标记X，尝试定性评估这些因素对贵公司食品安全管理体系的影响程度。 请记住，每个级别在排名顺序中具有恒定且相等的距离。

组	因素	影响程度		
		高	介质	低
人力资源	承诺			
	意识			
	知识和技能			
管理责任	经理们的承诺			
	责任和权力			
	食品安全政策和文化			
组织资源	设施和设备			
	经济状况			
	技术条件			
供应链管理	供应商管理			
	合作			
外部支持来自：	供应链中的利益相关者			
	政府和当局			

	商业协会			
	金融机构			
食品安全治理	审计和检查			
	激励(制裁和刺激)			
	信息和教育			

D部分:谢谢并结束采访。

面试官结束了采访,表示感谢,并表示愿意在访问后与受访者保持联系。

Appendix II

Letters in three languages sent to food firms in China and Vietnam to conduct the survey in Chapter Five

Management School
University of Liverpool

UNIVERSITY OF LIVERPOOL

Chatham Building
Chatham Street
Liverpool
L69 7ZH

Dir Sir/Madam,

Please allow us to introduce ourselves as a group of researchers at University of Liverpool Management School. We are writing this letter to express our interesting in the recent achievements of your firm in terms of food processing and exporting. We are currently working on a project regarding enhancing food safety management in global food supply chains, which is funded by the British Council. In details, firstly, this research contributes to investigate what are the critical factors of food safety management. Secondly, it expects to identify the effectiveness based on the primary activities in your company, such as prerequisite programs, HACCP, and so on. Finally, it is to examine the degree to which the implementation of food safety management influences the overall business performance. The findings will help food managers providing the necessary resources, supports, and developing the appropriate policies, practices and procedures to improve the current food safety management, as well as business performance.

We would like to thank you for participating in the research by answering our survey questionnaire based on your practical experiences in food safety management. All the information that you provide will be kept confidential. Many thanks again.

Best regards,

On behalf of the Research Team
Tram Nguyen
PhD Researcher in Supply Chain and Operations Management
University of Liverpool Management School
E: tram@liverpool.ac.uk
T: +44(0) 7447 707797

Management School
University of Liverpool
Chatham Building
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L69 7ZH

Kính gửi quý công ty,

Chúng tôi là đơn vị nghiên cứu thuộc Đại học Liverpool, Vương quốc Anh, hiện đang thực hiện một dự án nghiên cứu về năng lực cung cấp thực phẩm sạch và an toàn của các doanh nghiệp xuất khẩu thực phẩm Việt Nam và Trung Quốc. Chúng tôi gửi thư này đến quý công ty để bày tỏ sự quan tâm sâu sắc của chúng tôi đến các thành tựu trong những năm gần đây của quý vị trong chuỗi cung cấp thực phẩm toàn cầu. Chúng tôi thực hiện dự án nghiên cứu này nhằm tăng cường quản lý an toàn thực phẩm trong chuỗi cung cấp thực phẩm toàn cầu do Hội đồng Anh và Hội đồng châu Âu tài trợ. Cụ thể, nghiên cứu của chúng tôi nhằm mục đích: đầu tiên, để tìm ra những yếu tố quan trọng trong quản lý an toàn thực phẩm, thứ hai, để xác định hiệu quả dựa trên các hoạt động chính trong công ty như các chương trình tiên quyết, HACCP, vv và thứ ba, để xác định mức độ thực hiện quản lý an toàn thực phẩm liên quan như thế nào đến hiệu quả kinh doanh tổng thể. Các kết quả nghiên cứu này được mong đợi sẽ giúp các nhà quản lý cung cấp các nguồn lực cần thiết, hỗ trợ và phát triển các chính sách, quy trình và thủ tục phù hợp để cải thiện việc quản lý an toàn thực phẩm cũng như hiệu quả kinh doanh tại các doanh nghiệp xuất khẩu thực phẩm.

Chúng tôi mong muốn quý công ty sẽ tham gia nghiên cứu bằng cách trả lời bảng câu hỏi điều tra của chúng tôi dựa trên kinh nghiệm thực tế của quý công ty trong quản lý an toàn thực phẩm. Tất cả thông tin quý công ty cung cấp sẽ được bảo mật.

Hiện nay, nghiên cứu viên của chúng tôi là cô Nguyễn Thị Bích Trâm đang có mặt tại Việt Nam, quý công ty có thể phản hồi thông tin qua email: tram@liverpool.ac.uk hoặc số điện thoại tại Việt Nam: 0983579007.

Trân trọng cảm ơn.

Management School
University of Liverpool

Chatham Building
Chatham Street
Liverpool
L69 7ZH

亲爱的公司，

请允许我们以利物浦大学管理学院的研究小组的人员来介绍自己。我们写这封信是为了表达我们对贵公司最近在食品加工和出口方面取得的成就的关注。我们目前正在开展一项有英国议会资助的全球食品供应链中食品安全管理的项目。具体来说，我们的研究首先旨在调查食品安全管理中的关键因素。其次是根据贵公司的主要活动确定这些因素的有效性，如前提方案，HACCP等。第三，检验食品安全管理实施的等级会影响整体业务绩效。这些调查结果将有助于为管理者提供必要的资源和支持，以及制定相关的政策，完善实践及监管程序，以此改善当前的食品安全管理和业务绩效。

我们感谢您参与本研究，请您根据在食品安全管理方面的实践经验回答我们的调查问卷，以便我们更好地了解您在贵公司的工作。您提供的所有信息都将保密。

再次感谢您的参与

祝您好运

代表研究小组

Tram Nguyen

供应链和运营管理博士研究员

利物浦大学管理学院

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Appendix III

Survey questionnaires in three languages used in Chapter Five

RESEARCH QUESTIONNAIRE ON CRITICAL SUCCESS FACTORS FOR FOOD SAFETY MANAGEMENT SYSTEM IN GLOBAL SUPPLY CHAINS

We would like to thank you for participating in the research that is expected to contribute to improving food safety management based on developing the understanding of current practices. All the information that you provide will be kept confidential. Please carefully follow the below instructions to choose appropriate options that correctly reflect the profile and food safety management activities at your company.

PART ONE – GENERAL INFORMATION OF THE COMPANY PROFILE.

1. Please choose the number of existing employees of your company as the followings:
   - ☐ 1 - 10 employees
   - ☐ 11- 50 employees
   - ☐ 51 - 250 employees
   - ☐ More than 250 employees
2. What is your company's ownership structure?
   - ☐ Limited liability
   - ☐ Corporation
   - ☐ Private enterprise (Individually owned)
   - ☐ State-owned
   - ☐ Cooperatives
3. What is your current position at the firm?
   - ☐ Supply chain manager
   - ☐ Quality control manager
   - ☐ Director/CEO
   - ☐ Food safety team
   - ☐ Other. Please specify _____
4. What kind of food is your company exporting?
   - ☐ Fishery
   - ☐ Poultry
   - ☐ Dairy
   - ☐ Fresh fruit and vegetables
   - ☐ Drinks and beverage
   - ☐ Other. Please specify _____
5. How many tons does your company export per year?

- ☐ Less than 500
- ☐ 500 – 1000
- ☐ 1000 – 2000
- ☐ 2000 – 3000
- ☐ More than 3000

6. What certificates is your company complying? (As many as apply)
   - ☐ HACCP
   - ☐ ISO9001
   - ☐ ISO22000
   - ☐ BRC
   - ☐ GlobalGAP
   - ☐ SQF
   - ☐ IFS
   - ☐ Other. Please specify _____

PART TWO – CRITICAL FACTORS OF FOOD SAFETY MANAGEMENT SYSTEM

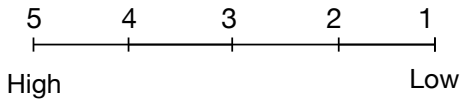
To what extent do you think these factors are important to your food safety management system within the organisation?	**High**	**Above average**	**Average**	**Below average**	**Low**
	5	**4**	**3**	**2**	**1**
INTERNAL FACTORS					
7. Managers commitments to food safety management	☐	☐	☐	☐	☐
8. Food safety policy at our company as the guiding principles to implement food safety practice	☐	☐	☐	☐	☐
9. Responsibilities and authorities are obviously defined for each person such as food safety team, team leader, direct workers within our organisation to ensure efficient operation and maintenance of food safety management system	☐	☐	☐	☐	☐
10. Established food safety culture within the organization	☐	☐	☐	☐	☐
11. Knowledge and skills of the employees in term of ensuring food safety	☐	☐	☐	☐	☐

12. Awareness of the personnel in the relevance and importance of their activities contributing to food safety management	☐	☐	☐	☐	☐
13. Training programs related to food safety for the employee	☐	☐	☐	☐	☐
14. The employee's involvement in food safety management activities	☐	☐	☐	☐	☐
15. Qualified facilities and equipment to ensure food safety management	☐	☐	☐	☐	☐
16. Your company's financial condition	☐	☐	☐	☐	☐
17. Your company's technological condition	☐	☐	☐	☐	☐
EXTERNAL FACTORS					
18. Food safety audits and inspections by regulatory agencies to induce compliance by the company	☐	☐	☐	☐	☐
19. Regulatory sanctions such as penalties, prosecution, and recalls to punish for committing an offence or repeatedly breaching regulations	☐	☐	☐	☐	☐
20. Stimulus such as awards, labels, tax reduction from regulatory agencies to encourage food safety management compliance	☐	☐	☐	☐	☐
21. Information and education such as guidelines, training, advice from regulatory agencies to support your company in food safety management	☐	☐	☐	☐	☐
22. Useful supports to enhance food safety management from:					
a. Other stakeholders in our supply chains (such as suppliers, contractors, buyers)	☐	☐	☐	☐	☐
b. Government and authorities	☐	☐	☐	☐	☐
c. Financial institutions (for example banks)	☐	☐	☐	☐	☐

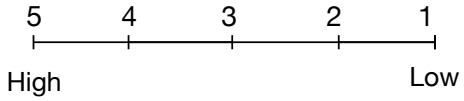
d. Business associations (such as NAFIDAD, VASEP in Vietnam)	☐	☐	☐	☐	☐
e. Non-governmental organizations	☐	☐	☐	☐	☐
23. Criteria to select suppliers under your food safety requirements:					
a. Cheaper price	☐	☐	☐	☐	☐
b. Certificates fulfilment	☐	☐	☐	☐	☐
c. Distance (local or not)	☐	☐	☐	☐	☐
d. Reliability	☐	☐	☐	☐	☐
e. Good inspection results	☐	☐	☐	☐	☐
f. Flexibility (such as payment, freight, price reduction, order frequency & amount, etc.)	☐	☐	☐	☐	☐
g. After-sale service	☐	☐	☐	☐	☐
24. Our company regularly works with the important suppliers to improve food safety management based on:					
a. Solving emerging problems related to product safety	☐	☐	☐	☐	☐
b. Having continuous improvement programs	☐	☐	☐	☐	☐
c. Planning and goal-setting activities	☐	☐	☐	☐	☐
d. Communicating and exchanging all information related to food safety management	☐	☐	☐	☐	☐

25. We would like you to describe the relationship between your company and most of the suppliers using the following set of descriptions. For each description, please circle the number below the line to indicate where your case falls:

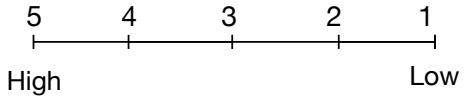
- Level of trust



- Level of commitment



- Level of interdependency



PART THREE – FOOD SAFETY MANAGEMENT ACTIVITIES

On the scale from 1 (poor) to 5 (good), please rate the condition of the followings within your food safety management activities

Activities	Good	Above average	Average	Below average	Poor
	5	4	3	2	1
PREREQUISITE PROGRAMMES					
26. Construction and layout of buildings and associated utilities	☐	☐	☐	☐	☐
27. Layout of premises, including workspace, employee facilities, laboratory facilities, storage and warehouse	☐	☐	☐	☐	☐
28. Supplies of air, water, energy and other utilities	☐	☐	☐	☐	☐
29. Supporting services, including waste and sewage disposal	☐	☐	☐	☐	☐
30. Suitability of equipment and its accessibility for cleaning, maintenance and preventive maintenance	☐	☐	☐	☐	☐
31. Management of purchased materials	☐	☐	☐	☐	☐
32. Measures for the prevention of physical, allergen and	☐	☐	☐	☐	☐

	microbiological cross-contamination					
33.	Cleaning and sanitising programmes are established to ensure that the food-processing equipment and environment are maintained in a hygienic condition	☐	☐	☐	☐	☐
	HACCP					
34.	Hazards that need to be prevented, eliminated, or reduced to acceptable levels are well identified at each step from incoming raw materials to finished product.	☐	☐	☐	☐	☐
35.	The points where control is critical to assuring the safety of the product are established by HACCP team	☐	☐	☐	☐	☐
36.	Level of efficiency in establishing critical limits at critical control points that separate acceptability from unacceptability for the prevention, elimination or reduction of identified hazards.	☐	☐	☐	☐	☐
37.	Monitoring procedures and systems at critical control points are established and implemented	☐	☐	☐	☐	☐
38.	Corrective actions are installed when monitoring indicates that a critical control point is not under control.	☐	☐	☐	☐	☐
39.	Validation procedures are carried out to assure that the critical control points will control the hazards of concern and verify that the system is working day-to-day as planned.	☐	☐	☐	☐	☐
40.	The ability to provide efficient documents and records that demonstrates HACCP system is operating under control, and that appropriate corrective action has been taken for any deviations from the critical limits.	☐	☐	☐	☐	☐

OTHER ACTIVITIES OF FOOD SAFETY MANAGEMENT					
41. Traceability system is effective to identify incoming material from the immediate suppliers and the initial distribution route of the end product	☐	☐	☐	☐	☐
42. Corrective actions are guaranteed to be initiated when critical limits are exceeded or when there is a lack of conformity with operational prerequisite programmes	☐	☐	☐	☐	☐
43. Proper procedures to handle potentially unsafe products	☐	☐	☐	☐	☐
44. Control measures are effective and capable of ensuring control of the identified food safety hazards	☐	☐	☐	☐	☐
45. The ability to provide sufficient evidence that the specified monitoring and measuring methods and equipment are adequate to ensure the performance of the monitoring and measuring procedures.	☐	☐	☐	☐	☐
46. Internal audits are conducted to determine whether the food safety management system is effectively implemented and updated based on evaluation and analysis of the result of verification activities.	☐	☐	☐	☐	☐
47. All records and documents required by the food safety management system are properly controlled	☐	☐	☐	☐	☐
48. Internal communication is efficient in exchange information concerning food safety throughout the organisation	☐	☐	☐	☐	☐
49. External communication is efficient in exchange information concerning food safety throughout the food chains such as suppliers and contractors, customers, statutory and regulatory	☐	☐	☐	☐	☐

authorities, and other organisations					
50. The ability to improve and continually update food safety management system.	☐	☐	☐	☐	☐
51. The active in seeking certification or registration of our food safety management system by an external organisation or make a self-assessment or self-declaration of conformity	☐	☐	☐	☐	☐

PART FOUR – THE COMPANY'S BUSINESS PERFORMANCE

On the scale from 1 (low) to 5 (high), please rate the followings that reflect your recent company's food safety outputs and business performance.

To what extent do the followings apply to your company's food safety outputs	**High**	**Above average**	**Average**	**Below average**	**Low**
	5	**4**	**3**	**2**	**1**
52. Company's productivity	☐	☐	☐	☐	☐
53. Company's efficiency	☐	☐	☐	☐	☐
54. Company's process effectiveness	☐	☐	☐	☐	☐
55. Level of employees' satisfaction	☐	☐	☐	☐	☐
56. Building positive image for the company in food safety assurance	☐	☐	☐	☐	☐
57. Delivery ability	☐	☐	☐	☐	☐
58. Company's operational costs of the previous year	☐	☐	☐	☐	☐
59. Company's profitability of the previous year	☐	☐	☐	☐	☐
60. Financial results of the previous year	☐	☐	☐	☐	☐
61. Net profit margin of the previous year	☐	☐	☐	☐	☐
62. Sales growth during the last three years	☐	☐	☐	☐	☐
63. Cash flow of the previous year	☐	☐	☐	☐	☐

The end of the questionnaire. Many thanks for your time. Best regards!

Khảo sát về quản lý an toàn thực phẩm tại doanh nghiệp xuất khẩu thực phẩm

Chúng tôi xin cảm ơn quý công ty đã tham gia nghiên cứu dự kiến sẽ góp phần cải thiện quản lý an toàn thực phẩm. Tất cả các thông tin mà quý công ty cung cấp sẽ được giữ bí mật. Vui lòng làm theo các hướng dẫn bên dưới để chọn các tùy chọn phù hợp phản ánh chính xác các hoạt động quản lý an toàn thực phẩm tại quý công ty.

Trân trọng cảm ơn!

PHẦN MỘT - THÔNG TIN CHUNG CÔNG TY

1. Vui lòng lựa chọn số lượng nhân viên hiện có của Công ty:
   - □ ≤ 10 nhân viên
   - □ từ 11 đến 50 nhân viên
   - □ từ 51 đến 250 nhân viên
   - □ > 250 nhân viên
2. Cơ cấu sở hữu của Quý Công ty là gì?
   - □ Cty TNHH
   - □ Cty cổ phần
   - □ Doanh nghiệp tư nhân
   - □ Doanh nghiệp nhà nước
   - □ Hợp tác xã
3. Vị trí hiện tại của bạn tại Công ty là gì?
   - □ Quản lý chuỗi cung ứng
   - □ Quản lý chất lượng
   - □ Giám đốc
   - □ Quản lý an toàn thực phẩm
   - □Khác. Xin cho biết cụ thể:

     _____
4. Vui lòng cho biết loại thực phẩm nào là sản phẩm xuất khẩu chủ lực của Quý Công ty ?
   - □ Thủy, hải sản
   - □ Gia cầm
   - □ Sữa và các sản phẩm từ sữa
   - □ Trái cây và rau quả tươi
   - □ Đồ uống và nước giải khát
   - □ Khác. Xin cho biết cụ thể:

     _____

5. Sản lượng xuất khẩu sản phẩm chủ lực trung bình của Quý Công ty là bao nhiêu tấn mỗi năm?
   - ☐ Dưới 500 tấn
   - ☐ 500 - 1000 tấn
   - ☐ 1000 - 2000 tấn
   - ☐ 2000 - 3000 tấn
   - ☐ Hơn 3000 tấn
6. Hiện có những tiêu chuẩn an toàn thực phẩm nào mà Quý Công ty đang áp dụng? (Có thể chọn nhiều lựa chọn)
   - ☐ HACCP
   - ☐ ISO 9001
   - ☐ ISO 22000
   - ☐ BRC
   - ☐ GlobalGAP
   - ☐ SQF
   - ☐ IFS
   - ☐ Khác. Xin cho biết cụ thể: _____

PHẦN THỨ HAI - CÁC YẾU TỐ QUAN TRỌNG CỦA HỆ THỐNG QUẢN LÝ AN TOÀN THỰC PHẨM TẠI DOANH NGHIỆP

Dựa trên kinh nghiệm thực tế và quan điểm cá nhân, các yếu tố này có mức độ quan trọng như thế nào tới hệ thống quản lý an toàn thực phẩm của Quý doanh nghiệp?	**Rất quan trọng**	**Khá quan trọng**	**Trung lập**	**Tương đối không**	**Không quan trọng**
	5	**4**	**3**	**2**	**1**
CÁC YẾU TỐ BÊN TRONG DOANH NGHIỆP					
7. Cam kết của nhà quản lý đối với quản lý an toàn thực phẩm	☐	☐	☐	☐	☐
8. Chính sách an toàn thực phẩm tại Công ty như là những nguyên tắc chính hướng dẫn thực hành an toàn thực phẩm	☐	☐	☐	☐	☐
9. Trách nhiệm và thẩm quyền được xác định rõ ràng cho từng cá nhân liên quan đến hoạt động an toàn thực phẩm từ quản lý cho đến công nhân trực tiếp sản xuất trong tổ chức để đảm bảo và duy trì hiệu	☐	☐	☐	☐	☐

quả của hệ thống quản lý an toàn thực phẩm					
10. Văn hoá an toàn thực phẩm được thiết lập và duy trì trong doanh nghiệp	□	□	□	□	□
11. Kiến thức và kỹ năng của nhân viên về đảm bảo an toàn thực phẩm	□	□	□	□	□
12. Nhận thức của nhân viên về sự liên quan và tầm quan trọng của các hoạt động của họ đóng góp vào quản lý an toàn thực phẩm	□	□	□	□	□
13. Các chương trình đào tạo liên quan đến quản lý an toàn thực phẩm cho nhân viên	□	□	□	□	□
14. Sự tham gia của nhân viên vào các hoạt động quản lý an toàn thực phẩm	□	□	□	□	□
15. Cơ sở vật chất và trang thiết bị đủ tiêu chuẩn để đảm bảo quản lý an toàn thực phẩm	□	□	□	□	□
16. Điều kiện và khả năng tài chính của doanh nghiệp	□	□	□	□	□
17. Điều kiện và khả năng ứng dụng khoa học công nghệ của doanh nghiệp	□	□	□	□	□
CÁC YẾU TỐ BÊN NGOÀI					
18. Kiểm nghiệm và kiểm tra an toàn thực phẩm của cơ quan quản lý nhằm đảm bảo sự tuân thủ của Công ty	□	□	□	□	□
19. Các chế tài xử phạt như phạt hành chính, thu hồi hàng hoá và truy tố về việc vi phạm các quy định về an toàn thực phẩm	□	□	□	□	□
20. Các hoạt động khuyến khích tuân thủ quản lý an toàn thực phẩm như giải thưởng, nhãn hiệu được công nhận, chính sách giảm thuế từ các cơ quan quản lý	□	□	□	□	□
21. Cung cấp thông tin và định hướng như hướng dẫn, đào tạo, tư vấn của các cơ quan quản lý để hỗ trợ	□	□	□	□	□

Công ty trong quản lý an toàn thực phẩm					
22. Các hỗ trợ hữu ích để tăng cường quản lý an toàn thực phẩm từ:					
a. Các bên liên quan khác trong chuỗi cung ứng (như nhà cung cấp, nhà thầu, đại lý, khách hàng)	☐	☐	☐	☐	☐
b. Các tổ chức thuộc chính phủ và chính quyền	☐	☐	☐	☐	☐
c. Các tổ chức tài chính (ví dụ như các ngân hàng)	☐	☐	☐	☐	☐
d. Các hiệp hội doanh nghiệp (như NAFIDAD, VASEP)	☐	☐	☐	☐	☐
e. Các tổ chức phi chính phủ (WHO, FAO)	☐	☐	☐	☐	☐
23. Các tiêu chí để lựa chọn nhà cung cấp nhằm đảo bảo các yêu cầu về an toàn thực phẩm như sau:					
a. Giá rẻ hơn	☐	☐	☐	☐	☐
b. Có các chứng chỉ về an toàn thực phẩm	☐	☐	☐	☐	☐
c. Khoảng cách của nguồn cung (tại địa phương hoặc nhập khẩu)	☐	☐	☐	☐	☐
d. Độ tin cậy của nhà cung ứng	☐	☐	☐	☐	☐
e. Kết quả kiểm nghiệm an toàn thực phẩm (do chính cty hoặc bên thứ ba lấy mẫu và kiểm nghiệm)	☐	☐	☐	☐	☐
f. Tính linh hoạt (như thanh toán, vận chuyển, giảm giá, tần suất và số tiền đặt hàng ...)	☐	☐	☐	☐	☐
g. Dịch vụ sau bán	☐	☐	☐	☐	☐
24. Cty kết hợp cùng với các nhà cung cấp quan trọng để cải tiến an toàn thực phẩm dựa trên các hoạt động như:					
a. Giải quyết các vấn đề phát sinh liên quan đến an toàn sản phẩm	☐	☐	☐	☐	☐

b. Tạo ra các chương trình cải tiến liên tục về quản lý an toàn thực phẩm	☐	☐	☐	☐	☐
c. Lập kế hoạch và thiết lập mục tiêu cho các hoạt động quản lý an toàn thực phẩm.	☐	☐	☐	☐	☐
d. Liên lạc và trao đổi các thông tin liên quan đến quản lý an toàn thực phẩm	☐	☐	☐	☐	☐

25. Chúng tôi muốn Quý Công ty mô tả mối quan hệ giữa Quý Công ty và hầu hết các nhà cung cấp sử dụng bộ mô tả sau. Đối với mỗi mô tả, vui lòng khoanh tròn dòng dưới đây để cho biết trường hợp của Quý Công ty:

- Mức độ tin tưởng

5 4 3 2 1

High Low

- Mức độ cam kết

5 4 3 2 1

High Low

- Mức độ phụ thuộc lẫn nhau

5 4 3 2 1

High Low

PHẦN THỨ BA - HOẠT ĐỘNG QUẢN LÝ AN TOÀN THỰC PHẨM

Trên thang điểm từ 1 (kém) đến 5 (tốt), Quý Công ty vui lòng đánh giá tình trạng mức độ hiệu quả của các hoạt động liên quan đến các hoạt động an toàn thực phẩm dưới đây.

Hoạt động quản lý an toàn thực phẩm	**Tốt**	**Khá**	**Trung bình**	**Dưới trung bình**	**Kém**
	5	**4**	**3**	**2**	**1**
A. CÁC CHƯƠNG TRÌNH TIÊN QUYẾT					
26. Xây dựng và bố trí các công trình và phương tiện liên hợp	☐	☐	☐	☐	☐
27. Sơ đồ mặt bằng, bao gồm không gian làm việc, trang thiết bị của nhân viên, phòng thí nghiệm và kho bãi	☐	☐	☐	☐	☐

28. Nguồn cung cấp ga, nước, năng lượng và các tiện ích khác	☐	☐	☐	☐	☐
29. Các dịch vụ hỗ trợ, bao gồm cả xử lý rác và nước thải	☐	☐	☐	☐	☐
30. Sự phù hợp của trang thiết bị và sự dễ dàng vệ sinh, bảo trì và bảo trì phòng ngừa trang thiết bị	☐	☐	☐	☐	☐
31. Hoạt động quản lý thu mua nguyên vật liệu	☐	☐	☐	☐	☐
32. Các biện pháp phòng ngừa lây nhiễm chéo vật lý, gây dị ứng và vi sinh vật	☐	☐	☐	☐	☐
33. Các chương trình làm sạch và vệ sinh được thiết lập để đảm bảo các thiết bị chế biến thực phẩm và môi trường sản xuất được duy trì trong điều kiện hợp vệ sinh	☐	☐	☐	☐	☐
B. HACCP					
34. Nhận diện các mối nguy về an toàn thực phẩm cần được ngăn ngừa, loại bỏ hoặc giảm đến mức có thể chấp nhận được ở từng bước từ nguyên liệu đến thành phẩm trong quá trình sản xuất.	☐	☐	☐	☐	☐
35. Thiết lập các điểm kiểm soát tới hạn (CCP - Critical Control Points) để đảm bảo sự an toàn của thực phẩm bởi đội HACCP của Quý Công ty	☐	☐	☐	☐	☐
36. Mức độ hiệu quả trong việc xác định giới hạn an toàn cho mỗi CCP	☐	☐	☐	☐	☐
37. Thiết lập và thực hiện các quy trình và hệ thống giám sát hiệu quả tại các điểm kiểm soát tới hạn	☐	☐	☐	☐	☐
38. Thiết lập kế hoạch hành động nhằm khắc phục khi giới hạn tới hạn bị phá vỡ	☐	☐	☐	☐	☐
39. Thiết lập và thực hiện các thủ tục thẩm tra hệ thống HACCP để xác minh rằng hệ thống đang làm việc hàng ngày theo kế hoạch.	☐	☐	☐	☐	☐
40. Thực hiện các thủ tục lưu trữ hồ sơ nhằm chứng minh rằng hệ thống HACCP của Công ty đang hoạt động dưới sự kiểm soát và hành động khắc phục phù hợp được thực hiện khi giới hạn tới hạn bị phá vỡ.	☐	☐	☐	☐	☐

C. CÁC HOẠT ĐỘNG KHÁC TRONG QUẢN LÝ AN TOÀN THỰC PHẨM					
41. Hệ thống truy xuất nguồn gốc để xác định nguồn gốc nguyên vật liệu từ các nhà cung cấp ngay cho tới sản phẩm cuối cùng của khâu phân phối ban đầu	☐	☐	☐	☐	☐
42. Hệ thống hành động khắc phục hậu quả khi vượt quá giới hạn tới hạn hoặc khi xuất hiện sự thiếu phù hợp với các chương trình tiên quyết	☐	☐	☐	☐	☐
43. Mức độ thích hợp của quy trình xử lý các sản phẩm có tiềm năng không đảm bảo an toàn thực phẩm	☐	☐	☐	☐	☐
44. Mức độ hiệu quả và khả năng của các biện pháp kiểm soát các mối nguy đã được xác định về an toàn thực phẩm	☐	☐	☐	☐	☐
45. Bằng chứng thể hiện rằng các phương pháp và thiết bị theo dõi, đo lường cụ thể là phù hợp nhằm đảm bảo thực hiện các quy trình giám sát và đo lường.	☐	☐	☐	☐	☐
46. Các chương trình đánh giá nội bộ để xác định liệu hệ thống quản lý an toàn thực phẩm được thực hiện và cập nhật có hiệu quả hay không dựa trên đánh giá và phân tích kết quả của các hoạt động xác minh.	☐	☐	☐	☐	☐
47. Tất cả các hồ sơ và tài liệu theo yêu cầu của hệ thống quản lý an toàn thực phẩm đều được kiểm soát bởi Công ty	☐	☐	☐	☐	☐
48. Hệ thống thông tin nội bộ nhằm đảm bảo hiệu quả trong trao đổi thông tin về các vấn đề liên quan đến an toàn thực phẩm trong toàn tổ chức	☐	☐	☐	☐	☐
49. Các chương trình trao đổi thông tin với bên ngoài về các vấn đề liên quan đến an toàn thực phẩm trong suốt chuỗi cung ứng như nhà cung cấp và nhà thầu, khách hàng, các cơ quan luật pháp, cơ quan quản lý và các tổ chức khác	☐	☐	☐	☐	☐
50. Khả năng cải tiến và liên tục cập nhật của hệ thống quản lý an toàn thực phẩm	☐	☐	☐	☐	☐
51. Sự chủ động tìm kiếm các chứng nhận hoặc đăng ký hệ thống quản lý an toàn thực phẩm bởi bên thứ ba hoặc tự đánh giá hay tự công bố sự phù hợp về an toàn thực phẩm	☐	☐	☐	☐	☐

PHẦN 4 - KẾT QUẢ HOẠT ĐỘNG CỦA CÔNG TY

Trên thang điểm từ 1 (thấp) đến 5 (cao), vui lòng đánh giá những mục sau phản ánh kết quả đánh giá an toàn thực phẩm và hiệu quả kinh doanh của Công ty gần đây.

Kết quả đánh giá an toàn thực phẩm và hiệu quả kinh doanh của Công ty	**Cao**	**Khá**	**Trung bình**	**Dưới trung bình**	**Thấp**
	5	4	3	2	1
52. Năng suất làm việc của Công ty	☐	☐	☐	☐	☐
53. Hiệu quả hoạt động của Công ty	☐	☐	☐	☐	☐
54. Hiệu quả quá trình hoạt động của Công ty	☐	☐	☐	☐	☐
55. Mức độ hài lòng của công nhân viên trong Công ty	☐	☐	☐	☐	☐
56. Hình ảnh tích cực cho công ty trong việc đảm bảo an toàn thực phẩm	☐	☐	☐	☐	☐
57. Khả năng giao hàng đúng yêu cầu của khách hàng và đối tác	☐	☐	☐	☐	☐
58. Chi phí hoạt động của Công ty trong năm	☐	☐	☐	☐	☐
59. Lợi nhuận của Công ty trong năm	☐	☐	☐	☐	☐
60. Kết quả tài chính trong năm	☐	☐	☐	☐	☐
61. Lợi nhuận biên ròng trong năm	☐	☐	☐	☐	☐
62. Tăng trưởng doanh thu trong ba năm trở lại đây	☐	☐	☐	☐	☐
63. Dòng tiền luân chuyển trong Công ty	☐	☐	☐	☐	☐

Kết thúc bảng câu hỏi.

Trân trọng cảm ơn Quý Công ty đã dành thời gian để tham gia khảo sát!

调研问卷

尊敬的先生/女士:

您好！感谢您在百忙之中抽时间参与我们的问卷调查。本问卷旨在对企业现有的食品安全管理实践进行研究，其结果有助于提高食品质量安全管理。我们向您做出郑重承诺:本问卷调查将采取匿名方式，其结果仅用作科研分析，所有的数据将严格保密，绝不会泄露贵公司的隐私。请您根据以下提示，认真阅读问卷的题项并选择出最符合贵公司实际情况的选项，同时请您在作答时不要遗漏选项。作为回馈，研究结果将反馈给企业作参考。再次对您的支持与信任致以衷心的感谢！

第一部分—贵公司的基本信息

1. 贵公司现有员工人数:
   - □ 1－10 人
   - □ 11－50 人
   - □ 51－250 人
   - □ 250人以上
2. 公司的所有权结构是:
   - □ 个体企业**或独**资**公司**
   - □ 有限公司
   - □ 合作企业
   - □ 国有企业
   - □ 合作社
3. 您目前在公司的职位是?
   - □ 供应链管理者
   - □ 质量控制管理者
   - □ 执行董事长/CEO
   - □ 食品安全小组
   - □ 其他_____
4. 贵公司出口食品的类型:
   - □ 渔产品
   - □ 家禽
   - □ 奶制品

□ 新鲜水果和蔬菜
□ 酒和饮料
□ 其他____

5. 贵公司每年出口食品的数量:
□ 500吨以下
□ 500-1000吨
□ 1000吨-2000吨
□ 2000吨-3000吨
□ 3000吨以上

6. 贵公司获得哪些认证(可多选)
□ HACCP管理体系认证
□ ISO9001认证
□ ISO22000认证
□ BRC认证
□ 全球GAP认证
□ SQF认证
□ IFS认证
□ 其他 _____

第二部分—食品安全管理体系的关键因素

您认为这些因素在多大程度上对组织内的食品安全管理体系重要？	**高**	**中等以上**	**介质**	**中等以下**	**低**
	5	**4**	**3**	**2**	**1**
内部因素					
7. 管理者对食品安全管理体系的承诺	□	□	□	□	□
8. 将公司的食品安全政策作为食品安全实践的指导原则	□	□	□	□	□
9. 明确每个成员（如食品安全小组，小组长和一线工作人员）的职责和权限，确保食品安全管理体系的高效运行和维护	□	□	□	□	□
10. 在企业内部建立重视食品安全的文化	□	□	□	□	□
11. 员工具有保证食品安全的知识和技能	□	□	□	□	□
12. 工作人员意识到其行为对食品安全的相关性和重要性	□	□	□	□	□

13. 与员工食品安全相关的培训计划	□	□	□	□	□
14. 员工食品安全管理活动的参与度	□	□	□	□	□
15. 确保食品安全管理的先进设施和设备	□	□	□	□	□
16. 贵公司的财务状况	□	□	□	□	□
17. 贵公司的技术状况	□	□	□	□	□
外部因素					
18. 食品安全审核和监管机构的检查	□	□	□	□	□
19. 诸如惩罚、起诉、召回等制裁措施来惩治违规或犯罪行为	□	□	□	□	□
20. 奖励、标签、税收减免等激励措施来鼓励食品安全管理	□	□	□	□	□
21. 监管机构的指导、培训和建议等信息和教育手段，旨在支持贵公司的食品安全管理	□	□	□	□	□
22. 获得以下机构的支持来加强食品安全管理：					
a. 供应链中的其他利益相关者（如供应商，承包商，采购商）	□	□	□	□	□
b. 政府和监管当局	□	□	□	□	□
c. 金融机构（如银行）	□	□	□	□	□
d. 行业协会	□	□	□	□	□
e. 非政府组织	□	□	□	□	□
23. 根据食品安全要求，贵公司选择供应商的标准：					
a. 较便宜的价格	□	□	□	□	□
b. 符合认证要求	□	□	□	□	□
c. 距离（是不是本地）	□	□	□	□	□
d. 可靠性	□	□	□	□	□

e. 良好的检测结果	□	□	□	□	□
f. 灵活性(如付款、运费、降价、订单频率和金额等)	□	□	□	□	□
g.售后服务	□	□	□	□	□
24. 贵公司采取了哪些方法来确保供应商的产品安全是一致的？（多选）					
a. 突袭现场检查	□	□	□	□	□
b. 随机样本抽样	□	□	□	□	□
c. 检查供应地点	□	□	□	□	□
d. 严格的合同协议	□	□	□	□	□

25. 请描述贵公司和大多数供应商之间的关系。对于每个题项，请在相应位置给出对程度的评价：

5 4 3 2 1

高 低

- 信任程度： ___
- 承诺程度： ___
- 相互依赖程度： ___

第三部分—食品安全管理工作

请分别圈选合适的分数来描述贵公司的食品安全管理活动(从差1到好5)：

工作内容	好	平均水平之上	中等	平均水平之下	差
	5	**4**	**3**	**2**	**1**
基础工作					

26. 建筑物和相关设施的布局和建设	□	□	□	□	□
27. 包括工作空间和员工设施在内的厂房布局	□	□	□	□	□
28. 空气、水、能源和其他基础条件的提供	□	□	□	□	□
29. 包括废弃物和污水处理的支持性服务	□	□	□	□	□
30. 设备的适宜性，及其清洁、保养和预防性维护的可实现性	□	□	□	□	□
31. 对采购材料的管理	□	□	□	□	□
32. 预防物理、过敏原和微生物交叉污染的措施	□	□	□	□	□
33. 制定清洁和消毒方案，确保食品加工设备和环境卫生	□	□	□	□	□
HACCP					
34. 从原材料到最终产品的每一步中都明确需要预防、消除或减少到可接受水平的危害	□	□	□	□	□
35. HACCP小组设定保证产品安全的关键控制点	□	□	□	□	□
36. 确定关键控制点中关键限值的效率水平，区分可接受的危害与不可接受的需要预防、消除或减少的危害的判定值。	□	□	□	□	□
37. 建立并实施了关键控制点的监测措施和制度	□	□	□	□	□
38. 当监测显示关键控制点不受控制时，会安装纠正措施。	□	□	□	□	□
39. 采取有效措施确保关键控制点会控制所关注的危害，并确保系统按照计划日常工作	□	□	□	□	□
40. 具有提供有效文件，记录并证明HACCP体系处于控制之中的能力，对于任何偏离关键限值的情况都会采取适当的纠正措施。	□	□	□	□	□
食品安全管理的其他工作					
41. 可追溯性系统应能够快速识别供应方的进料和终产品首次分销的途径	□	□	□	□	□

42. 如果超过关键限值或不符合操作性前提方案时，就会采取纠正措施	□	□	□	□	□
43. 适当处理潜在不安全产品的程序	□	□	□	□	□
44. 控制措施是有效的，并能够控制已识别的食品安全危害	□	□	□	□	□
45. 组织具备相关的能力去提供证据表明采用的监视、测量方法和设备是适宜的，以确保监视和测量的结果	□	□	□	□	□
46. 基于对验证活动结果的分析和评估进行内部审核，以确定食品安全管理体系是否得到有效实施和更新。	□	□	□	□	□
47. 食品安全管理体系要求的所有记录和相关文件都得到了恰当的控制	□	□	□	□	□
48. 整个企业就食品安全的内部沟通十分有效	□	□	□	□	□
49. 与整个食品链中其他主体（如供应方，分包商、消费者、法律与监管机构以及其他相关组织）的食品安全方面的外部信息交流十分有效	□	□	□	□	□
50. 不断改进和更新食品安全管理体系的能力	□	□	□	□	□
51. 寻求由外部组织对其食品安全管理体系的认证或注册，或进行自我评价和自我声明	□	□	□	□	□

第四部分—公司的经营绩效

从1(低)到5(高)，请对公司的以下食品安全产出和业务绩效进行评价：

请选择合适的分数来表达贵公司的食品安全生产情况	**高**	**平均水平之上**	**中等**	**平均水平之下**	**低**
	5	**4**	**3**	**2**	**1**
52. 贵公司的生产力	□	□	□	□	□
53. 公司的效率	□	□	□	□	□
54. 公司过程控制的有效性	□	□	□	□	□
55. 员工的满意度	□	□	□	□	□
56. 建立食品安全保证的正面形象	□	□	□	□	□

57. 供货能力	□	□	□	□	□
58. 公司上一年的经营成本	□	□	□	□	□
59. 公司上一年的盈利	□	□	□	□	□
60. 公司上一年的财务情况	□	□	□	□	□
61. 公司上一年的净利润	□	□	□	□	□
62. 过去三年的销售额增长情况	□	□	□	□	□
63. 公司上一年的现金流	□	□	□	□	□

问卷到此结束, 感谢您的合作！

Appendix IV

Codebook for the quantitative analysis used in Chapter Five

No.	Label of variable	Code name	Values	Value label
1	Number of employees	GE1	1	1-10 employees
			2	11- 50 employees
			3	51 - 250 employees
			4	More than 250 employees
2	Ownership structure	GE2	1	Limited liability company
			2	Joint stock company
			3	Private enterprise
			4	State-owned enterprise
			5	Cooperatives
			6	Other
3	Current position at the firm	GE3	1	Trading manager
			2	Quality control manager
			3	Director/CEO
			4	Supply chain manager
			5	Other
4	Kind of exporting food	GE4	1	Fishery
			2	Poultry
			3	Dairy
			4	Fresh fruit and vegetables
			5	Drinks and beverage
			6	Rice and grains
			7	Other
5	Average exporting tons/year	GE5	1	Less than 500
			2	500 – 1000
			3	1000 – 2000
			4	2000 – 3000
			5	More than 3000
6	Certificates	GE6.1	0	None
			1	HACCP
		GE6.2	0	None
			1	ISO9001
		GE6.3	0	None
			1	ISO22000
		GE6.4	0	None
			1	BRC
		GE6.5	0	None
			1	GlobalGAP
		GE6.6	0	None
			1	SQF
		GE6.7	0	None

			1	IFS
		GE6.8	0	None
			1	Others
INTERNAL CRITICAL FACTORS				
7	Managers commitments	MR1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
8	Food safety policy	MR2	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
9	Responsibilities and authorities	MR3	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
10	Food safety culture	MR4	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
11	Employees' knowledge and skills	HR1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
12	Awareness of the personnel	HR2	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
13	Training programs for employee	HR3	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect

			5	Major effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
14	Employees' involvement	HR4	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
15	Qualified facilities and equipment	OR1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
16	Financial condition	OR2	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
17	Technological condition	OR3	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
EXTERNAL CRITICAL FACTORS				
18	Food safety audits and inspections	G1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
19	Sanctions	G2	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
20	Stimulus	G3	1	No effect
			2	Minor effect

			3	Neutral effect
			4	Moderate effect
			5	Major effect
21	Regulatory information and education	G4	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
22	Supports from stakeholders in supply chains	S3	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Supports from government and authorities	S4	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Supports from financial institutions	S1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Supports from business associations	S2	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Supports from non-governmental organizations	S5	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
23	Price to select suppliers	SS1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect

	Certficates to select suppliers	SS2	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Distance to select supplier	SS3	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Reliability to select supplier	SS4	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Inspection results to select supplier	SS5	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Flexibility to select supplier	SS6	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	After-sale service to select supplier	SS7	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
24	Information exchange_ Collaboration	C1	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Emerging problems_ Collaboration	C2	1	No effect
			2	Minor effect
			3	Neutral effect

			4	Moderate effect
			5	Major effect
	Planning and goal-setting activities_ Collaboration	C3	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
	Continuous improvement programs_ Collaboration	C4	1	No effect
			2	Minor effect
			3	Neutral effect
			4	Moderate effect
			5	Major effect
25	Trust_Supplier relationship	SR1	0	Don't know
			1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
	Commitment_Supplier relationship	SR2	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
	Interdependency_ Supplier relationship	SR3	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
PREREQUISITE PROGRAMS				
26	Construction and layout of building & utilities	PRP1	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
27	Layout of premises	PRP2	1	Low
			2	Below average
			3	Average
			4	Above Average

			5	High
28	Supplies of air, water, energy and other utilities	PRP3	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
29	Supporting services	PRP4	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
30	Suitability of equipment	PRP5	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
31	Management of purchased materials	PRP6	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
32	Measures for the prevention of cross-contamination	PRP7	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
33	Cleaning and sanitising programmes	PRP8	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
HACCP				
34	Principle 1	HA1	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
	Principle 2	HA2	1	Low

35			2	Below average
			3	Average
			4	Above Average
			5	High
36	Principle 3	HA3	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
37	Principle 4	HA4	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
38	Principle 5	HA5	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
39	Principle 6	HA6	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
40	Principle 7	HA7	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
OTHER ACTIVITIES OF FSMS				
41	Traceability system	OA1	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
42	Corrective actions	OA2	1	Low
			2	Below average
			3	Average

			4	Above Average
			5	High
43	Procedures to handle potentially unsafe products	OA3	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
44	Control measures	OA4	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
45	Sufficient evidence	OA5	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
46	Internal audits	OA6	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
47	Required records and documents	OA7	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
48	Internal communication	OA8	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
49	External communication	OA9	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
		OA10	1	Low

50	The ability to improve and continually update		2	Below average
			3	Average
			4	Above Average
			5	High
51	The active in seeking certification or registration	OA11	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
BUSINESS PERFORMANCE				
52	Company's productivity	BP1	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
53	Company's efficiency	BP2	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
54	Company's process effectiveness	BP3	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
55	Level of employees' satisfaction	BP4	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
56	Building positive image	BP5	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
57	Delivery ability	BP6	1	Low
			2	Below average
			3	Average

			4	Above Average
			5	High
58	Company's operational costs of the previous year	BP7	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
59	Company's profitability of the previous year	BP8	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
60	Financial results of the previous year	BP9	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
61	Net profit margin of the previous year	BP10	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
62	Sales growth during the last three years	BP11	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
63	Cash flow of the previous year	BP12	1	Low
			2	Below average
			3	Average
			4	Above Average
			5	High
64	Mean of HACCP	HACCP_mean		Mean(HA1,HA2,HA3,HA4,HA5,HA6,HA7)
65	Mean of PRP	PRP_mean		Mean(PRP1, PRP2, PRP3, PRP4, PRP5, PRP6, PRP7, PRP8)
66	Mean of OA	OA_mean		Mean(OA1,OA2,OA3,OA4,OA5,OA6,OA7,OA8,OA9,OA10,OA11)
67	FSMS Implementation	FSMS		