Logistics Integration for Improving Distribution Performance: in the Context of Thai Egg Industry

By

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DECLARATION

I, Saichon Pinmanee, declare that the DBA thesis entitled "Logistics Integration for Improving Distribution Performance: in the Context of Thai Egg Industry" is no more than 65,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Saichon Pinmanee.… [redacted] ....Date…08/02/2016………………..

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ABSTRACT

Agricultural products are mostly perishable and require special logistics operations for storage, transportation and distribution to guarantee food safety and freshness. Logistics integration is critical for improving perishable food distribution. Although successful logistics integration has offered competitive advantage to firms operating in a wide range of industries, it has not yet achieved its full potential in the Thai agricultural sector. In Thailand, semi-industrial (commonly referred to as small and medium sized in extant literature) egg industry as an important agricultural sector. However, the industry presently faces critical issues primarily stemming from inadequate logistics. This results in suboptimal performance, such as unreliable delivery of goods and long or unpredictable order fulfilment lead times. Empirical evidence indicates that lack of comprehensive logistics supply chain and the absence of full integration of all related processes are the cause of these issues. On the other hand, in the extant studies in this field, factors such as information integration, logistics operations coordination, organisational relationship, and institutional support, are posited to play the main role in logistics integration. Hence, the present study aims to examine the role of these logistics integration factors in the ability to improve the logistics performance (specifically perfect order fulfilment and order fulfilment lead times), and identify the factors that have the potential to significantly affect the above relationships. The findings yielded by this study will assist in a better egg distribution logistics integration and will thus benefit the egg farmers, wholesalers, and retailers operating in the chain with the potential for improving distribution performance.

A conceptual framework of the study is developed based on four extant theories: resource dependence theory (RDT), resource-based view (RBV), institutional and supply chain management (SCM) theory. Afterwards, under the empirical research method this study surveyed farmers, wholesalers, and retailers operating in Thai small and medium egg supply chain, whereby their input on the factors that affect logistics performance was sought. The survey resulted in a final sample of 429 respondents, representing a 26 percent response rate. The collected data was subjected to data cleaning, a non-response bias test, and a common method variance test before exploratory and confirmatory analyses were carried out. Finally, structural equation modelling analysis was employed to establish the hypothesised relationships among the variables in the model that provided the best fit to the study data.

The study findings revealed that information integration, organisational relationship, logistics operations coordination and institutional support positively influence both perfect order fulfilment and order fulfilment lead times. Results further show that the institutional support, organisational relationship, logistics operations coordination, and information integration play significant role in improving the performance in Thai egg semi-industrial logistics integration, as it is related to both perfect order fulfilment and order fulfilment lead times.

Results show that the Thai egg industry needs to forge strong links with government, financial institutions, and educational institutions in order to obtain support they require. In this context, focus should be on ensuring that policies for improving logistic performance are put in place. Moreover, the industry also need to focus on improving organisational relationship and logistics operations coordination, while making more effective use of technology and information sharing, in order to achieve a supply chain integration strategy that meets their needs.

Overall, this research opens up the unexplored agricultural logistics integration elements, through which the egg sector can be benefited to improve the customer service as well as improve the system efficiency. It is expected that other Thai agricultural industry might benefit from this strategy, in particular those focusing on production and distribution of fresh food items or short shelf-life products, where similar conditions apply and supply chain integration can lead to improved logistics performance.

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PUBLICATIONS ASSOCIATED WITH THIS THESIS

Conference Papers

Pinmanee, S., Ahsan, K., and Shee, H. K. 2013, *Agricultural supply chain integration: a Thai egg industry context*, Paper published in the proceeding of 11th ANZAM-OM Symposium, Brisbane, 20 - 21 June, 2013.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Extant studies have shown that successful supply chain management integration has offered competitive advantage in many industries (Stank et al. 2001a). However, it has not yet achieved its full capacity in agricultural sector (Shukla & Jharkharia 2013). Agricultural products are unique in this context, as logistics pertaining to this class of perishable goods has to ensure that duration of all operations and ambient temperatures at which the goods are transported and stored guarantee food safety and freshness (Yingxia & Xiangyu 2006). In Thailand, egg industry is a significant part of agricultural sector (Taechawattananan 2008). Semi-industrial sector is of particular importance, as it comprises over 50% of the total egg production in Thailand (The Association of Hen-Egg Farmers Traders and Exporters 2010). Moreover, available evidence clearly indicates that egg logistics distribution is critical to this sector's performance, as it currently suffers from inefficiencies in logistics integration (TDRI 2012). Hence, this study aims to identify the factors that are most influential in successful logistics integration and improving logistics performance. This chapter provides an overview of the study, including research background, justification of the research topic, theoretical context pertaining to logistics integration (information integration, logistics operations coordination, organisational relationships, and institutional support), as well as the key indicators of logistics performance improvements (delivery reliability/perfect order fulfilment, responsiveness/order fulfilment lead times). It also presents the purpose and significance of the study, before outlining the thesis structure.

1.1 Background to the research

The challenges of global competition increasingly poses to firms have prompted the shift towards a greater focus on customer needs and expectations in order to reduce costs by improving service quality and efficiency (Lai & Cheng 2009). It is recognised that logistics performance can significantly influence customer satisfaction (Stank et al. 2003). This, in turn, affects their purchase choices and preferences and ultimately impacts on company profits (Islam et al. 2013). Given the importance the logistics plays in company's market position and profitability, it is not surprising that academics and industry practitioners have attempted to identify the key factors affecting logistics performance, namely improved integration of supply chain elements, which includes customers, internal processes, material/service suppliers, technology and planning, quality measurement standards, and relationship integration (Stank et al. 2001a).

Supply chain logistical integration implies an attempt to unify and streamline as many logistical activities within the supply chain as possible (Stank et al. 2001a). Consequently, improved logistics integration provides the organisations with better utilisation of time and space, allowing for the necessary quantity of products to reach all points in the chain efficiently, cost-effectively and in the timely manner (Prajogo & Olhager 2012). The following three main integration approaches help accomplish this goal: (i) external (between supplier and customer) and internal integration, (ii) process integration and (iii) information/data and physical/materials flows integration (Alfalla-Luque et al. 2013). The success of each of these aspects is contingent on comprehensive collaboration among supply chain network members in strategic, operational and tactical decision-making (Bagchi et al. 2005). Although supply chain logistics supports the movement of products and materials from the suppliers to consumers, it involves numerous sub-activities such as cash flow management, information dissemination, as well as waste disposal and reverse flows (Tseng et al. 2005).

Improving logistic performance yields numerous benefits, including greater customer satisfaction, increased delivery speed, more rapid response to demands, order and delivery flexibility, and faster order completion capability (Droge et al. 2004). However, optimal logistics performance implies efficiency and effectiveness of all steps in the supply chain (Gunasekaran & Kobu 2007, Fugate et al. 2010). Effectiveness is the extent to which a customer's requirements are met, whereas efficiency measures how economically a firm's resources are utilized when providing a pre-specified level of customer satisfaction (Shepherd & Günter 2006). Customer satisfaction is a primary measure of business success and is thus significant for evaluating logistics performance (Stank et al. 2003). Hence, when setting targets for logistics performance, order fulfilment must be a priority (Croxton 2003).

Despite marked improvements in all the individual elements that contribute to enhancing logistics performance, at present logistics integration is, unfortunately, still mostly rhetoric with very little practical implementation. The theory behind it posits that a manager must recognize the challenge of balancing the inherent difficulty of collaboration with the competitive potential of supply chain management (Fawcett & Magnan 2002). Consequently, in practice, logistic integration is typically very difficult to accomplish (Christopher & Juttner 2000, Power 2005), as different perceptions regarding the execution of the most optimal multi-dimensional supply chain integration framework may produce different performance results (Fabbe-Costes & Jahre 2008).

Agricultural product logistics differs from its industrial counterpart, as most agricultural products are characterised by easy putrescence and necessity of freshness (Yingxia & Xiangyu 2006). As consumers require fresh, nutritious, palatable and safe food, if inferior produce is delivered, it will not only remain unsold (and thus incur losses), but can pose risks to health and safety, jeopardising the company's reputation and potentially even causing closure of business and severe legal implications (Opara 2002). Based on the widely used classification of perishable agricultural products(Shukla & Jharkharia 2013), egg is a specific perishable agricultural produce that, due to short life and other characteristics (long production lead time, freshness, durability, undetermined market demand, limited sales period), is differentiated from other agricultural supply chain types (OTA 1979, Cao et al. 2007). On the other hand, Egg distribution logistics also share some features with the agricultural product logistics. Thai egg distribution logistics in small- or medium-sized (in Thailand, it is known as semi-industrial) farm production systems currently suffers primarily from lack of streamlined and effective information and payment flows, as well as absence of uniform framework that governs creation and distribution of products in the supply chain management (TDRI 2012). There is also notable absence of integration between internal and external logistics, partly due to the fact that the information technology, as a part of logistics systems, has not been fully utilised (Suthiwartnarueput 2007).

Based on the available agricultural supply integration literature, extant studies in this field primarily focused on agricultural logistics in other specific products (i.e., tomato, pork, beef, fish, chicken, meat, agro-food, vegetables, fruit, milk, cheese, strawberry, pineapple, sugar, rice, potato) in different countries. However, there is evident paucity of research on the egg industry (see Table 2.3). Moreover, in Thailand, very limited research had been conducted thus far in SCI and SCM, and that exploring egg industry is particularly scarce. Previous SCM studies conducted in the Thai context focused on rice, frozen foods, general foods, fruit, and vegetables (see Table 2.5). Hence, there is evident lack of research aiming to develop an SCI framework to support the operation and management in Thai egg industry.

Given the above shortcomings, it is vitally important to examine the factors that influence agricultural logistics integration for improving distribution performance and identify the key elements on which a modern logistics integration framework can be built in the future. In addition, in the agricultural industry, such as that pertaining to Thai semi-industrial egg products, there is paucity of studies on improving logistics performance through distribution logistics integration. Consequently, this study will aim to identify the key factors that influence and can improve distribution logistics performance in the Thai egg industry. Presently, lack of suitable supply chain/logistics integration is the main obstacle to creating the effective logistics performance in the context of distribution of Thai semi-industrial egg products.

1.2 Justification of the research

The price of agricultural products primarily increases due to growing transport costs, which contributes to the food prices by a large percentage (United Nations Economic and Social Council 2008). In particular, the price of oil, which has risen sharply in recent years (despite its most recent sharp decline), has increased overall expenditures on transport, affecting the distribution systems in all industry sectors, and thus egg production (TEMS 2008, Acharya et al. 2009, Gross & Hayden 2010). However, it should be recognized that the proportional value of logistics is a basic criterion when assessing the efficiency and modernity of logistics processes, as these costs greatly impact the total profitability of an enterprise and the ultimate outcome of its business activity (Kubon & Krasnodebski 2010). A functional transportation system is instrumental in joining these separate activities, as it comprises one-third of the logistic costs and significantly influences logistics system performance (Tseng et al. 2005). Costs arising in the transport workflow of any product consist of labour cost and owned vehicle cost, among others (Somuyiwa 2010). Consequently, the transportation cost of agricultural production (egg) comprises a relatively high percentage of the total cost of producing eggs.

The growing transport logistics cost is accompanied by increasing expenditure on warehouse/storage/distribution centre processes and infrastructure, which further contribute to the upward trend in food prices. Warehouse organisation plays a significant role in the business success, as they serve as intermediaries between supply chain partners, thus contributing to both service quality and supply chain costs (Faber et al. 2013). Consequently, warehouse management should aim to coordinate all warehouse process and distribution effectively and efficiently (Tompkins et al. 2003). In this respect, warehouse management pertains to planning and control procedures in warehouse operation (e.g., order management, transportation, warehousing activities, and value-added logistics) with the goal of ensuring efficient use of resources and fulfilling market demand (Vereecke et al. 2008). Given their effect on a wide range of functions, warehouses are the key determinants of logistics service performance effectiveness, especially timely deliveries and customer satisfaction (Marco & Mangano 2011). Most of the logistics costs arise from warehousing and transportation processes (Goh & Pinaikul 1998). The price of agricultural goods is primarily driven by logistics costs, which implicitly influence prices of the final food products (United Nations Economic and Social Council 2008). Thus, effective warehouse management has a significant potential to reduce the price of agricultural products (Crawford 2006).

Agricultural product logistics are, as noted earlier, distinct from the industrial products logistics, as they are characterized by a wide variety of products carried, often in large quantities. Moreover, the inherent biological properties of agricultural products (such as perishability, short shelf-life, freshness, deterioration, etc.) introduce unique challenges to the transport and storage processes typically associated with supply chain of any produce (Yingxia & Xiangyu 2006, Shukla & Jharkharia 2013). Agricultural production is dependent on the caprices of seasonal and geographical dispersion, which, in turn, increase the business risks of the associated logistics. In addition, price of such highly perishable goods are typically relatively low (in particular in the areas when such goods are widely available), thus the quantity required to achieve profit is considerable, requiring low-cost logistics operation (Xu 2011). The short produce durability and mandatory freshness requires certain technical measures in the logistical process, such as insect and moisture proofing, keeping in a temperature controlled place, drying and antisepticising, in order to guarantee quality the customers expect. As a result, in most food industry sectors, proper logistics equipment facility is necessary for agricultural product logistics, including special-purpose carrier vehicles, temperature and moisture controlled warehouses and special-purpose loading, unloading and processing equipment (Yingxia & Xiangyu 2006).

When someone lists the world’s top agricultural product producing countries, Thailand’s name comes out as one of the world’s largest agricultural product producers. In 2010, Thailand contributed 2.6% of the world’s agricultural market share (WTO 2011). However, logistics costs of agricultural products in Thailand are relatively high, accounting for 19% of overall expenses (Office of Transport and Traffic Policy and Planning 2006). In Thailand, the cost of logistics in 2009 was higher than in other countries, reaching approximately at 16.8% of the country's GDP (NESDB 2010). Comparatively, in Japan and the USA, it was 8.7 and 7.7% of their respective GDP (CSMP 2009). The major challenges facing Thai logistics development include its narrow focus, which is currently solely on physical distribution. Internally and externally integrated logistics are still lacking and information technology has not been fully utilised as an integral part of logistics systems (Suthiwartnarueput 2007). Effective supply chain management and integration is another logistic hindrance to the growth of the Thai agricultural sector (TDRI 2012).

SCM has become a valuable tool for gaining competitive advantage in many industries in Thailand. It is presently used throughout the entire supply chain integration (SCI) process, from upstream to downstream (Kritchanchai 2012). However, lack of appropriate SCI in the Thai agri-food supply chain is evident, in particular when it comes to the implementation of appropriate IT tools and Thai government policies (Thongrattana & Perera 2010). A detailed review of extant SCM literature in the Thai agricultural context revealed that only a few available articles are related to SCM in this sector. More specifically, extensive literature review was conducted via three main databases—Emerald, ScienceDirect, and EBSCO Business Source Complete—using the keywords supply chain, logistics, distribution, transportation, shipping, warehouse management, supply chain management, supply chain integration, agri-supply chain, agriculture, and Thailand, focusing on works published within the 1995-2015 period, to ensure currency of the data reported. This search identified only 18 articles in the SCM field related to Thai agricultural supply chain (all of which were published in English language). Moreover, it yielded no studies on agricultural (egg industry in particular) SCM in Thailand. Evidently, research aiming to assess the effect of the agricultural SCI on logistic performance is lacking, confirming the need for the present study (see Table 2.5 for more details).

In Thailand, with 22.7 million eggs produced per day, egg production is a significant aspect of agricultural sector (Choprakarn 2000). Almost all eggs (nearly 90%) are sold locally (the domestic market) (a cura di Ice 2010). Egg distribution in the commercial production process is typically conducted as a part of either a semi-industrial or large-scale industrial production system (Heft-Neal et al. 2008). Presently, semi-industrial production (equivalent to small and medium scale) accounts for over 50% of the total egg production in Thailand (The Association of Hen-Egg Farmers Traders and Exporters 2010). The logistics chain that pertains to this sector shares some common characteristics with those applied to other produce, such as transport of goods and information, as well as financial flows from the producer (farmer) to the collection centre, and further to the wholesaler and retailers. What is specific to the egg distribution is the need to maintain good quality and freshness for about 2-6 days (due to perishable nature of the produce), which requires transport and storage in constant low temperatures, protection from the heat of the sun, rain and extreme cold (FAO 2003). Egg distribution in the Thai semi-industrial sector is currently inefficient, as it lacks critical elements of logistics distribution from farmer to the wholesaler and retailers. As a result, the producers cannot respond to customer demands to their satisfaction, as late delivery of eggs to the customer is not an uncommon occurrence (Boonmee et al. 2013). Available evidence indicates that semi-industrial Thai egg businesses face numerous challenges, such as inadequate central logistics infrastructure, low quality and high cost of available transport modes, insufficient technology investment, poor communication methods, lack of information sharing, ineffective communication channels, ineffective use of supply contracts, participants' unwillingness to share the associated risks and unavailability of capital sources (TDRI 2012). Moreover, there is evident absence of SCI studies in egg industry in Thailand, the findings of which could be used to improve the performance of egg distribution (more details are given in Table 2.5). However, in other industries, SCI has been shown to play a significant role in logistics performance, as it can generate higher logistics effectiveness and improve order fulfilment (Stank et al. 2001a). Therefore, the present study focuses on logistics integration in the context of semi-industrial Thai egg sector, aiming to identify the key factors in logistics distribution performance, and thus make recommendations for order fulfilment improvements.

The aim of the present study is to improve logistics performance in the Thai egg semi-industrial distribution chain. Logistics performance pertains to planning, implementing, and controlling the forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption (CSCMP 2013). Hence, this study focuses on information, goods and financial flows, including order talking, order processing (warehouse management, billing, payment, and transportation) and customer order fulfilment. Most importantly, it extends to the entire distribution chain, from farmers, through the wholesaler, and to the retailers, as each of these steps is critical to performance and affects the ability to achieve efficient order fulfilment).

1.3 Theoretical context

Logistics performance is highly dependent on the quality, efficiency and effectiveness of the managerial involvement in the transportation of raw materials/products in a supply chain (Ülgen & Forslund 2015). Consequently, it affects the production speed, capacity to fill the customer orders, delivery flexibility, and creation of an efficient delivery system that meets customers' needs (Forslund 2012). In simpler terms, logistics performance measurements can be summarized as the ability to process orders in the shortest time at the lowest cost without affecting service and product quality (Kersten & Koch 2010). The ultimate aim of logistics is to respond to customer needs while minimising logistics costs. As logistics performance measurement is typically based on customer order fulfilment, it consists of delivery reliability or perfect order fulfilment and responsiveness or order fulfilment lead times (Supply Chain Council 2010).

Supply chain logistical integration implies fully integrated logistical processes within the supply chain, resulting in value creation that involves six critical areas of competence, all of which are related to effective integration (Stank et al. 2001a): customer, internal, material/service supplier, technology and planning, measurement, and relationship integration (Bowersox et al. 1999). In addition, supply chain integration should extend to information integration, logistics operations coordination, organisational relationships (Lee 2000, Alfalla-Luque et al. 2013) and institutional support (Cai et al. 2010). A comprehensive review of the pertinent literature (provided in Chapter 3) will include all sources pertaining to the current study and will examine these concepts in depth. More specifically, it will cover the significant factors of each dimension that might affect perfect order fulfilment and order fulfilment lead times. In sum, this study aims to identify the relationship among information integration, logistics operations coordination, organisational relationship, institutional support, and perfect order fulfilment and order fulfilment lead times. It is envisaged that the findings yielded by this research will serve as a framework for improving the Thai egg logistics distribution system.

1.4 Research problem and study objectives

The aim of the present study was to identify the factors that have the potential to significantly affect information integration, logistics operations coordination, organisational relationships, and institutional support, with the goal of improving logistics performance, and in particular perfect order fulfilment and order fulfilment lead times in the context of the semi-industrial

Thai egg production. To achieve these aims, this study was guided by the following research questions:

1) Which factors have the potential to significantly influence information integration, logistics operations coordination, organisational relationships, perfect order fulfilment, and order fulfilment lead times with the goal of improving logistics distribution?
2) Would information integration have a positive influence on perfect order fulfilment and order fulfilment lead times?
3) Would logistics operations coordination have a positive influence on perfect order fulfilment and order fulfilment lead times?
4) Would organisational relationships have a positive influence on perfect order fulfilment and order fulfilment lead times?
5) Would institutional support have a positive influence on perfect order fulfilment and order fulfilment lead times?

Answers to the first question will provide insights into the factors that have the potential to significantly affect information integration, logistics operations coordination, organisational relationships, institutional support, perfect order fulfilment and order fulfilment lead times. Moreover, the study findings will also explain how these factors are significantly related to information integration, logistics operations coordination, organisational relationships, institutional support, perfect order fulfilment and order fulfilment lead times. On the other hand, answers to the remaining research questions will provide insights into whether information integration, logistics operations coordination and organisational relationships could positively influence perfect order fulfilment and order fulfilment lead times.

1.5 Significance of the study

This study aims to analyse the most important factors that can assist in improving logistics integration performance in Thai egg distribution. As a part of this research, a framework will be developed, based on the key factors in four dimensions, namely (1) Information integration, (2) Logistics operations coordination, (3) Organisational relationship, and (4) Institutional support. Its significance thus lies in identifying the key factors in the Thai egg distribution where more effective logistics (as achieved through the integration of all the logistics steps in the supply chain) can contribute to the performance improvements in this sector. In other words, this study will provide information that enables those operating (farmers, distributors and retailers) in the Thai egg industry to improve their logistical strategy for integration that will benefit to improve productivity of the sector. Moreover, the research can show policy guideline for government policy maker for further improving the sector. This research will extend the extant knowledge pertaining to the optimal supply chain management strategies by proposing the changes and improvements in the supply chain integration in order to achieve effective logistics distribution in Thailand's egg semi-industrial.

Previous studies on supply chain integration have yielded very few published articles that address agricultural supply chain integration and there is not enough empirical evidence to prove that extended supply chain integration leads to improved performance (Naslund & Hulthen 2012). Moreover, most extant studies have focused on the relationship between factors affecting supply chain integration and logistics performance in general (such as Stank et al. (2001a), Boon-itt & Paul (2006), Wong et al. (2011), Alfalla-Luque et al. (2013), Prajogo & Olhager (2012)), failing to consider specific demands placed on the agricultural sector and, specifically in egg production. The strategic fit of supply chain integration leads to the improvement of firms' capability to meet customer requirements (order fulfilment), which implicitly leads to the creation of competitive advantages in the industry (Sha et al. 2008). Therefore, this study will fill the gap in the extant knowledge by focusing on identifying the significant factors in supply chain integration that affect logistics distribution performance of Thai egg semi-industrial sector. Moreover, the findings this study will yield are expected to help the industry practitioners in their attempt to achieve a complete supply chain integration strategy aimed at improving logistics performance of Thai egg semi-industrial sector.

This study will also provide practical contribution in the aspects of egg supply chain. For example, the findings will be relevant for improving performance of farms, logistics distributors and wholesalers in the Thai egg industry. The knowledge gained through this project will help improve logistic performance within the entire supply chain, thus reducing costs, bolstering response to customers' needs, and developing a competitive advantage in Thai egg logistics distribution. Moreover, effective logistics performance in Thailand's egg semi-industrial production system can help to reduce total logistics cost, increase profits and improve the response to customer needs (order fulfilment). Finally, it will create competitive advantage to the firms involved in the supply of eggs (in particular those in semi-industrial settings) that adopt these ideas. The outcome might also benefit other agricultural sectors that have similar logistics requirements to those of egg distribution (primarily fresh food items or short shelf-life products).

In addition, this study will provide information and knowledge that can be used to improve logistics strategy. In turn, this will enable marked improvements in efficiency and effectiveness of the participants in the perishable food industries (meat, poultry, fish, dairy products and all cooked leftovers, including eggs). In summary, the information this study will yield will allow the practitioners to improve the effectiveness of logistics distribution in Thailand's egg semi-industrial logistics distribution.

1.6 Structure of the thesis

This thesis commences by providing a critical review of relevant information regarding logistics integration (information integration, logistics operations coordination, organizational relationships and institutional support) for improving logistics performance (delivery reliability/perfect order fulfilment, responsiveness/order fulfilment lead times) in Thai egg semi-industrial production. This provides the context to the present study and informs the reader of the gaps in the extant knowledge. The work carried out is presented in eight chapters (see in Figure 1.1), briefly outlined below:

- Chapter 1 (introduction) provides the background information by identifying the research problem, the objectives of the research, significance of the study and the structure of the thesis. This chapter aims to present the research objectives, provide justification for the study and outline its contributions to research and practice.
- Chapter 2 (literature review) presents a detailed review of the pertinent literature, including SCM frameworks, SCI & logistics, agricultural logistics, and logistics integration in the Thai agricultural sector. This chapter aims to provide a comprehensive overview of extant literature sources that address topics relevant to the study framework and objectives.
- Chapter 3 (theoretical, contextual and conceptual background) describes the development of the theoretical, contextual, and conceptual model, and presents the research questions and hypotheses guiding the study. Its aim is to provide theoretical, contextual and conceptual background of the research.
- Chapter 4 (research design and methodology) describes the methodology used to empirically test the conceptual model developed in the study, and outlines the

quantitative methods employed in the data collection and analysis. This is followed by the development of the research instruments, the tests of their validity and reliability, as well as ethical considerations. The sample selection, data collection methods and the statistical techniques used in data analysis are also presented in this chapter. Thus, the aim of this chapter is to provide pertinent information on the methodologies that are used to answer the research questions and thus meet the study objectives.

- Chapter 5 (data preparation and preliminary analysis) reports the results of the preliminary analysis of the data gathered via a quantitative survey of the participants in the semi-industrial Thai egg logistic distribution chain. This is followed by the discussion of the initial findings, including data cleaning, comparison of respondents' characteristics, non-response bias, common method variance (CMV), exploratory factor analysis (EFA), response rate and respondent demographics. In sum, this chapter aims to provide the main results stemming from preliminary analyses of the gathered data.
- Chapter 6 (structural equation modelling analysis) presents the main data analysis related to testing and developing the model of measurement, construct and conceptual framework by utilising multivariate analysis using confirmatory factor analysis (CFA) and structural equation modelling (SEM). This chapter aims to represent the results of the CFA and SEM conducted in this study, as this directly relates to the research questions and study objectives.
- Chapter 7 (discussion) provides a discussion of the quantitative findings that help answer the research questions and test the hypotheses. It highlights the new relationships that have evolved as a result of the present study findings. Thus, its main aim is to outline the main study findings and discuss them in the context of extant research and study objectives.
- Chapter 8 (conclusions, implications, limitations and recommendations) provides a broad overview of the research carried out and its key findings. The limitations of the study, theoretical and practical implications and study significance are also discussed. The chapter closes with some recommendations for further research in this field. This chapter closes the thesis and thus aims to present the summary of all research findings, along with their implications for research and practice. In addition, study limitations help situate the present work and offer opportunities to provide recommendations for future research directions in this field.

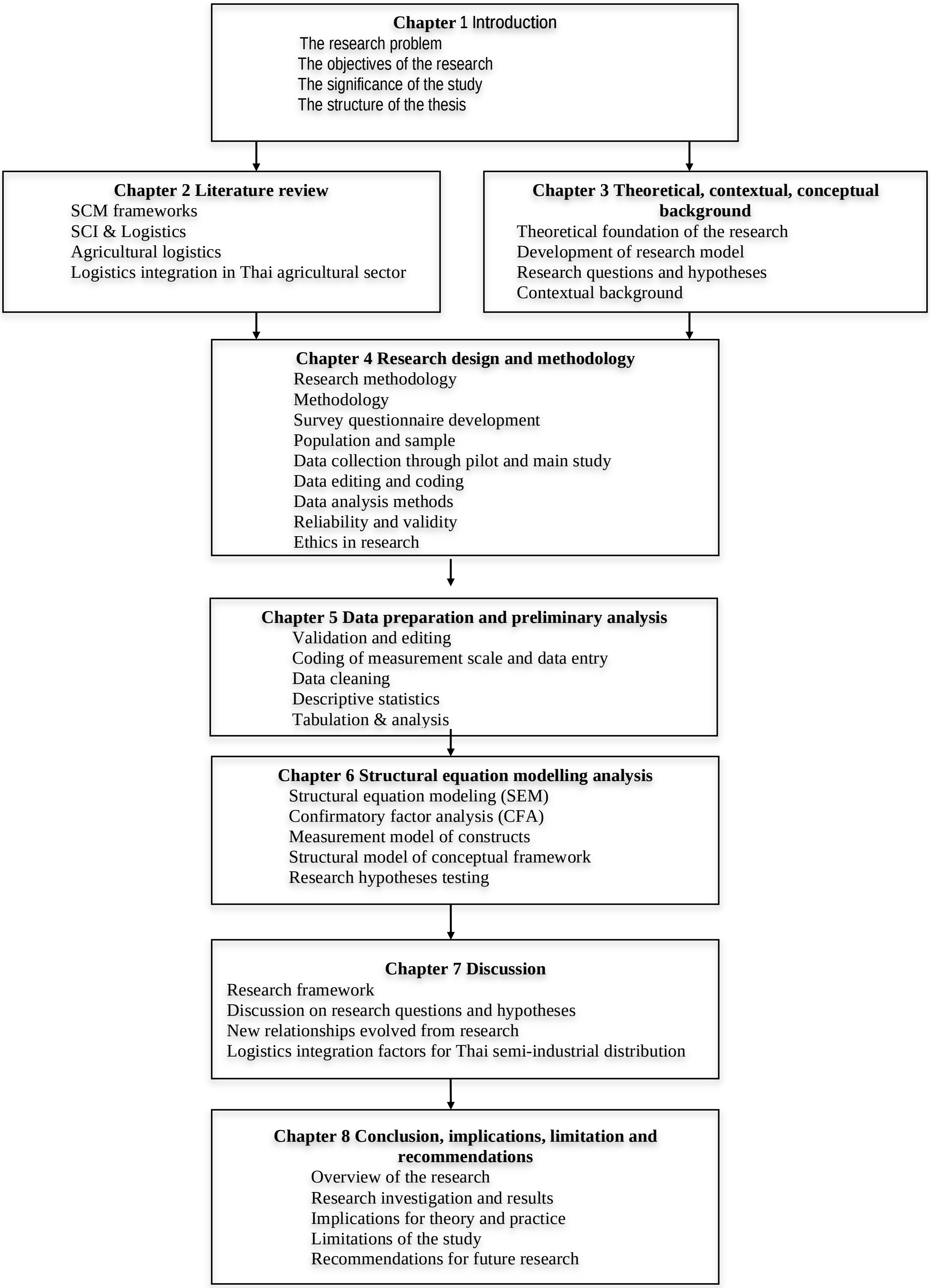


Figure 1.1 Structure of the thesis

1.7 Summary

This chapter has presented the background of this research, and has provided a detailed review of extant literature, thus helping identify the theoretical and practical gaps in the current knowledge in this filed. It outlined the study topic, and explained the need to conduct this type of study. In addition, it stated the research problem and study objectives, as well as the significance of the study. It also outlined the structure of this thesis, guiding the reader through the content that follows.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter presents review of extant literature focusing on the issues pertaining to the agricultural logistic integration in supply chain management (SCM), both in general context and the Thai context, which is of particular interest for the present study. Literature sources on general SCM characteristics are discussed first, followed by the historical development of SCM and SCI. Next, SCM frameworks and SCI in agricultural logistic are analysed, helping to identify the relationships between agricultural logistics, SCI and SCM. Finally, the review focuses on three aspects that are of main interest for the present study—SCM, agricultural logistics, and logistics in Thai agricultural sector.

2.1 Supply chain management (SCM)

Supply chain management (SCM) refers to the integration of interlinked and often inter-dependent business processes within the entire supply chain, commencing with the point of origin and ending at the point of sale or consumption (Lambert et al. 1998). It involves the original suppliers, as well as all parties in the product chain that provide products, services, and information that adds value for stakeholders and customers (Basnet et al. 2003, Sandhu et al. 2013).

2.1.1 The definitions of SCM

SCM allows systemic, strategic coordination of the traditional business functions and strategies within a particular organisation and across all businesses within the supply chain. Its main aim is to improve the long-term performance of the supply chain as whole and within the individual organisations (Mentzer et al. 2001). SCM comprises of all activities from production of raw materials through to delivery and sales to the customers. It thus includes sourcing raw materials and parts, manufacturing and assembly, order entry and order management, warehousing and inventory tracking, distribution across all channels, delivery to the customer, and the information systems necessary to monitor these activities (Lummus et al. 2001). Researchers and practitioners in this field have addressed the concept of SCM differently, with some perceiving it as an extension of logistics, others treating it as synonymous to logistics, and some as an all-encompassing approach to business integration (Cooper et al. 1997).

There are many definitions of SCM available in the academic and professional literature (see in Table 2.1). In Table 2.1, some of the well known supply chain definitions are summarised to identify the key focuses of supply chain.

Table 2.1 The Summary of SCM definitions and key focuses

Key points emphasized on SCM definition	**Definitions**	**Source**
Integration of flows	SCM is an integrative philosophy applied to manage the entire flow of a distribution channel from supplier to ultimate customer	Ellram& Cooper (1990)
	SCM is generally considered to involve integration, coordination, and collaboration within and across firms belonging to the entire supply chain.	Stank et al. (2001a)
	Supply chain deals with total flow of materials from suppliers to end users is managed as a collaborative and cohesive process.	Jones & Riley (1993)
Process of integrating	Integration of all business processes involved in the supply chain	Cooper et al. (1997)
	SCM is the integration of key business processes, from suppliers to end users	Lambert et al. (1998)
	SCM is a process of integrating a chain of entities such as suppliers, manufacturers, warehouses, and retailers.	Sandhu et al. (2013)
Supply and demand integration	Supply chain management integrates supply and demand management within and across companies.	CSCMP (2013)
	Supply chain considers integration of all the value-generating elements in the supply, manufacturing, and distribution processes.	Basnet et al. (2003)
	SCM implies managing the entire chain of events and processes performed by the supplier, the distributor, and the customer in order to create one efficient, cost-effective and cohesive process.	Elmuti (2002)

Cooperation and co-ordination	SCM enables full cooperation of all entities (sourcing, manufacturing, warehousing, distribution, and ending with delivery to the customer) involved in a supply chain,	Folkerts&Koehorst (1997)
	Supply chain means coordination of the traditional business functions and activities across all business functions.	Mentzer et al.(2001)
Network of relationships among key stakeholders	Supply chain manages the interface relationships among key stakeholders and enterprise functions that occur in the process of maximization of value creation	Walters & Lancaster (2000)
	SCM is the management of a network of relationships within a firm and between interdependent organizations.	Stock & Boyer (2009)
	SCM encompasses the planning and management of all activities involved in conversion, sourcing and procurement.	Council of Logistics Management (2003)
Internal and external integration	SCM focuses on establishing internal and external links for enabling effective and timely communication channels for cost-effective outsourcing of services.	Meredith & Roth (1998)
Information Integration	SCM pertains all activities from handling raw material, through sales and delivery to the customer in the provision and utilization of information systems necessary for monitoring and performing all chain activities cost-effectively and efficiently.	Lummus et al. (2001)

From Table 2.1, it can be seen that most of the supply chain definitions are focusing on integration of various elements of supply chain such as: information integration, internal business process integration, external partners and stakeholders integration, information integration, integration of supply and demand management. It means SCM encompasses management of a network of relationships, which implies integration, co-operation, coordination, collaboration and effective sharing of information. It pertains to all partners in the supply chain (suppliers, manufacturers, wholesalers, retailers, and customers), which could be internal, external, or third party companies. Thus, in implementing SCM, the aim is to provide the benefits (with the focus on profit, value, efficiencies and achieving customer needs) that meet the needs of all the parties involved, in a cost-effective and efficient manner.

2.1.2 SCM developments

Supply chain management discipline consists of some knowledge areas that were developed over time. SCM knowledge areas comprise many different fields that help execute product, information and logistics flows successfully. From SCM definition (Table 2.1), it can be seen that most of the definitions are emphasising on issues of integration. Supply chain focuses primarily on process integration and use of information technology, whereas management of supply chain relate to collaboration among chain partners, strategic management, supplier management, logistics operations, manufacturing, demand management, and customer accommodation management (Carter & Ellram 2003, Giunipero et al. 2008, Soni & Kodali 2013).

In the following, a glimpse into the historical development of the concept of SCM will be extended to the understanding of SCM. Due to this variability in the understanding of SCM and logistics, historical development of the two concepts are summarized in the timeline shown in Figure 2.1. As can be seen in Figure 2.1, the developments in the field of logistic and SCM eventually led to the emergence of SCI as we understand it today.

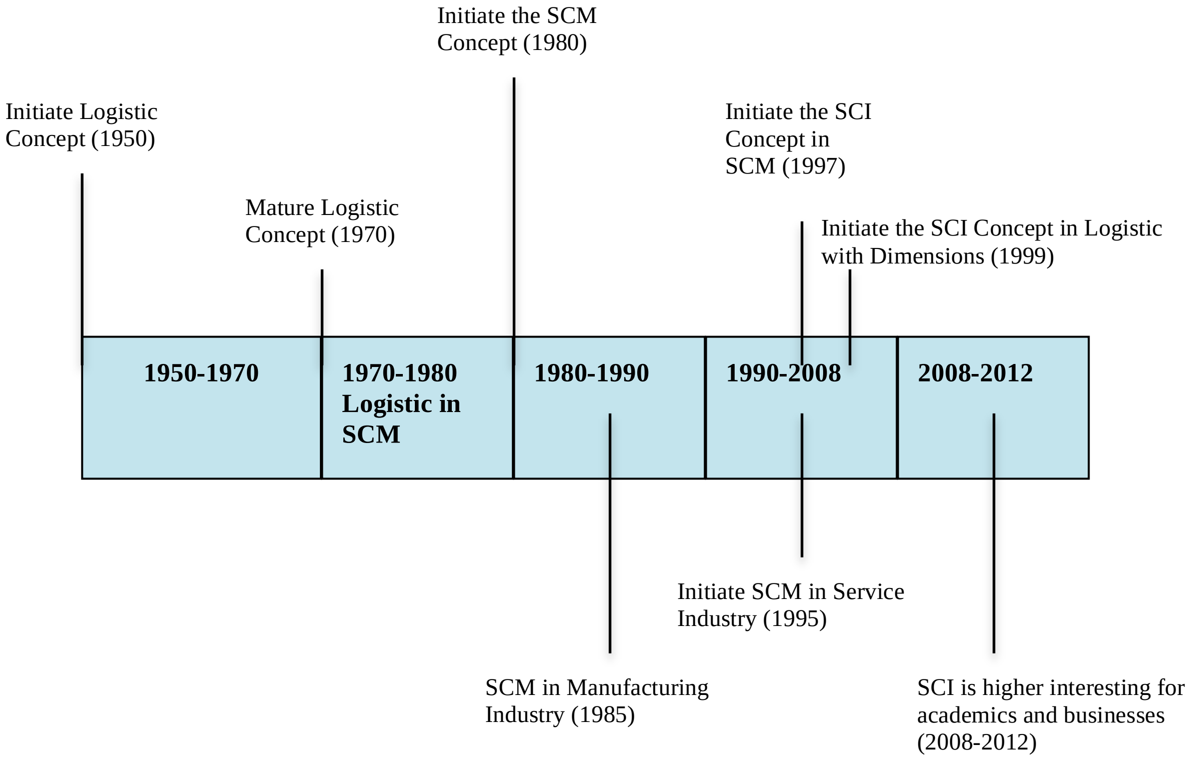


Figure 2.1: The historical timeline of SCM (Adapted from Habib and Jungthirapanich (2008) and Soni and Kodali (2013))

The term ‘logistics’ was first used in the context of military activities, its origins dating back to the late 18th and early 19th century. Its wider usage commenced following the World War II, in recognition that some of the military practices could be utilised in civilian context. The development of logistics as a practice in the US was prompted by the post-war necessity to rebuild the country and its infrastructure, as well as the need to improve circulation of goods. The original term derives from the Greek *logistikos* that means “skilled in calculating” (Tseng et al. 2005, Mangan et al. 2012). The concept of logistics has evolved over time in response to a wide range of factors, including changes in the business environment and market demands, as well as changes in communication systems, transport, etc. (Grunnet 1996 cited in BITRE (2001)). For example, in the 1950s, the focus was on keeping accurate inventory, whereas product distribution was the most important aspect of supply chain in the 1960s, and the 1970s business models emphasised production (BITRE 2001).

The interest in SCM has steadily increased over time, in particular since the 1980s, when firms started to recognise the benefits of collaborative relationships within and beyond their own organisation (Lummus & Vokurka 1999). The SCM concept first appeared in manufacturing industry in the mid 1980s, when, for the first time, the flow of goods from the manufacturer to the customer was seen as a single interlinked process. This became known as a supply chain, to be viewed as a single entity, rather than set of linked segments with fragmented responsibility assigned to respective departments, such as purchasing, manufacturing, sales, and distribution (Houlihan 1985). Keith Oliver, a consultant at Booz Allen & Hamiton, was the first person to use the term supply chain management (SCM). He did so in an interview for the Financial Times in 1982. However, it was not until the mid-1990s that the expression became more widely utilised. In the mid- to late 1990s, a number of books and articles were published on the subject, allowing SCM to rise to prominence as a management buzzword. Subsequently, operations managers began to use the term SCM with increasing regularity (Blanchard 2010). In 1995, a study was conducted in order initiate SCM that focuses on the use of third-party logistics providers by shippers in the United States as a part of their core business-supply chain integration. The aim of this project was to identify and understand the key aspects of the alliance between third-party operators and transportation providers in order to create vertically integrated logistics service. Moreover, the findings were used to highlight the potential pitfalls of avoiding dealing with third-party providers, as well as advantages of entering into such contracts (Troyer & Cooper 1995).

As previously noted, at present SCM is defined as the integration of key business processes, from the original suppliers to end users, and involves all parties that provide products, services, and information that add value for stakeholders and customers (Cooper et al. 1997, Lambert et al. 1998). Consequently, supply chain logistics integration can be evaluated using six critical areas of competence, namely customer integration, internal integration, material/service supplier integration, technology and planning integration, measurement integration, and relationship integration (Bowersox et al. 1999). In a study conducted by Stank et al. (2001), these six logistics integration competencies were used to design a survey questionnaire, which was distributed by mail to the senior logistics or supply chain executives in all North American-based manufacturing companies, as well as wholesale/distribution businesses, and retail firms listed in the Council of Logistics Management membership directory. This was a first study on SCI that tested the validity of the six dimensions in evaluating the logistic supply chain integration quality (Stank et al. 2001a). Thus, in a time span of less than one century, what was initially primarily military concern became a widely accepted business practice, as the value of SCM in a wide variety of contexts became apparent (Monczka et al. 2002). Logistics has since become an integral part of the modern production processes. While SCM has become widely accepted, there is still no consensus regarding its definition and function within the business model (Larson & Halldorsson 2004).

2.1.3 SCM frameworks

The concept of framework can be extended to include a set of basic assumptions or fundamental principles of intellectual origin in which discussions and actions can proceed (Popper 1994). In the SCM context, framework presents an approach to handling/developing/implementing a particular situation/process/philosophy. It prescribes a set of elements or constructs that constitute the situation/process/philosophy. To achieve its objectives, a framework must depict the complete structure of relationships between elements of the system under study, rather than simply identifying the elements comprising the system. Moreover, the chosen framework must describe stages of activities to be used for the designated purpose. The activities involved, which connect various elements of framework, must also be described (Soni & Kodali 2013). Researchers and managers can greatly benefit from the following four SCM frameworks, which were developed in order to standardise the approach to SCM and make the access to information and tools easier for all supply chain members: (i) the supply chain operations reference (SCOR) model; (ii) the global supply chain forum (GSCF) framework; (iii) collaborative planning, forecasting, and replenishment

(CPFR) tool; and (iv) the chartered institute of purchasing & supply (CIPS) intelligence. As these frameworks are frequently used in SCM (Lambert et al. 1998, Lockamy III & McCormack 2004, Eriksson et al. 2006, Attaran & Attaran 2007, Naslund & Williamson 2010, CIPS 2012), each is described in more detail in the following sections.

***(i)* Supply chain operations reference (SCOR) model**

The supply chain operations reference (SCOR) model aims to integrate well-known concepts, such as business process benchmarking, reengineering, and process measurement, into a cross-functional framework (Huan et al. 2004). The SCOR model was developed in 1996 by the Supply-Chain Council (SCC) and at the time, the SCOR model was comprised of four core business processes: planning, sourcing, production, and delivery. Their characteristics and functionalities served as the foundation for further development of the SCOR model (Lockamy III & McCormack 2004). The version of SCOR, was introduced in 1997, represented the culmination of 12 months of intensive collaboration of 70 world-class manufacturers from diverse industry segments in Europe. The processes associated with sourcing, production, and delivery activities of the SCOR model create a continuous chain of activity throughout a firm's internal operations and, potentially, across the entire inter-organisational supply chain. The high level planning process balances aggregate demand and supply to develop a course of action that best meets the company requirements, and addresses the specific characteristics of the sourcing, production, and delivery activities (Lambert et al. 2005). In the updated version of SCOR, which was published in 2001, returns were added as one of the components, in order to enhance the model validity. Each of the five processes SCOR now describes is implemented by progressing through four individual levels. The first level defines the scope and content of the model itself, in addition to specifying basis for competition performance targets. At level two, firms implement their operational strategies, in line with the chosen supply chain configuration. Level three defines inputs, outputs, and flows of each transactional element. Finally, level four defines the implementation of specific SCM practices (Lockamy III & McCormack 2004).

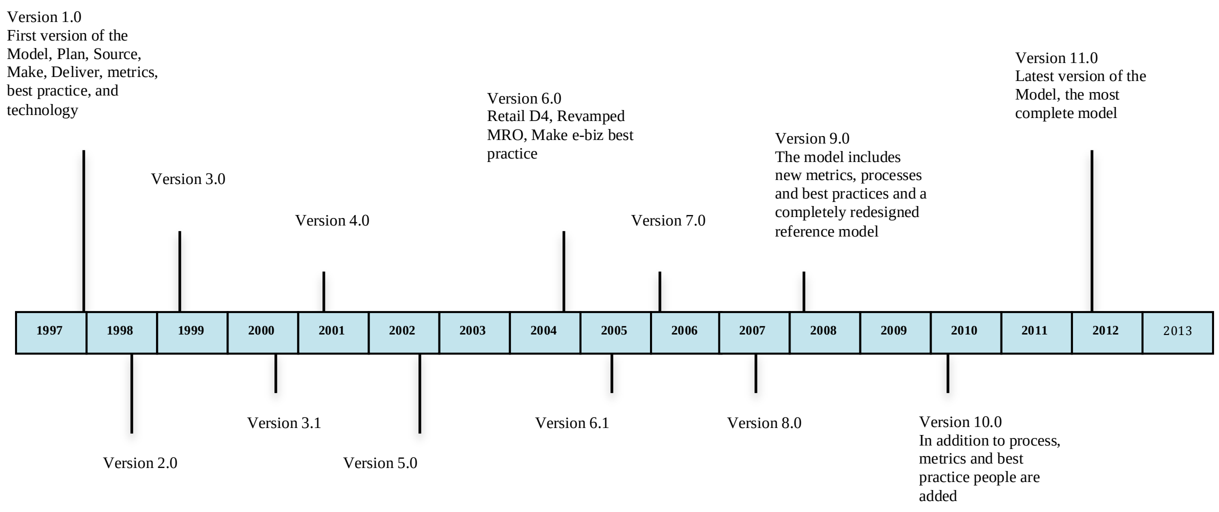


Figure 2.2: SCOR release timeline, adapted from Georgise et al. (2012)

The SCOR model has been subjected to several revisions since 2001. The timeline of revisions to the model is shown in Figure 2.2. It can be seen that the SCOR model version 11.0 is the latest modification and the one that is currently in use. The latest version of SCOR identifies five core supply chain performance attributes: reliability, responsiveness, agility, costs, and asset management. Without these characteristics, it is difficult to compare an organisation that strategically chooses to be the low-cost provider against an organisation that chooses to complete on reliability and performance (SCC 2012a). To provide a platform that assists in making such comparisons and allows a company to make objective assessment of its performance, SCOR model provides a unique framework that links performance metrics, processes, best practices, and people into a unified structure. The framework supports communication between supply chain partners, as well as enhances the effectiveness of SCM, technology, and related supply chain improvement activities (SCC 2010).

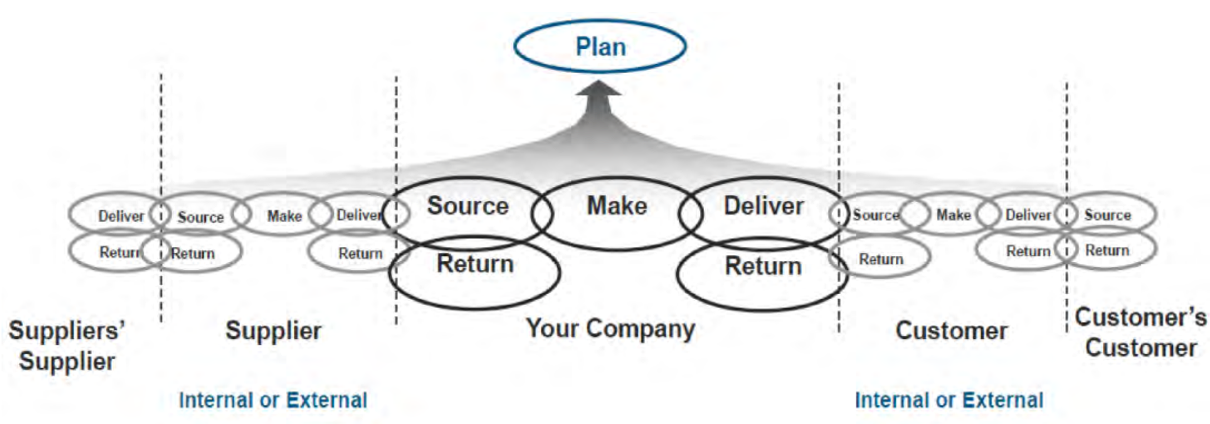


Figure 2.3: The SCOR structure [Source: SCC(2010)]

Figure 2.3 represents the SCOR structure, revealing that its processes extend across a wide network that includes not only the immediate partners and collaborators, but also those that they interact with, such as the organisation supplier's supplier and organisation customer's customer. It includes all customer interactions, from order entry through paid invoice; all product (physical material and service) transactions, including equipment, supplies, spare parts, software, etc.; and all market interactions, from understanding aggregate demand to the fulfilment of each order (SCC 2010).

(*ii*) Global supply chain forum (GSCF) framework

The global supply chain forum (GSCF) framework identifies eight key processes that form the foundation for SCM (Lambert et al. 1998). As shown in Figure 2.4, which depicts the organisation as a silos, these processes are customer relationship management, customer service management, demand management, order fulfilment, manufacturing flow management, supplier relationship management, product development and commercialisation, and return management (Cooper et al. 1997). Each process is cross-functional, cutting through functional silos within each organisation (Croxton et al. 2001). The functions included in GSCF model are marketing, research and development, finance, production, purchasing, and logistics. Each process is furthermore broken down into a series of strategic sub-process, thus providing the blueprint for implementation of the framework (Lambert et al. 2005). Although each of the eight processes should be considered by all firms in each supply chain, as the significance of each process may differ, they will be implemented according to the company needs and proprieties (Croxton et al. 2001). For example, while some firms may need to consider just one key process, others must link multiple processes. It is thus essential to identify and analyse all the key processes, in order to successfully integrate and manage each specific case (Cooper et al. 1997). Moreover, under this model, coordinating activities within the firm is another important prerequisite for successful SCM (Lambert et al. 1998).

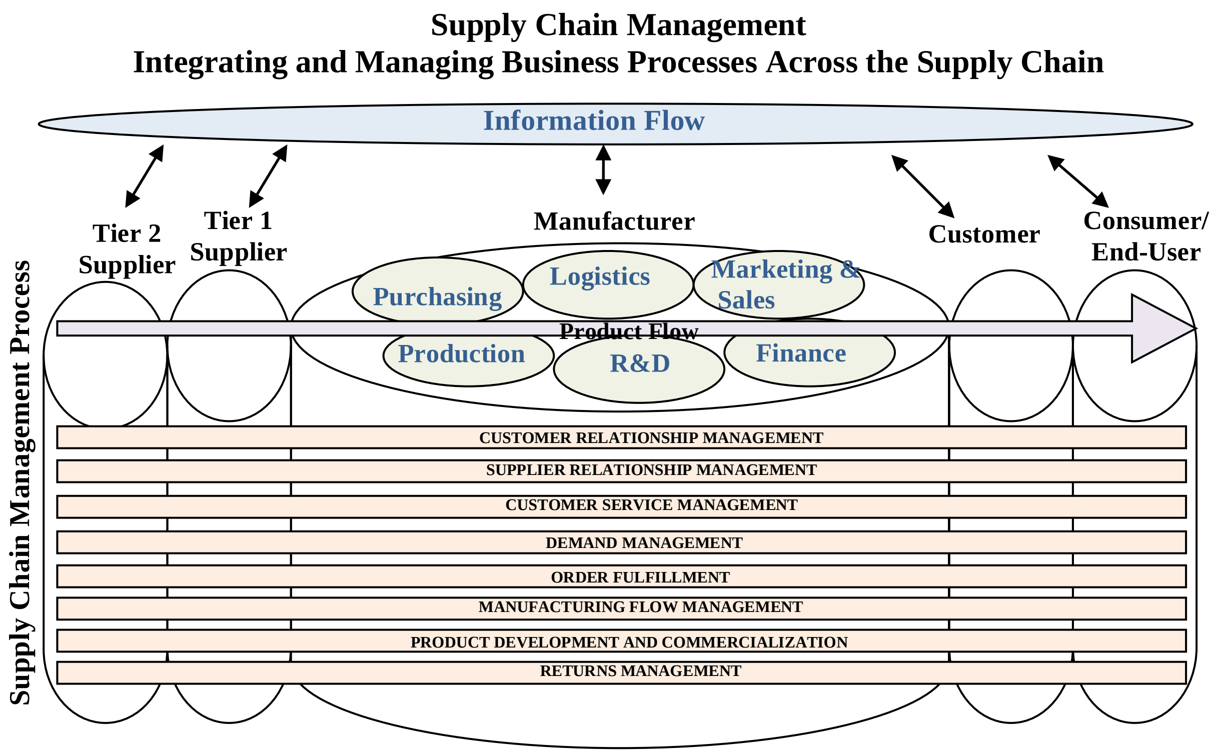


Figure 2.4: The global supply chain forum (GSCF) model [Source: Lambert et al. (1998)]

(*iii*) Collaborative planning, forecasting, and replenishment (CPFR) tool

The collaborative planning, forecasting, and replenishment (CPFR) tool was developed in order to provide a unified methodology for improved supply chain collaboration. The final CPFR model that emerged was implemented in a web-based format, making it widely accessible and easy to use. It helps firms coordinate various activities between supply chain trading partners, such as production and purchase planning, demand forecasting, and inventory replenishment (Attaran & Attaran 2007). The main aim of CPFR is to facilitate the exchange of the internal information over a shared web server, in order to provide more reliable and long-term views of demand within the supply chain (Fliedner 2003). This platform benefits all the users, as due to the enhanced visibility of all the components and processes in the supply chain, inventory reductions, improved customer service and sale increases can be achieved by both retailers and manufacturers (Cassivi 2006). The CPFR process is divided in four stages, as shown in Figure 2.5. The first step is planning, which involves a front-end agreement and the development of a joint business plan between the supplier and the customer. Step two pertains to forecasting of demand and supply and involves the creation of sales and order forecasts. Step three refers to the execution, whereby the order is generated, after which the products are shipped, received and stocked on retail shelves. The final step is analysis, performed so that trading partners can come together to share insights and adjust strategies in order to improve planning and execution performance going forward (Cassivi 2006, Attaran & Attaran 2007).

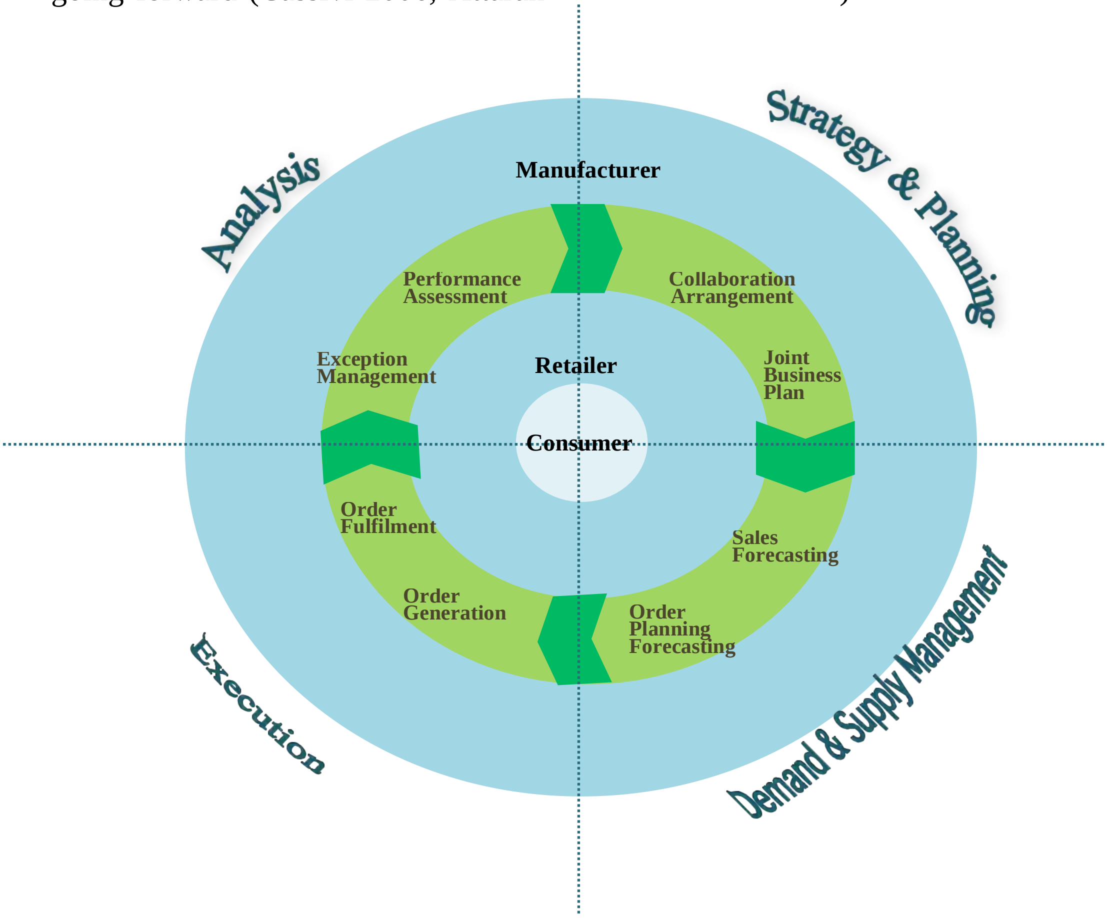


Figure 2.5: The collaborative planning, forecasting, and replenishment (CPFR) model, [Source: Attaran & Attaran (2007)]

(*iv*) Chartered institute of purchasing & supply (CIPS) intelligence

The CIPS defines SCM as the continuous planning, developing, controlling, informing and monitoring of actions within and between supply chain members, aiming to create an integrated supply process that meets overall strategic goals (CIPS 2012). As shown in Figure 2.6, under CIPS, the process of SCM includes strategic issues (optimising the network of product distribution and collaboration with partners), as well as tactical and operational issues (demand forecasting, order promising, materials sourcing, production, distribution planning, scheduling and inventory control) (Eriksson et al. 2006). Effective SCM aims to increase transparency and alignment of the supply chain's coordination and configuration, irrespective of functional or corporate boundaries. Under CIPS, SCM is based on the premise that production is treated as a flow. This is in contrast to the traditional way of managing, which was based on a conversion/transformation view of production (Cooper & Ellram 1993).

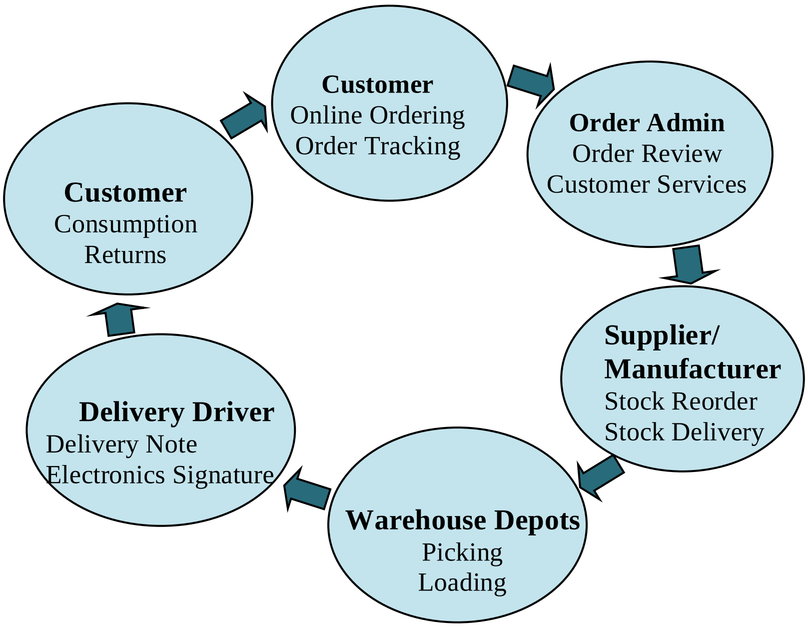


Figure 2.6: The CIPS intelligence [Source: CIPS(2012)]

2.1.4 Definition of logistics

Logistics management is responsible for planning, implementing, and controlling the forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption, in order to make the processes efficient and cost-effective while meeting customer requirements (CSCMP 2013). Logistics management is the part of SCI.

In a company, logistics is the resource group that supports the physical movement of merchandise through the supply chain. This group includes: transportation, distribution centre operations (inbound transportation, receipt, storage, processing and merchandise delivery to the stores), import, and vendor communications (Tseng et al. 2005). Logistics, when successfully executed, ensures that all the flows in the supply chain are accomplished effectively and products of expected quality physically moved to their desired location (Lummus et al. 2001). Moreover, logistics is the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods, services, and related information, from the point of origin to the point of consumption. Its main value proposition of logistics are to ensure that customer needs and expectations pertaining to the quality of goods and services are met at all times in a cost-effective and efficient manner (Mangan et al. 2012). Successfully implemented logistics enable anticipating customer requirements; facilitate acquisition of the capital, materials, people, technologies, and information necessary to meet those requirements; assist in optimising the goods- or service-producing network to fulfil customer requests; and provide means for utilizing the network to fulfil customer requests in a timely and cost-effective way (Tilanus 1997).

2.1.5 How SCI is interpreted in different research

Integration is frequently mentioned as a key characteristic of SCM (Naslund & Hulthen 2012). SCI is one of the major performance-improving factors in the supply chain management (van der Vaart & van Donk 2008). SCI refers to collaborative intra- and inter-organisational management at the tactical, strategic and operational activity levels, from the treatment of raw materials, through finished products, to the efficient and cost-effective response to customer needs (Frohlich & Westbrook 2001, Bagchi et al. 2005, Flynn et al. 2010, Alfalla-Luque et al. 2013).

The supply chain integration includes information integration, logistics operations coordination, organisational relationship (Lee 2000, Alfalla-Luque et al. 2013) and institutional support (Cai et al. 2010).

Table 2.2: The definitions of SCI provided by the extant literature

SCI integration focus	Source
Six critical areas are important in SCI: (i) customer integration, (ii) internal integration, (iii) material/service supplier integration, (iv) technology and planning integration, (v) measurement integration, and (vi) relationship integration.	Bowersox et al. (1999)
SCI pertains to supplier (or upstream), customer (or downstream) horizontal (associated with all processes within the supply chain) integration.	Vickery et al. (2003)
SCI includes three main approaches: (i) external integration (between supplier and customer) and internal (within the entities belonging to the organisation) integration, (ii) process integration, and (iii) information/data and physical/material flows integration	Alfalla-Luque et al. (2013)

SCI is the coordination and management of the upstream and downstream product, service, financial and information flows, through extended network of the supplier's key suppliers and the customer's key customers.	Naslund & Hulthen (2012)
SCI can be perceived as the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organisational processes.	Flynn et al. (2010)
SCI is the strategy that encompasses all material and product flows within the supply chain, commencing with vendors, and ending with delivery to the final consumers through a wide array of different organisational entities, as well as external (suppliers) and internal (functions) processes.	Kim (2009)

Summarising the SCI definitions (see in Table 2.2), it can be concluded that SCI is a mechanism that, when successfully applied, supports business processes across a supply network. It is closely associated with the effort to overcome intra- and inter-organisation boundaries (Romano (2003).

2.1.6 Logistics integration with the supply chain

Logistic integration is covered under SCM integration. Supply chain logistics integration is defined as the integration of logistics activities across functional departments of a firm, including the integration of the firm's logistics activities with the logistics activities of other supply chain members (Ballou 2004). A high degree of internal and external logistics integration in extended manufacture supply chains can significantly improve the performance of firms (Stock et al. 1998, 2000). Supply chain logistics integration unifies and streamlines logistical activities within the supply chain (Stank et al. 2001b). Improved logistics integration provides an organisation with better utilisation of time and space, allowing for the necessary quantity of products to reach all points in the chain efficiently, cost-effectively and in the timely manner (Prajogo & Olhager 2012). The following three approaches help accomplish this goal: (i) external (between supplier and customer) and internal integration, (ii) process integration and (iii) information/data and physical/materials flows integration (Alfalla-Luque et al. 2013). The success of each of these aspects is contingent on comprehensive collaboration among supply chain network members in strategic, operational and tactical decision-making (Bagchi et al. 2005).

Logistics performance is highly dependent on the quality, efficiency and effectiveness of the managerial involvement in the transportation of raw materials/products in a supply chain (Ngwainbi 2008) and thus affects the production speed, capacity to fill the order, delivery flexibility, and creation of an efficient delivery system that meets customers' needs (Tseng et al. 2005). In simpler terms, it can be summarised as the ability to process orders in the shortest time at the lowest cost (Christopher 2005). Supply chain logistical integration implies fully integrated logistical processes within the supply chain, resulting in value creation that involves six critical areas of competence, all related to effective integration (Stank et al. 2001a): customer, internal, material/service supplier, technology and planning, measurement, and relationship integration (Bowersox et al. 1999).

Despite marked improvements in all the individual elements that contribute to the improvements in logistics performance, at present logistics integration is unfortunately still mostly rhetoric with very little practical implementation. The theory behind it posits that a manager must recognise the challenge of balancing the inherent difficulty of collaboration with the competitive potential of supply chain management (Fawcett & Magnan 2002). Consequently, in practice logistic integration is typically very difficult to accomplish (Christopher & Juttner 2000, Power 2005), as different perceptions regarding the execution of the most optimal multi-dimensional supply chain integration framework may produce different performances results (Fabbe-Costes & Jahre 2008). There is a positive and significant correlation between logistics integration and firm performance that specific dimensions of SCI related to firm performance in relationships (Leuschner et al. 2013).

2.2 Agricultural logistics

Commercial and academic interest in SCM has steadily increased over time (Lummus & Vokurka 1999). Initially, logistics was first utilised in military, as the value of effective and streamlined management of personnel, goods, services and information flows was evident (Habib & Jungthirapanich 2008). However, it soon came to focus of civilian managers, who recognized that similar approach to their business operation can yield substantial benefits. The SCM concept first appeared in manufacturing industry in the mid-1980s, when, for the first time, the flow of goods from the manufacturer to the customer was seen as a single interlinked process. Since then, logistics, in both military and civilian contexts, has continued to develop, as new knowledge emerged and usage of information technology gained importance. In civilian contexts, logistics has mostly advanced in the areas of customer service, information technology management, marketing, and social sciences (Rutner et al. 2012). Owing to the fast pace of modern life, SCM is facing new challenges, and the key focus for most companies today is on shortening the product life cycles and decreasing time to market. Although SCM is a well known and frequently utilised framework, supply chain and logistics integration within the agricultural sector is not well researched, as most extant studies focus on business and manufacturing logistics (Salin 1998). Consequently, agricultural product logistics differs from its industrial counterpart, as most agricultural products are characterised by easy putrescence and necessity of freshness (Yingxia & Xiangyu 2006). Given the aforementioned factors that heavily influence the success and, ultimately, profitability of the agricultural sector, in particular when dealing with highly perishable and fragile produce, supply chain management is one of the most important issues the stakeholders must address (Opara 2002, Rong et al. 2011). Thus, supply chain integration (SCI) in agricultural sector is particularly significant when managing a supply of perishable goods, such as eggs, milk and dairy products, the quality of which can easily be compromised in the course of storage and transportation (Shen et al. 2009).

2.2.1 Elements of agricultural logistics

The agricultural logistics is a relatively new concept/application area, as the underlying elements are related to the farms and farmers, as well as agricultural equipment and infrastructure, which are unique to this sector (Gebresenbet & Bosona 2012). However, other SCM elements, such as transportation, information technology, communication, planning, policies, procedures, and inventory management, are encountered in many business operations, albeit with different characteristics. Although agricultural supply chain has many similarities with supply chains in other sectors, the key difference is the importance of food safety and quality, both of which are partly dependent on the factors that are difficult to control, such as weather, inherent natural produce characteristics, etc. (Salin 1998). Consequently, agricultural logistics differs from its industrial counterpart, as most agricultural products are characterised by easy putrescence and necessity of freshness (Yingxia & Xiangyu 2006).

In the context of supply chain management, the most important characteristics of agricultural products include their limited shelf life, price variability and their demand, as these factors make the supply chain harder and more complex to manage in comparison to other supply chains (Ahumada & Villalobos 2009). Given the aforementioned factors that heavily influence the success and, ultimately, profitability of the agricultural sector, in particular when dealing with highly perishable and fragile produce, supply chain as well as logistics management is one of the most important issues the stakeholders must address (Opara 2002, Rong et al. 2011).

Logistics integration (SCI) with the agricultural supply chain is particularly significant when managing a supply of perishable goods, such as eggs, milk and dairy products, the quality of which can easily be compromised in the course of storage and transportation (Shen et al. 2009). In the context of Thai egg industry, the issues facing the egg distribution logistics in small or medium-sized (semi-industrial) farm production systems stem primarily from lack of streamlined and effective information and payment flows, as well as the absence of uniform framework that governs creation and distribution of products in the supply chain management (TDRI 2012). Absence of integration between internal and external logistics is also evident, partly due to the fact that the information technology, as a part of logistics systems, has not fully been utilised (Suthiwartnarueput 2007). Thus, SCI might be of significance when attempting to improve logistic distribution in Thai semi-industrial egg production.

2.2.2 Agricultural products and logistics issues

Agricultural supply chain is a network of organisations responsible for different processes and activities that can be broadly grouped into production, distribution, processing, and marketing, all of which comprise a cohesive unit the aim of which is providing quality agricultural products and services to the customers in the timely and cost-efficient manner (Ahumada & Villalobos 2009, Christopher 2011). Agricultural logistics deal with different types of natural products. Classification of agricultural products can be based on the type of food, such as plant-based, and animal-based extracted from the nature**.** Agricultural products are fresh products (e.g. flowers, fruit, fish, and vegetables), processed products (e.g., meals, sauces, etc.), long shelf life produce (e.g., grains, pulses, spices, etc.) and animal produce (e.g., meat, eggs, milk, dairy, etc.) (Shukla & Jharkharia 2013). According to shelf life, agricultural produce can also be broadly classified into (1) non-perishable (long life) produce, (2) semi-perishable (medium life), and (3) perishable foods (short life) (OTA 1979, Roday 1999). The last group of products is characterised by a very short life during which the food is fit for sale (typically referred to as 'shelf life'); hence, the supply chain must work efficiently and ensure that the food quality and safety is not compromised before reaching the retailers, and ultimately consumers (OTA 1979, Rong et al. 2011)

Agricultural Products can be classification based on product shelf life and type of agricultural produce. In line with Shukla and Jharkharia, (2013) fresh products group such as animal, fish, poultry and their produce can be further divided into subcategories, as the focus is on eggs (Figure 2.7). Overall, in this research, we can categorize eggs as short shelf life, perishable poultry produce (shelf life of less than 30 days) as a subcategory of the broader group named animals/fish/poultry and their produce. Egg is a specific perishable agricultural produce, whose handling, due to its short shelf life and other characteristics, is differentiated from other agricultural supply chain types.

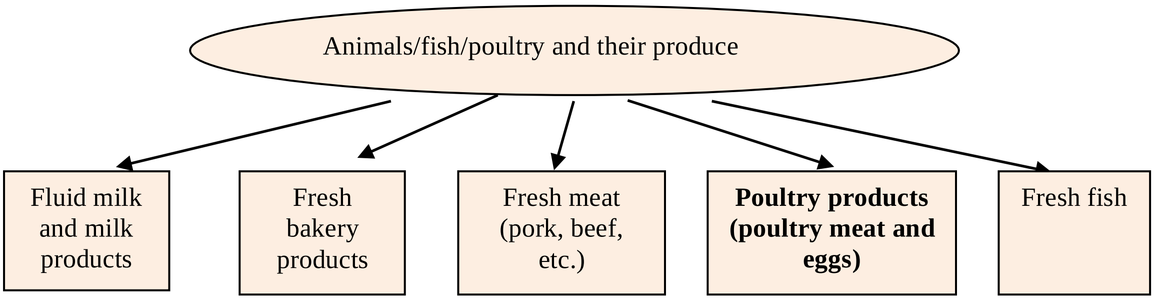


Figure 2.7: Classification of animals/poultry/fish and their produce, adapted from OTA (1979).

Agricultural logistics are defined as the collection, aggregation, storage and transport of agricultural produce from the farm to the consumer and all intermediate stages, for example, the processing facility (factory), retailers and market (Srinivas & Seksaria 2011). Agricultural product logistics are distinct from the industrial products logistics, as they are characterised by wide variety of product carried, often in large quantities and often depends on seasonal and geographical dispersion factors. In particular, perishable products like eggs are characterized by long production lead time, undetermined market demand, limited sales period, and very low value of unsold products that typically incur an additional disposal cost (Cao et al. 2007).

The inherent biological properties of agricultural products introduce unique challenges to the transport and storage processes typically associated with supply chain of any produce. Agricultural production is dependent on the caprices of seasonal and geographical dispersion, which, in turn, increase the business risks of the associated logistics. In addition, price of such highly perishable goods are typically relatively low (in particular in the areas when such goods are widely available), thus the quantity required to achieve profit is considerable, requiring low-cost logistics operation in order to generate profit (Xu 2011). The short produce durability and mandatory freshness requires certain technical measures in the logistical process, such as insect and moisture proofing, drying and antisepticising, in order to guarantee quality the customers expect. As a result, in most food industry sectors, logistics equipment facility is necessary for agricultural product logistics, including special-purpose carrier vehicles, temperature and moisture controlled warehouses and special-purpose loading, unloading and processing equipment (Yingxia & Xiangyu 2006).

Logistics at agricultural sector in specific is not well researched like business and manufacturing logistics. The agricultural logistics area is relatively new compared to business logistics. The elements of agricultural products (i.e., easy putrescence, many varieties, large scale, and product seasonality) are unique to this sector, it is not possible to simply adopt logistics approaches that have worked well in other areas. Thus, when considering agricultural logistics, it is essential to carefully analyse all aspects of farm production, required equipment or infrastructure; transportation requirements (such as temperature and humidity controlled trucks); information technology or communication limitations (given that there are many contributors to the production chain, not all will have the same technological aptitude and Internet connectivity, for example); planning, policies, procedures; and inventory management (Yingxia & Xiangyu 2006).

2.2.3 Recent trends in agricultural logistics research.

Review of extant literature focusing on agricultural logistics has revealed several streams of research, which can be broadly classified by research methods adopted (e.g., case study, survey, literature review), products (i.e. tomato, pork, beef, fish, chicken, meat, agro-food, vegetables, fruit, milk, cheese, strawberry, pineapple, sugar, rice, potato), and geographical emphasis (Sweden, UK, Spain, Eastern Europe, Eastern Africa, Asian, South Africa, India, Norway, UAE, Australia, Hungary, China, Kazakhstan, Netherlands, Senegal, Ghana, French, Italy, Nepal, Germany, Austria, Switzerland, Ethiopia, Hong Kong, US, Peru, Canada, Brazil, Morocco, Turkey, Asia, Vietnam, Europe and Generic) (see Table 2.3). It is evident that none of the previous research was conducted on Thailand and speciality for egg production sector.

Table 2.3: Research on agricultural supply chain integration – literature sources published in the 2005-2015 period

Author	Research objective	Industry/ Product	Geography	Research Method

Mintcheva (2005)	To study the supply chain of tomato ketchup production and the integrated product policy framework.	Tomato ketchup	Sweden	Case study
Taylor (2005)	To investigate value chain improvement techniques applicable to a complete food product supply chain, from farm to consumer.	Pig	UK	Case study
German et al. (2006)	To study the agricultural technology approaches and their implications on tracking produce in the supply chain.	Agri-product	Eastern Africa	Case study
Gimenez (2006)	To analyse the integration processes that firms follow when aiming to implement SCM.	Food	Spain	Empirical study
Pingali (2007)	To identify implications of the evolving demand trends for food supply and retail systems.	Food	Asia	Case study
Swinne (2007)	To investigate the role of the reform and international integration of food supply chains in Eastern Europe.	Food	Eastern Europe	Case study
Theuvsen & Franz (2007)	To explore the success factors of livestock rearing cooperatives in German pork production	Pork	Germany	Empirical study
Louw et al. (2008)	To study integration of small-scale farmers into the urban retail market.	Vegetable and fruit	South Africa	Case study
Adebanjo (2009)	To study demand management practices in a trading organisation. The goal is to understand the key principles, including forecasting, promotion management and power, and the organisational operations.	Food	UK	Case study

Chandrashekar & Muttalageri (2009)	To study supply chain management and network distribution.	Vegetables and fruit	India	Case study
Engelseth (2009)	To study the relationship between food product traceability and supply network integration (information connectivity).	Strawberry	Norway	Case study (exploratory empirical study)
Laeequddin (2009)	To explore the partner selection effect on the supply chain management practices under five perspectives of partnership, namely characteristics, economics, dynamic capabilities, technology, and institutions.	Food	UAE	Empirical study
Lu & Swatman (2009)	To study the use of mobile commerce technology to enhance information access and provision for organic primary producers with the goal of improving their integration into the grocery supply chains.	Organic agri-products	Australia	Case study (exploratory empirical study)
Szabo & Popovics (2009)	To study theoretical and practical potential for establishing private (market) coordinating organisations.	Dairy agri-product	Hungary	Case study (exploratory empirical study)
Zhang et al. (2009)	To study the manner in which governance mechanisms linking small-scale apple farmers in China with export markets were formed.	Apple	China	Case study (exploratory empirical study)
Zhang & Aramyan (2009)	To study government structure in Chinese agri-food supply chains.	Food	China	Literature review
Cormier (2010)	To study the vertical integration strategies aimed at addressing chronic supply chain problems.	Vegetable and fruit	Kazakhstan	Case study (exploratory empirical study)

Hingley et al. (2010)	To investigate barriers to network innovation in the context of food service in the UK.	Food	UK	Case study (exploratory empirical study)
Wolfert et al. (2010)	To study information integration (information sharing and organising ICT) in agri-food supply chain networks (AFSCN).	Agri-products	Netherland	Case study (exploratory empirical study)
Zhang et al.(2010)	To identify evolutionary prototyping model (EPM) that was used in the meat supply chain.	Meat	China	Case study (exploratory empirical study)
Bosona & Gebresenbet (2011)	To investigate local food chain characteristics and develop a coordinated distribution system capable of improving logistics efficiency.	Food	Sweden	Survey
Hingley et al.(2011)	To study the benefits of, and barriers to, the use of fourth-party logistics (4PL) management as a catalyst for horizontal collaboration.	Food	UK	Case study (exploratory empirical study)
Maertens et al. (2011)	To identify levels of supply base consolidation and vertical integration.	Tomato	Senegal	Case study
Suzuki et al. (2011)	To identify vertical integration by applying an adapted version of Carton’s model.	Pineapple	Ghana	Case study
Thakur et al. (2011)	To study application of electronic product code information services (EPCIS) framework for managing food traceability information.	Frozen mackerel, and corn wet milling	Generic	Case study

Traversac et al. (2011)	To investigate farm resources, transaction costs and forward (vertical) integration by examining the workflow adopted by French wine producers.	Wine	French	Empirical study
Gale & Hu (2012)	To identify the pressures imposed by food safety integration on the agricultural sector.	Pork & fresh food	China	Case study
Gupta & Roy (2012)	To study vertical coordination in the milk sector.	Milk	India	Empirical study
Ji et al. (2012)	To study governance structure choices (uncertainty, asset specificity, and willingness and capability to collaborate) in China's pork supply chain.	Pork	China	Empirical study
Papetti et al. (2012)	To examine and evaluate the integration of electronic tracking system (RFID) and its effect on quality traceability.	Cheese	Italy	Case study
Santa et al. (2012)	To study information and communication technologies, in conjunction with integration of electronics in vehicles.	Vegetable, fruit, canned food	Spain	Case study
Bastian & Zentes (2013)	To investigate the effect of governance on the four main performance dimensions in sustainable supply chain management (social, ecological, operational performance, and log-term relationship success).	Food	Germany, Austria and Switzerland	Empirical study
Bhattarai et al. (2013)	To identify the key factors in dyadic relationships between smallholders and their buyers.	Vegetables	Nepal	Case study
Bosona & Gebresenbet (2013)	To provide a comprehensive review of literature on food traceability (tracing and tracking) issues.	Food	Generic	Literature review

Dannenberg (2013)	To determine the level of integration of small farms in supply chains in the South African context using the global value chain approach.	Food	South Africa	Case study
Han et al. (2013)	To examine the supply chain integration and its dimensions (internal and external integration, buyer-supplier relationship coordination, IT integration, logistics integration) in the pork processing industry.	Pork	China	Empirical study
Jaleta et al. (2013)	To study the evolution of input supply and service provision in the dairy sub-sector.	Milk	Ethiopia	Case study (exploratory empirical study)
Kaloxylos et al. (2013)	To study the use of Internet technologies in the agriculture and food production sector.	Agri-food	Europe	Case study (exploratory empirical study)
Lai et al. (2013)	To study collaborative food safety agent system (CFSAS) based on a scalable, flexible, and intelligent multi-agent information system (MAIS) architecture that is intended to provide proactive aids and trust-based decision support to citizens when purchasing food.	Food	Hong Kong	Case study
Mainetti et al. (2013)	To study the importance and scope of traceability technology in modern agriculture.	Vegetables	Italy	Case studies
Mohan et al. (2013)	To explore the operational planning issues (food acquisition, scanning, quality control, sorting, assembling and storage) in a non-profit supply chain that distributes food for the underprivileged.	Food	US	Case study

Poppe et al. (2013)	To assess the potential of information and communication technology (ICT) to change agri-food chain processes.	Food	Generic	Case study (exploratory empirical study)
Schuster & Maertens (2013)	To study the effect of private standards (certification) on the inclusion of small-scale farmers in export supply chains.	Asparagus	Peru	Case study (exploratory empirical study)
Seed et al. (2013)	To study the impact of integrating food security into provincial government departments and public health policies.	Food	Canada	Case study (exploratory empirical study)
Simon et al. (2014)	To investigate business processes in supply chain integration based on Cooper, Lambert and Pagh reference model for SCM	Sugar and ethanol	Brazil	Case study (exploratory empirical study)
Agustina et al. (2014)	To study the application of a VRSP system (mixed-integer linear program) in cross-docking operations.	Milk	Generic	Mathematical modeling
Castellini et al. (2014)	To identify organisational arrangements and a degree of integration, as well as evaluate the existing horizontal and vertical relationships.	Wheat-pasta	Italy	Case study
Cembalo et al. (2014)	To propose a method for developing and managing integration, cooperation and coordination in bio-energy supply chains.	Energy crop	Italy	Case study
Codron et al. (2014)	To investigate the role of market forces and food safety institutions in the adoption of sustainable farming practices.	Tomato	Morocco and Turkey	Case study

Ding et al. (2014)	To ascertain the effect of supply chain practices (strategic alliance, customer focus, information sharing, information quality, learn system and antecedent cooperative behaviour) on food quality.	Beef	Australia	Empirical study
Eksoz et al. (2014)	To study a conceptual framework for factors included in collaborative forecasting in food supply chains.	Food	Generic	Literature review
Dongting et al. (2014)	To examine traceability of the information communication technologies (ICTs) and the internet of things (IOT) technologies within the entire agri-product supply chain**.**	Agro-products	Generic	Literature review
Palmieri & Pirazzoli (2014)	To study the level of integration (both horizontal and vertical) among the supply chain actors.	Potato	Italy	Case study
Reardon et al. (2014)	To explore transformation segments of the rice value supply chain.	Rice	Asia	Empirical study
Trifkovic (2014)	To study the interaction between food standards and vertical coordination in aquaculture.	Pangasius	Vietnam	Case study
Xu et al. (2014)	To study applications (near field communication (NFC), Beidou system (BDS), and global system for mobile communications) of internet of things in supply chain information systems.	Chicken	China	Case study

Note: The articles summarised above were identified via a keyword search, using “supply chain integration” or “supply chain collaboration” search strings, retaining only peer-reviewed articles published in journals specialising in the agricultural sector in the last 10 years (2005-2015). The search was conducted via Emerald, ScienceDirect, and EBSCO Business Source Complete databases.

Further research is conducted on agricultural supply chain literature to identify the key dimensions of supply chain integration. In Table 2.4, for different SCI dimensions, summary of the articles are identified with relevant key words. The authors of these studies identified seven key dimensions of agricultural supply chain integration, namely (i) information integration, (ii) operations coordination, (iii) organisational relationship, (iv) institutional support, (v) internal integration, (vi) external integration, and (vii) internal and external integration (as shown in Table 2.4).

Table 2.4: Classification of agri-supply chain integration in terms of dimensions

Dimensions	Authors	Keywords
Information integration	Taylor (2005), German et al. (2006), Adebanjo (2009), Chandrashekar & Muttalageri (2009), Engelseth (2009), Laeequddin (2009), Lu & Swatman (2009), Zhang & Aramyan (2009), Wolfert et al. (2010), Zhang et al. (2010), Bosona & Gebresenbet (2011), Thakur et al. (2011), Papetti et al. (2012), Santa et al. (2012), Bastian & Zentes (2013), Bhattarai et al. (2013), Bosona & Gebresenbet (2013), Han et al. (2013), Kaloxylos et al. (2013), Lai et al. (2013), Mainetti et al. (2013), Mohan et al. (2013), Poppe et al. (2013), Agustina et al. (2014), Castellini et al. (2014), Dongting et al. (2014), Ding et al. (2014), Xu et al. (2014)	Information system, information sharing, supply chain communication, IT applications, software programs, information communication technologies (ICTs), the internet of things (IOT), mobile commerce technology, electronic tracking system (RFID), electronic product code information services (EPCIS), global positioning system (GPS), information connectivity, technologies
Operations coordination	Taylor (2005), Theuvsen & Franz (2007), Adebanjo (2009), Chandrashekar & Muttalageri (2009), Zhang &Aramyan (2009), Szabo & Popovics (2009), Zhang et al. (2009), Hingley et al. (2010), Bosona & Gebresenbet (2011), Hingley et al. (2011), Maertens et al. (2011), Traversac et al. (2011), Bastian	Cooperation, collaboration, coordination, consolidation, strategic alliance, operations coordination with third-party, operations coordination with fourth-party logistics

	&Zentes (2013), Bhattarai et al. (2013), Han et al. (2013), Jaleta et al. (2013), Lai et al. (2013), Mohan et al. (2013), Castellini et al. (2014), Cembalo et al. (2014), Ding et al. (2014), Eksoz et al. (2014), Palmieri & Pirazzoli (2014), Reardon et al. (2014)	
Organisational relationship	Laeequddin (2009), Zhang & Aramyan (2009), Han et al. (2013), Castellini et al. (2014), Ding et al. (2014), Simon et al. (2014)	Learning systems, relationships, long-term relationship, creating trust and commitment, cross-functional team
Institutional support	Mintcheva (2005), Swinne (2007), Laeequddin (2009), Zhang et al. (2009), Cormier (2010), Gale & Hu (2012), Papetti et al. (2012), Bastian & Zentes (2013), Schuster & Maertens (2013), Seed et al. (2013), Codron et al. (2014), Reardon et al. (2014)	Legal requirements, private institutions policy, research institutions, state support, government regulations, public and private safety regulations, union policy, government policy
Internal integration	Gimenez (2006), Wolfert et al. (2010), Han et al.(2013), Kaloxylos et al. (2013), Mohan et al. (2013), Castellini et al. (2014), Ding et al. (2014), Palmieri & Pirazzoli (2014)	Intra-organisational integration, department collaboration, horizontal integration
External integration	Mintcheva (2005), Taylor (2005), Gimenez (2006), Pingali (2007), Swinne (2007), Theuvsen & Franz (2007), Louw et al. (2008), Adebanjo (2009), Chandrashekar & Muttalageri (2009), Engelseth (2009), Laeequddin (2009), Szabo & Popovics (2009), Zhang & Aramyan (2009), Zhang et al. (2009), Cormier (2010), Hingley et al. (2010), Wolfert et al. (2010),Bosona & Gebresenbet (2011), Hingley et al. (2011), Maertens et al. (2011), Suzuki et al. (2011), Traversac et al. (2011), Gale & Hu (2012), Papetti et al. (2012), Bastian & Zentes (2013), Bhattarai et al. (2013), Dannenberg (2013), Han et al. (2013), Jaleta et al. (2013), Kaloxylos et al. (2013), Lai et al.	Partner integration (customer, buyer, supplier, retailer, wholesaler, manufactures, government, private institutions, research institutions), manufacturer-retailer, farm-customers, supply chain partner, private certificate institution, private sector demands, inter-organisation integration, third-party integration, vertical integration, vertical coordination, external integration

	(2013), Schuster & Maertens (2013), Seed et al. (2013), Castellini et al. (2014), Cembalo et al. (2014), Ding et al. (2014), Eksoz et al. (2014), Palmieri&Pirazzoli (2014), Simon et al. (2014), Reardon et al. (2014), Trifkovic (2014)	
Internal and external integration	Gimenez (2006), Wolfert et al. (2010), Han et al. (2013), Kaloxylos et al. (2013), Castellini et al. (2014), Ding et al. (2014), Palmieri & Pirazzoli (2014)	Horizontal and vertical integration, intra- and extra-integration, internal and external integration

2.3 Logistics integration in Thai agricultural sector

2.3.1 Thai agricultural sector

Agricultural sector in Thailand has grown in size, scope and importance during the past 50 years (Leturque & Wiggins 2010). According to the available data, between 1960 - 2009, the agricultural GDP increased by 4.4 percent on average (Poapongsakorn 2011). Presently, this sector includes about one-third of the total population, with the farmers engaged in agriculture (predominantly farming and fishing) constituting 41 percent of the total land (Singhapreecha 2014). More recently, there has been a significant increase in the number of agribusiness companies, which have since 2004 become important players in the development of input supply chains, the creation of new production relationships, and the diffusion of improved varieties (i.e. certification and contract farming) (Leturque & Wiggins 2010). In response to this shift in the way that Thai agricultural sector operates, many multinational companies (MNCs) have entered the production chain, mostly focusing on poultry products, frozen and caned seafood, preserved and canned vegetables and fruits, sugar, dairy products, and beer. A few firms in some of these industries (e.g., poultry, prawn, and fish sectors) have adopted a vertically integrated structure (Poapongsakorn 2011). For example, in the broiler industry, modern company operations include much more complex activities that traditionally did not exist in Thailand, such as research on generic improvement, hatcheries, breeding of grandparent and parent stock, production of animal feeds, production of drugs and premixes, contract farms for growing broilers, slaughterhouses and meat-processing plants (Heft-Neal et al. 2008, Poapongsakorn 2011). As a result of the increasing presence of large corporations, in the egg industry, the number of small- and medium-sized producers is decreasing, as they can no longer be competitive. In 2011, around

47,000 egg farms operated in Thailand, including small commercial/backyards farms, semi-commercial farms and large commercial farms (Department of Livestock Development 2011). However, in order to standardise the production and product quality, and respond to this increasingly diversified industry, in 2013, the Department of Livestock Development introduced mandatory registration for all commercial egg farms. As result, only 1,526 egg semi-industrial farms and a few large companies obtained the certificate in 2013, significantly reducing the number of those that can legitimately operate an egg production business (Bureau of Livestock Standards and Certification 2013). This trend is likely to continue, as many small farms will find it prohibitively expensive to make the necessary changes in order to obtain the certificate and will need to close.

2.3.2 SCM and logistics studies in Thai agricultural sector

Effective supply chain management and integration in Thai agricultural sector is another logistic impediment to the growth (TDRI 2012).

More specifically, previous SCM studies on Thai agricultural sector such as Salin and Nayga (2003), Thongrattana and Perera (2010), Ritthaisong et al. (2014) were conducted in specific agricultural products and activities and are thus insufficient. Extensive literature review conducted as a part of this study revealed only 18 articles focusing on the entire supply chain (see Table 2.5). Authors of these studies have identified cross-network alliance relationships (Salin & Nayga Jr 2003), technologies (Trienekens et al. 2003, Kittipanya-ngam et al. 2011, Weerathamrongsak & Wongsurawat 2013), social/legal and environmental (Trienekens et al. 2003, Setthasakko 2007, 2009, Suksa-ard & Raweewan 2011) economics-political forces (Kittipanya-ngam et al. 2011), and government policy and cooperation in activities (Kritchanchai 2004, Srimanee & Routray 2012, Weerathamrongsak & Wongsurawat 2013, Ritthaisong et al. 2014) as the common SCI factors in the Thai context. All the aforementioned studies have been conducted in the food sector, ranging from single produce such as rice, to frozen foods, general foods, fruits and vegetables. However, thus far, the main factors affecting logistics integration have not been identified directly. There is evident lack of research that explores the key factors affecting SCI and SCM in egg production and distribution.

Table 2.5: Summary research on Thai agricultural supply chain - published between 1995-2015.

Author	**Research summary**	**Industry/ Product**	**Research Method**
Salin & Nayga (2003)	The study focus is on the business relationships (a cross-network alliance that includes all levels of the value chain) in the cold chain used for exporting food to new markets in developing countries.	Frozen foods	Case study
Trienekens et al. (2003)	Research focuses on innovation through (international) food supply chain development. Authors identify the key elements (economy, technology, social/legal and environmental issues) from a broad, comprehensive perspective on international food chains in developing countries.	General foods	Case study
Kritchanchai (2004)	The study assesses responsiveness (speed) of the food industry in Thailand, and identifies three methods of creating responsiveness: responding by production plan adjustment to customer, raw material available level, and raw material.	General foods	Survey
Kanchanasuntorn & Techanitisawad (2006)	The study develops an approximate periodic model for fixed-life perishable products in a two-echelon inventory-distribution system. Authors investigate the effects of product perishability and retailers' stock out policy on the system total cost, net profit, service level, and average inventory level in a two-echelon inventory-distribution system.	Agricultural foods	Analytical modelling
Pathumnakul et al. (2007)	The research develops an analytical model to assist Thai shrimp suppliers in the procurement decisions. The model identifies the key factors/ that can minimize the cost related to inventory by shrimp size,	Shrimp	Analytical modelling
Setthasakko (2007)	The study examines the key determinants that drive corporate sustainability and barriers of frozen seafood processing companies in Thailand.	Frozen seafood	Case study interview

Chiadamrong & Kawtummachai (2008)	The research developed a genetic algorithm based decision support system for sugar distribution activities within an export channel. The model identifies optimal inventory levels and transport route in the distribution system	Sugar	Analytical modelling
Pathumnakul et al. (2009)	The research identifies an approach that can minimise overall inventory costs of the chain, based on a shrimp-growth model, database management, and a supply allocation algorithm. Integrating a shrimp-growth function, farming skills information, and a supply allocation algorithm in the framework used for managing the shrimp supply chain.	Shrimp	Analytical modelling
Piewthongngam (2009)	The study explores the concept of cultivation planning and implements it in a mathematical model. Application of crop growth simulation and mathematical modelling to supply chain management in the Thai sugar industry.	Sugar	Analytical
Setthasakko (2009)	The study identifies primary barriers to the implementation of environmental responsibility in Thai seafood supply.	Seafood	Case studies interview
Schipmann & Qaim (2010)	This study examines the factors typically affecting farmers' decisions when attempting to introduce innovation in smallholder farmers, focusing on adoption of sweet pepper. Factors explored include characteristics of the person responsible for farming decisions, the farm and household where the production takes place, as well as the contextual characteristics.	Sweet pepper	Survey
Thongrattana & Perera (2010)	For the Thai rice industry, the research identifies perceived uncertainties based on the seven key factors: demand, supply, planning and control, competitor behaviour, government policy and climate.	Rice	Survey

Kittipanya-ngam et al. (2011)	For Thailand-based food supply chain (FSC), the authors identify FSC geographical dispersion pattern based on product perishability, value density, economic-political forces, and technological advancement as the key factors affecting the food industry.	General foods	Case Studies (exploratory empirical study)
Suksa-ard & Raweewan (2011)	Based on a survey the research identifies indicators of sustainable agricultural practices that can be used to measure sustainability in a local food supply chain.	Rice	Survey
Apichottanakul et al. (2012)	The study develops an artificial neural network based model for pig size prediction in supply chain planning.	Pig	Analytical
Srimanee & Routray (2012)	With specific focus on policy impacts and implications, the authors explore the fresh fruit and vegetables marketing chains (FFV) in Thailand that consist of procurement systems and FFV marketing policies.	Fruit and vegetable	Survey and observation
Weerathamrongsak & Wongsurawat (2013)	The authors identify the key factors that determine the sustainability of competitive advantage in Thai rubber industry.	Rubber	Interview
Ritthaisong et al. (2014)	The research identifies the effects of organisational reputation, human resource management practices, networks, and vertical integration in production of Thai rice-milling firms.	Rice mill	Interview and survey

From Table 2.5, It is evident that appropriate supply chain integration in the Thai agri-food supply chains is lacking, in particular when it comes to the implementation of appropriate IT tools and Thai government policies (Thongrattana & Perera 2010). As this sector has historically been dominated by small- and medium-sized businesses, utilising traditional forms of production and distribution, it is not surprising that integrated logistics are still lacking and information technology has not been fully utilised as an integral part of logistics systems both internally and externally (Suthiwartnarueput 2007). Moreover, logistics business providers are relatively scarce, and there is evident lack of connection across different transport modes (Suthiwartnarueput 2007). As a result, Thai agricultural sector is undermined by ineffectiveness, which results in higher operational costs that are implicitly translated to higher food prices(Office of Transport and Traffic Policy and Planning 2006). Moreover, presently, the knowledge/theory development in Thai agricultural SCM and SCI is lacking, further contributing to the lack of progress in this area. Despite widely acknowledging this issue, research in this field is relatively scarce.

2.4 Summary

This chapter reviewed the logistics integration, as well as its relations to SCM, and specifically its role in the SCM framework for various industries. The reviewed literature included publications pertaining to studies on agricultural logistics, with a particular focus on SCI research performed in agricultural industries in different geographic areas. This allowed identifying the benefits of SCI as a means of supporting agri-SCM. It also provided an overview of SCI effects on recent trends in agricultural logistics, which might be helpful in improving the effectiveness of Thai egg logistics. Moreover, this chapter also revealed the shortcomings in the current Thai agricultural sector, as well as problems inherent in the Thai egg logistics performance. Hence, the findings presented provided justification for further studies on critical aspects of logistics integration. Finally, the gap in the extant literature was identified, confirming that the current study on critical factors contributing to operations and management in logistic performance on order fulfilment is needed.

CHAPTER 3

THEORETICAL, CONTEXTUAL AND CONCEPTUAL BACKGROUND

3.0 Introduction

This chapter explains and discusses the basic concepts behind forming a theoretical framework based on extant theoretical knowledge. This chapter is divided into four sections, which respectively present theoretical foundation, contextual aspects, conceptual background, and the research model and research hypotheses governing this study.

3.1 Theoretical foundation of the research

The present study is founded on the conceptual framework (the research model) chosen in line with its objectives (improving logistics in the Thai egg supply chain). Within the scope of the contextual background (Thai egg industry), the conceptual framework integrates SCM framework (SCI), which is adopted with the aim of improving logistic performance and comprises key aspects of four extant theories: resource dependence theory (RDT), resource-based view (RBV), institutional and SCM theory.

3.1.1 Resource dependence theory (RDT)

RDT postulates that organisations are dependent on resources provided by others, as well as on other organisations, in order to sustain growth (Pfeffer & Salancik 1978). In other words, it is virtually impossible for organisations to be fully self-sufficient, as they will always need strategically critical resources, as well as products or services provided by others. Thus, for survival, and especially growth and development, they need to form strategic alliances with outside parties (Heide 1994). According to RDT, organisations can reduce uncertainly by carefully managing their dependence on external factors by exchanging resources (both material and skill-based) with other organisations (Ulrich & Barney 1984). In the SCM context, RDT suggests that member organisations should be dependent and collaborate with one another, as this will ensure higher performance gains in the long run. This type of collaboration is much more beneficial and less risky than pursuing short-term benefits at the expense of others (Sarkis et al. 2010). In that respect, RDT theory places an emphasis on partners (such as buyers and suppliers) and forging mutually beneficial relationships, with a particular focus on coordination and cooperation among the supply chain partners (Paulraj &

Chen 2007a, McCarthy-Byrne & Mentzer 2011). Given the above, it is evident that SCI, as a framework, is based on RDT theory, as the focus in both is on cooperation among the supply chain partners aimed at performance effectiveness.

3.1.2 Resources based view (RBV)

RBV theory proposes that firms can only outperform their competitors by developing capabilities and resources that are rare, valuable, difficult to imitate and non-substitutable (Schroeder et al. 2002, Barney et al. 2011). The firms operating according to RBV continually explore opportunities for creating new market positions. The RBV concepts are based on the assumption that the competitive advantage lies in the firm's capabilities, both in terms of tangible and intangible resources (Barney 1996). Tangible resources refer to physical assets, such as equipment and funds; while intangible resources comprise all benefits company derives from it's processes and functions, such as brand, reputation, knowledge and organisational culture. The focus of RBV resources and capabilities is on creating competitive advantage in the chosen market or industry sector (Barney 1991, Barney 1996). Market orientation is, in turn, related to embedding operant resources and resource integration, aimed at value co-creation. The value co-creation further produces value constellations, which serve as the key drivers of innovation (Verma & Jayasimha 2014). In the context of supply chain, this leads to channel integration and is positively related to supply chain performance (Lin et al. 2010). In sum, adoption of RBV theory in a supply chain network aims to improve logistic performance, create most optimal strategy framework, such as SCI that incorporates all tangible and intangible resources, such as information, technology, cooperation, and relationship management.

3.1.3 Institutional theory

According to the institutional theory, firms embedded in social networks perceive strong pressure to conform to institutional expectations to acquire social legitimacy**,** as any violations may jeopardise organisation performance and existence (Meyer & Rowa 1977, DiMaggio & Powell 1983). Institutional theory has been very influential in strategic management and innovation. It addresses the behaviour of organisations, motivated by forces at play in the wider society. It posits that organisations will seek legitimacy by adhering to the rules and norms that are valued by the society they operate in and aim to attain recognition by certain institutions (DiMaggio & Powell 1983). The mechanism through which organisations adopt similar procedures is termed institutional isomorphism.

Isomorphism is a constraining process that forces one unit in the population to resemble other units exposed to the same set of environmental conditions (Meyer & Rowa 1977). Institutional isomorphic change is exhibited through three mechanisms, namely coercive, mimetic and normative isomorphism. These institutional forces influence organisational strategy and behaviour (DiMaggio & Powell 1983). Coercive isomorphism refers to the organisation's dependency on other organisations, as well as the prevalent cultural expectations and standards of the society in which the organisation functions. It relates to the formal and informal pressures that result from coercive authority. Organisations may directly alter some of their structural features as a result of changing rules imposed by governing authority, such as legislation or anti-pollution laws, employee health and safety codes, or consumer laws (DiMaggio & Powell 1983, Dacin et al. 2007). Another mechanism through which institutional theory is manifested in practice is mimetic isomorphism. It occurs in situations characterised by a high degree of uncertainty, as a powerful driver of imitation (most commonly encountered in technology and management sectors). In particular, ambiguous goals, poorly understood technologies or symbolic uncertainty may cause organisations to model themselves on other organisations. Organisational structures tend to be homogenous (DiMaggio & Powell 1983, Haveman 1993). Therefore, attempts to identify and adopt an organisational structure that can help mitigate ambiguity and uncertainty are often based on similar organisational templates. This mechanism influences the strategic management in that it helps increase efficiency and address extant knowledge gaps in companies. More specifically, it assists in creating new product development strategies that can be applied to increase product usefulness and thus improve market position. The change from a functional structure to a multidivisional structure is often the outcome of this process, and is best exemplified by the introduction of Japanese management techniques in US firms (DiMaggio & Powell 1983). Finally, normative isomorphism describes the situation that stems from pressures arising due to increasing professionalisation. Normative isomorphism comprises two distinct aspects, namely (1) the grounding of formal education and of legitimacy on cognitive base produced by university specialists, and (2) the influence and growth of professional networks that allow new practices to be diffused rapidly across organisations (Powell & DiMaggio 1991). According to this classification, any action is a result of shared socialisation among professional groups, which are thus forced to create novel strategies and invest greater effort into innovation. Such practices promote normative standards that make professionals comparable, as they can be measured against normatively determined standards, such as professional associations for lawyers, accountants and medical practitioners (DiMaggio & Powell 1983).

In the context of supply chain management, institutional pressures coming from only one particular supply chain member are of particular importance (Huo et al. 2013), despite the widespread view that the institutional environment is a critical factor for SCM development (Yaibuathet et al. 2008). In practice, institutional forces affect the firms operating through SCI (Cai et al. 2010). Moreover, institutional theory implies that the organisations exert forces on other organisations and the cultural expectations in the society. They do so through technologies and professionalisation, following governmental standards and institutional laws to provide management strategy, such as SCI, in order to ensure organisational success.

3.1.4 SCM theory

Thus far, SCM studies have played a key role in corporate efficiency and their potential practical applications have prompted numerous researchers to focus on this field in their work. Academic literature review reveals significant number of studies on SCM theory and practice (Janvier-James 2012). Most authors agree with the view that SCM should be understood as coordination of the chain of events associated with the movement of goods from the raw materials to the product delivery to the ultimate customer (Mentzer et al. 2001). Consequently, several SCM frameworks emerged, including the supply chain operations reference (SCOR) model, the global supply chain forum (GSCF) framework, collaborative planning, forecasting, and replenishment (CPFR) tool, and the chartered institute of purchasing & supply (CIPS) intelligence. All these approaches are frequently used in an attempt to improve logistic performance (Naslund & Williamson, 2010, APICS, 2011). SCM has been described as the integration of business processes that span the full spectrum—from the raw material extractor to the end user—to provide product, information, and services that add value (Richey Jr et al. 2010). In this context, integration is defined as a firm’s objective to attain operational and strategic efficiencies through collaboration among internal functions and with other firms (Flynn et al. 2010). Thus, in line with these definitions, SCM pertains to the governance of integration that transforms the supply chain into a network in which a series of relationships form to ensure that the end customer receives value from efficient and effective processes that deliver the best products and service to market (Fawcett & Magnan 2004). SCI is a strategy based on SCM, developed and implemented with the aim to utilise the supply chain to provide effective performance and respond to customer needs.

3.2 Development of Research Model

The research model applied in this study was based on the theoretical framework developed based on the theoretical principles of resource dependence, resource-based view, institutional and SCM theory. SCI is developed from these theories, as this approach might improve the Thai egg logistics distribution. The development of the research framework is described in more detail in the subsequent sections.

3.2.1 Logistics performance measurement and distribution logistics integration

It is recognised that firms perform better on various cost and customer performance measures when they have identified themselves with high performers with respect to supply chain integration and they can modify their processes to reach the standard comparable to that of their competitor (Lummus et al. 2008). SCOR model provides guidance on the types of metrics that can be used in order to create a balanced approach towards measuring the performance of one's overall supply chain. The SCOR model supports a set of supply chain performance measures comprised of cycle time metrics (e.g., production cycle time and cash-to-cash cycle), cost metrics (e.g., cost per shipment and cost per warehouse pick-up), service/quality metrics (on-time shipments and defective products), and asset metrics (e.g. inventories) (Supply-Chain Council 2004). In this study, logistics performance will be assessed using SCOR model performance measures: perfect order fulfilment and order fulfilment cycle time.

SCOR model (in Table 3.1) includes perfect order fulfilment and order fulfilment cycle time. Order fulfilment cycle time measures supply chain responsiveness in terms of the speed at which a supply chain provides products to the customer, it can be evaluated as a part of responsiveness performance attributes (Supply Chain Council 2010). Perfect order fulfilment cycle time measures reliability in distribution; it means sending the right product, to the correct place, at the right time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the right customer (Kocaoğlu et al. 2013). Customer orders generate business and put the supply chain in motion; thus filling them efficiently and effectively is the first step in providing customer service. The operational order fulfilment process includes generating and communicating the specifics of the order, entering order details, processing the order, handling the documentation, filling the order, order delivery, performing post-delivery activities and measuring the performance pertaining to all preceding steps (Croxton 2003, Forslund 2006). Ensuring correct order fulfilment is of high importance in the supply chain management (Croxton 2003, Lambert et al. 2005).

Based on the SCOR model, this study will work on a premise that benefits to effective supply chain integration. Benefits will comprise of on-time delivery, quick respond to customer requests, order fulfilment lead times, and in the long run minimisation of inventory costs and transportation costs (Fawcett et al. 2008), and more market penetration (Deshpande 2012). Hence, the key benefit of supply chain integration in logistic performance is in improving the effectiveness of the order fulfilment processes, so that the distribution costs in are reduced (Sahin & Robinson 2005, Amer et al. 2010).

Table 3.1: SCOR level 1 strategic metric based on order fulfilment.

Performance Attribute	**Performance Attribute Definition**	**Level 1 Strategic Metric**
Supply chain reliability	Supply chain reliability is to ensure customer orders are fulfilled through delivering: the right product, to the right place, at the right time, in the right condition and packaging, in the right quantity, with the correct documentation, to the right customer.	Perfect order fulfilment
Supply chain responsiveness or agility	The speed at which a supply chain provides products to the customer or fullfill customer orders.	Order fulfilment cycle time

Source: Supply Chain Council (2010)

3.2.2 Supply chain integration approach

As previously noted SCI is a strategy based on SCM, whose objective is to optimise the processes implicit in the product supply chain. Thus, it can be perceived as a degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organisation processes (Romano 2003). The goal is to achieve effective and efficient flows of products and services, information, funds and decisions, in order to provide maximum value to the customer cost-effectively and efficiently without compromising product safety and quality (Flynn et al. 2010). SCI focuses on six different integration contexts: customer, internal, supplier, technology and planning, measurement, and relationship integration (Bowersox et al. 2000). Empirical evidence supports the view of many researchers that SCI is one of the most important activities when leveraging company's internal and external networks (He & Lai 2012). The review of the extant SCI literature revealed three types of integration: integration with suppliers, integration with customers, and internal integration across the supply chain (Campbell & Sankaran 2005, Kim 2013). It also indicates that most researchers recognise two main types of integration: external and internal (Lee et al. 2007, Flynn et al. 2010, Zhao et al. 2011), and in supply networks, both integration practices have a significant and positive impact on logistics performance (Danese 2013). In this study, supply chain integration in terms of information sharing, logistics operations coordination**,** development of organisational relationship, and availability of institutional support will be considered the focus on internal and external integration. Table 3.2 outlines several literature sources focus on internal and external integration with the aim of improving the performance through four variables (information integration; logistics operations coordination; organisational relationship; institutional support).

3.2.2.1 Internal integration

Internal integration refers to the degree to which a company can organise its practices, procedures, information, and decisions, as well as conduct business in a collaborative and synchronised manner (Zhao et al. 2011). This pertains not only different operational areas, but also its external relationships and is essential in order to comply with client requirements and effectively interact with its suppliers (Flynn et al. 2010). In this context, internal integration refers to organisational practices aimed at improving and combining information and resources in order to generate knowledge sharing beyond the boundaries of individual functions or departments. It's primary objective is assisting external integration initiatives, meeting organisational goals and satisfying client requirements (Sanders 2007, Zhao et al. 2011).

3.2.2.2 External integration

External integration refers to the degree to which a company understands the needs of its clients and collaborates with clients and/or suppliers to develop inter-organisational strategies, as well as shared practices and processes, with the aim of meeting client requirements (Flynn et al. 2010). It thus requires integration of all processes related to clients, suppliers and customers, in order to make the process cost-effective and efficient (Frohlich 2002, Flynn et al. 2010, Zhao et al. 2011).

Table 3.2: SCI constructs of proposed research framework

Dimensions	Dimensions	Variables on scope		Reference
		Internal integration	**External Integration**	
Information integration	Information sharing	Internal Information sharing	External Information sharing	Dong et al. (2001), Frohlich & Westbrook (2001), Stank et al. (2001b), Gimenez& Ventura (2003, 2005), Sanders (2007) , Prajogo & Olhager (2012)
	IT capability	Internal IT capability	External IT capability	Stock et al. (2000), Dong et al. (2001), Vickery et al. (2003), Prajogo & Olhager (2012)
Logistics operations coordination	Transport cooperation (3PL)	-	Transport cooperation (3PL)	Frohlich & Westbrook (2001), Prajogo et al. (2012)
	Distribution centre/warehouse sharing	-	Distribution centre/ warehouse sharing	Fugate et al. (2009), Prajogo et al. (2012)
Organisational relationship	Forging and maintaining long-term relationships	-	Forging and maintaining long-term relationships	Prajogo & Olhager (2012), Prajogo et al. (2012)
	Sharing of knowledge & skills	Internal sharing of knowledge & skills	External sharing of knowledge & skills	Gimenez & Ventura (2003, 2005), Droge et al. (2004)
	Creating teamwork along supply chain and cross-functional teams	Creating teamwork cross-functional teams	Creating teamwork along supply chain	Gimenez & Ventura (2003, 2005), Vickery et al. (2003)
Institutional support	Government support, incentive or policy	-	Government support, incentive or policy	Gebresentbet & Bosona (2012)

The role of banks/financial services	-	The role of banks/financial services	Sun & Cheung (2007)
Knowledge support from boards and associations, and educational institutions/educational support	-	Knowledge support from boards and associations, and educational institutions/educational support	Lutz & Birou (2013)

3.2.3 Dimensions of logistics integration

Supply chain management is the collaborative effort of multiple channel participants to implement, design and manage seamless value-added activities with the aim to identify and fulfil the actual needs of the end customer (Fawcett et al. 2008). SCM refers to the development and integration of technology and people in order to coordinate management of information, materials, and financial flows essential for supply chain integration success (Fawcett & Magan 2001). Clearly, supply chain integration is a key component of supply chain management and is gaining more attention among both academics and practitioners. In this context, it refers to interlinking major business processes (Chen et al. 2009). Educators and practitioners have addressed the concept of supply chain management as the extension of logistics. However, most have drawn upon the similarity to logistics as an all-encompassing approach to business integration. Supply chain management is the integration of all aspects of business process from end user through suppliers that provides services, as well as products and information that add value for customer (Basnet et al. 2003). However, it is important to recognise that logistics supply chain integration includes not only service and goods, but also pertinent information movement. Its success thus contributes to current and future profitability of the firm and helps the processes and standards applied conform to customer requirements. However, some academics view the output of the logistics process solely as creating value for the customer (Simatupang et al. 2002). The most comprehensive evidence of supply chain integration as specific strategy followed by manufacturers stems from the fact that firms that are outward-facing are implicitly choosing to support supply chain integration that has the highest level of performance improvements (Frohlich & Westbrook 2001).

The supply chain integration could be achieved through four dimensions: information integration, logistics operations coordination, organisational relationship (Lee 2000, Alfalla-Luque et al. 2013) and institutional support (Cai et al. 2010). It is assumed that in the context of Thai Egg supply chain above four dimensions of SCI will be applicable and based on these dimensions, a conceptual model was developed for Thai Egg logistics integration. The conceptual model is schematically presented in Figure 3.5 (at the end of this chapter).

3.2.3.1 Information integration

Information integration, in the context of supply and logistics, is based on effective sharing of key information along the supply chain network that is enabled by the use of information technology (IT) (Lotfi et al. 2013). Its primary aim is real time information transmission, dissemination and processing, as required by supply chain participants responsible for decision making (Prajogo & Olhager 2012). Although IT can increase the volume and complexity of supply chain information that needs to be communicated with trading partners, the communication is achieved seamlessly, thus aiding supply chain efficiency. IT systems provide real-time information, order delivery status, inventory and production scheduling and planning, which enables firms to manage their supply chain activities and coordinate tasks assigned to different entities more effectively. In other words, IT helps overcome the limitations of spatial distance and time (Ljungberg et al. 2007, Paulraj & Chen 2007b) and hence ensure quick response to customer demand. Thus, appropriate IT capabilities and efficient and timely communication contribute to reliable and timely supply for parties in logistics operations to engage in participation, coordination and problem solving activities (Sheu et al. 2006, Bosona & Gebresenbet 2011). In the Thai context, it is envisaged that greater IT capabilities can make marked improvements towards higher logistics efficiency and enhancement of market operation levels with less time involvement and reduced financial expenditure (Supasansanee & Kasiphongphaisan 2009).

When attempting to improve supply chain performance, the integration of the organisations and organisational units should start with making the exchange of information as efficient and as streamlined as possible (Lee 2000, Frohlich & Westbrook 2001), as that allows for collaborative planning (Narasimhan & Kim 2002, Gimenez & Ventura 2003, Rodrigues et al. 2004), and production of joint demand forecasts (Mollenkopf & Dapiran 2005), amongst many other benefits. Information sharing can be achieved across the various functional departments of an organisation, as well as between supplier and customer organisations, both of which aim to improve the decision-making processes across the supply chain (Dong et al. 2001, Frohlich & Westbrook 2001). Thus, if conducted effectively, it can enhance visibility, proper and timely decision making for inventory management, as well as production planning and distribution (Kent & Mentzer 2003). Extant studies have demonstrated various logistical benefits of information sharing with supply chain partners in the area of inventory management (Cachon & Fisher 2000, Lee et al. 2000, Yu et al. 2001), such as cost reduction stemming from coordinated, well-informed decision-making (Sahin & Robinson 2005), which helps improve firm's reliability (operational speed) and performance flexibility (Swafford et al. 2008). Moreover, in ASEAN countries, such as Vietnam, Thailand, Philippines, Malaysia, and Indonesia, information sharing with supply chain members is positively related to operational performance. It was shown to minimise delivery lead times (time from the production initiation to the delivery of the finished product to the customer) and production lead times (time taken for all pre-production processes to be completed), as well as reduce the quantity of purchased material. It also helped increase total inventory turnover (thus increasing the business efficiency) and accuracy of inventory levels (important for ordering new materials and keeping the stocks low), while reducing machine downtime (determines operational efficiency, as companies that work in, for example, shifts can utilise their fixed resources, such as building premises and production lines, more effectively). All these elements contribute to the greater effectiveness of the entire chain while minimising the associated costs (Laosirihongthong et al. 2011).

In the context of information integration, it is essential to examine each entity's IT capabilities, i.e., each participant's ability to implement and use IT assets (IT functionalities) in combination with other resources to execute business processes. IT capability of a firm is defined as its ability to mobilise and deploy IT-based resources in combination with other resources and capabilities (Guo et al. 2008). It is measured by the effectiveness and compatibility of IT infrastructure, human IT resources and IT-enabled intangible resources (Bharadwaj 2000). Most widely used IT elements in logistics include EPOS (Electronic Point of Sale), Business-To-Business (B2B) communication, and B2B private (Ethernet), enterprise resource planning (ERP) systems, and electronic data interchange (EDI), and radio frequency identification (RFID) (Bagchi et al. 2005, Attaran 2007). When this concept is extended to inter-firm and other external relationships, IT capabilities are formed by implementing and using IT functionalities along with other resources to execute processes (Rai et al. 2012).

Numerous studies and practical examples indicate that firms with high IT capability have better profit and cost performance compared to those with inferior IT infrastructure and human capital (Dale Stoel & Muhanna 2009). As noted by LCSAR (2008), the wholesale market in Medllin, Colombia, uses text messaging and the internet to inform small farmers about prices and marketed quantities. Such information also serves as a reference in forward or long-term marking contracts. The information provided in this manner is more relevant and up-to-date. Agricultural supply chain uses appropriate IT (mobile phone or smart phones, personal digital assistants (PDAs), fax, TV information) in many countries such as Syria, India, Pakistan, Kenya and Tanzania (Yu 2010). For Thai egg industry, as it is expected that similar appropriate IT capabilities would be beneficial, this study will explore this premise further. Moreover, and essentially for this study, by developing IT capabilities, the participants in the egg supply chain systems will be able to improved agility or responsiveness of order fulfilment and can reduce order lead time of the entire process (Lai et al. 2008). Thus, given that in Thai agriculture, traditional supply chain is characterised by insufficient communication and information sharing, ineffective communication channels, and insufficient technology investment (TDRI 2012), these are the key issues that need to be addressed in order to improve its performance. Moreover, semi-industrial egg farms are typically not as equipped and skilled for using modern IT tools as industrial farms are due to lack of financial and other resources (Heft-Neal et al. 2008). Therefore, the focus should be on addressing this discrepancy in order to make the egg production as efficient and as uniform as possible, irrespective of the entity size. The an appropriate IT capability can be optimally utilised by using existing telephone, fax, and internet facilities, as these are also important to ensuring effective communication to reduce order lead time and quick response to customer orders in Thai egg semi-industrial production. This research aims to identify the types of 'appropriate IT' capability needed for integration.

It is widely recognised that information technology capabilities and information sharing have significant effects on logistics integration (Prajogo & Olhager 2012). Information integration has been identified as the key factor in the success of logistical integration in a range of industries, such as manufacturing (Bagchi et al. 2005, Mollenkopf & Dapiran 2005, Sanders & Premus 2005, Quesada et al. 2008), construction (Briscoe & Dainty 2005), and automotive manufacturing (Droge et al. 2004, Laosirihongthong et al. 2011), as it helps in achieving optimal logistics integration, thus affecting the operational performance (i.e. speed of deliveries, volume or capacity flexibility) (Prajogo & Olhager 2012). Given the above, in the context of Thai egg distribution logistics integration, this research proposes the following hypothesis:

H1: Information integration and perfect order fulfilment are positively correlated.

H2: Information integration and order fulfilment lead times are positively correlated.

Based on the hypotheses guiding the study, a research model of information integration and logistics performance is developed (as shown in Figure 3.1).

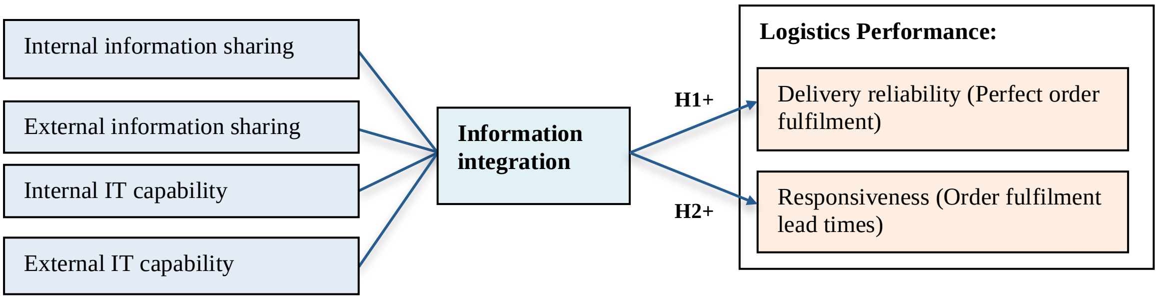


Figure 3.1: Conceptual model of information integration and logistics performance

3.2.3.2 Logistics operations coordination

Cooperation described as the realisation of joint actions across companies and departments in order to achieve the same result and meet a common goal as effectively as possible (Simatupang & Sridharan 2005) can occur in many ways. As the cooperative supply chain can be broadly characterised by its structure—vertical, horizontal, or lateral—cooperation can be achieved in each case, albeit differently. Vertical cooperation (which refers to cooperation amongst different chain members at different levels in the distribution process) occurs when two or more organisations that provide different services (e.g. manufacturers, distribution centres, logistics service providers, carriers, retailers, etc.) share their responsibilities, performance information, and resources in order to serve the customer in the most optimal and efficient manner (Cruijssen et al. 2007a). On the other hand, horizontal cooperation (which implies collaboration amongst entities that provide the same or similar services) is achieved by exploiting and identifying opportunities for sharing resources or dividing responsibilities in order to increase performance and cost-effectiveness of the processes they are in charge of (Cruijssen et al. 2007b). Finally, lateral collaboration aims to gain more flexibility by combining and sharing capabilities of companies that are involved in both vertical and horizontal manner (Simatupang & Sridharan 2005).

Third-party logistics (3PL) is referred to as logistics outsourcing (Knemeyer et al. 2003) and thus implies relying on external companies to perform logistics functions that have traditionally been performed within a firm (Lieb & Bentz 2005). The cooperation between manufacturers and third party logistics companies is expected to result in more standardised services, more segmented markets, as well as more intense competition and various services (Mortensen & Lemoine 2008). The logistics services providers (LSPs) propose integrated solutions for the chain, one of which is the logistics process integrator that can act in the following manner: service integrator mixing various logistics offers, internal integrator mobilising various resources of the firm (different tools, services, geographic localities), and external integrator capable of coordinating business actors (carriers, other LSPs, information systems providers, etc.) (Fabbe-Costes & Roussat 2011). The use of 3PL is most significant in transportation, where it can provide integrated logistics services that result in marked performance improvements (Fabbe-Costes et al. 2009). In terms of the Thai context, empirical evidence shows that Thailand's logistics service industry has become even more competitive with the entry of international 3PL providers. Thai 3PLs are smaller and less sophisticated, and tend to lack information technology capability that would assist them in expanding their operations. Consequently, thus far, they focused on local Thai customers, offering cheaper standard service packages. In contrast, international 3PLs provide a much wider range of services, including offering specialised solutions targeted at multi-national corporations that have also adapted to the local market. They had also made significant investment into developing standard service offerings aimed at small and medium-sized local companies, allowing them to compete across the entire market and thus with the extant Thai companies (Visuddhisat 2009). Owing to their diversity and capabilities, 3PLs play significant role in Thai organisations. Many manufacturing companies have realised the importance of employing 3PLs and utilising their services in strategies aimed at gaining competitive advantage (i.e., better delivery, reduced inventory and lower logistics costs) (Setthakaset & Basnet 2005) .

Distribution centres also differ in terms of the activities that can be divided in four categories—order management, transportation, warehousing activities, and value-added logistics (VAL). In this context, order management refers to the responsibilities of the warehouse administrative office, which include taking care of order intakes, forecasting, selection of suppliers and invoicing. Transportation (inbound and outbound) can be planned and executed by the warehouse or by other parties in the supply chain, whereas warehousing activities that can be executed in the distribution centre are storage, sorting, consolidation, order picking and inventory management. Finally, VAL can be described as the combination of logistic and simple industrial actions that take place before the final distribution of the product. Low-end VAL activities—e.g. parts or manuals, making the products country and customer specific, ticketing and testing of the goods—add little value to the goods. Thus, the main advantages of VAL are the increased flexibility in order to satisfy unique customer demands and the elimination of excess inventories of similar products (Vereecke et al. 2008). In other words, distribution centres are more effective when road-centred logistics functions are adopted, including road freight transport, road transport, courier pick-up and delivery service, as well as warehouse operations (Chhetri et al. 2014). Distribution centres can provide much higher benefits to companies involved in joint operations, as they can take advantage of distribution centre sharing. In addition, they can reduce congestion by decreasing the number of deliveries (as smaller deliveries can be combined and transported in the same vehicle), improve the quality of delivery service to retailers (as more frequent deliveries can be made if several companies use one truck and benefit from available stock at the distribution service), and ameliorate conflicts between in unloading areas and delivery bays (Scott Wilson Ltd 2010). As mentioned above, distribution centre sharing can reduce the required stock levels, while also avoiding inventory shortages, thus increasing sales opportunities while minimising chances of lost sales due to product unavailability (Bordley et al. 1999). In the Thai context, distribution centre sharing is not yet well developed, even though some larger retailers (end-delivery companies) are contracted with 7-eleven as the parent company, thus benefiting from grouping and sharing some of the operations. Similarly, CP Group manufacturers and suppliers share a distribution centre, which serves several store locations, allowing fresh and high quality products to be delivered with less lead time. This not only improves relationships with the customers, but also helps reduce inventory and logistics cost to the entire chain (Supasansanee & Kasiphongphaisan 2009).

Coordination sharing is contingent on synergy based on trust and the dependence between supply chain members. However, not all suppliers or customers can achieve the same level of integration, as it is highly contingent on the mutual interest of the firms involved in the process (Lambert et al. 1998). Thus, the increased levels of interaction through communication, regular meetings and other joint activities can improve the level and outcome of supply chain integration (Cousins & Menguc 2006) and lead to supply chain capabilities that significantly improve the overall performance (Chen et al. 2009). Cooperative logistics are the key in this context, as they offer the potential to increase profitability or improve the quality of services the firms offer (Cruijssen et al. 2007a). As in the various industry sectors, logistics operations coordination in the context of transportation can be achieved with 3PL and distribution centre sharing. Both elements have great influence on the supply chain logistics integration, as their correct incorporation can lead to significant value (i.e., improving logistics performance and reducing transaction costs) across the entire chain, including Thai industry (Bordley et al. 1999, Stefansson 2006, Scott Wilson Ltd 2010, Zacharia et al. 2011), Thai manufacturing (Setthakaset & Basnet 2005, Visuddhisat 2009) and Thai import and export sectors (Charanwanitwong 2012).

Overall, in the case of Thai egg supply chain logistics integration, logistics operation coordination by cooperation with 3PLs and distribution centre sharing could have a significant positive effect on the ability to improve logistics performance for SME. Hence, the following hypotheses will be tested in this study:

H3: Logistics operations coordination and perfect order fulfilment are positively coordinated.

H4: Logistics operations coordination and logistics order fulfilment lead times are positively coordinated.

From the hypotheses formed, a research model of logistics operations coordination and logistics performance was developed (see Figure 3.2).

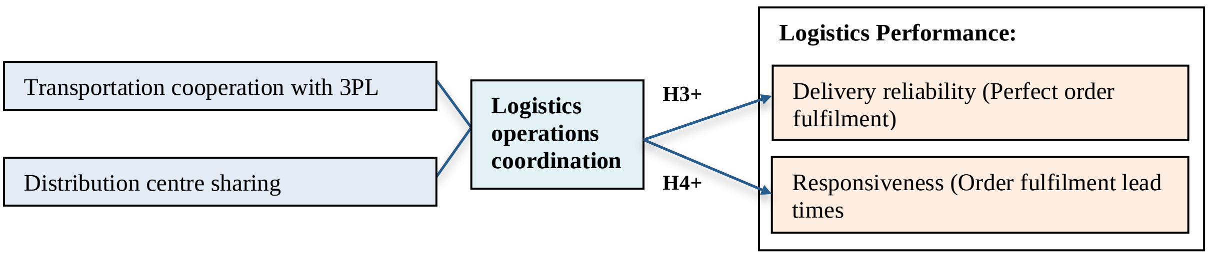


Figure 3.2: Conceptual model of logistics operations coordination and logistics performance

3.2.3.3 Organisational relationship

Supply chain management (SCM) enhances organisational competition by integrating the internal functions within the firm and linking them with the external operations pertaining to customers, suppliers and other channel members(Stock & Boyer 2009). Organisations strive to achieve competitive advantage through improved customer satisfaction, enhanced supply chain productivity, intensifying competition (Singh et al. 2010), building an effective supply chain team, competing against global supply chains, focusing on core competence (Fawcett & Magan 2001), and improving access to global markets (Agrawal 2007). In this context, a trusting and effective inter-organizational relationship refers to stable interactions and transparent relationships between all supply chain partners that entails, among other factors, common visions and objectives, incentive realignment and sharing of skills (Alfalla-Luque et al. 2013).

Forging and maintaining long-term relationships is crucial in establishing stable links with partners and, in turn, enables and increases mutual trust between manufacturers and customers (Droge et al. 2004, Bagchi et al. 2005). Creating and maintaining a good quality, trusting and beneficial cooperative relationship is the key for both buyers and suppliers, as it helps creating superior customer value, which is significant to a supplier's long-term survival and success (Woodruff 1997). The buyers who are satisfied with a firm's product/service feel that the firm offers them value beyond that other market players provide and are thus more likely to remain loyal and develop long-lasting business relationship with this firm (Anderson & Narus 1990). Maintaining relationships is important for any organization, thus it is also essential for an industrial buyer, as it improves the synergies among suppliers and buyers and ultimately develops trust, confidence and motivation. The importance of buyer-supplier relationship is essential for improving the performance and market standing of the organization (Mishra 2011). In the Thai context, for example, historically, automobiles have been imported from Germany. This has created opportunities to forge and maintain long-term relationships, leading to trust in organisations and partners (customers, suppliers and other supply chain members). These relationships are crucial in the process of logistics integration, as they ensure trust and cooperation, providing opportunities to improve work practices in the organisations involved, as well as reduce operational cost incurred by all partners (Kerdpitak & Heuer 2013).

Sharing skills, knowledge, experiences, ideas and institutional culture is essential in the dissemination of the best practices among the various members of the supply chain (Alfalla-Luque et al. 2013). The main challenge the supply chain managers are facing is finding the way to successfully coordinate partner efforts in order to efficiently generate new knowledge and capabilities (Cai et al. 2013). However, extended collaboration networks—which are key to exploiting the already developed, yet but scattered knowledge—are becoming more important, as the market is becoming more globalised and companies, their partners and customers are increasingly spread across different localities (Li et al. 2012). It is widely recognised that knowledge gained through a closer relationship with stakeholders across a network (e.g. suppliers, customers, employees, etc.) can help the firm in its drive for further improvement in its business operations (Bessant et al. 2003). Thus, the knowledge exchange facilitates can markedly improve performance with the network (Cai et al. 2013), as they help organisations involved learn from each other and benefit from new knowledge developed by other organizations. In this context, intra-organisational knowledge sharing is typically associated with increased cross-functional coordination within a network, and can thus benefit all the members in a supply chain (Christopher & Gaudenzi 2009). In the Thai context, development of relationships is geared towards exchanging ideas in order to solve logistics issues. Most importantly, this collaboration can also lead to improved performance and increased sales (Kerdpitak & Heuer 2013).

Improving the quality of teamwork with the aid of optimal logistics services along the supply chain and within cross-functional teams is based on the ability to encourage team building that allows for coordination and active cooperation between members of different departments and companies across the supply chain (Das et al. 2006). Cross-functional team building is important for establishing relationships that can assist the supply chain members with different cultures or backgrounds in the cross-functional team to succeed in the implementation of common language. Cross-functional teams can reduce misunderstandings that can potentially arise due to different values, norms, goals or general modes of operation or communication. Cross-functional team members that communicate effectively are able to develop a shared language and shared mental models (Santa et al. 2010), resulting in improved project performance and increased effectiveness of all operations within the chain (McDonough Iii 2000).

Organisational relationship is achieved through stable interactions and transparent relationships between the supply chain members and it entails, among other factors, common vision and objectives, as well as sharing of skills, ideas and carefully selected performance measures. When executed well, it can lead to significant performance improvements (Alfalla-Luque et al. 2013, Kerdpitak & Heuer 2013). For Thai egg SCM integration, it is important to integrate different partners of supply chain to share knowledge, skills, and developing long term relationship /partnership in order to improve the supply chain responsiveness and reliability through perfect order fulfilment and minimising order fulfilment lead times.

Therefore, the following hypothesis will be tested in this study:

H5: Organisational relationship and perfect order fulfilment are positively correlated.

H6: Organisational relationship and order fulfilment lead times are positively correlated.

Based on the aforementioned hypotheses, a research model of organisational relationship and logistics performance was developed (depicted in Figure 3.3).

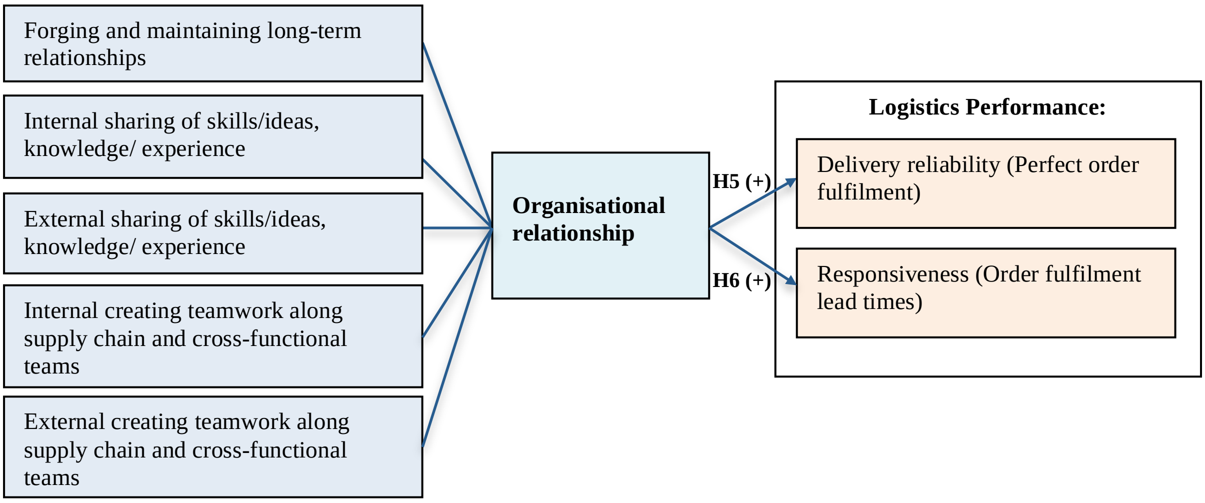


Figure 3.3: Conceptual model of organisational relationship and logistics performance

3.2.3.4 Institutional support

Institutional theory posits that firm's business decisions depend on various economic, cultural, social and political forces, as well as decisions made by relevant institutes, such as state and local government, social networks and other powerful organisations (Lau et al. 2002, Cai et al. 2010). Institutional theory has gained widespread popularity, as a means to explain organisations' behaviour across different countries worldwide. As a result, it is now widely recognised, amongst both theorists and industry practitioners, that various social, economic, and political institutional forces derive at least partly from national culture, which may shape the nature and impact of management practices in that country (Wu et al. 2008).

Governments often implement policies to induce active collaboration within and across different industry sectors (Cai et al. 2010). In Thailand, the government policy on infrastructure development can help to reduce logistics and transportation costs, especially in agricultural sector, as the country is still developing and relies heavily on this part of the nation's economy. When these policies are implemented fully, significant trade barrier reductions will be expected (BOI 2012). Laws and regulations pertaining to infrastructure are drivers of logistics performance, whereby government support plays the key role in achieving logistics performance improvements (ADB 2012). For example, in Indonesia, logistic providers rely on the government to improve and enforce laws and regulations, optimal investment and utilisation of infrastructure, advancement of logistic information and communication technology (Sumantri & Lau 2011).

Moreover, financing support that banks can provide through preferential loans and structured repayment systems can help budget-constrained retailers that are under increasing pressure to improve cash flow during financial crises. It is widely recognised that limited budget hinders the development of many start-ups and fast-growing companies (Chen & Cai 2011). However, banks are often reluctant to provide financial services to such companies, as retailers may later divert the funds obtained through bank loan to other riskier projects (Burkart & Ellingsen 2004). In this context, careful monitoring of the financial supply chain, which refers to all transactions related to the flow of cash and information in the trading process, from the buyer's initial purchase order, seller's invoice issuance and delivery, buyer's invoice final confirmation of sufficient funds is essential for the bank to offer its assistance. Here, the information refers to the documents and key data, such as invoice number and payer information, passing through supply chain with the goods, in order to facilitate the transaction (Sun & Cheung 2007).

In order for all entities in the supply chain to function and collaborate effectively, institutions must provide the necessary supports well as education and training (Habib 2014). That is why educational institutions nowadays offer a significant assistance to the supply chain members both in terms of providing extensive literature on relevant topics and actively offering courses, as well through research activities, conferences and seminars (SCC 2012b). For example, the Chartered Institute of Logistics and Transport in the UK, CILT (UK), is the preeminent independent professional body for individuals working in the fields of logistics, transport and other aspects of the supply chain. CILT is also recognised as the knowledge centre that provides extensive information through its logistics and transport library, which is not only the largest and most comprehensive in Europe, but is also accessible both in person and online. 'The Knowledge Bank' allows remote access to full text articles from more than 4,000 trade journals, 600 abstracted journals, over 1,100 country economic reports, 10,000 firm profiles and 1,600 reports from Data monitor (CILT 2012). In Thailand, Logistics and Supply Chain Management Institute provides training of logistics and supply chain managers employed in both private firms and public organisations (Logistics and Supply Chain Management Institute 2008).

Supply chain integration in practice influenced by the institutional norms (Cai et al. 2010, Huo et al. 2013, Kauppi 2013). Historically, Thai government has been playing significant role in creating institutional norms of automotive industry that promote supply chain integration (Wong & Boon-itt 2008). For the Thai egg industry, similar institutional support is needed for the supply chain partners, if they are to sustain their businesses and remain competitive in this market. Many government institutions are now involved in the effort to help companies by providing resources and training aimed at assisting them in improving their performance.

Therefore, the following hypothesis will be tested in this study:

H7: Institutional support and perfect order fulfilment are positively correlated.

H8: Institutional support and order fulfilment lead times are positively correlated.

The hypotheses presented above helped develop a research model of institutional support and logistics performance (see Figure 3.4).

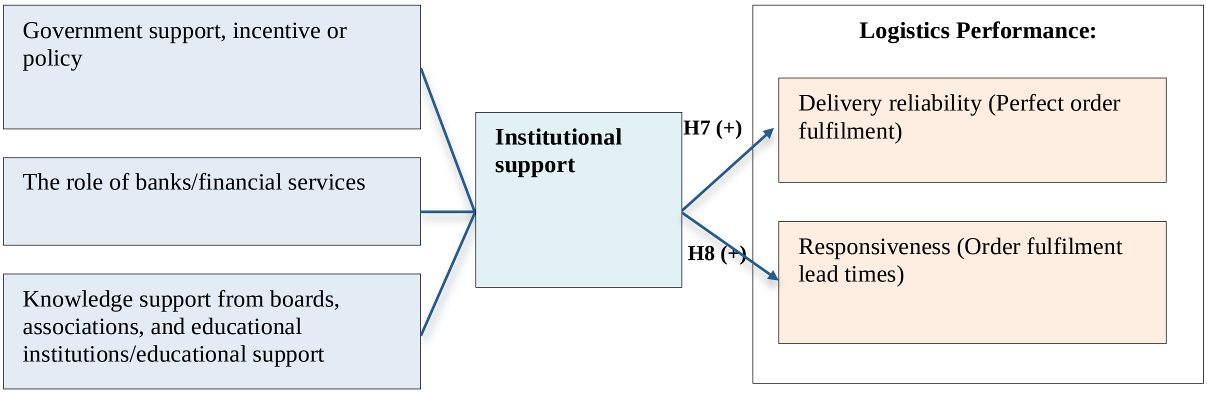


Figure 3.4: Conceptual model of institutional support and logistics performance

3.3 Research model and research hypotheses

The proposed research model consists of six key constructs, including four independent variables, and two dependent variables (see Figure 3.5). The independent variables are (1) information integration, (2) logistics operations coordination, (3) organisational relationship, and (4) institutional support. The dependent variables consist of (1) delivery reliability or perfect order fulfilment, and (2) responsiveness in terms of order fulfilment lead times. A summary of the variables definitions are provided on Table 3.3 ,

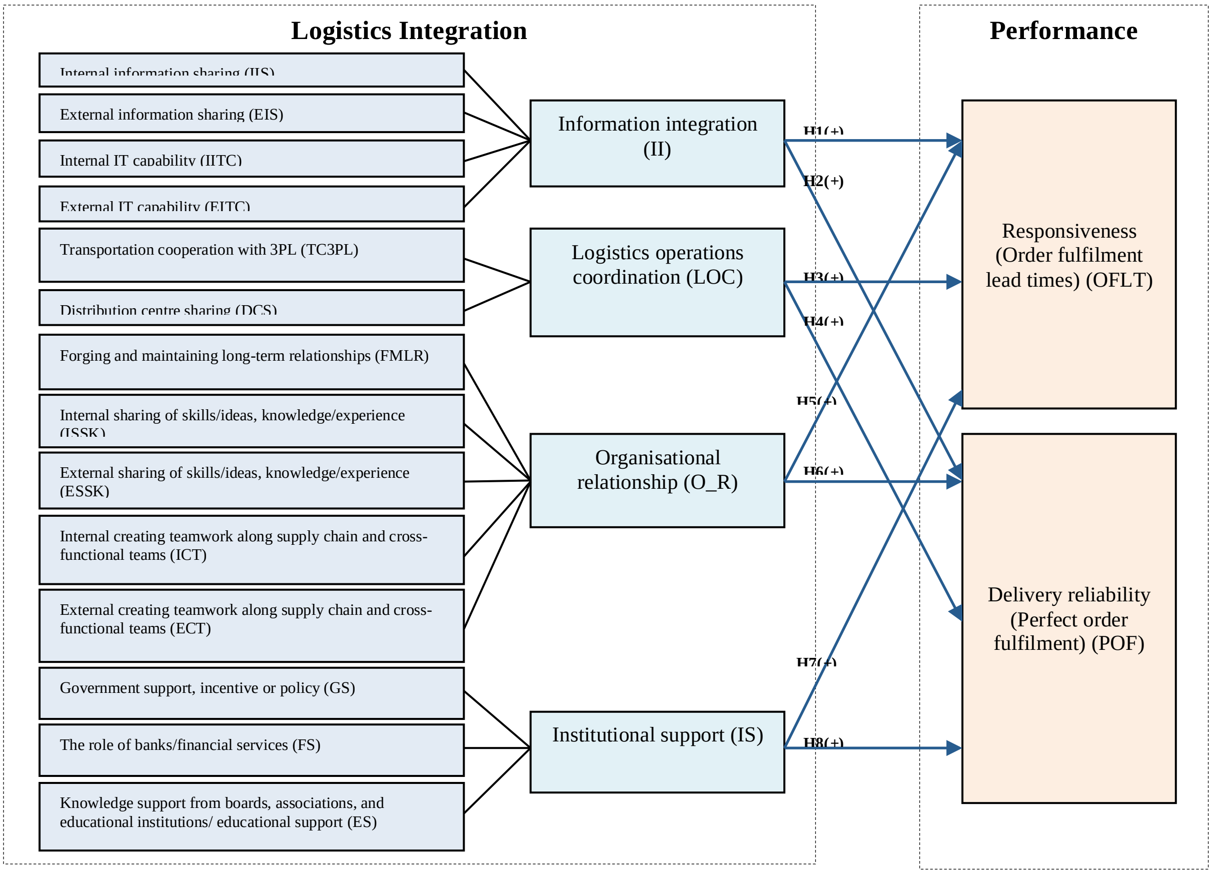


Figure 3.5: Conceptual framework of the study (indicating H1, H2, H3, H4, H5, H6, H7 and H8)

Table 3.3: Definition of dimensions in the constructs

Dimension	Definition/brief explanation	Source
Information integration (II)	Information integration is based on effective sharing of key information along the supply chain network that is enabled by the use of information technology (IT).	Dong et al.(2001), Prajogo & Olhager (2012)
Logistics operations coordination (LOC)	Cooperation and coordination, in the context of logistics operations is described as the realisation of joint actions across companies or suppliers (vertical integration) in order to achieve better results and meet common goals as effectively as possible.	Fabbe-Costes et al.(2009)
Organisational relationship (O_R)	Organisational relationship refers to stable interactions and transparent relationships among all chain partners. It entails incentive realignment, sharing of skills, teamwork and creation of cross-functional teams, all of which are geared towards improving effectiveness of all operations within the chain.	Alfalla-Luque et al. (2013)
Institutional support (IS)	The policy, incentives, services, and support of institutions (i.e., state and local government, social networks, educational institutes and other powerful organizations) that have the potential to affect the firm's business performance either directly or indirectly.	Lau et al. (2002), Cai et al. (2010)
Responsiveness (Order fulfilment lead times) (OFLT)	The time interval from the receipt of the order to the delivery of product/service to the customer.	Supply Chain Council (2010), Kocaoglu et al. (2013)
Delivery reliability (Perfect order fulfilment) (POF)	Ability to consistently deliver the right product of the right quality and in the right quantity to the right customer.	Supply Chain Council (2010), Kocaoglu et al. (2013)

The conceptual framework of the study presented in Figure 3.5 is developed based on the hypotheses (H1, H2, H3, H4, H5, H6, H7 and H8) on above.

3.4 Contextual background

The proposed conceptual model was developed from the theoretical foundation that was subsequently tested within the Thai egg logistics context. This section provides the detailed background information on the Thai egg industry, its characteristics, and critical logistics distribution issues. In sum, it delineates the manner in which the theoretical framework adopted in this study might address the gap in the current knowledge and practical management of logistics distribution problems.

3.4.1 Egg industry and supply chain distribution issues in Thailand

Thailand is also one of the world's leading egg producing countries with approximately 49.4 million hens (Department of Livestock Development 2011). This industry has become one of the major livestock components in the country and a significant part of Thai agriculture (Taechawattananan 2008). In 2000, Thailand ranked number 16 of the world's largest egg producers with 22.7 million eggs per day (Choprakarn 2000). From the production viewpoint, poultry can be classified as either broiler or layer, i.e. a source of chicken meat or eggs, respectively. In Thailand, 96% of egg production is aimed for the domestic market, with the remaining 4% exported both as an attempt profit from the oversupply and to stabilize the domestic price of eggs (a cura di Ice 2010). As of 2011, in Thailand, there were about 48,000 egg farms of various sizes and categories (commercial or non-commercial), typically classified as small-scale (backyard farms, small farms and medium farms) and large-scale (big and large farms). Semi-industrial production accounts for 52.22% of total egg production in Thailand, with the surplus met by the large-scale operations (The Association of Hen-Egg Farmers Traders and Exporters 2010). The most these egg farms are located in the central region of Thailand, with Chachoengsao ranking the highest by production volume, followed by Chonburi and Nakorn Nayok provinces (Department of Livestock Development 2011). As part of regulation by the government body, in 2013 the Department of Livestock Development has initiated that all commercial Egg firms must be registered to do business in Thailand. As a result in total 2,231 firms were identified as registered firms of which 1,526 organisations are identified as semi-industrial or small and medium size firms (Bureau of Livestock Standards and Certification 2013) and Egg production and distribution process is typically organized as a complex network of vertically integrated companies controlling every stage of production, from breeding hens to marketing processed chicken. As industrial poultry products are both exported and sold domestically, the organisation of such systems requires careful management and in-depth knowledge of many fields—from farming, poultry nutrition to sales and marketing. On the other hand, semi-industrial farms—small- or medium-sized farms—are typically somewhat autonomous in the production process. However, irrespective of their size, they are still not independent from other levels of the production system. In particular, semi-industrial farms tend to be characterised by medium intensive inputs and marketing (Heft-Neal et al. 2008).

In both semi-industrial or large-scale industrial production system systems, the product is sold in the same market and at the same price, which is unique for Thailand. In most other countries, egg type and price depends on the commercial aspects of production and typically cage, barn, and free rage eggs are the most popular types. Each product type is given a different price, whereas in Thailand, all eggs are sold at cage prices (Heft-Neal et al. 2008, DAFF 2013). Moreover, Thai shell egg transport cost is higher than in most industrialised countries (EU members in particular), as the system is not streamlined and fuel is expensive (Horne 2012). Thus, in order for Thai egg industry to become competitive and even create an advantage based on its unique characteristics, it is necessary to develop and implement an effective logistic distribution model.

Egg transport distribution as a part of the semi-industrial production process (Figure 3.6) is based on producers transporting the eggs reared on their farms to a collection centre by using their proprietary transportation services(Heft-Neal et al. 2008). Semi-industrial distribution process is different from large-scale egg supply chain setting. In large-scale setting collection and distribution centre is an integral part of the egg collection chain from farms to wholesalers or retailers. Semi-industrial farms can choose to sell their eggs to retailers either through (1) direct market, or by taking in (2) wholesalers market. In the case of wholesalers' market, producers' transportation arrangements will depend on several issues, such as the quantity and frequency of supply, the size of the producer's operation, the distance travelled etc. and may involve either the producer providing proprietary transport, or relying on the wholesalers for providing the egg transportation as a part of larger logistic operations. Although the technological advancements would make this operation more efficient and cost effective, most retailers, wholesalers and producers would typically use the phone for their communication (FAO 2003, Heft-Neal et al. 2008).

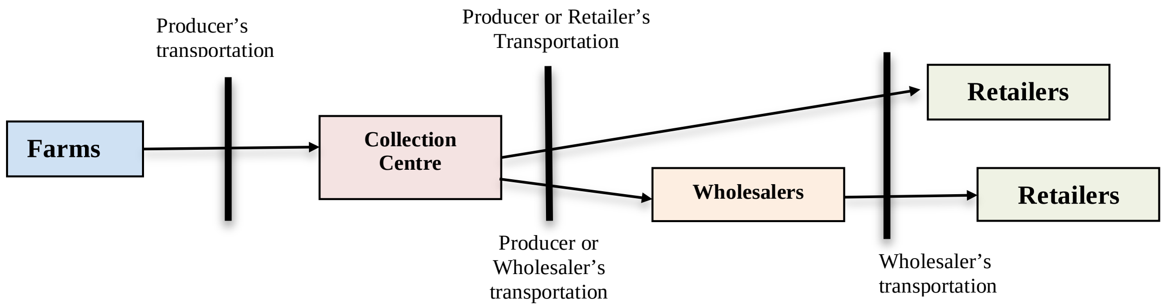


Figure 3.6: Egg supply chain distribution in semi-industrial setting, adapted from FAO (2003)

Thai egg distribution logistics in small or medium-sized (semi-industry) farms production systems currently suffers primarily from lack of streamlined and effective information and payment flows, as well as the uniform framework that governs creation and distribution of products in the supply chain management (Heft-Neal et al. 2008, TDRI 2012). This issue affects all participants in the chain (farmers, wholesalers and retailers) and they all have to work together in order for any improvements in the current situation to be possible. Semi-industrial Thai egg business clearly faces numerous problems, such as inadequate central logistics infrastructure, low quality and high cost of all currently available transport modes, insufficient technology investment, poor communication methods, lack of information sharing, ineffective communication channels, ineffective use of supply contracts, the participants' unwillingness to share the associated risks and unavailability of capital sources, all of which contribute to imperfect environment (TDRI 2012).

The semi-industrial egg production in Thailand is lacking logistic performance effectiveness, which is widely recognized as the key strategy for improving its overall performance. Studies conducted in many courtiers worldwide have shown that SCI can improve logistics in various industries (Dong et al. 2001, Frohlich & Westbrook 2001, Stank et al. 2001b, Narasimhan & Kim 2002, Bagchi et al. 2005, Mollenkopf & Dapiran 2005, Sanders & Premus 2005, Quesada et al. 2008). Hence, it is valid to assume that its adoption would improve logistics performance in the semi-industrial egg production in Thailand. However, in order to propose a strategy for improving logistics performance in the Thai semi-industrial egg distribution context, it is necessary to consider the related theoretical foundations (RDT, RBV institutional and SCM theory). Grounding the research in sound theoretical foundations would help address extant problems affecting the semi-industrial egg distribution in Thailand.

The conceptual framework based on SCI was developed based on these theories and was used to test the model developed as a part of the present study. Empirical evidence indicates that different forms of SCI have been used in theory and practice, depending on the context and industry. However, most include four dimensions comprising of fourteen factors (see in Figure 3.5).

3.5 Summary

This chapter has presented a theoretical framework (or a research model), developed based on prominent theories and models published in the extant literature focusing on the application of SCI with the aim to improve Thai egg logistics distribution. The development of the theoretical framework was contingent on an in-depth understanding of resource dependence theory, resource-based view (RBV) theory, institutional theory and SCM, all of which will be applied in order to facilitate finding a new SCI strategy applicable to the objective of this study. In short, the aim is to improve logistic distribution performance in Thai egg industry, with the goal of improving order fulfilment rates and customer satisfaction. These theories helped develop a research model and hypotheses guiding this study. In the next chapter, the research method will be described, as well as the application of structural equation modelling using AMOS version 22.0, which was employed in the testing of the proposed hypotheses in relation to the theoretical framework.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.0 Introduction

This chapter presents the research design and methodology adopted in this thesis, which were selected based on their ability to test the research model and study hypotheses. It is organised into nine main sections, respectively describing research design; methodology; survey questionnaire development; pilot study; population, sampling and data collection method; data editing and coding; data analysis; data management for multivariate data analysis; and ethics pertaining to this research.

4.1 Research methodology

Selection of an appropriate research approach is vital to the successful study outcome, as it helps determine where the research should commence, how the data collection, analysis and interpretation is conducted, and what types of research techniques are appropriate for answering the research questions guiding the study (Blaikie 2009). For example, in social science research, the positivist paradigm has its roots in physical science, as it adopts a systematic, scientific approach to research (Veal 2005). In other words, the positivist paradigm involves application of scientific methodology to answer the research questions guiding the study (Fraser et al. 2004). The key features of the scientific method include (1) observation and data collection, (2) search for patterns and theory development, (3) forming hypotheses to test the theory, (4) conducting research to test the hypotheses, and (5) providing support for the theory, or making adjustments, if needed (Coolican 2014).

Based on these characteristics, quantitative approach can be said to align with the positivist paradigm (Sachan & Datta 2005). Quantitative research methods involve measuring concepts using scales that provide numerical data either directly or indirectly. The numerical data thus obtained is subsequently analysed using mathematical procedures. These procedures can be extremely simple, such as expressing results as percentages, or more complex, requiring development of statistical models. In the latter case, hypothesis testing is typically facilitated by sophisticated software (Zikmund et al. 2010). Quantitative methods also provide better representation of population, and comparatively higher degree of generalisation (Neuman 2011). Quantitative research is usually conducted when the goal is measuring potential causes of outcomes, as numerical results clearly present the relationship between causes and outcomes (Creswell 2009). Moreover, the literature review conducted as a part of this study revealed that quantitative approach was the most frequently applied technique in extant logistics research (Stank et al. 2003, Selviaridis & Spring 2007). Therefore, quantitative approach is considered the most appropriate for meeting the objectives of the present study, as it enables testing the hypotheses and evaluating the research model developed. This research was underpinned by the positivist philosophy, and deductive approach is used to test the hypotheses developed in the study. The positivist philosophy enables drawing deductive inferences about a population from the results of a statistical analysis performed on a sample (Collis & Hussey 2009). Thus, deductive approach is suitable for hypothesis testing, as it allows the researcher to reach more generalisable conclusions based on the study findings pertaining to a relatively small sample drawn from a population of interest (Blaikie 2009). Hence, as theory testing is the primary study objective, quantitative approach is considered most appropriate for this research project. The research questions are formulated with the aim of examining the effects of information integration, logistics operations coordination, organisational relationship, and institutional support on logistics performance. The proposed hypotheses, which provide the framework for the study, were formulated based on an extensive literature review. Thus, quantitative approach was considered suitable for achieving the study objectives (Neuman 2011).

The authors of extant studies focusing on supply chain management have adopted a wide range of research methodologies, including substantive justification for theory building, survey, case study, action research, and modelling supply chains (Kotzab et al. 2005). In this research, survey is used as a data collection instrument, as it enables quantification of gathered information, through statistical tests and analyses, in order to meet the set objectives. Surveys can be employed in empirical/quantitative research that aims to test the hypotheses in order to answer the research questions. Moreover, surveys allow systematic gathering of the relevant information from a broad base of respondents, whereby their individual responses provide sufficient amount of relevant data that can be used in subsequent analyses. The main goal is to deepen the understanding of the phenomenon under investigation and/or predict some aspect of the behaviour of the population (provided that the sample is chosen in a manner that permits generalisation of the study findings) (Veal 2005). A questionnaire survey was used as a primary data collection instrument in this study, as it allows easy access to a large number of respondents. For that, and many other reasons, it is one of the most popular methods of gathering quantitative data. According to Neuman (2011), it is less biased and less intrusive than other data collection methods, such as face-to-face interviews or direct observation. Moreover, primary data gathered through questionnaires allows the researcher to test the current perceptions of participants towards a business circumstance under investigation (Boyer & Swink 2008). This technique is also quicker, cheaper and more anonymous to administer than face-to-face interviews or direct observations, as a large number of respondents can be given the questionnaire to complete at their convenience (Veal 2005). Questionnaire survey has also been one of the most commonly used instruments in studies measuring SCM and performance (Stank et al. 2001a, Bagchi et al. 2005, Boon-itt & Paul 2006). Thus, due to the aforementioned benefits, in this study, the data required to meet its objectives was gathered through a survey, whereby the questionnaire was mailed to the target population sample. This approach was chosen because it was cost-effective, required minimal involvement on behalf of the researcher, and increased the survey population without increasing variable cost. It was also easier to secure participation from individuals who would otherwise not take part in the study, as they were not accessible in person. Finally, it provided enough time for participants to think about questions before responding (Cooper & Schindler 1998). The data collection implemented in this study comprised two phases—the pilot study and the full sample survey—which will be presented later in this chapter.

4.2 Methodology

This study was conducted in accordance with the requirements of a research process based on the concepts of hypothetical-deductive method shown in Figure 4.1. The adopted methodology included questionnaire development, pilot study in which the questionnaire was evaluated and revised, followed by the main study using the final questionnaire as the data collection instrument, analysis of the questionnaire data, and a summary of the key study findings in a form of a report. Moreover, reliability and validity measurements were integrated into the survey research process to confirm the quality and appropriateness of a measuring instrument and its ability to reduce measurement error/bias.

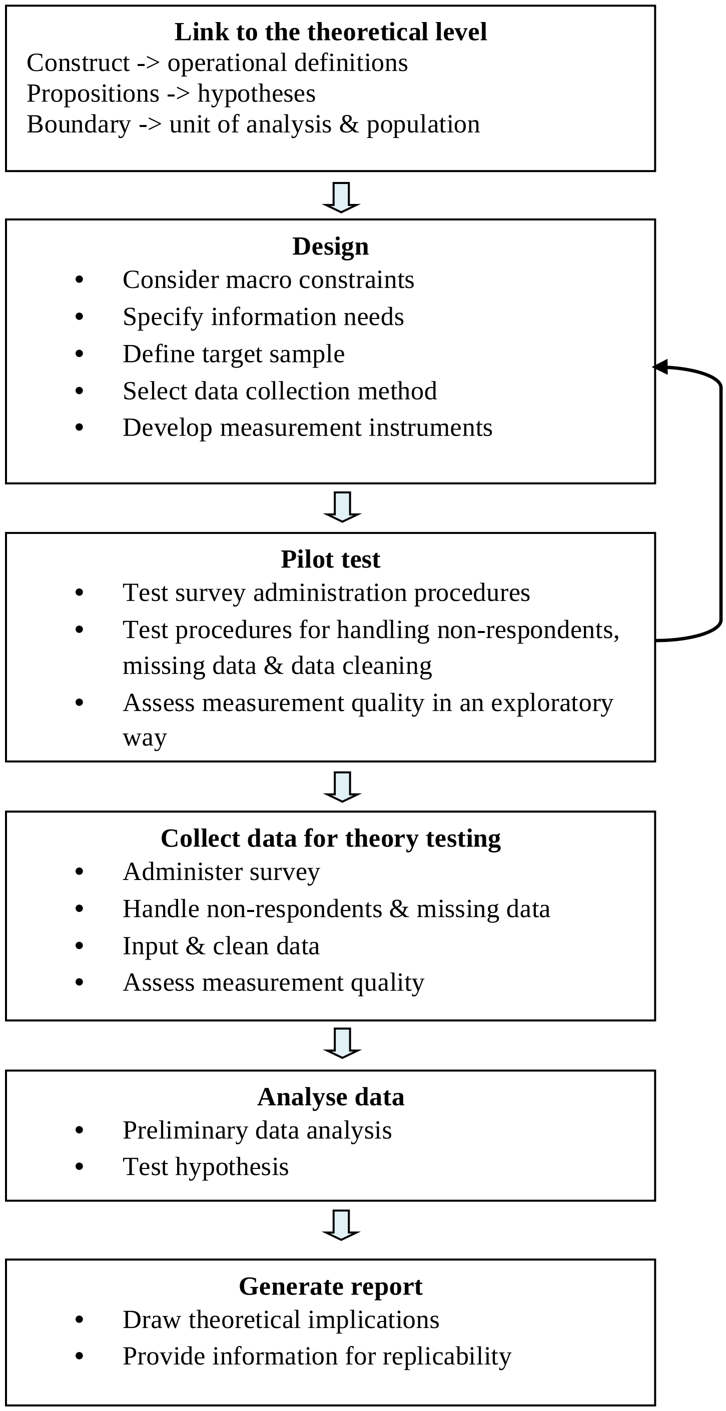


Figure 4.1: Survey research process, Source: Forza (2002).

4.3 Survey questionnaire development

When developing a survey questionnaire, it was essential to first define constructs and their respective measuring items (Churchill Jr 1979). These steps are described in more detail below.

4.3.1 SCI constructs

In this study, the SCI constructs are treated as independent variables, whereas logistics performance is considered as dependent variable. Thus, based on the extant literature and the analysis performed in this study, the following elements are included as independent variables: information integration, logistics operations coordination, organisational relationship, and institutional support. On the other hand, logistics performance, as a dependent variable, consisted of two components—reliability (perfect order fulfilment) and responsiveness (order fulfilment lead times).

4.3.1.1 Information integration

Information integration refers to the sharing of key information along the supply chain network, facilitated by the use of information technology (IT) (Prajogo & Olhager 2012). In this study, information integration included four dimensions: (1) internal information sharing, (2) external information sharing, (3) internal IT capability, and (4) external IT capability (defined in Table 4.1)

Table 4.1: Definition of dimensions of information integration construct

Dimension	Definition/explanation	References
Internal Information Sharing	Internal information sharing in logistics means exchange of information within the company (all staff/employees) as efficient and as streamlined as possible.	Gimenez & Ventura (2003), Mollenkopf & Dapiran (2005), Prajogo & Olhager (2012)
External Information Sharing	External information sharing in logistics means exchange of information with the supply chain partners as efficient and as streamlined as possible and thus allows collaborative planning and joint demand forecast for the supply chain as a whole.	Frohlich & Westbrook (2001), Mollenkopf & Dapiran (2005), Prajogo & Olhager (2012)
Internal IT Capability	Internal IT capability refers to the organisation's ability to implement and use IT assets or functionalities with the staff/employees in combination with other resources to execute everyday business processes more effectively and efficiently.	Piccoli & Ives (2005)
External IT Capability	External IT capability refers to the ability to implement and use IT assets or functionalities	Rai et al. (2012)

	between business partners in combination with other resources to execute everyday business processes	

4.3.1.2 Logistics operations coordination

Logistics operations coordination pertains to the cooperation between firms and third party logistics companies in some or all logistic operations. When executed successfully, through logistics operation coordination it is expected to result in greater standardisation of services, greater market segmentation, as well as more intense competition and improved services (Mortensen & Lemoine 2008). Logistics operations coordination includes two dimensions: (1) transportation cooperation with 3PL, and (2) distribution centre sharing/warehouse sharing (defined in Table 4.2).

Table 4.2: Definition of dimensions of logistics operations coordination construct

Dimensions	**Definition**	**References**
Transportation cooperation with 3PL	Focal companies outsource logistics services to the 3PL companies to perform logistics functions that have traditionally been performed within a firm.	Mortensen & Lemoine(2008), Fabbe-Costes & Roussat (2011)
Distribution centre sharing/warehouse sharing	Distribution centre or warehouse sharing through shared services (e.g. order management, transportation, warehousing activities, and value-added logistics) in the field of physical distribution offers great advantages, such as significant reduction in distribution cost, better marketing position, and improved customer service.	Vereecke et al. (2008)

4.3.1.3 Organisational relationship

Organisational relationship refers to stable interactions and transparent relationships among all supply chain partners. Among other aspects, it pertains to maintaining long-term relationships, creating teamwork, incentive realignment, and sharing of knowledge, skills and ideas (Alfalla-Luque et al. 2013). Organisational relationship includes five dimensions: 1) forging and maintaining long-term relationships, 2) internal sharing of skills/ideas, knowledge and experience, 3) external sharing of skills/ideas, knowledge and experience, 4) internal creation of teamwork along the supply chain and cross-functional teams, and 5) external creation of teamwork along the supply chain and cross-functional teams. Brief definitions of the dimensions of organisational relationship construct are shown in Table 4.3.

Table 4.3: Definition of dimensions of organisational relationship construct

Dimensions	Definition	References
Forging and maintaining long-term relationships	Forging and maintaining long-term relationships implies developing a stable interactions and transparent inter-organisational relationship between all chain partners and entails common visions and objectives, incentive realignment and sharing of skills.	Droge et al. (2004), Bagchi et al. (2005)
Internal sharing of skill/ideas, knowledge/experience	Sharing of internal skills/ideas and knowledge/experience assumes finding ways to successfully coordinate the best practices among the various members (staffs/employees) in the firm.	Christopher & Gaudenzi (2009), Rahman & Yang (2012), Alfalla-Luque et al. (2013)
External sharing of skill/ideas, knowledge/experience	Sharing of external skills/ideas and knowledge/experience assumes finding ways to successfully coordinate among the supply chain partners of the inter-firm in order to efficiently generate new knowledge and capabilities.	Gu et al. (2007), Christopher & Gaudenzi (2009), Alfalla-Luque et al. (2013)
Creating internal teamwork along supply chain and cross-functional teams	Creating teamwork along the supply chain and cross-functional teams is based on the ability to encourage team-building that allows for coordination and active cooperation between internal employees or staffs.	Das et al. (2006), Campany et al.(2007), Santa et al. (2010)
Creating external teamwork along supply chain and cross-functional teams	Creating external teamwork along the supply chain and cross-functional teams is based on the ability to encourage inter-firm team-building, enabling coordination and active cooperation between business parties (inter-firm).	Das et al. (2006), Santa et al. (2010), Shi & Liao (2013)

4.3.1.4 Institutional support

Institutional support requires the relevant institutional forces to assist firm's business in terms of issues such as financial, legislative, social and environmental aspects. The primary institutions that can offer this type of support are state and local government, social networks, and powerful non-government organisations (Lau et al. 2002, Cai et al. 2010). Institutional support includes three dimensions: namely government support, incentive or policy; the role of banks/financial services; knowledge support from boards and associations, and educational institutions/educational support; all of which are defined in Table 4.4.

Table 4.4: Definition of dimensions of institutional support construct

Dimensions	Definition	References
Government support, incentive or policy	Government support, incentive, or policy refers to developing and implementing policies with the aim to induce active collaboration within and across logistic distribution sectors.	Cai et al. (2010), Sumantri & Lau (2011)
The role of banks/financial services	The role of banks/financial services is in provision of preferential loans and structured repayment systems that can help budget-constrained retailers that are under increasing pressure to improve cash flow during financial crises.	Chen & Cai (2011), Silvestro & Lustrato (2014)
Knowledge support from boards and associations, and educational institutions/educational support	Knowledge support from boards and association refers to the necessary support, as well as education and training by educational institutions.	Logistics and Supply Chain Management Institute (2008), SCC (2010), CILT (2012)

4.3.1.5 Perfect order fulfilment (reliability)

Perfect order fulfilment means the performance of the supply chain in delivering with the right product, to the correct place, at the right time, in the right condition and packaging, in the correct quantity, with the correct documentation, to the right customer (Supply Chain Council 2010). Perfect order fulfilment includes four dimensions: (1) information integration through perfect order fulfilment, (2) Logistics operations coordination through perfect order fulfilment, (3) Organisational relationship through perfect order fulfilment, and (4) institutional support through perfect order fulfilment, which are defined in Table 4.5.

Table 4.5: Definition of dimensions of perfect order fulfilment construct

Dimensions	Definition/explanation	References
Information integration for perfect order fulfilment	Information integration through information sharing platform, help logistics providers to be capable of delivering the right quantity of product to the right customer, at the right place to the right quantity if information integration is incorporated in logistics distribution.	Fawcett et al. (2007)
Perfect order fulfilment through logistics operations coordination	Logistic provider will be capable to fulfil customer order by delivering the right quality and the right quantity of product to the right customer, if logistics operations coordination is maintained in logistics distribution.	Selviaridis et al. (2008),Wang et al. (2010), Audy et al. (2012), Gebresenbet & Bosona (2012)
Organisational relationship for perfect order fulfilment	Development of long-term relationships, trust, and teamwork helps logistic providers to deliver with the right quality and the right quantity of product to the right customer	Stank et al. (2001a), Bagchi et al. (2005)
Institutional support for perfect order fulfilment	Institutional support through employee training and sharing resources help or facilitate logistics providers to improve their capabilities to delivery the right quality product in the right quantity to the right customer.	Sun&Cheung (2007), Gebresenbet & Bosona (2012)

4.3.1.6 Order fulfilment lead times (responsiveness)

Order fulfilment lead times is the term used to describe the period required for the supply chain to deliver products to the customer (Supply Chain Council 2010). Order fulfilment lead times includes four dimensions: (1) information integration through order fulfilment lead times, (2) logistics operations coordination through order fulfilment lead times, (3) organisational relationship through order fulfilment lead times, and (4) institutional support through order fulfilment lead times, which are defined in Table 4.6.

Table 4.6: Definition of dimensions of order fulfilment lead time construct

Dimensions	Definition	References
Information integration for order fulfilment lead times	The time from receipt of customer order to delivery can be reduced, if information integration is used among supply chain partners in	Fawcett & Magan (2001),Fawcett et al. (2007)

	logistics distribution.	
Logistics operations coordination for order fulfilment lead times	The time from receipt of customer order to delivery can be decreased, if logistics operations coordination is maintained in logistics distribution.	Friedman, Stank et al. (2001b)
Organisational relationship through order fulfilment lead times	The time from receipt of customer order to delivery can be decreased, if organisation relationship is established in logistics distribution.	Stank et al. (2001a), Deshpande (2012)
Institutional support for order fulfilment lead times	The time from receipt of customer order to delivery can be decreased, if institutional support is properly utilised in logistics distribution.	Gebresenbet & Bosona (2012), Silvestro & Lustrato (2014)

4.3.2 Measurement of constructs (in the main survey)

The survey questionnaire was developed to capture all data required for answering the research questions and testing the study hypotheses. As shown in Appendix 1, where it is reproduced in full, it comprises eight sections, labelled Section A-H. Section A includes items that aim to elicit the respondents' views on factors that are critical for information integration. Section B seeks to elicit their views on factors that are critical for logistics operations coordination, while Section C seeks input on factors that are critical for organisational relationship. The respondents' perceptions pertaining to factors that are critical for institutional support are elicited by the items included in Section D, while Section E aims to identify factors that are critical for distribution logistics integration through delivery reliability and responsiveness (expedience). Section F seeks general information about respondents' organisation, while items included in Section G pertain to the general information about the respondents. Lastly, Section H allows each respondent to express any additional comments or add further information regarding specific items included in the survey. Items included in Section A-E require a Likert-type answer, whereby the respondents are instructed to select only one point on the scale that best describes their evaluation of the factor being examined. The remaining sections (F, G and H) include items that are presented as statements, whereby the respondents are instructed to fill the gap in each statement using one of the options provided (which they select by circling the choice that best describes them as individuals and their organisation). However, it should be noted that, when the constructs were measured, only the responses provided in the questionnaire sections A-E were used

4.3.2.1 Measurement of the information integration construct

Measurement of the information integration construct included the measurement items pertaining to internal information sharing, external information sharing, internal IT capability, and external IT capability dimensions.

(i) Measurement items for the internal information sharing dimension

The items generated for the internal information sharing dimension are presented in Table 4.7. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.7: Measurement items for the internal information sharing dimension

Dimension	Measurement item	References
1.1 Internal information sharing could be achieved through:	1.1.1 Intending to provide staffs/employees with any egg distribution information that might help them improve logistics performance.	Germain & Lyer (2006), Prajogo & Olhager (2012)
	1.1.2 Aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	Germain & Lyer (2006), Prajogo & Olhager (2012)
	1.1.3 Planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	Germain & Lyer (2006), Prajogo & Olhager (2012)
	1.1.4 Intending to share product planning related information with the your egg distribution staffs/employees.	Germain & Lyer (2006), Frohlich & Westbrook (2001)

(ii) Measurement items for the external information sharing dimension

The items generated for the external information sharing dimension are indicated in Table 4.8. The items were measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.8: Measurement items for the external information sharing dimension

Dimension	Measurement item	References

1.2 External information sharing could be obtained through	1.2.1 Sharing sensitive information on financial, service, design, and research on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	Prajogo & Olhager (2012)
	1.2.2 Planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that takes place frequently, informally, and in timely manner.	Prajogo & Olhager (2012)
	1.2.3 Aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	Prajogo & Olhager (2012)
	1.2.4 Considering frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	Prajogo & Olhager (2012)
	1.2.5 Keeping each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).	Prajogo & Olhager (2012)
	1.2.6 Sharing egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	Wu et al. (2014)

(iii) Measurement items for the internal IT capability dimension

The items generated for the internal IT capability dimension are indicated in Table 4.9. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.9: Measurement items for the internal IT capability dimension

Dimension	Measurement item	References
2.1 Internal IT capability through using the modern information and communication technologies and devices:(e.g. landline phone, fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staffs/employees.	2.1.1 Can help to fulfil customer demand more accurately to improve service level.	Bharadwaj (2000), Piccoli & Ives (2005)
	2.1.2 Developing IT solutions can significantly reduce the production or delivery lead time.	Bharadwaj (2000), Piccoli & Ives (2005)
	2.1.3 Latest /appropriate ICT allows integration of operational functions that support egg distribution.	Bharadwaj (2000), Piccoli & Ives (2005)
	2.1.4 Use of ICT can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.	Bharadwaj (2000), Piccoli & Ives (2005)

(iv) Measurement items for the external IT capability dimension

The items generated for the external IT capability dimension are indicated in Table 4.10. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.10: Measurement items for the external IT capability dimension

Dimension	Measurement item	References

2.2 External IT capability can be achieved by integrating supplier and customer through IT technology (such as landline phone, Fax, mobile, smart phone, computer, software, etc.) that will help:	2.2.1 Further improving the business information sharing with chain partners.	Piccoli & Ives (2005), Rai et al. (2012)
	2.2.2 Can improve customer service by sharing the information with all SCM parties.	Piccoli & Ives (2005), Rai et al.(2012)
	2.2.3 Improve IT support.	Piccoli & Ives (2005), Rai et al.(2012)
	2.2.4 Develop IT capabilities that focus on optimising the scheduling and routing of transportation.	Piccoli & Ives (2005), Rai et al. (2012)
	2.2.5 Allow integration of IT functions into the distribution chain.	Piccoli and Ives (2005), Rai et al. (2012)

4.3.2.2 Measurement of the logistics operations coordination construct

Measurement of the logistics operations coordination construct includes measurement items for the transportation cooperation with 3PL, distribution centre/warehouse sharing dimensions.

(i) Measurement items for the transportation cooperation with third party logistics (3PL) dimension

The items generated for the transportation cooperation with 3PL dimension are indicated in Table 4.11. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.11: Measurement items for the transportation cooperation with 3PL dimension

Dimension	Measurement item	References
3. Transportation cooperation (3PL)	3.1 Intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	Selviaridis & Spring (2007)
	3.2 Aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	Selviaridis & Spring (2007), Selviaridis et al. (2008)
	3.3 Anticipating to collaborate with 3PL for freight truck on investment such as buying or hiring vehicles.	Selviaridis & Spring(2007)
	3.4 Expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	Selviaridis & Spring (2007), Selviaridis et al. (2008)
	3.5 Intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	Selviaridis & Spring (2007), Selviaridis et al. (2008)

(ii) Measurement items for the distribution centre/warehouse sharing dimension

The items generated for the distribution centre/warehouse sharing dimension are indicated in Table 4.12. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.12: Measurement items for the distribution centre/warehouse sharing dimension

Dimension	Measurement item	References
4. Distribution centre/warehouse sharing	4.1 Intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	Gu et al. (2007), Rimiene (2008)
	4.2 Aiming to share shipping processes and resources (trucks, trolley, equipments and	Gu et al. (2007), Rimiene (2008)

employees/staffs) in egg distribution.	
4.3 Anticipating to share storage facilities in egg distribution centre/warehouse management.	Gu et al. (2007), Rimiene (2008)
4.4 Expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	Gu et al. (2007), Rimiene (2008)
4.5 Intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	Faber et al. (2013)
4.6 Aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	Franklin & Spinler (2011)

4.3.2.3 Measurement of the organisational relationship construct

Measurement of the organisational relationship construct includes measurement items for the forging and maintaining long-term relationships, internal sharing of skills/ideas & knowledge/experience, external sharing of skills/ideas & knowledge/experience, internal creation of teamwork along the supply chain and cross-functional teams, and external creation of teamwork along the supply chain and cross-functional teams dimensions.

(i) Measurement items for the forging and maintaining long-term relationships dimension.

The items generated for the forging and maintaining long-term relationships dimension are indicated in Table 4.13. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.13: Measurement items for the forging and maintaining long-term relationships dimension

Dimension	Measurement item	References
5. Forging and maintaining long-term relationships through:	5.1 Sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).	Doney & Cannon (1997), Kwon (2004)
	5.2 Keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm) such as delivery date, and quantity and quality of delivered eggs.	Doney & Cannon (1997), Kwon (2004)
	5.3 Being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	Kwon (2004)
	5.4 Keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	Doney & Cannon (1997)
	5.5 Making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.	Doney & Cannon (1997)

(ii) Measurement items for the internal sharing of skills/ideas, knowledge/experience dimension

The items generated for the internal sharing of skills/ideas, knowledge/experience dimension are indicated in Table 4.14. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.14: Measurement items for the internal sharing of skills/ideas, knowledge/experience dimension

Dimension	Measurement item	References

6.1 Internal sharing of skills/ideas, knowledge/experience through:	6.1.1 Sufficient and up-to-date knowledge sharing with your employee/staff.	Shih et al.(2012)
	6.1.2 Sufficient skill to handle the shipping processes in egg distribution with your employee/staff.	Gu et al.(2007), Rimiene(2008), Rahman & Yang (2012)
	6.1.3 Expertise for order receiving services in egg distribution with your employee/staff.	Gu et al.(2007), Rimiene(2008), Rahman & Yang (2012)
	6.1.4 Experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	Gu et al.(2007), Rimiene(2008), Rahman & Yang (2012)
	6.1.5 Skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	Gu et al.(2007), Rimiene(2008), Rahman & Yang (2012)
	6.1.6 Knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	Faber et al.(2013), Rahman & Yang (2012)

(iii) Measurement items for the external sharing of skills/ideas, knowledge/experience dimension

The items generated for the external sharing of skills/ideas, knowledge/experience dimension are indicated in Table 4.15. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.15: Measurement items for the external sharing of skills/ideas, knowledge/experience dimension

Dimension	Measurement item	References

6.2 External sharing of skills/ideas, knowledge/experience; through:	6.2.1 Sufficient and up-to-date knowledge on egg distribution shared with partners.	Thomas (2011), Shih et al.(2012), Cai et al. (2013)
	6.2.2 Skill to handle the shipping processes in egg distribution shared with partners.	Gu et al. (2007), Rimiene (2008), Rahman & Yang (2012)
	6.2.3 Necessary skill for order receiving services in egg distribution shared with partners.	Gu et al. (2007), Rimiene (2008), Rahman & Yang (2012)
	6.2.4 Skills related to order processing in egg distribution through centre/warehouse management shared with partners.	Gu et al. (2007), Rimiene (2008), Rahman & Yang (2012)
	6.2.5 Skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	Faber et al. (2013), Rahman & Yang (2012)

(iv) Measurement items for the internal creation of teamwork along the supply chain and cross-functional teams dimension

The items generated for the internal creation of teamwork along the supply chain and cross-functional teams dimension are indicated in Table 4.16. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.16: Measurement items for the internal creation of teamwork along the supply chain and cross-functional teams dimension

Dimension	Measurement item	References

7.1 Internal creation of teamwork along the supply chain and cross-functional teams	7.1.1	Providing training your employees, so that they can work under diverse situation.	Campany et al.(2007)
	7.1.2	Creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	Druskat & Wolff (2001)
	7.1.3	Enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	Campany et al. (2007)
	7.1.4	Creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	Campany et al. (2007)
	7.1.5	Encouraging staff members to help each other to improve their skills to improve logistics performances.	Campany et al. (2007)
	7.1.6	Frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	Campany et al. (2007)

(v) Measurement items for the external creation of teamwork along the supply chain and cross-functional teams dimension

The items generated for the external creation of teamwork along the supply chain and cross-functional teams dimension are indicated in Table 4.17. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree)

Table 4.17: Measurement items for the external creation of teamwork along the supply chain and cross-functional teams dimension

Dimension	Measurement item	References
7.2 External creation of teamwork along the supply chain and cross-functional teams	7.2.1 Empowering decision-making and operation rights to the team.	Shi & Liao (2013)
	7.2.2 Enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	Shi & Liao (2013)
	7.2.3 Encouraging joint problem-solving in egg distribution.	Shi & Liao (2013)
	7.2.4 Specifying acceptable team cooperation in the egg distribution.	Stock (2006)
	7.2.5 Clearly identifying partners roles and responsibilities.	Stock (2006)
	7.2.6 Appreciating partners cooperation in the egg distribution.	Stock (2006)

4.3.2.4 Measurement of the institutional support construct

Measurement of the institutional support construct includes measurement items for the government support & incentive or policy, the role of banks/financial services, and educational institution/knowledge support from boards and association dimensions.

(i) Measurement items for the government support, incentive or policy dimension

The items generated for the government support, incentive or policy dimension are indicated in Table 4.18. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.18: Measurement items for the government support, incentive or policy dimension

Dimension	Measurement item	References
8. Government	8.1 Good-quality roads within the delivery	Ferreira & Tetther

support, incentive or policy: :	route.	(2004)
	8.2 New technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	Ferreira & Tetther (2004)
	8.3 Programs/research for identifying and implementing the best practices in freight transport.	McKinnon (2009)
	8.4 Policy that ensures food safety control in delivery.	NSW Government (2010)
	8.5 Financial support for logistics providers to build new facilities and to purchase vehicles.	Elkhouly & Hamdy (2012)
	8.6 Policy that supports education system in incorporating the logistics for egg industry in curricula.	Elkhouly & Hamdy (2012)

(ii) Measurement items for the role of banks/financial services dimension

The items generated for the role of banks/financial services dimension are indicated in Table 4.19. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.19: Measurement items for the role of banks/financial services dimension

Dimension	Measurement item	References
9. For Egg business, banks/financial services should introduce efficient services in:	9.1 Converting to electronic payment methods (e.g., online banking, electronic payment systems, telephone banking).	Gregory (2008), Australian Government (2012)
	9.2 Introducing commercial bills (the bills of exchange for cash needs) as means of financing.	Australian Government (2012)
	9.3 Implementing modern card-payment	Gregory(2008),

	technologies (i.e., credit/debit cards).	Sprenger & Stavins (2010), Australian Government (2012)
9.4	Approving business loans/microcredit facilities with lower interest for SMEs.	Australian Government (2012), Fararah & Al-Swidi (2013)
9.5	Facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	Australian Government (2012)
9.6	Streamlining one-stop financial service delivery.	Liu & Wu (2007), Australian Government (2012)

(iii) Measurement items for the knowledge support from boards and associations, and educational institutions/educational support dimension

The items generated for the knowledge support from boards and associations, and educational institutions/educational support dimension are indicated in Table 4.20. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree)

Table 4.20: Measurement items for the knowledge support from boards and associations, and educational institutions/educational support dimension

Dimension	Measurement item		References
10. Knowledge support from boards and associations, and educational institutions/educational support	10.1	For understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	Lutz & Birou (2013)
	10.2	Identifying and defining logistic strategies in egg logistics distribution.	Lutz & Birou (2013)
	10.3	Understanding of the purpose and	Lutz & Birou

		appropriateness of existing business logistics models.	(2013)
	10.4	Organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	Wu (2007)

4.3.2.5 Measurement of the delivery reliability (perfect order fulfilment) construct

Measurement of the perfect order fulfilment construct includes measurement items for the information integration through perfect order fulfilment, logistics operations coordination through perfect order fulfilment, organisational relationship through perfect order fulfilment, and institutional support through perfect order fulfilment dimensions.

(i) Measurement items for the information integration through delivery reliability (perfect order fulfilment) dimension

The items generated for the information integration through perfect order fulfilment dimension are indicated in Table 4.21. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.21: Measurement items for the information integration through perfect order fulfilment dimension

Dimension	Measurement item		References
Information integration through delivery perfect order fulfilment dimension;	11.1	if information sharing is used with staffs/employees.	Fawcett et al.(2007)
	11.2	if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	Fawcett et al.(2007)
	11.3	if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is	Fawcett et al.(2007), Sezen(2008)

		used in Egg distribution for reliability.	
	11.4	if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	Fawcett et al.(2007)

(ii) Measurement items for the logistics operations coordination through (delivery reliability) perfect order fulfilment dimension

The items generated for the logistics operations coordination through perfect order fulfilment dimension are indicated in Table 4.22. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.22: Measurement items for the logistics operations coordination through perfect order fulfilment dimension

Dimension	Measurement item		References
Logistics operations coordination through perfect order fulfilment (logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,…………..)	12.1	if transportation sharing (delivery, inventory, truck/employee hire) with 3PL is used.	Selviaridis et al. (2008),Wang et al. (2010)
	12.2	if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	Franklin & Spinler(2011), Audy et al. (2012)
	12.3	if transportation is shared with partners (farmers, wholesalers, retailers).	Franklin & Spinler(2011), Audy et al. (2012)

(iii) Measurement items for the organisational relationship through delivery reliability (perfect order fulfilment) dimension

The items generated for the organisational relationship through perfect order fulfilment dimension are indicated in Table 4.23. The items were measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.23: Measurement items for the organisational relationship through perfect order fulfilment dimension

Dimension	Measurement item		References
Organisational relationship through perfect order fulfilment (Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,………….)	13.1	if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	Stank et al. (2001a), Bagchi et al. (2005)
	13.2	if internal sharing of knowledge & skills is maintained with your staffs/employees.	Stank et al. (2001a)
	13.3	if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).	Stank et al. (2001a), Bagchi et al. (2005)
	13.4	if creating teamwork cross-functional teams is continued with your staffs/employees.	Stank et al. (2001a)
	13.5	if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	Stank et al. (2001a), Bagchi et al. (2005)

(iv) Measurement items for the institutional support through delivery reliability (perfect order fulfilment) dimension

The items generated for the institutional support through perfect order fulfilment dimension are indicated in Table 4.24. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.24; Measurement items for the institutional support through perfect order

fulfilment dimension		
Dimension	**Measurement item**	**References**
Institutional support through perfect order fulfilment (logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,…………..)	14.1 if government is providing support through incentives or better policy in egg distribution.	Ferreira & Tetther (2004)
	14.2 if banks/financial services institutions are supporting the egg distribution.	Silvestro & Lustrato (2014)
	14.3 if educational institutions/egg associations are providing knowledge support to the egg distribution partners.	SCL (2012), Gebresenbet & Bosona (2012)

4.3.2.6 Measurement of the responsiveness (expedience/order fulfilment lead times) construct

Measurement of the order fulfilment lead times construct includes measurement items for the information integration through order fulfilment lead times, logistics operations coordination through order fulfilment lead times, organisational relationship through order fulfilment lead times, and institutional support through order fulfilment lead times dimensions.

(i) Measurement items for the information integration through responsiveness (order fulfilment lead times) dimension

The items generated for the information integration through order fulfilment lead times dimension are indicated in Table 4.25. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.25: Measurement items for the institutional support through order fulfilment lead times dimension

Dimension	Measurement item	References
Information integration through order fulfilment lead times (	11.5 if information sharing with your staffs/employees is used in egg distribution is used.	Fawcett et al. (2007)

the time from receipt of customer order to delivery) will decrease,…………	11.6	if appropriate IT capability (mobile, smart phone, landline phone, fax, computer & internet) by your staffs/employees in egg distribution is used.	Fawcett et al. (2007)
	11.7	if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in egg distribution.	Fawcett et al. (2007) , Sezen (2008), Laosirihongthong et al. (2011)
	11.8	if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in egg distribution.	Fawcett et al. (2007)

(ii) Measurement items for the logistics operations coordination through responsiveness (order fulfilment lead times) dimension

The items generated for the logistics operations coordination through order fulfilment lead times dimension are indicated in Table 4.26. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.26: Measurement items for the logistics operations coordination through order fulfilment lead times dimension

Dimension	Measurement item		References
Logistics operations coordination through order fulfilment lead times (the time from receipt of customer order to delivery will decrease,…………..)	12.4	if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	Selviaridis et al. (2008), Wang et al. (2010)
	12.5	if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	Franklin & Spinler (2011), Audy et al. (2012)
	12.6	if transportation is shared with	Franklin &

	partners (farmers, wholesalers, retailers).	Spinler(2011), Audy et al. (2012)

(iii) Measurement items for the organisational relationship through responsiveness (order fulfilment lead times) dimension

The items generated for the organisational relationship through order fulfilment lead times dimension are indicated in Table 4.27. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.27: Measurement items for the organisational relationship through order fulfilment lead times dimension

Dimension	Measurement item		References
Organisation relationship through order fulfilment lead times (the time from receipt of customer order to delivery will decrease,………….)	13.6	if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	Deshpande (2012)
	13.7	if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	Stank et al. (2001a)
	13.8	if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	Stank et al. (2001a), Deshpande (2012)
	13.9	if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	Stank et al. (2001a)
	13.10	if creating teamwork along supply chain is maintained with partners	Stank et al. (2001a),

	(customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	Deshpande (2012)

(iv) Measurement items for the institutional support through responsiveness (order fulfilment lead times) dimension

The items generated for the institutional support through order fulfilment lead times dimension are indicated in Table 4.28. The items are measured using Likert scale that ranged from 1 (corresponding to strongly disagree) to 5 (strongly agree).

Table 4.28: Measurement items for the institutional support through order fulfilment lead times dimension

Dimension	Measurement item		References
Institutional support through order fulfilment lead times (the time from receipt of customer order to delivery will decrease,………….)	14.4	if government is providing support through incentives or better policy in egg distribution.	Ferreira & Tetther (2004)
	14.5	if banks/financial services institutions are supporting the egg distribution.	Silvestro & Lustrato (2014)
	14.6	if educational institutions/egg associations are providing knowledge support to the egg distribution partners.	SCL (2012), Gebresenbet & Bosona (2012)

4.4 Population and sample

This section describes the study population and the sample included in the survey, as well as the data collection procedure.

4.4.1 Population

When commencing any research study, it is essential to carefully select the sample that best represents the population the researcher wishes to investigate (Sekaran 2003). As this study involves egg production and distribution operations in Thailand, the total target population consists of 1,645 organisations operating in the Thai egg semi-industrial, i.e., 1,526 farms, 40 wholesalers, and 79 retailers. This target population was identified from two databases, namely Thai online Yellow Pages (2014), (2014) were used to identify the egg wholesalers and egg retailers, while Bureau of Livestock Standards and Certification (2013) served as the source of information on the farms. The data pertaining to the egg farms operating in Thailand is represented in Table 4.29.

Table 4.29: Zone based tabulation of Egg farms, wholesalers and retailers in Thailand. (Source: Bureau of Livestock Standards and Certification (2013), Thai online Yellow Pages (2014), (2014))

Area	Number of Provinces	Provinces	Number of egg farms	Number of wholesalers	Number of retailers	Total population
Zone 1	7	Bangkok, Pathun Thani, Sing Buri, Suphan Buri, Lop Buri, Saraburi, Ayuthaya	72	24	36	132
Zone 2	9	Chonburi, Trat, Rayong, Sa Kaeo, Prachin Buri, Nakhon Nayok, Chachoengsao, Chanthanburi, Samutprakarn	281	4	10	295
Zone 3	6	Amnat Charoen, Surin, Ubon Ratchathani, Nakhon Ratchsima, Roi Et, Buriram, Yasothon	156	0	5	161
Zone 4	9	Sakon Nakhon, Nakhon Phanom, Kalasin, Nong Bua Lam Phu, Nong Khai, Maha Sarakham, Loei, Udon Thani, Khon Kaen	178	5	8	191
Zone 5	8	Chiang Mai, Lampang, Lamphun, Nan, Mae Hong Son, Phrae, Phayao, Chiang Rai	418	0	5	423
Zone 6	9	Kamphaeng Phet, Uttaradit, Nakhon Sawan, Uthai Thani, Phitsanulok, Sukhothai, Tak, Phichit, Phetchabun	102	0	6	108
Zone 7	7	Nakhon Pathom, Kanchanaburi, Ratchaburi, Prachuap Khiri Khan, Samut Songkhram, Samut Sakhon, Phetchaburi	151	4	5	160

Zone 8	7	Ranong, Phangnga, Nakhon Si Thammarat, Surat Thani, Chumphon, Phuket, Krabi	135	1	0	136
Zone 9	4	Phatthalung, Trang, Songkhla, Satun	33	2	4	39
Total	**66**		**1,526**	**40**	**79**	**1,645**

Note: Nine zones utilized in this study conform to the classification by the Department of Livestock Development, where all Thai egg farmers are registered.

4.4.2 Sample size

Sampling design and the sample size are important for establishing the representativeness of the sample in terms of generalisability of the subsequent findings to the entire population of interest (Veal 2005). Sampling is the process of selecting a sufficient number of members of the population of interest, which can be done purposefully or randomly. For this study, as the population size was small, it was important to include the entire population as potential study participants (Sekaran 2003). As the study aimed to investigate egg production and distribution operations in Thailand, whereby the total target population consisted of 1,645 organisations operating in the Thai egg semi-industrial. These are located in 9 zones, in 66 provinces comprising all egg production areas in Thailand. Of these, 1,526 are egg farms, 40 are wholesalers, and 79 operate as retailers. The data pertaining to these three groups of respondents is represented in Table 4.29.

4.5 Data collection through pilot and main study

4.5.1 Pilot study

Pilot studies are a vital part of survey-based research, as they are conducted prior to commencing the main study, allowing the researcher to test the data collection instrument on a group of respondents drawn from the same population as the individuals that would respond to the main survey. The main aim of pilot studies is identifying problems in the questionnaire instructions or design. Thus, its findings indicate whether the respondents would have any difficulty in understanding the questionnaire due to ambiguous or biased questions (Sekaran 2003). Pilot study should replicate the main survey exactly, i.e., the respondents should be selected from the target population, yet not take part in the main study, and the same procedures and protocols that will be adopted in the data collection should be followed. For example, if the survey is to be distributed by mail, the pilot questionnaire should be mailed as well (Cooper & Schindler 1998). According to Ticehurst and Veal (2000), the purpose of a pilot survey can be summarised as follows:

1) Testing the wording of the questionnaire
2) Assessing the question sequencing
3) Evaluating the questionnaire layout
4) Gaining familiarity with the respondents
5) Testing fieldwork arrangements (if required)
6) Training and evaluating fieldworkers (if required)
7) Estimating the response rate
8) Estimating the interview or questionnaire completion time
9) Testing the data analysis procedures

The pilot group size may range from 25 - 100 participants, depending on the target population that would be included in the main study (Cooper & Schindler 2006). For the purpose of the present research project, based on the pilot study included 150 individuals (including farmers, wholesalers, and retailers in semi-industrial egg production and distribution sector), who were sent questionnaires on February 10th, 2014 via mail. As four weeks were allocated for the data collection phase of the pilot study, only the questionnaires that were returned by March 9th, 2014 were included in the subsequent data analysis. During this period, 44 questionnaires were returned, which corresponded to the response rate of 29.33%. These questionnaires were subjected to reliability and validity tests, as well as some basic data analyses. Based on the results obtained, some minor changes (font size, style, and colour) were made to the questionnaire format, in order to improve the respondents' understanding.

The pilot study data was analysed through basic statistical methods using SPSS software (AMOS version 22.0). Responses were analysed in terms of their validity and relevance to the research objectives. The respondents' summative feedback was also carefully reviewed and summarized. Careful note was also made of all the cases where the respondents tended to respond similarly to all items by, for example, repeatedly selecting a certain point on the scale (Sekaran 2003).

The data analysis, as well as the respondents' feedback, revealed that the questionnaire required further revision before commencing the main survey. Hence, the researcher consulted with the professionals, farmers, wholesalers, retailers and translators, in order to ensure that all difficulties experienced during the pilot survey were eliminated. The main survey is thus a result of a careful consideration of all the issues (typographical errors, misspelled words, font size and style, number of items per measured construct, choice of wording with respect to the level of understanding and literacy of the target audience, the format in which the items are presented and the choice of responses given, skip patterns, sensitivity to the demographic and cultural characteristics of the respondents, etc.) raised by the pilot study participants, as well as the feedback and suggestions from the individuals that were consulted in order to improve its design and content (Litwin 1995). Examples of corrections made in the final questionnaire as a result of the pilot study include: Item 2.1.2 "Develop IT functions/solutions that can significantly reduce the production cost and delivery lead time" was changed to "Develop IT solutions that can significantly reduce the production or delivery lead time"; Item 2.1.3 "Allow integration of IT functions that support egg distribution" was changed to "Latest /appropriate ICT allows integration of operational functions that support egg distribution"; Item 2.2.2 "Improving customer service" was changed to "Improving customer service by sharing the information with all SCM parties"; and Item 10.4 "Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed" was changed to "Organise, invite, and assist in participation in seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed. The following seven tests focus on the missing value assessment, demographic profile of respondents, multivariate outliers assessment, multivariate normality assessment, multicollinearity test, unidimensionality test (Cronbach's Alpha) and EFA that were used in the pilot study. In particular, tests focus on assessing the goodness of the data collected via the questionnaire (Ticehurst & Veal 2000). Based on the results of these tests, nine items (1.1.1, 1.1.6, 2.1.3, 2.2.6, 3.5, 5.2, 6.2.4, 10.1 and 10.5) were excluded from the questionnaire utilised in the main survey (these nine items were deleted from the final version of the questionnaire, which is presented in Appendix 1). However, the titles of these items were retained in the main survey, as the inappropriate questions were simply replaced by more suitable alternatives. The subsequent analyses of the revised questionnaire confirmed that the instrument was ready for use in the main survey.

4.5.2 Main study

In this study, questionnaire was chosen as data collection instrument, as it can be easily distributed to a significant number of participants, irrespective of their location. Thus, the study was not limited to a specific geographical area and the data collection process was fast, convenient and cost effective. The respondents were informed that the information they share in the questionnaires would be treated as confidential, and that their name and that of their organisation would not be revealed in any reports. This was important, as it made it more likely that the participants would answer all the questions truthfully, and thus increased the usefulness of the data obtained. In addition, by mailing the questionnaires, the researcher allowed the respondents to complete it in their own time, which ensured sufficient number of survey responses(Veal 2005). In order to maximise the response rate, a prepaid and self-addressed envelope in which the completed survey could be returned was included into the mail delivered to each potential study participant. As previously noted, the questionnaires were delivered to individuals working in various roles within Thai egg logistic distribution in a semi-industrial setting. Each potential respondent was provided a copy of the questionnaire, a consent form and detailed guidelines for completing the questionnaire. The questionnaire content was translated from English to Thai by translation institution in possession of translation service certification from Professional Certified Translation Sources and EN15038 Certified Translation Service (Language Marketplace 2012).

As previously noted, the survey questionnaire consists of eight sections (the content is reproduced in full in Appendix 1). Section A comprises 19 items and seeks participants' views on factors that are critical for information sharing. Section B, consisting of 11 items, seeks their views on factors that are critical for logistics operations coordination. Section C examines factors that are critical for organisational relationship and includes 28 items. Section D comprises 16 items related to factors that are critical for institutional support. Section E seeks participants' views on factors that are critical for distribution logistics integration through delivery reliability and responsiveness (expedience) and includes 30 items. Section F, consisting of 5 items, seeks general information about the participants' organization, and Section G seeks general information about the participants and includes 4 items. Lastly, section H allows the respondents to express any additional comments in the blank space provided, which can be treated as one item.

Data collection was conducted in two waves, each lasting three weeks (see the results in Table 4.30). According to Sheikh and Mattingly (1981), employment of waves during the data collection process allows the researcher to test the non-response bias and sample representativeness. Thus, in the present study, the data gathered was first tested by comparing respondents' characteristics and non-response bias (see Chapter 5 for more details). The first wave started on June 2nd, 2014 whereby 1,645 questionnaires (the final version) were mailed to the prospective participants using Thai National Post. The questionnaire package included the questionnaire, consent form, letter providing the participants all relevant information about the study, and a stamped self-addressed envelope for returning the questionnaire (see Appendix 1).

The participants who chose to complete the survey were instructed to read and sign the consent form to certify that they voluntarily agreed to take part in the survey and understand that they are free to withdraw from the study at any time, if they choose to do so, without any penalties. The letter to the participant aimed to provide general information about the study. It was hoped that explaining the study purpose and the envisaged benefits that would arise from its findings would increase the response rate, as participants would be more motivated to complete the survey. The first wave ended on June 22nd, 2014, by which time 331 completed questionnaires were returned, including 313 by farmers, 5 by wholesalers, and 13 by retailers. In addition, 97 incomplete questionnaires (missing some part of response) were returned, of which 91 were from farmers, 2 from wholesalers, and 4 from retailers. The most common reason for not completing the questionnaire was the business the survey was mailed to no longer being operational, followed by change of address and no recipient.

In order to increase the survey response rate, Dillman (1978) recommended periodically sending reminders and making telephone calls. Hence, once the first wave ended, a reminder letter was sent on June 23rd, 2014 to all potential respondents that have not yet returned the survey, reiterating the study significance and the importance of their participation in the research. Researcher also made phone calls to all respondents whose contact phone number was available, reminding them, once again, of the value of their participation in the study. The second wave of the data collection process started on June 25th, 2014 and ended on July 13th, 2014. It yielded 98 completed questionnaires, of which 57 were from farms, 19 from wholesalers, and 22 from retailers. In addition, 38 incomplete questionnaires were also returned, including 35 farms, 1 wholesaler, and 2 retailers. Thus, the two phases yielded 564 questionnaires in total, which were carefully scrutinised in order to establish their suitability for inclusion in the subsequent data analysis. As a result of this process, 429 questionnaires were found usable, pertaining to 370 farms, 24 wholesalers, and 35 retailers. This yielded the response rate of 26.08%.

Table 4.30: Response rates pertaining to two survey waves in term of the respondents' roles

Waves	Farms		Wholesalers		Retailers		Total	
	Responses received	%	Responses received	%	Responses received	%	Responses received	%
1	313	20.51	5	12.50	13	16.46	**331**	20.12
2	57	3.74	19	47.50	22	27.85	**98**	5.96
Total	370	24.25	24	60.00	35	44.30	**429**	26.08

4.6 Data editing and coding

Once completed questionnaires are returned, coding is required, so that the information the respondents provided can be stored and subsequently used for statistical analyses (Zikmund 2003). In this study, SPSS software version 22.0 was chosen for data editing, coding and analysis tool. SPSS is deemed the most suitable data analysis tool, given that most questionnaire responses were provided on a Likert scale and were thus in numerical format. Before coding, data is edited by using frequency distribution in SPSS through checking and adjusting for errors, omissions, legibility and consistency in order ensure completeness, consistency, and reliability. Next, the data that met all the criteria was coded by assigning character symbols (mostly numerical symbols), and was edited, before being entered into SPSS (see Appendix 2.1).

4.7 Data analysis methods

Data analysis was performed in two stages. In the first stage, the data set was checked for data consistency via preliminary data analysis by using SPSS. The evaluation included missing data assessment, identification of multivariate outliers, multivariate normality and multicollinearity testing, comparing respondents' characteristics, non-response bias assessment, and common method variance (CMV). These tests assist in data management and data cleaning (Tabachnick & Fidell 2007, Hair et al. 2010). Moreover, exploratory factor analysis (EFA) was also employed for the purpose of data exploration (Hair et al. 2010). In the second stage, the data set from the EFA was analysed by confirmatory factor analysis (CFA), and structural equation modelling (SEM) using AMOS. In studies of this type, CFA is employed to confirm validity and reliability of all measurement items (observed variables) (Ugulu 2013). On the other hand, SEM allows to estimate a series of interrelated dependence relationships among variable simultaneously (Hair et al. 2006). Each of the aforementioned methodological techniques is explained in next sections and sub-sections.

4.7.1 Data cleaning methods

Data cleaning allows evaluating the impact of missing data, identifies outliers, and tests for the assumptions underlying most multivariate techniques. The aim of these data examination procedures is elimination of any potential for introducing biases into the results, thus ensuring that the data submitted for factor analysis, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM) are suitable for that purpose and for meeting the study objectives (Hair et al. 2006, Hair et al. 2010). Data cleaning typically includes four assessments, which respectively identify (1) missing data, (2) multivariate outliers, (3) multivariate normality, and (4) multicollinearity (Tabachnick & Fidell 2007, Hair et al. 2010).

4.7.1.1 Missing data

Missing data assessment aims to identify any missing values pertaining to the study variables, as these may affect data interpretation and analysis (Hair et al. 2010). In multivariate analysis, missing data results in the reduction of the sample size available for analysis. In some cases, the sample may no longer be suitable for meeting the study objectives, as its size would be too small to yield findings of sufficient power and significance. On the other hand, it is usually possible to avoid this outcome by applying suitable remedies (such as replacing the missing values with the most common response). However, it is important to note that any statistical results based on data that was not subjected to a non-random missing data cleansing process could be biased, as the missing data could potentially lead to erroneous results (Hair et al. 2006). Moreover, the impact of missing data in SEM using AMOS, with respect to computing some fit measures, requires fitting the saturated and independence models in addition to the model developed by the researcher. If the data set is complete, this process is relatively straightforward; however, an attempt to fit these models when some values are missing requires extensive computation. In such cases, the problem arises mainly from the saturated model, as presence of a large number of parameters may make fitting this model impractical. In addition, some missing data value patterns can make it impossible to fit the saturated model even if it is possible to fit the researcher model (Arbuckle 2005). Thus, it was necessary to remedy the missing data issue before performing the SEM data analysis in this research.

4.7.1.2 Multivariate outliers

After completing the missing data analysis, multivariate outlier detection needs to be performed. Outliers are observations (cases) with a unique combination of characteristics that are distinctly different from the remaining observations (Hair et al. 2010). Typically, unique characteristics include unusually high or low values, or a unique combination of values across several variables that make the observation stand out from the others. Outliers cannot be categorically characterised as either beneficial or problematic, but should be considered within the context of the analysis and should be evaluated by the types of information they may provide. Beneficial outliers may be indicative of population characteristics that would not be discovered in the standard course of analysis (Hair et al. 2006). Outliers can be identified by calculating the Mahalanobis distance, which is the distance of a particular case from the centroid of the remaining cases, where the centroid is the point created by the means of all the variables (Tabachnick & Fidell 2001). Thus, in multivariate outlier detection, as there are several dimensions, Mahalanobis (D^2) measure is the multidimensional position of each observation compared with the centre of all observations on a set of variables. In multivariate methods that are best suited for examining a complete variable, for small sample size (not exceeding 80 observations) the threshold levels for the D^2/df (the *z*-score) measure should be conservative. Thus, values equal or above ± 2.5 signify presence of outliers. For a larger sample (exceeding 80 observations), outliers are identified by the absolute standard score of the observation in the ± 3 range (Hair et al. 2010). Thus, in this study, the *z*-score was calculated for multivariate outliers.

4.7.1.3 Multivariate normality

Normality refers to the correspondence between the distribution of a given data set and the normal distribution, which is the benchmark for statistical methods as it allows many inferences to be made based on its properties (Hair et al. 2006). One of the basic requirements for SEM is that all data must follow a multivariate normal distribution (Hulland et al. 1996). If the data does not meet multivariate normality criteria, this will severely affect the standard error and goodness-of-fit indices on SEM (Baumgartner & Homburg 1996). There are many statistical methods that can only be applied if the distribution of scores on the dependent variable is normal. Normal distribution is characterised by a symmetrical, bell-shaped curve, in which mean, mode and median coincide and lie in the middle of the graph (Gravetter & Wallnau 2000). Normality can be assessed to some extent by obtaining skewness and kurtosis values. The skewness value provides indication of the symmetry of the distribution, while kurtosis pertains to the peakedness or the flatness of the distribution compared with the normal distribution (Kenny & Keeping 1962, Pallant 2005). Negative kurtosis values indicate a flatter distribution while positive values denote a peaked distribution. Similarly, positive (negative) skewness values indicate that the distribution is shifted to the left (right) relative to the normal distribution. Thus, skewness that takes the value of 1 indicates moderately skewed distribution (Pallant 2010). Similarly, values exceeding 3.0 refer to a skewed data set (Hair et al. 2006). On the other hand, when kurtosis is greater than 10.0, the data set is considered not to follow normal distribution (Hoyle 1995, Kassim 2001). In most cases, the 5% Trimmed Mean test is also performed, whereby it is verified that the mean calculated with the highest and lowest 5% of the values removed is not substantially different from that calculated for the entire dataset. This ensures that the extreme values, as indicated by the skewness and kurtosis values, do not influence the actual mean value (Pallant 2010). Finally, data set normality can be verified via the normal probability plot (Normal Q-Q Plot). In this test, Q-Q plot of each measurement item should be generated, in order to verify that all data is scattered as closely to a straight line as possible. Once the data passes the aforementioned tests, it can be confirmed that the data set is normally distributed (Hair et al. 2010). Thus, in this study, the data was assessed by calculating skewness and kurtosis, as well as by performing the 5% Trimmed Mean test and producing the normal Q-Q plot.

4.7.1.4 Multicollinearity

Multicollinearity is the extent to which a particular construct can be explained by other constructs in the analysis (Hair et al. 2006). It occurs when the variables that appear distinct and unrelated actually measure the same thing. Hence, when the dependent variables are highly correlated, this phenomenon is referred to as multicollinearity (Pallant 2005). High correlation among variables may be harmful for multiple regression analysis and other multivariate data analyses. In this context, when the correlation coefficient between measurement items exceeds 0.8, this is considered an extreme value (Hair et al. 2010). In such cases, it is recommended to consider removing one of the strongly correlated dependent variables or, alternatively, combining them to form a single measure (Pallant 2005). Hence, in this study the data was tested for the presence of multicollinearity. Here, it was assumed that, when the correlation coefficient between measurement items exceeded 0.8, one of the highly correlated variables should be removed.

4.7.2 Comparing respondents' characteristics

When comparing respondents' characteristics, the aim is to assess the difference between their demographic characteristics and their attitudes towards measurement items, in order to see if there is any relationship. This was achieved by conducting one-way analysis of variance (ANOVA). This is important to establish as, if the differences in respondents' attitudes are not statistically significant, the data set can be used to represent population and the sample can be used as one element (Chen & Paulraj 2004, Li et al. 2006). In this study, there were three groups of respondents—farmers, wholesalers, and retailers. Hence, comparing respondents' characteristics is necessary to ensure that the findings are unaffected by their demographic data. In other words, before the data yielded by all questionnaires was combined into one element for factor analysis, the aforementioned tests are performed to confirm that the difference among the three respondent groups was not statistically significant.

4.7.3 Non-response bias

Non-response bias is a method that can be applied to test whether the sample represents the target population (Armstrong & Overton 1977). In practice, this is performed by conducting the ANOVA to test the difference in the attitudes of two groups of interest towards measurement items (Li et al. 2006). As, in this study, the data collection was performed in two waves, before the data was combined into one element for factor analysis, it was tested for non-response bias to ensure that there were no statistically significant differences in the characteristics of the data sets yielded by the two waves.

4.7.4 Common method variance (CMV)

Common method variance (CMV) refers to the overlap in variance between two variables that arises due to the measurement instrument used, rather than representing a true relationship between the underlying constructs. The outcome of CMV is an inflation of the observed correlations, thus providing false support for the theories being tested (Campbell & Fiske 1959). It is widely accepted that, in measurement, CMV is a major potential validity threat (Reio 2010). Therefore, CMV must be assessed and remedied (Podsakoff et al. 2003). CMV can be assessed by Harman's single-factor test in exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Hult et al. 2006). In Harman's single-factor test, all the measures in a study are subjected to EFA, with the assumption that the presence of CMV is indicated by the emergence of a single-factor, accounting for the majority of covariance among measures (Andersson & Bateman 1997, Aulakh & Gencturk 2000, Podsakoff et al. 2003). Thus, in this study, this test was performed in order to test for the presence of spurious covariance shared among measurement items.

4.7.5 Exploratory factor analysis (EFA)

The goal of EFA is to reduce the dimensionality of the original space and to give an interpretation to the new space. When such a reduction is performed, the new dimensions should underlie the old ones or be able to explain the variance in the observed variable in terms of underlying latent factors (Rietveld & Van Hout 1993). In this approach, the data set pertaining to each measurement item is calculated and clustered into a smaller group, based on their inter-correlations. This process aims to (1) identify the relationship or correlation between either respondents or variables, (2) identify representative variable from a large set of variables, and (3) create a smaller new set of variables to replace the original set of variables. Hence, before performing CFA and SEM, the items that are measuring the construct are extracted by EFA (Hair et al. 2010). As, in the present study, both CFA and SEM were required, and the measurement items were first analysed via EFA.

However, before subjecting the data to EFA, its suitability must be assessed by testing it against several established conditions. First, the value of Kaiser-Meyer-Olkin (KMO) must be greater than 0.8 for a good EFA (Kaiser 1974). KMO measures whether the correlations between pairs of variables can be explained by other variables – a necessary condition to support the existence of an underlying factor structure. Kaiser (1974) describes KMO values greater than 0.9 as *marvellous*, 0.8-0.9 as *meritorious*, 0.7-0.8 as *middling*, 0.6-0.7 as *mediocre,* 0.5-0.6 as *miserable*, and values less than 0.5 as *unacceptable*. Second, as factor analysis is based on the correlation among measurement items, at least some of the measurement items must have the correlation coefficient greater than 0.3 (Tabachnick & Fidell 2001). Third, the value of Bartlett's test of sphericity of each variable set should be significant ($p < 0.05$), as factor analysis is not appropriate otherwise (Bartlett 1954). Fourth, communalities refer to the proportion of the variance in the original measurement items that are accounted for by the factor solution. Thus, if any of the measurement items share some common variance with other measurement items, the communality values should exceed 0.5; otherwise, the items to which they pertain should be removed (Pallant 2010). Fifth, the factor loading of each measurement item should exceed 0.5 in order to generate a more reliable factor. Thus, measurement items with the factor loading less than 0.5 should be removed (Hair et al. 2010). Sixth, the reliability coefficient (Cronbach's alpha) for items within the single factor should be well above the recommended minimum of 0.6 (Field 2009). Lastly, the factors with eigenvalue exceeding 1.0 are considered significant and should be retained for CFA (Hair et al. 2010).

4.7.6 Confirmatory factor analysis (CFA)

CFA is used to establish how well the measurement items represent the measurement dimensions and constructs (Hair et al. 2010). Thus, CFA, as its name implies, is a confirmatory technique, as it enables the researcher to ascertain the number of factors present and their relationships, as well as the relationship between the factors and measured variables. The purpose of the analysis is to test the hypothesised structure and, if applicable, assess the competing theoretical models describing the structure (Ullman 2006). Using CFA, the researcher can also analytically test a conceptually grounded theory explaining how different measured items represent important sociological, psychological, or business measures (Hair et al. 2010). Thus, CFA is employed to confirm validity and reliability of all measurement items (observed variables) (Ugulu 2013). Due to its importance and value of its findings, CFA is employed in this study and is applied to all measurement items to confirm their validity and reliability.

4.7.7 Structural equation modelling analysis (SEM)

SEM is a multivariate technique combining aspects of multiple regression (examining dependence relationships) and factor analysis (representing unmeasured concepts or factors potentially affecting multiple variables) to estimate a series of interrelated dependence relationships simultaneously (Hair et al. 2010). This is of some interest to the present study, which examines the relationships, management and performance of all supply chain members in Thailand context, it is important to find examples of the SEM use in similar settings. Recently, Jayaram et al. (2014), Limoubpratum et al. (2014) used SEM to achieve the purpose of their study. The main objective of this research is to generate a model of SCI & logistics performance that yields most optimal outcomes. Thus, SEM is considered best suited for achieving this main research objective, as the generated model is expected to be both substantively meaningful and statistically valid, in that it provides good fit to the actual data (Byrne 2006).

For CFA and SEM, the goodness or fitness of structural model can be assessed by calculating and interpreting the goodness-of-fit (GOF) index. GOF is a measure indicating how well a specified model reproduces the observed covariance matrix among the indicator variables (i.e., it reveals the extent of similarity between the observed and estimated covariance matrices). The measurement of fitness of the model can be justified by three main types of indices namely: absolute fit, incremental fit, and parsimony fit indices (Hair et al. 2010).

4.7.7.1 Absolute fit indices

Absolute fit indices are measures of overall goodness-of-fit for both structural and measurement models and include Chi-square probability level (χ^2), relative Chi-square (*CMIN/df*), goodness-of-fit index (*GFI*), root mean square error of approximation (*RMSEA*) and *p* of close fit (*PCLOSE*) (Hair et al. 2010). In that respect, Chi-square probability level (χ^2) is the most fundamental absolute fit index, as it is a statistical measure of difference used to compare the observed and estimated covariance matrices. Here, the non-significant value ($p > 0.05$) indicates a good fit, whereas a significant value ($p < 0.05$) indicates a poor fit (Baumgartner & Homburg 1996). Relative Chi-square (*CMIN/df*) is also known as normed Chi-square and its value is calculated dividing the χ^2 value by the degrees of freedom (Hamid 2006). It is applied to reduce the sensitivity of χ^2 to the sample size, given that, as a sample size increases, χ^2 tends to increase. Consequently, a large sample size is likely to produce a significant result when it is actually non-significant (Byrne 2010). The *CMIN/df* value less than 3.0 indicates good overall fit (Kline 2011). Another index that is typically calculated is Goodness-of-fit index (*GFI*), which is a ratio of the sum of weighted variances from the estimated model covariance matrix to the sum of the squared weighted variances from the sample covariance (Tabachnick & Fidell 2007). As this index compares the results yielded by the hypothesised model with those obtained when no model is applied, the findings are referred to as absolute indices of fit. *GFI* index should be between 0 and 1, whereby values exceeding 0.9 indicate that the model is a good fit, while a value close to 0 indicates poor fit (Hair et al. 2010). Similarly, root mean square error of approximation (*RMSEA*) is calculated to assess how well the model fits the population irrespective of the sample size (Hair et al. 2006, Hair et al. 2010). Thus, *RMSEA* value equal or less 0.08 indicates a good fit (Byrne 2010). Lastly, *p* of close fit (*PCLOSE*) tests the null hypothesis that *RMSEA* is no greater than 0.08. If *PCLOSE* is less than 0.05, the null hypothesis should be rejected and conclude that the computed *RMSEA* is greater than 0.08, indicating lack of a close fit. Thus, *PCLOSE* value greater than 0.5 indicates a good fit (Byrne 2010).

4.7.7.2 Incremental fit indices

Incremental fit indices are a group of goodness-of-fit indices that assess how well a specified model fits the data relative to some alternative baseline model. The baseline model is a null model that treats all measured variables as unrelated to each other (Hair et al. 2010). Incremental fit indices are thus typically calculated when comparing the standard hypothesised model with the hypothesised model (Byrne 2010). In this context, the researchers consider incremental fit indices, including normed fit index (NFI), Tucker-Lewis index (TLI), and comparative fit index (CFI) (Hamid 2006, Hair et al. 2010). Normed fit index (NFI) produces the original incremental fit indices. It is calculated as the difference between the χ^2 value for the fitted model and a null model, divided by the χ^2 value for the null model. As a result, NFI ranges between 0 and 1, and a value closer to 1 indicates a better fit (Hair et al. 2010). Tucker-Lewis index (TLI) is an alternative measurement used to compare the hypothesised model with the null model, such as that used in NFI. However, as TLI is not normed, its value can be below 0 or exceed 1 (Hair et al. 2006). TLI value greater than 0.95 indicates a good fit (Weston & Gore 2006). Lastly, comparative fit index (CFI) is employed to compare the hypothesised model with the null model and test the covariance of the full data set. Once again, a value close to 1 indicates a good fit, whereas a value close to 0 indicates a poor fit. More specifically, a value exceeding 0.95 indicates a good fit, while that equal or above 0.9 indicates moderates fit (Hu & Bentler 1999, Byrne 2010).

4.7.7.3 Parsimony fit indices

Parsimony fit indices are measures of overall goodness-of-fit representing the degree of model fit per estimated coefficient. It attempts to correct for any over fitting of the model and evaluates the parsimony of the model compared to the goodness-of-fit. In statistical analysis, it is used to identify the best model among a set of competing models (Hair et al. 2010). Typically, the parsimony fit is obtained by calculating the adjusted goodness of fit index (*AGFI*) (Hamid 2006, Byrne 2010). Adjusted goodness of fit index (*AGFI*) allows for a comparison of the difference between complexity degrees of different models and ranges from 0 to 1, whereby *AGFI* value closer to 1 indicates a better fit (Byrne 2010).

4.8 Reliability and validity

The key indicators of the quality of a measuring instrument are its measure reliability and validity (Kim 2009). The reliability and validity of the measure aim to reduce measurement errors (Hair et al. 2010). Here, reliability refers to the consistency or stability of measurement over a variety of conditions in which the same result should be obtained (Nunnally 1978). In other words, reliability indicates the extent to which the measure is without bias (error free) and hence offers consistent measurement across time and across various items in the instrument (Ticehurst & Veal 2000). It thus helps to assess the goodness of measure, as it indicates measurement accuracy (Sekaran 2003). Measurement reliability provides an estimation of confirmatory factor analysis (CFA) results, or those produced by a path model with latent variables (Holmes-Smith et al. 2006). Typically, construct reliability is assessed by examining the Cronbach's alpha coefficient of each construct (factor), alongside composite reliability (CR) and squared multiple correlations (SMC) (Holmes-Smith et al. 2006, Hair et al. 2010). In addition, measurement reliability provides an estimation of confirmatory factor analysis (CFA) results (Holmes-Smith et al. 2006). Construct reliability of these tests is discussed in Chapter 6.

Validity is the extent to which the data collected truly reflect the phenomenon being studied. Usually, business research faces difficulties in ensuring validity, in particular as it relates to the measurement of attitudes and behaviours, since some degree of uncertainty is always present when attempting to establish the true meaning of responses given in surveys and interviews, in which the participants are self-reporting on the phenomena of interest (Ticehurst & Veal 2000). Several types of validity tests that can be applied to assess the goodness of measures, including content validity, criterion-related validity, and construct validity (Sekaran 2003).

Content validity, or face validity, assesses the correspondence between the individual items and the concept through, among other means, ratings by expert judges, and pre-tests (or pilot studies) with multiple sub-populations (Hair et al. 2006). Content validity can be determined by experts that use the questionnaire prior to the main study and point out any deficiencies that can be addressed. In line with this assertion, the questionnaire used in this study was rigorously tested by several academic experts, who confirmed its content validity (Karim et al. 2008). In this research, both expert judges and pre-tests strategies were employed. Thus, to test content validity (face validity) all the survey questions were first proofread by two academic professionals, two farmers, two wholesalers and two retailers in the field, whose feedback was used to validate survey content, wording, layout, and sequencing. This also helped estimate the approximate time required to complete the survey (Veal 2005). In addition, a pilot study was conducted, whereby the instrument was pre-tested by a small group of farmers, wholesalers, and retailers in Thai egg logistic distribution, who were drawn from the same population as the main study participants, but were not included in the actual study. This approach is often used, as responses in the pre-test can be evaluated by using item-to-total correlations or contribution to Cronbach's α (Churchill Jr 1979).

Construct validity pertains to how well the results obtained from the use of the measure fit the theories that served as a foundation for test design. In other words, construct validity verifies that the instrument reflects the theoretical understanding of the concept (Peter 1981). Construct validity can be divided into convergent validity and discriminant validity. Convergent validity examines whether the measures of the same construct are highly correlated, while discriminant validity determines whether the measures of a construct are not correlated too highly with other constructs (Sekaran 2000). In other words, convergent validity indicates that items pertaining to a specific construct should converge, or have a high proportion of variance in common (Hair et al. 2006). In other words, it assesses the degree to which two measures of the same concept are correlated, with high correlation indicating that the measurement item is measuring its intended concept (Hair et al. 2010). Discriminant validity is also used to test construct validity, as this measure is characterised by discriminant validity when it has a low correlation with measures of dissimilar concepts (Zikmund et al. 2010). Construct validity can be established through (1) correlational analysis (convergent and discriminant validity), (2) factor analysis, and (3) the multi-trait, multi-method matrix of correlations. According to the pertinent literature, the most widely accepted forms of validity are convergent and discriminant validity (Peter 1981). Construct validity results of these tests are presented in Chapter 5 (multicollinearity) and Chapter 6 (CFA).

Criterion-related validity is synonymous with convergent validity (Zikmund et al. 2010), and is confirmed by calculating the relevant statistics. It is used to establish whether the measurement items pertain to the same construct or concept. In this study, in addition to all the aforementioned tests, the items included in the final version of the questionnaire were assessed via criterion-related validity, as was previously done in relevant literature sources presented above.

4.9 Ethics in this Research

Ethics in business research refers to a code of conduct and adherence to expected social norms and behaviours while conducting research. Ethical conduct should also be reflected in the behaviour of the researchers who conduct the investigation, the participants who provide the data, the analysts who provide the results and the presentation of the study findings (Veal 2005). Ethical norms must be respected in each step of the research process, including data collection, data analysis and reporting, and even in the dissemination of study findings, whether through conference presentations and scientific publications, or publishing information on the Internet (Sekaran 2000). As the participants in this study were famers, wholesalers and retailers, it was essential that all individuals were treated fairly and ethically throughout the study. Of equal importance was ensuring that the information they provided was safeguarded and treated as confidential, in line with business ethics and code of conduct. Moreover, if the research involves human activities and/or requires human participation, the researcher and the supervisor must exhibit ethical behaviour at all times (Veal 2005). In this study, in order to ensure that all ethical standards and requirements were met, the research method, survey procedure, consent form, ethical application, and information sheets to participants were submitted for approval by the Human Research Ethics Committee of the Victoria University. The study commenced only once this approval was obtained. Various aspects of ethical considerations have already been covered in this thesis, thus only a brief summary will be presented here. One of the primary responsibilities of the researcher is treating the information given by the respondents as strictly confidential and guarding their privacy. To ensure that all respondents understood the extent of their involvement in the study and how the information they shared would be subsequently used, the purpose of the research was explained in the covering letter (information sheet to participants) that accompanied the mailed questionnaires. Moreover, when designing the questionnaire and choosing the wording of the individual items, care was taken not to violate the respondents' self-esteem and self-respect. As participation in the study is voluntary, all respondents were reminded that they could choose not to take part in the survey, and those that opted to participate were asked to sign the informed consent form, which was provided with the questionnaire. Finally, every care was taken to avoid misrepresentation or distortion in reporting the data collected during the study.

4.10 Summary

This chapter provided a description of the research methods employed in this study. Quantitative approach was considered an appropriate method for testing the proposed hypotheses. The reasons behind the decision to use questionnaire survey as a data collection tool was discussed followed by the description of measurement and instrument design. The statistical techniques used in the study (i.e., missing data assessment, multivariate outliers, multivariate normality and multicollinearity, comparing respondents' characteristics, non-response bias assessment, CMV, EFA, CFA, and SEM) were also explained. Moreover, the manner in which reliability, validity and ethics were ensured in this research was briefly discussed at the end of this chapter.

CHAPTER 5

DATA PREPARATION AND PRELIMINARY ANALYSIS

5.0 Introduction

This chapter represents data preparation and preliminary analysis, including four sections: (1) validation & editing (2) coding& data entry (3) data cleaning (missing data, multivariate outliers, multivariate normality and multicollinearity) (4) tabulation &analysis (comparing respondents' characteristics, non-response bias assessment, common method variance (CMV) and exploratory factor analysis (EFA)).

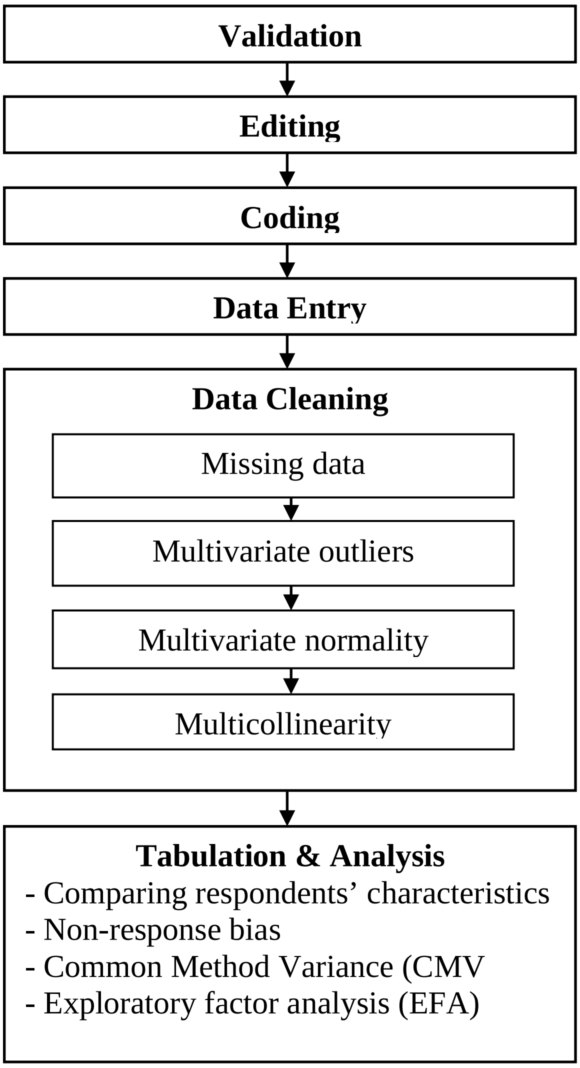


Figure 5.1: Stages of data preparation and preliminary analysis [adapted from Tabachnick & Fidell (2007), Hair et al. (2010), and Sreejesh et al. (2014)].

5.1 Validation and editing

Validation is the preliminary step in data preparation. Validation helps ascertain that the demographic data of the participants are correct and reflect those of the population of interest. Another aspect of this process is editing, whereby any mistakes the respondents made in filling the questionnaire are identified and corrected if possible. Editing is usually performed twice before the data set is submitted for analysis. When reviewing the completed questionnaire, all illegible, incomplete, inconsistent or ambiguous responses are labelled as unsatisfactory responses. Such responses are usually discarded, making the entire questionnaire invalid. Thus, respondents that submitted such questionnaires should be excluded from the subsequent analyses. This method is well suited when proportion of unsatisfactory respondents is very small compared to the sample size. It is usually applied when the responses provided by the excluded respondents comprise a large proportion of the questionnaire, and especially when those pertaining to the key variables are missing (Sreejesh et al. 2014).In this study, the questionnaires were checked for the appropriateness and completeness of the demographic data and no issues were found. Similarly, in line with the above recommendations, the individual items in each questionnaire were examined twice, in order to ensure that they were completed by the respondents correctly. The survey yielded 564 questionnaires that were returned by the respondents. After manual checking, 135 were excluded due to incompleteness, resulting in 429 questionnaires suitable for analysis. As the survey targeted 1,645 organisations, 135 unsatisfactory responses comprised a very small proportion of the entire sample (8.21%). Among the excluded questionnaires, those where the respondent consistently chose the same number on the Likert scale, or failed to answer entire sections were in majority. Hence, these incomplete questionnaires had to be discarded, as their inclusion would introduce bias into the study findings. After completing this process, the digital record of the data set was created for data analysis.

5.2 Coding of measurement scale and data entry

This section shows the coding of measurement scales for this study. There are 104 scale items including information integration factors (19 items), logistics operations coordination (11 items), organisational relationship (28 items), institutional support (16 items), Perfect order fulfilment (15 items), and order fulfilment lead times (15 items). Details of coding of measurement scale are represented in Appendix 2.1.

5.3 Descriptive statistics

The descriptive statistics analysis focuses on sample size, survey response rate and demographic profile of the respondents, which are discussed in the subsequent sections.

5.3.1 Sample size and Response rate

As show in Table 5.1, the sample of interest includes entities involved in egg production and distribution operations in Thailand. The total target population consists of 1,645 organisations operating in Thai egg semi-industry, including 1,526 farmers, 40 wholesalers, and 79 retailers. However, the size of the sample drawn from this population, i.e., the participants included in this study, includes 429 organisations, of which 370 are farmers, 24 are wholesalers and 35 retailers. This is equivalent to the response rate of 26.08%.

Table 5.1: Sample sizes of the three participants groups included in the study (i.e., egg farmers, wholesalers and retailers in Thailand)

Area	Number of Provinces	Number of farms		Number of wholesalers		Number of retailers		Total		
									Sample	
		Population	Sample	Population	Sample	Population	Sample	Population	Frequency	%
Zone 1	7	72	19	24	16	36	17	132	52	39.4
Zone 2	9	281	84	4	4	10	4	295	92	31.2
Zone 3	6	156	34	0	0	5	2	161	36	22.4
Zone 4	9	178	40	5	1	8	1	191	42	22.0
Zone 5	8	418	120	0	0	5	4	423	124	29.3
Zone 6	9	102	22	0	0	6	4	108	26	24.1
Zone 7	7	151	39	4	2	5	0	160	41	25.6
Zone 8	7	135	8	1	1	0	0	136	9	6.6
Zone 9	4	33	4	2	0	4	3	39	7	17.9
Total	66	1,526	370	40	24	79	35	1645	429	26.1

Note: The study participants are grouped based on their role in Thai egg production and distribution, and thus comprise (1) farmers, (2) wholesalers, and (3) retailers, based on the Bureau of Livestock Standards and Certification (2013)**,** Thai online Yellow Pages (2014),(2014)**.** However, according to Thai online Yellow Pages (2014),(2014), some of the respondents are both farmers and wholesalers, while others act both as wholesalers and retailers. Thus, as a part of the survey undertaken in this study, the respondents' characteristics were checked once again, in order to verify their role in the Thai egg production and distribution chain. Consequently, additional options were added to the questionnaire, allowing the respondents to choose among (1) farmer, (2) wholesaler, (3) retailer, (4) farmer and wholesaler, (5) wholesaler and retailer, (6) farmer and retailer, and (7) farmer, wholesaler and retailer. The results of this new respondent classification are presented in the next section.

5.3.2 Demographic profile of the respondents

The general information provided by the survey respondents was analysed and the results are summarised in Table 5.2-5.8, each of which represents one of the following demographic characteristics: respondents' role; respondents' organisation size, in terms of the number of eggs bought and sold per day; the age of the organisation; the position of the respondent within the organisation; the respondent's work experience in the current organisation; the work experience in the egg industry; and the highest educational attainment.

5.3.2.1 The respondents' role

In Table 5.2, the roles that the respondents indicated in the questionnaire are summarised; revealing that 40.1% work as farmers, 5.6% are wholesalers, 8.2% are retailers, and 46.2% act as both farmers and wholesalers.

Table 5.2: Summary of the respondents' roles, in terms of areas in Thailand (N = 429)

Area	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Zone 1	16	30.8	14	26.9	17	32.7	5	9.6	52	12.1
Zone 2	44	47.8	4	4.3	4	4.3	40	43.5	92	21.4
Zone 3	22	61.1	0	0.0	2	5.6	12	33.3	36	8.4
Zone 4	17	40.5	1	2.4	1	2.4	23	54.8	42	9.8
Zone 5	43	34.7	0	0.0	4	3.2	77	62.1	124	28.9
Zone 6	7	26.9	2	7.7	4	15.4	13	50.0	26	6.1
Zone 7	17	41.5	2	4.9	0	0.0	22	53.7	41	9.6
Zone 8	3	33.3	1	11.1	0	0.0	5	55.6	9	2.1

Zone 9	3	42.9	0	0.0	3	42.9	1	14.3	7	1.6
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

5.3.2.2 The respondents' organisation size

In Table 5.3, the size of the respondents' organisations is classified into categories, in terms of the number of eggs bought and sold per day. As can be seen from the results, 22.8% of the study participants buy/sell less than 5,000 eggs per day, 52.9% buy/sell 5,001-25,000 eggs per day, 2.1% buy/sell 25,001-45,000 eggs per day, 8.4% buy/sell 45,001-65,000 eggs per day, 5.6% buy/sell 65,001-85,000 eggs per day, 7.2% buy/sell 85,001-105,000 eggs per day, and 0.9% buy/sell more than 145,000 eggs per day. It implies respondents organisations are of small and medium size.

Table 5.3: Summary of the respondents' organisation size, in terms of the number of eggs bought and sold per day (N = 429)

The numbers of egg bought/sold per day	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
(1) Less than 5,001	25	25.5	1	1.0	20	20.4	52	53.1	98	22.8
(2) 5,001-25,000	91	40.1	14	6.2	15	6.6	107	47.1	227	52.9
(3) 25,001-45,000	0	0.0	9	100.0	0	0.0	0	0.0	9	2.1
(4) 45,001-65,000	0	0.0	0	0.0	0	0.0	36	100.0	36	8.4
(5) 65,001-85,000	24	100.0	0	0.0	0	0.0	0	0.0	24	5.6
(6) 85,001-105,000	28	90.3	0	0.0	0	0.0	3	9.7	31	7.2
(9) Above 145,000	4	100.0	0	0.0	0	0.0	0	0.0	4	0.9
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

Note: In the questionnaire, the respondents were provided nine options to choose from, based on the number of eggs bought and sold per day. These were (1) less than 5,001; (2) 5,001-25,000; (3) 25,001-45,000; (4) 45,001-65,000; (5) 65,001-85,000; (6) 85,001-105,000; (7)

105,001-125,000; (8) 125,001-145,000; and (9) above 145,000. However, as none of the respondents selected options 7 and 8, these are not represented in the table.

5.3.2.3 The age of the organisation

In Table 5.4, the information provided by the respondents in the questionnaire regarding the age of their organisation is summarised. As can be seen, 16.8% of the study participants work for an organisation that has been in operation for less than 6 years; in 53% cases, the organisation is 6-10 years old; in 5.6% cases, it is 11-15 years old; in 12.8% cases, it is 16-20 years old; in 5.4% cases, it is 21-25 years old; in 0.7% cases, it is 26-30 years old; and in 4.0% cases, the company has been operational for more than 30 years. Most of the respondent's organisations are of 6-10 years age.

Table 5.4: Summary of the respondents' organisation age (N = 429)

Age of the organisation	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
(1) Less than 6 years	13	18.1	1	1.4	12	16.	46	63.9	72	16.8
(2) 6-10 years	63	27.3	18	7.8	20	8.7	130	56.3	231	53.8
(3) 11-15 years	1	4.2	2	8.3	2	8.3	19	79.2	24	5.6
(4) 16-20 years	49	89.1	3	5.5	0	0.0	3	5.5	55	12.8
(5) 21-25 years	23	100.0	0	0.0	0	0.0	0	0.0	23	5.4
(6) 26-30 years	3	100.0	0	0.0	0	0.0	0	0.0	3	0.7
(7) Above 30 years	20	95.2	0	0.0	1	4.8	0	0.0	21	4.9
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

5.3.2.4 The position held within the organisation

In Table 5.5, the information the respondents provided regarding the position held within the organisation is summarised, based on the categories provided in the questionnaire. As can be seen, 0.5% respondents work as a chairperson/president; 0.2% have a role of a coordinator; 0.9% are directors; 4.0% are working as a marketing director; while 94.4% selected "other" (indicating that they are company owners come managers).

Table 5.5: Summary of the respondents' position held within the organisation (N = 429)

Respondents' position in the organisation	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
(3) Chairperson/President	1	50.0	1	50.0	0	0.0	0	0.0	2	0.5
(4) Coordinator	0	0.0	1	100.0	0	0.0	0	0.0	1	0.2
(5) Director	4	100.0	0	0.0	0	0.0	0	0.0	4	0.9
(11) Marketing Director	16	94.1	1	5.9	0	0.0	0	0.0	17	4.0
(12) Other (Owner)	151	37.3	21	5.2	35	8.6	198	48.9	405	94.4
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

5.3.2.5 The work experience at the current organisation

The information that respondents provided regarding the work experience at the current organisation is summarised in Table 5.6. According to the data, 18.2% of the study participants have worked for their current organisation for less than 6 years; 55.5% for 6-10 years; 9.6% for 11-15 years; 9.6% for 16-20 years; 5.4% for 21-25 years; 0.7% for 26-30 years; and only 1.2% of the respondents indicated that they worked for their current organisation for more than 30 years. It shows that majority of the employees are with the current organisation for 6-10 years.

Table 5.6: Summary of the respondents' work experience at the current organisation (N = 429)

Respondents' work experiences at the current organisation	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
(1) Less than 6 years	19	24.4	1	1.3	12	15.4	46	59.0	78	18.2
(2) 6-10 years	70	29.4	18	7.6	20	8.4	130	54.6	238	55.5
(3) 11-15 years	18	43.9	2	4.9	2	4.9	19	46.3	41	9.6
(4) 16-20 years	35	85.4	3	7.3	0	0.0	3	7.3	41	9.6
(5) 21-25 years	23	100.0	0	0.0	0	0.0	0	0.0	23	5.4

(6) 26-30 years	3	100.0	0	0.0	0	0.0	0	0.0	3	0.7
(7) Above 30 years	4	80.0	0	0.0	1	20.0	0	0.0	5	1.2
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

5.3.2.6 Respondents' work experience in the egg industry

In Table 5.7, the information the respondents provided with respect to their working experience in the egg industry is classified into categories corresponding to those offered in the questionnaire. As can be seen, 16.8% of the study participants have less than 6 years of work experience; 56.9% have 6-10 years; 9.3% have 11-15 years; 9.8% have 16-20 years; 5.6% have 21-25 years; 0.7% have 26-30 years; and 0.9% have more than 30 years of work experience in the egg industry. It indicates that most of the respondents have 6-15 years experience in egg industry.

Table 5.7: Summary of the respondents' work experience in the egg industry (N = 429)

Respondents' work experiences in the egg industry	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
(1) Less than 6 years	13	18.1	1	1.4	12	16.7	46	63.9	72	16.8
(2) 6-10 years	76	31.1	18	7.4	20	8.2	130	53.3	244	56.9
(3) 11-15 years	17	42.5	2	5.0	2	5.0	19	47.5	40	9.3
(4) 16-20 years	36	85.7	3	7.1	0	0.0	3	7.1	42	9.8
(5) 21-25 years	24	100.0	0	0.0	0	0.0	0	0.0	24	5.6
(6) 26-30 years	3	100.0	0	0.0	0	0.0	0	0.0	3	0.7
(7) Above 30 years	3	75.0	0	0.0	1	25.0	0	0.0	4	0.9
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

5.3.2.7 The respondents' highest educational attainment

In Table 5.8, the information the respondents shared regarding their highest educational attainment is summarised. According to the classification provided in the questionnaire, 33.6% completed only primary school; 52% graduated from high school; 0.2% hold a graduate certificate; 1.4% have a diploma; 12.4% completed a bachelor degree; 0.2% have a master's degree; and 0.2% have a doctorate degree. It is interesting to observe that in Thailand, most of the egg industry owners come managers are having high school diploma.

Table 5.8: Summary of the respondents' highest educational attainment (N = 429)

Respondents' highest educational attainment	Farmer		Wholesaler		Retailer		Farmer and Wholesaler		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
(1) Primary school	30	20.8	8	5.6	15	10.4	91	63.2	144	33.6
(2) High school	116	52.0	13	5.8	19	8.5	75	33.6	223	52.0
(3) Certificate	1	100.0	0	0.0	0	0.0	0	0.0	1	0.2
(4) Diploma	4	66.7	1	16.7	1	16.7	0	0.0	6	1.4
(5) Bachelor Degree	19	35.8	2	3.8	0	0.0	32	60.4	53	12.4
(7) Masters Degree	1	100.0	0	0.0	0	0.0	0	0.0	1	0.2
(8) Doctorate Degree	1	100.0	0	0.0	0	0.0	0	0.0	1	0.2
Total	172	40.1	24	5.6	35	8.2	198	46.2	429	100.0

5.4 Data cleaning

Data cleaning, in the context of the scientific research process, is a stage following data collection that aims to eliminate any potential for introducing biases into the results (Hair et al. 2006). It typically includes four assessments, which identify (1) missing data, (2) multivariate outliers, (3) multivariate normality, and (4) multicollinearity (Tabachnick & Fidell 2007, Hair et al. 2010).

5.4.1 Missing data

When a questionnaire is used as a data collection instrument, it is possible that some of the data required for the subsequent analyses will be missing. This typically occurs when a respondent fails to answer one or more questions in the survey. Presence of missing or incomplete data will lead to the reduction of the sample size available for analysis. If this problem is significant, the previously adequate sample may become inadequate. In addition, any statistical results based on data affected by non-random missing items could be biased, leading to inaccurate or erroneous conclusions (Hair et al. 2006, Hair et al. 2010). Moreover, patterns in the missing data values can make it impossible to fit the saturated model, even if a good fit to the researcher model is obtained (Arbuckle 2005). Thus, it is essential to check the data for any missing values and assess their impact on the validity of the results. This is particularly important in multivariate data analysis.

In this study, as the survey was conducted via questionnaires distributed to the study participants, it was possible that some were affected by missing data. In section 5.1, it was mentioned that during the manual checking of the survey questionnaires 135 were identified as incomplete and excluded from analysis. Among the excluded questionnaires majority (80%) of them were incomplete in answering entire sections. This research further investigated the missing data subjected to relevant tests, as indicated by the data shown in Appendix 2.2. However, the analyses indicated that none of the 429 acceptable questionnaires returned by the study participants contained any missing values. Thus, all measurement items were suitable for use in further analyses.

5.4.2 Multivariate outliers

Outliers are observations with a unique combination of characteristics identifiable as distinctly different from the other observations. Generally, these unique characteristics include unusually high or low values, or a unique combination of values across several variables that make the observation stand out from the others (Hair et al. 2006). Multivariate outliers are essential to identify, as their presence will distort the statistics (Tabachnick & Fidell 2007). In this study, this was done using SPSS statistical package, including Mahalanobis distance (D^2) and degrees of freedom (df) tests. D^2/df or the Z-score exceeds 3 or is less than -3, this indicates presence of outliers. If outliers do occur, they should be removed from the dataset (Hair et al. 2010).

The results of the multivariate outlier test performed as a part of this study are presented in Appendix 2.3. As can be seen, the Z-score pertaining to Item 3.3 and 4.2 exceeded 3, indicating that these are outliers and should be excluded from further analyses.

5.4.3 Multivariate normality

For the dataset to meet the multivariate normality condition, all individual measurement items, as well as any combination thereof, must be normally distributed (Hooley & Hussey 1994). Moreover, if all data related to each measurement item is normally distributed, skewness and kurtosis tests should also be run, whereby the former should be below 3.0 and the latter less than 10.0 (Hoyle 1995, Kassim 2001). In such cases, the 5% Trimmed Mean test is also performed. Under the Trimmed Mean test it is verified that the mean calculated with the highest and lowest 5% of the values removed is not substantially different from that calculated for the entire dataset. This ensures that the extreme values, as indicated from skewness and kurtosis values, do not influence the actual mean value (Pallant 2010). Finally, Q-Q plot of each measurement items should be generated, in order to verify that all data is scattered as closely to a straight line as possible. Once the data passes the aforementioned tests, it can be confirmed that the data set is normally distributed (Hair et al. 2010).

In this study, the multivariate normality test results revealed that both skewness and kurtosis values were in the acceptable range. This confirms that all measurement items are normally distributed (as shown in Appendix 2.4). In addition, once the top and bottom 5% of the value set of this study were excluded, the new mean was different from the original by only 0.02 (as show in Appendix 2.5). Therefore, the extreme values did not influence the original mean value in this study. Moreover, the Q-Q plot of each measurement item confirmed that the values were scatted closely to a straight line (as shown in Appendix 2.6). Thus, it is confirmed that the data are normally distributed. Hence, all measurement items could be used in the subsequent analyses.

5.4.4 Multicollinearity

Multicollinearity refers to the situation in which two or more variables (measurement items) are highly correlated (Var 1998). Some multivariate techniques, such as MANOVA, work effectively when the dependent variables are only moderately correlated. In such cases, it is recommended to consider removing one of the strongly correlated pairs of dependent variables or, alternatively, combining them to form a single measure (Pallant 2005). Extant research indicates that the inter-item correlation value should exceed 0.3 (Robinson et al. 1991). Moreover, when the correlation coefficient between any two measure items is greater than 0.8, one of the highly correlated variables should be removed from the data collection instrument (Pallant 2010). As can be seen from the results reported in Appendix 2.7, most of the inter-item correlation values for the pilot study were in the 0.3-0.8 range, and were thus acceptable. The following items were the notable exceptions: (1) 2.2.2 & 2.2.4, (2) 3.4 & 3.5, (3) 4.1 & 4.5, (4) 6.1.5 & 6.1.6, (5) 6.2.1 & 6.2.2, (6) 7.1.1 & 7.1.2, (7) 7.1.3 & 7.1.4, (8) 7.2.3 & 7.2.4, (9) 7.2.5 & 7.2.6, (10) 8.1 & 8.4 and (11) 9.1 & 9.2. Hence, based on the above recommendation, the decision was made to remove one of the highly correlated items in each case (Grewal et al. 2004), which resulted in item 2.2.4, 3.5, 4.1, 6.1.5, 6.2.1, 7.1.2, 7.1.4, 7.2.4, 7.2.6, 8.4 and 9.1 being excluded from the further analysis.

5.5 Tabulation & Analysis

Once all errors were removed from the data set, the information was stored in tabular form in a database designated for this purpose, to facilitate further analysis (Sreejesh et al. 2014). In this study, the raw data was subjected to further analyses, including one-way analysis of variance (ANOVA), t-test, common method variance (CMV) and exploratory factor analysis (EFA). This ensured that all errors were identified and dealt with prior to storing the data in the database.

5.5.1 Comparing respondents' characteristics

The respondents' characteristics were compared via one-way analysis of variance (ANOVA) that tests the difference in the data pertaining to demographic characteristics. If the results indicated that the data were not statistically different ($p > 0.05$), these were combined in one element in the subsequent analysis. Alternatively, different data ($p < 0.05$) were removed from the set (Li et al. 2006). As a result of this process, in this study (Appendix 2.8), the differences in the demographic data pertaining to three groups of respondents (farmer, wholesaler and retailer) were shown not to be statistically different ($p > 0.05$). The only exception was item 1.1.2 with $p = 0.026$, which was removed from the data set prior to conducting SEM analysis.

5.5.2 Non-response bias

Non-response bias test is applied to the data set collected in this study, as it allows detecting any differences in the information yielded by the respondents in the first and the second wave of the survey (Studer et al. 2013). If the responses to the same question differ significantly ($p < 0.05$), the relevant item has to be removed from the subsequent analysis (Li et al. 2006). In this study (see Appendix 2.9), item 1.2.2 ($p = 0.002$) drew responses that were significantly different in the two waves. Thus, item 1.2.2 was removed prior to the SEM analysis

5.5.3 Common Method Variance (CMV)

CMV is adopted when a common method (questionnaire survey) is used to collect data and there is a need to test for the presence of spurious covariance shared among measurement items (Buckley et al. 1990). However, it is important to note that CMV refers to variance pertaining to the measurement method employed, rather than the measurement construct. If any measurement errors are present, this could lead to spurious correlation among measurement items, in which case CMV must be performed and any issues remedied (Podsakoff et al. 2003). Typically, CMV is conducted by employing Harman's single-factor test in EFA and CFA (Hult et al. 2006). In this study, EFA approach was adopted (see Appendix 2.10), revealing that the first factor explained 31.22% of the variance. Thus, as it failed to explain the majority of the variance among the variables under investigation, the data was not significantly affected (Andersson & Bateman 1997). Thus, the CFA approach was also utilised (see Appendix 2.11), as it provides a sophisticated test of the hypothesis that a single factor can account for all the variance in their data (Iverson & Maguire 2000). In this approach, all items are modelled as the indicators of a single factor that represents method effects. Thus, CMV are assumed to be substantial if the hypothesised model fits the data (Mossholder et al. 1998). In this study, the goodness-of-fit of the single CFA model yielded a high chi-square value, with a significant p-value (*p*) (Chi-Square (χ^2) = 36393.298, p = 0.000, CMIN/DF = 6.929), and the fit indices were below the threshold values (GFI = 0.295, AGFI = .0267, CFI = 0.329, TLI = 0.315, NFI = .297, and RMSE = 0.118) that were chosen because they did not fit the data. Moreover, these results demonstrate that the probability of common method variance occurring is minimised (i.e., the potential for inflating any identified relationship between constructs is low) (Podsakoff & Organ 1986). Thus, common method bias is not an issue in this study (as the likelihood of introducing substantial method bias in the data set is small).

5.5.4 Exploratory factor analysis (EFA)

EFA is employed when the aim is to reduce the size of the data set or to summarise the available data. As a part of this process, the data set pertaining to each measurement item is subjected to the required mathematical calculations, allowing it to be clustered into smaller groups, based on the existing inter-correlations. The objective of employing the EFA is threefold: (1) identifying representative variables from a large data set; (2) identifying the correlation or relationship between either variables or respondents; and (3) creating a new, smaller, set of variables that can serve as a representative of the original data set, as it shares its key characteristics (Hair et al. 2010).

While EFA is immensely valuable, it cannot be applied to all data sets. The suitability of the data set is assessed by testing it against the following seven conditions, summarised in Table

5.9: (1) the factor loading of each measurement item should exceed 0.5 in order to generate a more reliable factor (Hair et al, 2010); (2) the communality values should exceed 0.5; otherwise, the items to which they pertain should be removed (Pallant 2010), (3) the factors with Eigenvalue greater than 1.0 are considered significant and should be retained for further analysis (Hair et al. 2010), (4) the reliability coefficient for items within the single factor should be well above the recommended minimum of Cronbach 0.6 (Field 2009), (5) the value of Kaiser-Meyer-Olkin (KMO) exceeding 0.8 (Kaiser 1974) (6) presence of many correlations between variables of each measurement construct, with the correlation coefficient exceeding 0.3 (Tabachnick & Fidell 2001); and (7) the value of Bartlett's test of sphericity of each variable set should be significant ($p < 0.05$) (Bartlett 1954). In addition, the scree plot test should also be employed, allowing the number of extracted factors to be determined (Cattell 1966). A scree plot is a plot of the Eigen values for each factor. Cattell argues that the most appropriate number of factors that adequately represent the constructs underlying the variables in the analysis is equal to the number of factors that come before the scree. Typically, after the first couple of factors, the Eigen values fall way asymptotically.

Table 5.9: Summary of the conditions a data set must fulfil for EFA

Conditions	**Values**	**Authors**
1) Factor loading	> 0.5	Hair et al. (2010)
2) Communality	> 0.5	Hair et al. (2010)
3) Eigenvalue	> 1	Hair et al. (2010)
4) Cronbach	> 0.6	Field (2009)
5) Kaiser-Meyer-Olkin (KMO)	> 0.8	Kaiser (1974)
6) Inter-item correlation	> 0.3	Tabachnick & Fidell (2001)
7) Bartlett (p-value)	> 0.05	Bartlett (1954)

As a part of the EFA, factor analysis using 'maximum likelihood' extraction and 'promax' oblique rotation was conducted. The use of maximum likelihood extraction and oblique rotation can generalise to other samples that are deemed representative of the population (Costello & Osborne 2005). Moreover, maximum likelihood extraction is the most suitable choice, as it allows for the computation of a wide range of indices of the model's goodness of fit. In addition, it permits statistical significance testing of factor loadings, as well as establishing correlations among the factors and computing confidence intervals (Fabrigar et al. 1999). Oblique rotation allows the factors to be correlated (Costello & Osborne 2005). According to the findings of this process, correlations among the factors employed in this study were identified (see Table 5.10, 5.12, 5.14, 5.16, 5.18, and 5.20). The 'promax' rotation is an oblique rotation approach allowing identification of distinct factors (Hendrickson & White 1964). In this study, the promax rotation was performed by combining the advantage of varimax (orthogonal) and oblique rotation techniques (Fabrigar et al. 1999).

5.5.4.1 EFA pertaining to factors for information integration (II)

Information integration (II) construct, which included four factors and 18 items in total, was subjected to EFA, which was analysed in SPSS 22. More specifically, there were four items pertaining to internal information sharing (IIS), six items related to external information sharing (EIS), and four item search pertaining to internal IT capability (IITC) and external IT capability (EITC), respectively. For EFA, 'Maximum Likelihood method' and 'Promax' rotation with Kaiser Normalization (the oblique rotation method) were used. The results indicated that all four factors of information integration construct are strongly correlated with each other with maximum correlation 0.640 and minimum co-relation factor 0.420 (see Table 5.10), thus confirming the suitability of the oblique rotation method. Table 5.11 and Figure 5.2 summarise the reported findings, indicating the presence of four factors with eigenvalue exceeding 1(can be seen from scree plot); explaining 51.424%, 61.242%, 70.020% and 76.176% of the cumulative variance respectively. The first factor (EIS) included the measurement items EIS1.2.2, EIS1.2.1, EIS1.2.4, EIS1.2.3, EIS1.2.6, and EIS1.2.5. The second factor (EITC) consisted of the measurement items EITC2.2.1, EITC2.2.2, EITC2.2.3, and EITC2.2.5. The third factor (IIS) included the measurement items IIS1.1.4, IIS1.1.3, IIS1.1.1, and IIS1.1.2 while the measurement items IITC2.1.1, IITC2.1.4, IITC2.1.3, and IITC2.1.2 pertained to the fourth factor (IITC). All items are unidimensional, significant and suitable for CFA (as shown in Table 5.9), as the factor loadings and communalities are greater than 0.5, the inter-item correlation values are greater than 0.3, Cronbach's alpha and KMO are greater than 0.8, and the value of Bartlett's test of sphericity is less than 0.05.

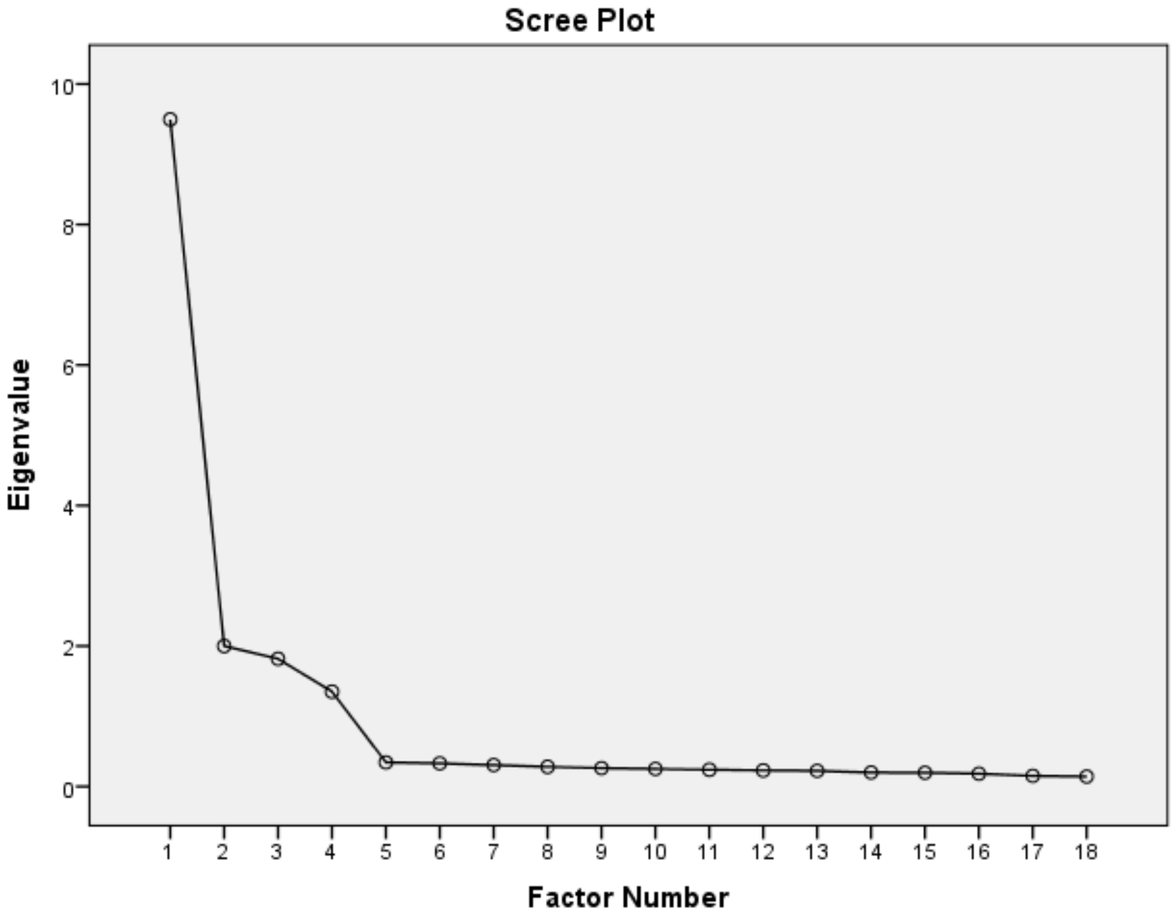


Figure 5.2: Scree plot of factors under the information integration (II) construct

Table 5.10: Factor correlation matrix for information integration (II)

Factor	1 (EIS)	2 (EITC)	3 (IIS)	4 (IITC)
1	1.000			
2	0.517	1.000		
3	0.540	0.420	1.000	
4	0.640	0.513	0.566	1.000

Table 5.11: EFA pertaining to information integration (II)

Items	**Components**				**Communalities**	
	1	2	3	4	Initial	Extraction
EIS1.2.2	0.897				0.773	0.796
EIS1.2.1	0.887				0.758	0.789
EIS1.2.4	0.872				0.763	0.798
EIS1.2.3	0.855				0.724	0.761

EIS1.2.6	0.850				0.710	0.735
EIS1.2.5	0.812				0.702	0.726
EITC2.2.1		0.909			0.752	0.806
EITC2.2.2		0.868			0.732	0.787
EITC2.2.3		0.861			0.710	0.766
EITC2.2.5		0.855			0.706	0.750
IIS1.1.4			0.885		0.732	0.797
IIS1.1.3			0.859		0.690	0.745
IIS1.1.1			0.828		0.717	0.767
IIS1.1.2			0.820		0.619	0.663
IITC2.1.1				0.872	0.739	0.800
IITC2.1.4				0.852	0.694	0.742
IITC2.1.3				0.844	0.720	0.768
IITC2.1.2				0.814	0.678	0.714
Eigenvalue	9.495	2.000	1.818	1.350		
Cumulative variance explained	51.424%	61.242%	70.020%	76.176%		
Reliability (Cronbach's alpha)	0.951	0.932	0.919	0.925		
Inter-item correlation values	0.732-0.796	0.752-0.790	0.697-0.778	0.727-0.781		
Kaiser-Meyer-Olkin (KMO)	0.941					
Bartlett's test of sphericity	0.000					

Note: Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

5.5.4.2 EFA pertaining to the factors for logistics operations coordination (LOC)

In this study, logistics operations coordination (LOC) construct subjected to EFA included two factors and seven items. Distribution centre/warehouse sharing (DCS) factor consists of four items and transport cooperation (3PL and TC3PL) factor consists of three items. Like previous construct, the EFA conducted on the LOC factors employed 'Maximum Likelihood' method and 'Promax' rotation with Kaiser Normalization (the oblique rotation method) by SPSS 22 software package. The obtained results revealed that the two factors are strongly correlated with correlation 0.523 (see Table 5.12), thus providing support for the selection of the oblique rotation method. The summary results are presented in Table 5.13 and Figure 5.3, revealing presence of two factors with eigenvalue exceeding 1 (can be seen from scree plot), explaining 59.200% and 76.827% of the cumulative variance respectively. The first factor (DC) included the measurement items DC4.6, DC4.5, DC4.4, and DC4.3, while the measurement items TC3PL3.4, TC3PL3.2, and TC3PL3.1 pertained to the second factor (TC3PL). Hence, all items are unidimensional, significant and suitable for CFA (please refer to Table 5.9 for more details) as the factor loadings and communalities are greater than 0.5, the inter-item correlation values exceeded 0.3, Cronbach's alpha and KMO exceeded 0.8, and the value of Bartlett's test of sphericity is below 0.05.

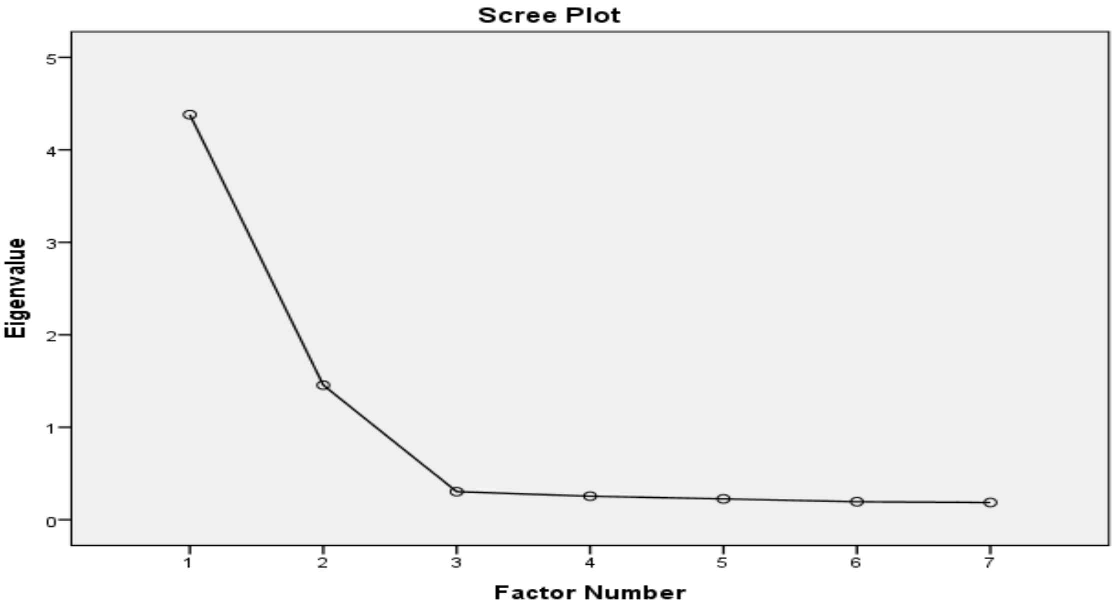


Figure 5.3: Scree plot of factors under the logistics operations coordination (LOC) construct

Table 5.12: Factor correlation matrix for logistics operations coordination (LOC)

Factor	1 (DC)	2 (TC3PL)
1	1.000	
2	0.523	1.000

Table 5.13: EFA pertaining to logistics operations coordination (LOC)

Items	**Component**		**Communalities**	
	1	2	Initial	Extraction
DC4.6	0.903		0.719	0.796
DC4.5	0.871		0.698	0.765
DC4.4	0.866		0.708	0.776
DC4.3.	0.823		0.636	0.687
TC3PL3.4		0.894	0.701	0.784
TC3PL3.2		0.884	0.721	0.814
TC3PL3.1		0.869	0.679	0.756

Eigenvalue	4.380	1.455	
Cumulative variance explained	59.200%	76.827%	
Reliability (Cronbach's alpha)	0.925	0.916	
Inter-item correlation values	0.725-0.784	0.770-0.798	
Kaiser-Meyer-Olkin (KMO)	0.866		
Bartlett's test of sphericity	0.000		

Note: Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

5.5.4.3 EFA pertaining to the factors for organisational relationship (O_R)

Organisational relationship (O_R) construct includes five factors and 22 items. These factors are (1) forging and maintaining long-term relationships (FMLR), with five items; (2) internal sharing of skills/ideas, knowledge/experience (ISSK), also measured through five items; (3) external sharing of skills/ideas, knowledge/experience (ESSK), with four items; (4) internal creation of teamwork along the supply chain and cross-functional teams (ICT), also with four items; and (5) external creation of teamwork along the supply chain and cross-functional teams (ECT), measured through four items. The five factors pertaining to organisational relationship (OR) were subjected to EFA, which was conducted in SPSS 22 by applying 'Maximum Likelihood' method and 'Promax' rotation with Kaiser Normalization (the oblique rotation method). The findings indicated that all five factors are strongly correlated with each other with maximum correlation 0.548 and minimum co-relation factor 0.448 (see Table 5.14), thus providing support for the use of the oblique rotation method. The key results are reported in Table 5.15 and Figure 5.4, which reveal the presence of five factors with eigenvalue exceeding 1 (can be seen from scree plot), explaining 47.718%, 56.214%, 64.253%, 71.061% and 77.294% of the cumulative variance, respectively. The first factor (FMLR) included the measurement items FMLR5.3, FMLR5.4, FMLR5.1, FMLR5.5, and FMLR5.2, while the second factor (ISSK) consisted of the measurement items ISSK6.1.6, ISSK6.1.2, ISSK6.1.1, ISSK6.1.4, and ISSK6.1.3. The measurement items ECT7.2.5, ECT7.2.3, ECT7.2.1, and ECT7.2.2 pertained to the third factor (ECT), while the fourth factor (ICT) consisted of the measurement items ICT7.1.1, ICT7.1.3, ICT7.1.6, and ICT7.1.5. Finally, the fifth factor (ESSK) included the measurement items ESSK6.2.5, ESSK6.2.4, ESSK6.2.3, and ESSK6.2.2. It shows that the factor loadings and communalities exceeded 0.5, the inter-item correlation values are greater than 0.3, Eigenvalues exceeded 1, Cronbach's alpha and KMO are greater than 0.8, and the value of Bartlett's test of sphericity is less than 0.05. Hence, all items are unidimensional, significant and suitable for CFA based on the values shown in Table 5.9.

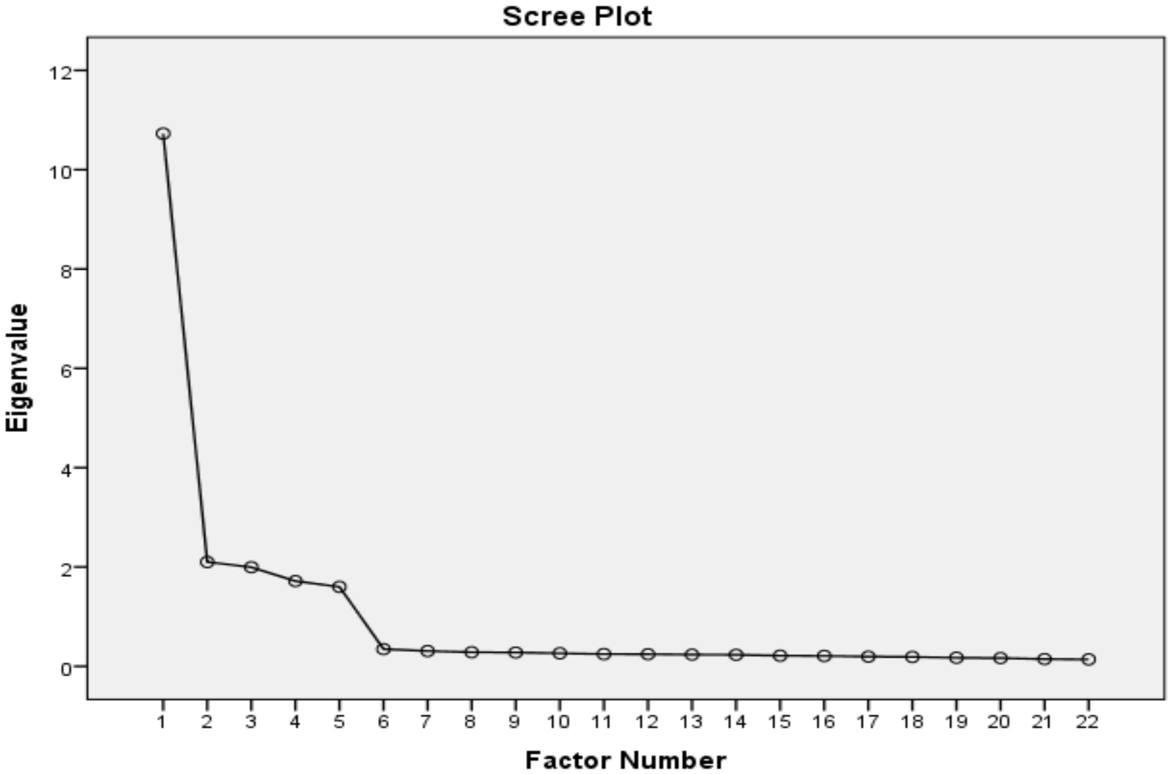


Figure 5.4: Scree plot of factors under the organisational relationship (O_R) construct

Table 5.14: Factor correlation matrix for organisational relationship (O_R)

Factor	1(FMLR)	2(ISSK)	3(ECT)	4(ICT)	5(ESSK)
1	1.000				
2	0.535	1.000			
3	0.463	0.448	1.000		
4	0.511	0.514	0.485	1.000	
5	0.525	0.548	0.497	0.531	1.000

Table 5.15: EFA pertaining to organisational relationship (O_R)

Items	**Component**					**Communalities**	
	1	2	3	4	5	Initial	Extraction
FMLR5.3	0.886					0.743	0.786
FMLR5.4	0.882					0.761	0.798
FMLR5.1	0.874					0.743	0.779
FMLR5.5	0.871					0.748	0.788

FMLR5.2	0.852					0.727	0.747
ISSK6.1.6		0.880				0.719	0.755
ISSK6.1.2		0.877				0.746	0.791
ISSK6.1.1		0.874				0.744	0.784
ISSK6.1.4		0.851				0.699	0.729
ISSK6.1.3		0.846				0.734	0.766
ECT7.2.5			0.891			0.740	0.793
ECT7.2.3			0.886			0.764	0.809
ECT7.2.1			0.878			0.726	0.766
ECT7.2.2			0.829			0.703	0.745
ICT7.1.1				0.891		0.745	0.809
ICT7.1.3				0.864		0.712	0.763
ICT7.1.6				0.858		0.715	0.766
ICT7.1.5				0.844		0.700	0.749
ESSK6.2.5					0.888	0.754	0.803
ESSK6.2.4					0.886	0.733	0.788
ESSK6.2.3					0.862	0.703	0.761
ESSK6.2.2					0.821	0.691	0.726
Eigenvalue	10.726	2.101	1.995	1.716	1.600		
Cumulative variance explained	47.718%	56.214%	64.253%	71.061%	77.294%		
Reliability (Cronbach’s alpha)	0.946	0.941	0.930	0.930	0.929		
Inter-item correlation values	0.762-0.790	0.739-0.781	0.743-0.795	0.753-0.786	0.739-0.790		
Kaiser-Meyer-Olkin (KMO)	0.943						
Bartlett’s test of sphericity	0.000						

Note: Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

5.5.4.4 EFA pertaining to the factors for institutional support (IS)

Institutional support (IS) construct includes three factors with 14 items in total. More specifically, (1) government support, incentive or policy (GS) is measured via five items, (2) the role of banks/financial services (FS) also included five items, and (3) knowledge support from boards and associations, and educational institutions/educational support (ES) is assessed through four items. As before, the EFA of the factors pertaining to institutional support (IS) was conducted in SPSS 22, employing ‘Maximum Likelihood’ method and

‘Promax’ rotation with Kaiser Normalization (the oblique rotation method). The results these analyses yielded indicate that the three factors are strongly correlated with each other with maximum correlation 0.632 and minimum co-relation factor 0.602 (see Table 5.16), thus providing support for the usage of the oblique rotation method. The main results are reported in Table 5.17 and Figure 5.5, revealing the presence of three factors (can be seen from scree plot) with eigenvalue exceeding 1, explaining 57.712%, 67.566%, and 76.120%of the cumulative variance, respectively. The first factor (GS) included the measurement items GS8.2, GS8.1, GS8.5, GS8.3, and GS 8.6, while the second factor (FS) consisted of the measurement items FS9.4, FS9.5, FS9.3, FS9.2, and FS9.6. Finally, the measurement items ES10.1, ES10.3, ES10.2, and ES10.4 assessed the third factor (ES). More specifically, this conclusion is reached, as the factor loadings and communalities are greater than 0.5, the inter-item correlation values exceeded 0.3, Eigenvalues are greater than 1, Cronbach’s alpha and KMO exceeded 0.8, and the value of Bartlett’s test of sphericity is less than 0.05. Hence, all items are unidimensional, significant and suitable for CFA (please refer to Table 5.9 for more details).

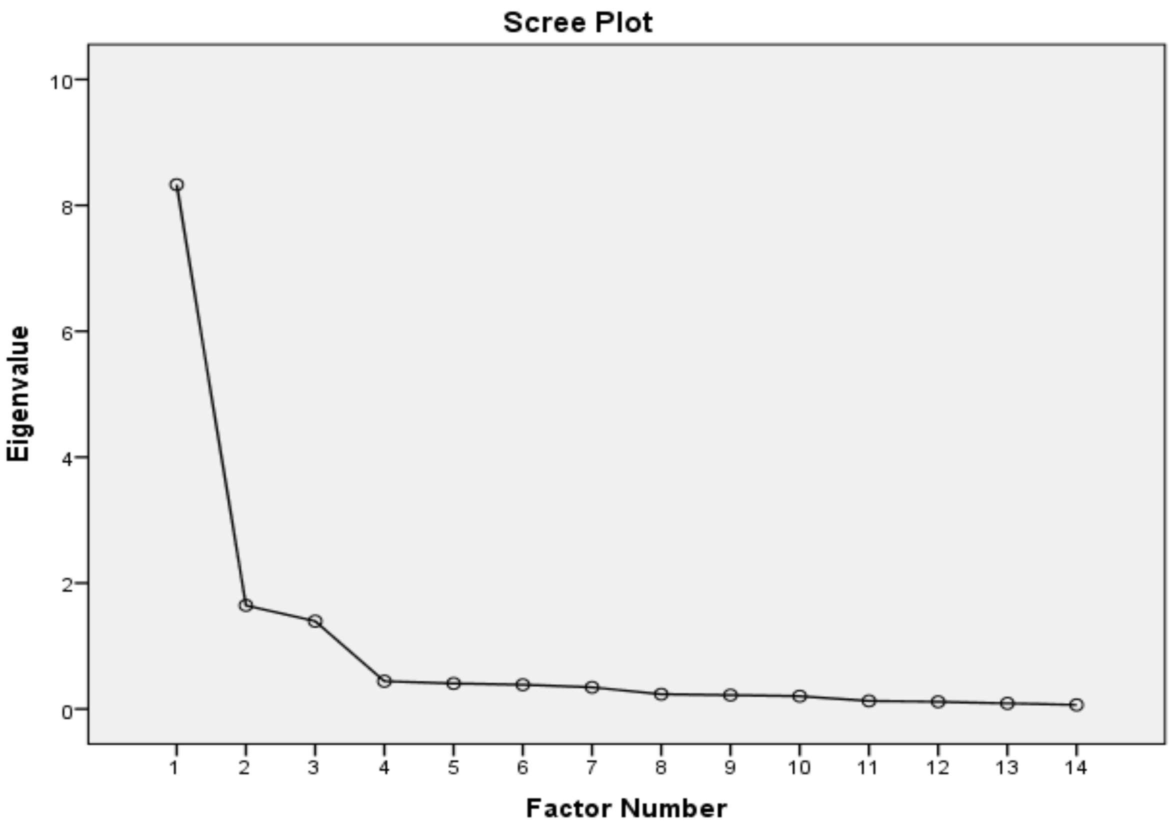


Figure 5.5: Scree plot of factors for the institutional support (IS) construct

Table 5.16: Factor correlation matrix for institutional support (IS)

Factor	1(GS)	2(FS)	3(ES)
1	1.000		
2	0.611	1.000	
3	0.632	0.602	1.000

Table 5.17: EFA pertaining to institutional support (IS)

Items	**Component**			**Communalities**	
	1	2	3	Initial	Extraction
GS8.2	0.884			0.828	0.805
GS8.1	0.884			0.842	0.768
GS8.5	0.876			0.864	0.774
GS8.3.	0.863			0.800	0.782
GS8.6	0.818			0.785	0.757
FS9.4		0.864		0.775	0.771
FS9.5		0.844		0.847	0.745
FS9.3		0.840		0.772	0.720
FS9.2		0.836		0.807	0.711
FS9.6		0.829		0.744	0.715
ES10.1			0.893	0.745	0.810
ES10.3			0.862	0.744	0.782
ES10.2			0.850	0.700	0.744
ES10.4			0.850	0.735	0.774
Eigenvalue	8.330	1.645	1.394		
Cumulative variance explained	57.712%	67.566%	76.120%		
Reliability (Cronbach's alpha)	0.945	0.931	0.933		
Inter-item correlation values	0.762-0.794	0.710-0.760	0.758-0.795		
Kaiser-Meyer-Olkin (KMO)	0.883				
Bartlett's test of sphericity	0.000				

Note: Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

5.5.4.5 EFA pertaining to the factors for perfect order fulfilment (POF)

EFA was also performed on the perfect order fulfilment (POF) construct, comprising four factors and 15 items. More specifically, these factors were: (1) information integration through perfect order fulfilment (II_POF), measured through four items; (2) logistics operations coordination through perfect order fulfilment (LOC_POF), assessed via three items; (3) organisational relationship through perfect order fulfilment (OR_POF), comprising five items; and (4) institutional support through perfect order fulfilment (IS_POF), consisting of three items. In line with the previous analyses, the factors pertaining to perfect order fulfilment (POF) are subjected to EFA, conducted in SPSS 21 using ‘Maximum Likelihood’ method and ‘Promax’ rotation with Kaiser Normalization (the oblique rotation method). According to the analysis results, all four factors are strongly correlated with each other with maximum correlation 0.624 and minimum co-relation factor 0.492 (see Table 5.18), thus providing support for the use of the oblique rotation method. Table 5.19 and Figure 5.6 summarise the findings, revealing the presence of four factors with eigenvalue exceeding 1, (can be seen from scree plot), respectively explaining 52.715%, 61.460%, 69.413%, and 76.372%of the cumulative variance. The first factor (OR_POF) included the measurement items OR_POF13.4, OR_POF13.5, OR_POF13.2, OR_POF13.1, and OR_POF13.3, while the second factor (II_POF) consisted of the measurement items II_POF11.2, II_POF11.3, II_POF11.1, and II_POF11.4. The third factor (IS_POF) included the measurement items IS_POF14.2, IS_POF14.1, and IS_POF14.3 and the measurement items LOC_POF12.1, LOC_POF12.3, and LOC_POF12.2 assessed the fourth factor (LOC_POF). More specifically, this conclusion was reached, as the factor loadings and communalities are greater than 0.5, the inter-item correlation values exceeded 0.3, Eigenvalues are greater than 1, Cronbach’s alpha and KMO exceeded 0.6, and the value of Bartlett’s test of sphericity is less than 0.05. Hence, all items are unidimensional, significant and suitable for CFA (refer to Table 5.9).

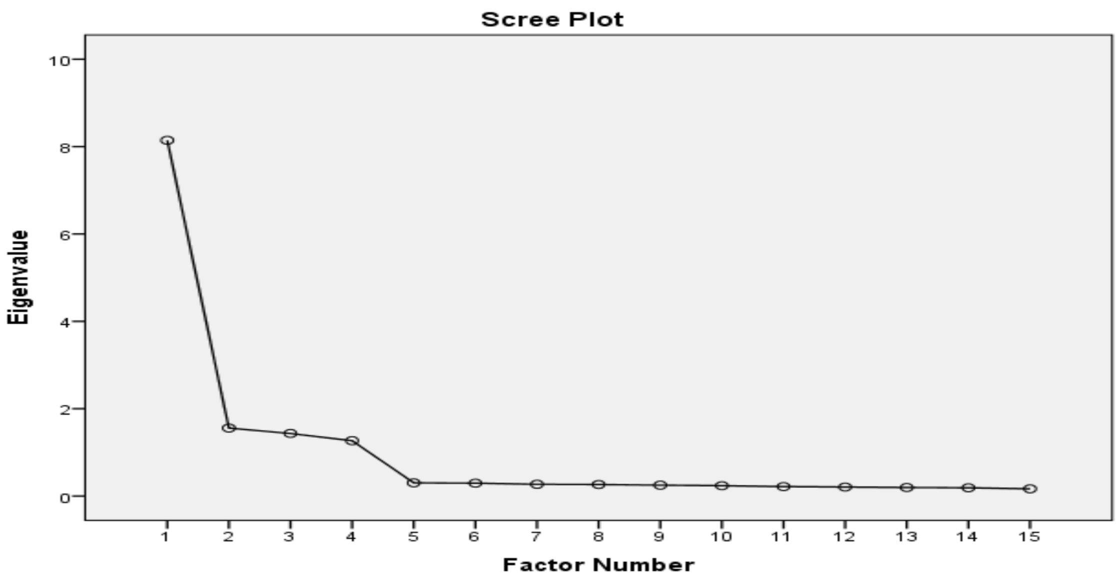


Figure 5.6: Scree plot of factors for the perfect order fulfilment (POF) construct

Table 5.18: Factor correlation matrix for perfect order fulfilment (POF)

Factor	1(OR_POF)	2(II_POF)	3(IS_POF)	4(LOC_POF)
1	1.000			
2	0.624	1.000		
3	0.514	0.503	1.000	
4	0.586	0.572	0.492	1.000

Table 5.19: EFA pertaining to perfect order fulfilment (POF)

Items	**Component**				**Communalities**	
	1	2	3	4	Initial	Extraction
OR_POF13.4	0.895				0.764	0.818
OR_POF13.5	0.868				0.719	0.762
OR_POF13.2	0.865				0.713	0.752
OR_POF13.1	0.859				0.734	0.773
OR_POF13.3	0.833				0.718	0.754
II_POF11.2		0.870			0.708	0.773
II_POF11.3		0.863			0.707	0.775
II_POF11.1		0.854			0.668	0.729
II_POF11.4		0.829			0.689	0.744
IS_POF14.2			0.870		0.663	0.750
IS_POF14.1			0.867		0.689	0.784
IS_POF14.3			0.850		0.651	0.732
LOC_POF12.1				0.889	0.705	0.800
LOC_POF12.3				0.846	0.690	0.769
LOC_POF12.2				0.841	0.680	0.741
Eigenvalue	8.144	1.553	1.433	1.268		
Cumulative variance explained	52.715 %	61.460 %	69.413 %	76.372%		
Reliability (Cronbach's alpha)	0.943	0.925	0.902	0.908		
Inter-item correlation values	0.748-0.790	0.734-0.771	0.738-0.766	0.753-0.781		
Kaiser-Meyer-Olkin (KMO)	0.930					
Bartlett's test of sphericity	0.000					

Note: Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

5.5.4.6 EFA pertaining to the factors for order fulfilment lead times (OFLT)

Order fulfilment lead times (OFLT) construct, comprising four factors and 15 items, is also subjected to EFA. These factors consisted of (1) information integration through order fulfilment lead times (II_OFLT) with 4 items; (2) logistics operations coordination through order fulfilment lead times (LOC_OFLT) with 3 items; (3) organisational relationship through order fulfilment lead times (OR_OFLT) with 5 items; and (4) institutional support through order fulfilment lead times (IS_OFLT) with 3 items. In line with the approach employed for other constructs, for the factors pertaining to order fulfilment lead times (OFLT) are subjected to EFA, which was conducted in SPSS 22 using 'Maximum Likelihood' method and 'Promax' rotation with Kaiser Normalization (the oblique rotation method). The results confirmed that all four factors are strongly correlated with each other with maximum correlation 0.561 and minimum co-relation factor 0.489 (see Table 5.20), thus providing support for adopting the oblique rotation method. The key results can be seen Table 5.21 and Figure 5.7, which reveal the presence of four factors with eigenvalues exceeding 1 (can be seen from scree plot), explaining 50.685%, 60.732%, 69.473% and 76.457% of the cumulative variance, respectively. The first factor (OR_OFLT) included the measurement items OR_OFLT13.6, OR_OFLT13.8, OR_OFLT13.7, OR_OFLT13.9, and OR_OFLT13.10, while the second factor (II_OFLT) consisted of the measurement items II_OFLT11.5, II_OFLT11.7, II_OFLT11.6, and II_OFLT11.8. The measurement items LOC_OFLT12.5, LOC_OFLT12.4, and LOC_OFLT12.6 pertained to the third factor (LOC_OFLT), and the fourth factor (IS_OFLT) consisted of the measurement items IS_OFLT14.4, IS_OFLT14.6, and IS_OFLT14.5. As the factor loadings and communalities exceeded 0.5, the inter-item correlation values are greater than 0.3, Cronbach's alpha and KMO exceeded 0.8, and the value of Bartlett's test of sphericity was less than 0.05; all items are unidimensional, significant and suitable for CFA (as shown in Table 5.9).

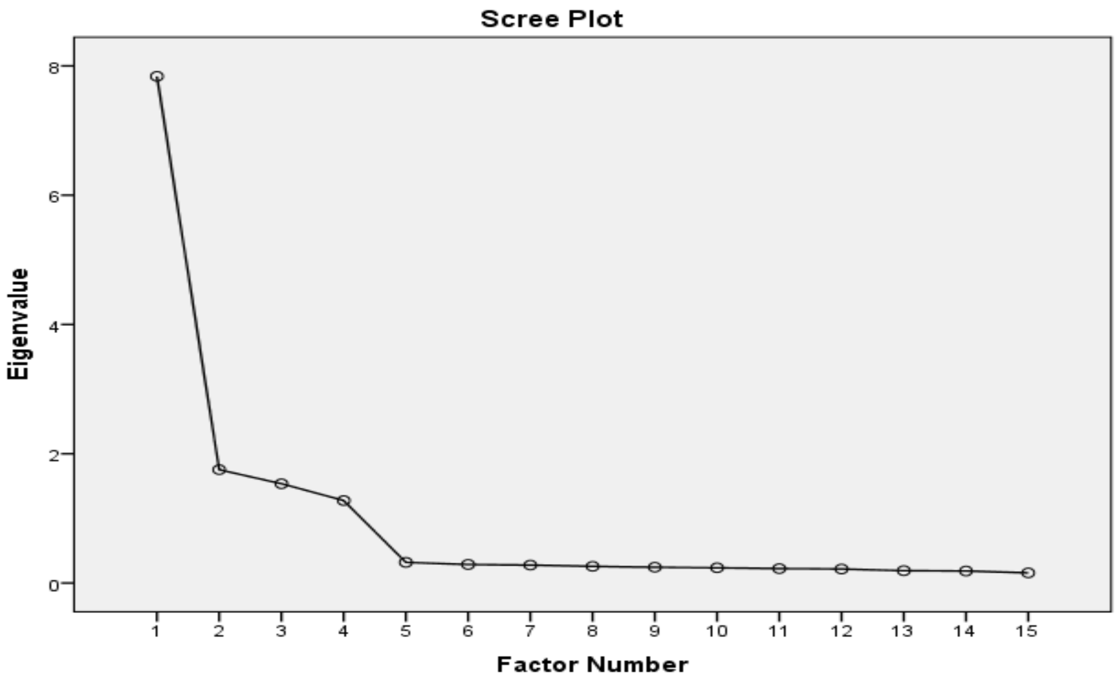


Figure 5.7: Scree plot of factors for the order fulfilment lead times (OFLT) construct

Table 5.20: Factor correlation matrix for order fulfilment lead times (OFLT)

Factor	1(OR_OFLT)	2(II_OFLT)	3(LOC_OFLT)	4(IS_OFLT)
1	1.000			
2	0.539	1.000		
3	0.522	0.489	1.000	
4	0.561	0.516	0.526	1.000

Table 5.21: EFA pertaining to order fulfilment lead times (OFLT)

Items	Component				Communalities	
	1	2	3	4	Initial	Extraction
OR_OFLT13.6	0.904				0.771	0.828
OR_OFLT13.8	0.873				0.709	0.758
OR_OFLT13.7	0.856				0.728	0.770
OR_OFLT13.9	0.842				0.712	0.750
OR_OFLT13.10	0.840				0.659	0.697
II_OFLT11.5		0.898			0.724	0.791
II_OFLT11.7		0.859			0.707	0.763
II_OFLT11.6		0.855			0.684	0.741
II_OFLT11.8		0.843			0.685	0.740
LOC_OFLT12.5			0.878		0.694	0.778

LOC_OFLT12.4			0.874		0.697	0.784
LOC_OFLT12.6			0.854		0.694	0.764
IS_OFLT14.4				0.892	0.698	0.796
IS_OFLT14.6				0.859	0.680	0.759
IS_OFLT14.5				0.842	0.675	0.750
Eigenvalue	7.838	1.753	1.536	1.276		
Cumulative variance explained	50.685%	60.732 %	69.473 %	76.457 %		
Reliability (Cronbach's alpha)	0.940	0.925	0.911	0.908		
Inter-item correlation values	0.716-0.795	0.739-0.776	0.772-0.776	0.753-0.776		
Kaiser-Meyer-Olkin (KMO)	0.923					
Bartlett's test of sphericity	0.000					

Note: Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

5.6 Summary

In this chapter, the methods of preliminary data analysis were explained and their key findings can be accepted on the basis of recommendations made in well-known statistical theories. More specifically, the processes of validation and editing, coding and data entry, data cleaning (missing data, multivariate outliers, multivariate normality and multicollinearity), as well as tabulation and analysis (comparing respondents' characteristics, non-response bias assessment, common method variance (CMV)) are presented. The findings confirm that the data can be utilized in further analyses conducted in the study, as they would not introduce any errors/bias. In addition, descriptive statistics were discussed to describe the demographic profile of respondents. Moreover, exploratory factor analysis (EFA) was conducted, with the aim of achieving data reduction. The aforementioned processes yielded findings that confirmed that the data set was suitable for further analysis. Finally, EFA confirmed that the measurement items were suitable for the CFA, which is the topic of the next chapter.

CHAPTER 6

STRUCTURAL EQUATION MODELLING ANALYSIS

6.0 Introduction

This chapter presents structural equation modelling (SEM) analysis employed in this study to reveal the key factors that have the potential to significantly affect information integration, logistics operations coordination, organisational relationships, and institutional support. Their identification was necessary for improving logistics performance (specifically perfect order fulfilment and order fulfilment lead times) in the context of Thai semi-industrial egg production. This, in turn, answers the research questions guiding the study. In this chapter, the final measurement model is also described, comprising of information integration (II), logistics operations coordination (LOC), organisational relationships (O_R), institutional support (IS), perfect order fulfilment (POF), and order fulfilment lead times (OFLT). It was developed by employing the CFA technique using AMOS version 22. The final structural model was assessed via SEM in order to test the hypothesised relationships, as well as determine whether there were any simultaneous relationships among the study variables. Eight alternative structural models were proposed and compared with the structural path model in order to arrive at the model parsimony for this research.

6.1 Structural equation modelling (SEM)

SEM typically involves a combination of factor analysis and path analysis sets. In that respect, SEM consists of two primary components, namely (1) the measurement model and (2) the structural model (Tabachnick & Fidell 2001). The measurement model describes the relationships between the observed variables and the latent construct or constructs those variables are hypothesised to measure (Dattalo 2008). Thus, it allows evaluating how well the observed (measured) variables combined to identify the underlying latent constructs (Hair et al. 2010). CFA method is used in testing the measurement model (Tabachnick & Fidell 2001). The structural model, on the other hand, is based on equations in the structural portion of the model that specifies the hypothesised relationships among latent constructs (Dattalo 2008). As such, it describes relationships among latent constructs and can detect presence of variances and covariances, as well as direct or indirect (mediated) effects of exogenous (antecedents) on endogenous variables (outcome) (Tabachnick & Fidell 2007). Covariances are analogous to correlations in that they are defined as nondirectional relationships among exogenous variables (Tabachnick & Fidell 2001). In this context, direct effects refer to the relationships among measured and latent variables that are similar to those found in ANOVA and multiple regressions (Weston & Gore 2006). The requirements of CFA and the structural model developed as a part of this study are presented in the next section.

6.2 Confirmatory factor analysis (CFA)

CFA is used to establish how well the measurement items represent the measurement constructs (Hair et al. 2010). Hence in this research, CFA is employed to confirm validity and reliability of all measurement items (observed variables) (Fornell & Larcker 1981). CFA not only provides information on the number of constructs measured, as it can be used to establish which items measure the same construct, distinguishing them from those that measure different constructs. CFA confirms unidimensionality and model fit, which is essential when developing models that describe data collected as a part of a study (Levine 2005).

6.2.1 Reliability assessment

Reliability refers to the consistency of measurements, while construct reliability measures the internal consistency of a set of measures that capture the degree to which a set of measures indicate the latent constructs (Hair et al. 2006, Hair et al. 2010). Measurement reliability provides the estimation of confirmatory factor analysis (CFA) results, or those produced by a path model with latent variables (Holmes-Smith et al. 2006). Typically, construct reliability is assessed by examining the Cronbach’s alpha coefficient of each construct (factor), alongside composite reliability (CR) and squared multiple correlations (SMC) (Holmes-Smith et al. 2006, Hair et al. 2010). According to established criteria, a construct has good reliability if a Cronbach’s alpha exceeds 0.7 (Pallant 2010). CR values greater than 0.7 indicate that the measurements pertain to the same construct (Hair et al. 2010). Finally, in SMC, item reliability coefficients should be greater than 0.3 in order for these items to be acceptable (Holmes-Smith et al. 2006, Tabachnick & Fidell 2007).

6.2.2 Validity assessment

In the context of scientific research, validity refers to the ability of a measure to assess what was intended to measure (Holmes-Smith et al. 2006). When applied to a test or a specific item, it can be understood as the degree to which it measures what it purports to be measuring. Validity comprises of construct, content, and criterion validity; the first of which is composed of convergent and discriminant validity, both of which are required to meet the construct validity criteria (Campbell & Fiske 1959, Peter 1981). Convergent and discriminant validity tests are applied to assess the findings of CFA in SEM (Anderson & Gerbing 1988, Hair et al. 2010).

6.2.2.1 Convergent validity

Convergent validity measures whether the items that are indicators of specific construct share a high proportion of variance, or converge on a common factor. The relative amount of convergent validity among item measures can be estimated in a variety of ways, including calculation of factor loadings and average variance extracted (AVE) (Hair et al. 2010). Factor loading is a critical consideration for convergent validity. A high loading on latent factor indicates that the measurement items included converge on a common latent factor. When assessing convergent validity of factors, the standardised loading of 0.5 at a minimum is used (Holmes-Smith et al. 2006, Hair et al. 2010). As noted above, convergent validity is also often assessed by the AVE method (Fornell & Larcker 1981). AVE represents the amount of common variance in a latent variable in relation to the amount of error variance (Dillon & Goldstein 1984). According to the widely accepted criteria, AVE exceeding 0.5 indicates convergent validity (Fornell & Larcker 1981). In addition, the CR value should be greater than the AVE (Fornell & Larcker 1981, Nunnally & Bernstein 1994, Holmes-Smith et al. 2006).

6.2.2.2 Discriminant validity

Discriminant validity refers to the extent to which a construct differs from other constructs (Hair et al. 2010). Four methods are commonly used to assess discriminant validity (Anderson & Gerbing 1988, Holmes-Smith et al. 2006). The first method relies on performing CFA on the goodness-of-fit results (Yi-Ching & Shu-Ting Hiang 2004). The second method consists of calculating Pearson’s correlations between measurement items or dimensions. It is typically performed via AMOS that indicates that the measurement items under investigation belong to the same measurement dimension (Holmes-Smith et al. 2006). More specifically, measurement items are deemed to have discriminant validity when there is a low correlation with measures of dissimilar concepts (other dimensions), while the correlation between the measurement items under the same measurement dimension is high. In other words, the measurement dimensions under the dissimilar constructs (unrelated constructs) should have low correlation, while those under the same construct should be highly correlated (Zikmund 2003, Holmes-Smith et al. 2006). The third method commonly used to assess discriminant validity relies on the calculation of covariance, whereby it tests the correlation between measurement dimensions or constructs in CFA. In this approach, none of factor correlations can be equal to 1.0 to establish discriminant validity, if the dimensions or constructs are to be deemed different (Anderson & Gerbing 1988, Bagozzi et al. 1991). The fourth method is the chi-square difference test, which is conducted to compare the fit of the finalised CFA model with those pertaining to the restricted models, with each factor correlation constrained and set to 1. If the chi-square difference test yields significant results, it confirms the discriminant validity of the factors (Anderson & Gerbing 1988, Hair et al. 2010).

While all the methods discussed earlier are useful, the data set needs to meet specific criteria as summarised in Table 6.1.

Table 6.1: Reliability and validity assessment criteria in CFA

Assessment	Conditions	Authors
1) Reliability	Cronbach's alpha > 0.7	Pallant (2010)
	Composite (CR) > 0.7	Hair et al (2010)
	The squared multiple correlations (SMC) > 0.3	Tabachnick & Fidell (2007)
2) Convergent validity	The average variance extracted (AVE) > 0.5	Fornell & Larcker (1981)
	Standardised loading, $\beta > 0.5$	Hair et al (2010)
	CR > AVE	Fornell & Larcker (1981)
3) Discriminant validity	The fit measures are indications of the CFA model (see in Table 6.2)	Baumgartner & Homburg (1996), Weston & Gore (2006), Byrne (2010), Hair et al (2010), Kline (2011)
	The measurement items under the same measurement dimension should be highly correlated, while having lower correlation with measurement items in other measurement dimensions	Zikmund (2003)

Correlation between measurement dimensions or constructs is not equal to 1	Anderson & Gerbing (1988)
The chi-square difference test between the finalised CFA model and the constrained model should produce statistically significant results	Anderson & Gerbing (1988)

6.3 Measurement model of fit

Multiple fit indices of CFA and structural models should be used to assess a model's goodness-of-fit and should include the χ^2 value and the associated df (degrees of freedom), in addition to one absolute fit index (i.e., GFI, RMSEA, or SRMR), one incremental fit index (i.e., CFI or TLI), one goodness-of-fit index (GFI, CFI, TLI, etc.), and one badness-of-fit index (RMSEA, SRMR, etc.) (Hair et al. 2010). As these fit indices were discussed in detail in Chapter 4 (Research Design and Methodology), only their key characteristics are summarised in Table 6.2.

Table 6.2: Summary of fit measures' indications

Fit measures	**Fit measures' indications**
Bentler's comparative fit index (CFI)	A value equal or greater than 0.9 indicates moderate fit, while a good fit is indicated by a value greater than 0.95 (Hu & Bentler 1999, Byrne 2010).
Tucker Lewis fit index (TLI)	A value greater than 0.95 indicates a good fit (Weston & Gore 2006)
Chi-square probability level (χ^2)	A non-significant value ($p > 0.05$) indicates a good fit (Baumgartner & Homburg 1996).
Relative Chi-square (χ^2/df)	A value less than 3.0 indicates an overall fit (Kline 2011).
Goodness-of-fit index (GFI)	A value close to 0 indicates poor fit, while a good fit is indicated by a value equal to or exceeding 0.9 (Hair et al. 2010).
Root mean square error of approximation (RMSEA)	A value equal or less than 0.08 indicates a good fit (Byrne 2010).

P of close fit (PCLOSE)	A value greater than 0.5 indicates a good fit (Byrne 2010).
Adjusted goodness of fit index (AGFI)	A value closer to 1 indicates a better fit (Byrne 2010).
Normed fit index (NFI)	A value closer to 1 indicates a better fit (Hair et al. 2010).

6.4 Measurement model of information integration (II)

Figure 6.1 presents the initial model employed in the assessment of information integration. From this model, some items are removed in order to achieve the best fit. Figure 6.2 depicts the modified model for information integration. The standardised loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table 6.3-6.6, where the values of the figures presented are rounded by AMOS version 22. The internal information sharing (IIS) dimension consists of two observed variables, IIS1.1.1 and IIS 1.1.5, which ideally cannot explain the factor, as the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, the model is still useful, as it could establish if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Based on the results, it can be confirmed that a two-item factor is not an issue. Thus, the results can apply to the conditions presented in Table 6.1.

These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 ($0.864 < \beta < 0.900$) ($p < 0.01$) (see Table 6.3). In addition, the value of CR (0.875) is greater than the value of AVE (0.778) (see Table 6.5).

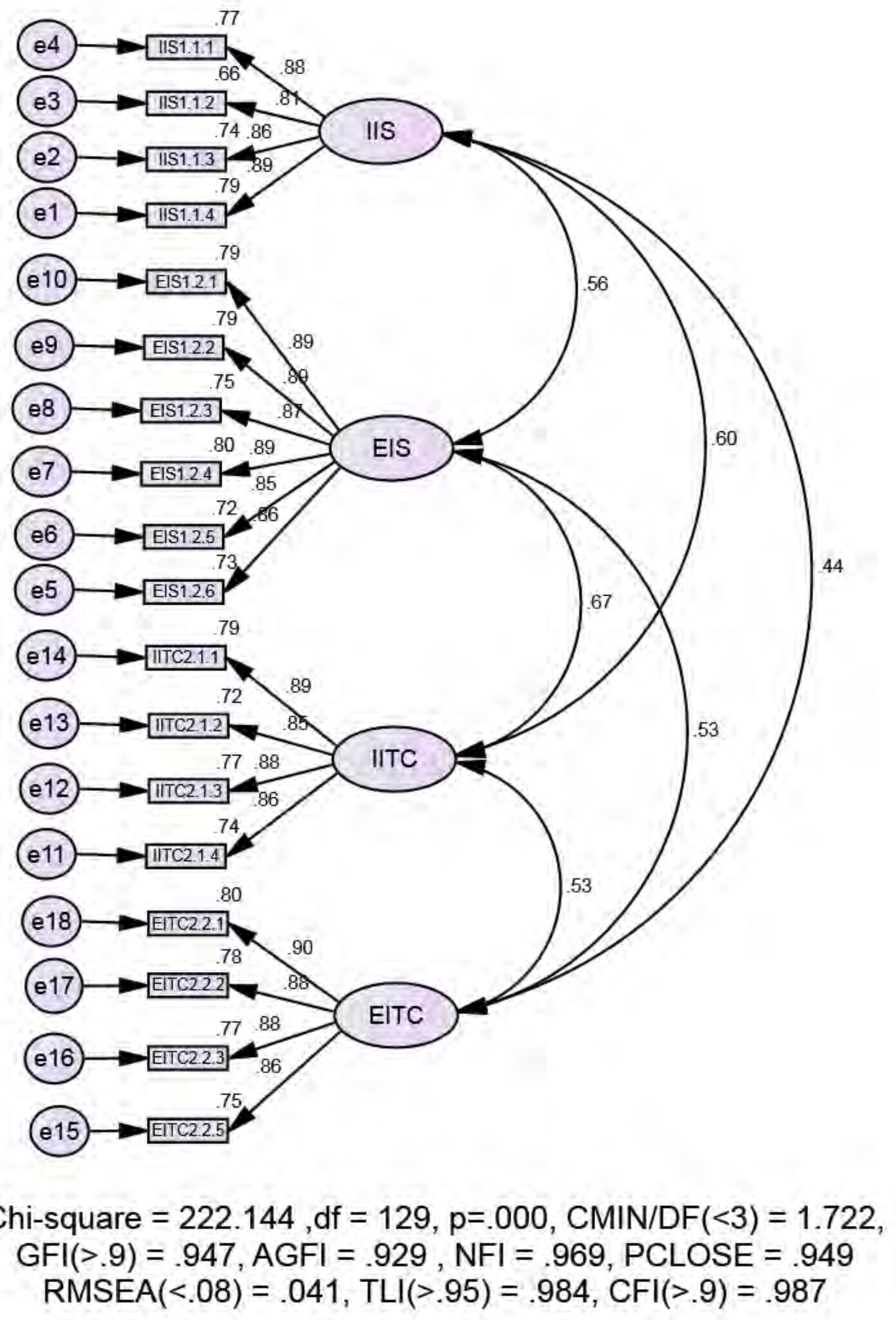
Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions, with the covariance ranging from 0.451 to 0.610 (see Table 6.4). The observed variables IIS1.1.1 and IIS 1.1.5 are thus reliable, since their SMC is greater than the minimum threshold of 0.3 (0.747-0.811) (see Table 6.3). These observed variables are also reliable because the Cronbach's alpha is 0.875, CR is 0.875, and AVE is 0.778 (see Table 6.5).

The external information sharing (EIS) dimension consists of two observed variables, EIS1.2.1 and EIS1.2.5, which ideally cannot explain the factor because the measurement of the model fitness for CFA and the structural model should be justified by three indicators

(Hair et al. 2010). However, as above, through the use of this initial model, it was possible to ascertain if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Thus, two-item factor is not an issue, as can be seen in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.867-0.873) ($p < 0.01$) (see Table 6.3). Again, in line with the above, the value of CR (0.862) is greater than AVE (0.757) (see Table 6.5). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions with the covariance in the 0.546 to 0.681 range (see Table 6.4). The observed variables EIS1.2.1 and EIS1.2.5 are thus reliable, as their SMC is greater than the minimum threshold of 0.3 (0.751-0.763) (see Table 6.3). Moreover, their reliability is confirmed by the Cronbach's alpha of 0.862, composite reliability of 0.862, and AVE of 0.757 (see Table 6.5).

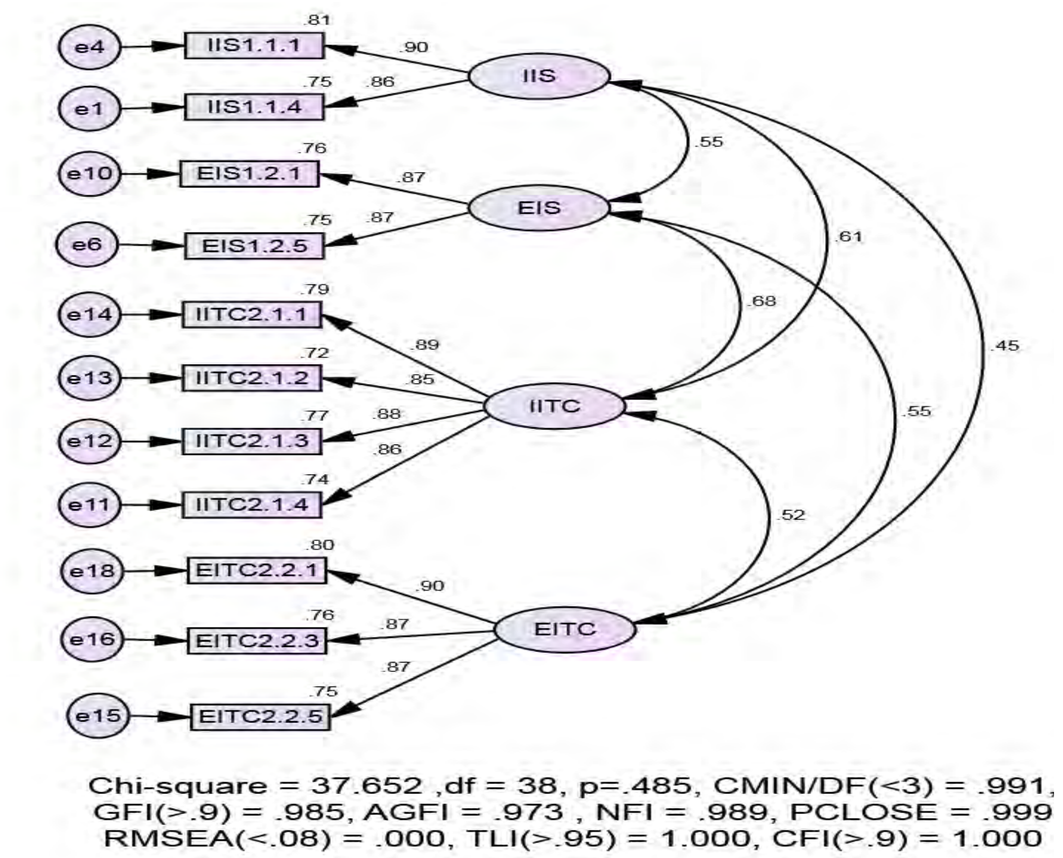
The internal IT capability (IITC) dimension consists of four observed variables, IITC2.1.1, IITC2.1.2, IITC2.1.3 and IITC2.1.4. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.848-0.891) ($p < 0.01$)(see Table 6.3). In addition, the value of CR (0.925) is greater than AVE (0.755) (see Table 6.5). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance ranging from 0.520 to 0.681 (see Table 6.4). It can be concluded that the observed variables IITC2.1.1, IITC2.1.2, IITC2.1.3 and IITC2.1.4 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.719-0.795) (see Table 6.3). Their reliability is further ascertained by the Cronbach's alpha of 0.925, composite reliability of 0.925, and AVE of 0.755 (see Table 6.5).

The external IT capability (EITC) dimension consists of the observed variables, EITC2.2.1, EITC2.2.3, and EITC2.2.5. The results can be suitable in the conditions presented in Table 6.1, as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.867-0.897) (p <0.01) (see Table 6.3). In addition, the value of CR (0.911) is greater than the value of AVE (0.773) (see Table 6.5). Moreover, the variables are shown to exhibit discriminant validity, as they clustered into their respective dimensions with the covariance in the 0.451-0.546 range (see table 6.4). The observed variables EITC2.2.1, EITC2.2.3, and EITC2.2.5 are reliable, since their SMC is greater than the minimum threshold of 0.3 (0.752-0.804) (see Table 6.3). Moreover, Cronbach's alpha of 0.910, composite reliability of 0.911, and AVE of 0.773 further confirm their reliability (see Table 6.5).



Note: IIS = internal information sharing, EIS = external information sharing, IITC = Internal IT capability, EITC = external IT capability

Figure 6.1: Standardised estimates of the initial model for information integration



Note: IIS = internal information sharing, EIS = external information sharing, IITC = Internal IT capability, EITC = external IT capability

Figure 6.2: Standardised estimates of the modified model for information integration

Table 6.3: Standardised factor loading, squared multiple correlation, and p-value of the information integration (II) construct

Information Integration (II) Factors				
Internal Information Sharing (IIS)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
IIS1.1.1	You are intending to provide your staff/employees with any egg distribution information that might help them improve logistics	0.900	0.811	0.001

	performance.			
IIS1.1.4	You are intending to share product planning related information with your egg distribution staff/employees.	0.864	0.747	0.001

External Information Sharing (EIS)

Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
EIS1.2.1	You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g., farmers, wholesalers, transporters, and/or retailers).	0.873	0.763	0.001
EIS1.2.5	You are intending to keep each other informed about events or changes that may affect the other egg distribution parties (farmers, wholesalers, transporters, and/or retailers).	0.867	0.751	0.001

Internal IT Capability (IITC)

Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
IITC2.1.1	You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	0.891	0.795	0.001
IITC2.1.2	You intend to use the modern information and communication	0.848	0.719	0.001

	technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.			
IITC2.1.3	You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	0.878	0.771	0.001
IITC2.1.4	You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.	0.858	0.735	0.001

External IT Capability (EITC)

Items	Item descriptions	Standardised Loading (β)**	Squared Multiple Correlation (SMC)	P-value
EITC2.2.1	To receive orders or to communicate with your business partners (e.g., farmers, wholesalers, and/or retailers), you intend to use the modern information and	0.897	0.804	0.001

	communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with the chain partners.			
EITC2.2.3	To receive orders or to communicate with your business partners (e.g., farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support in order to make it suitable for egg distribution within the entire egg supply chain.	0.873	0.761	0.001
EITC2.2.5	To receive orders or to communicate with your business partners (e.g., farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allowing integration of IT functions that support egg distribution within the entire egg supply chain.	0.867	0.752	0.001

Note: ** $p < 0.01$

Table 6.4: Covariances and pattern coefficients of factors and their measurement items for information integration construct

	EITC	IITC	EIS	IIS
EITC	1.000			
IITC	0.520	1.000		
EIS	0.546	0.681	1.000	

	EITC	IITC	EIS	IIS
IIS	0.451	0.610	0.553	1.000
EITC2.2.1	**0.897**	0.466	0.489	0.405
EITC2.2.3	**0.873**	0.453	0.476	0.394
EITC2.2.5	**0.867**	0.450	0.473	0.391
IITC2.1.1	0.463	**0.891**	0.607	0.544
IITC2.1.2	0.440	**0.848**	0.577	0.517
IITC2.1.3	0.456	**0.878**	0.598	0.536
IITC2.1.4	0.446	**0.858**	0.584	0.523
EIS1.2.1	0.476	0.595	**0.873**	0.483
EIS1.2.5	0.473	0.591	**0.867**	0.479
IIS1.1.1	0.406	0.550	0.498	**0.900**
IIS1.1.4	0.390	0.527	0.478	**0.864**

Table 6.5: Validity and reliability test of the information integration construct

	Cronbach's alpha (α)	*Composite reliability (CR)*	*Average variance extracted (AVE)*
Information integration (II)	0.916	0.973	0.764
IIS	0.875	0.875	0.778
EIS	0.862	0.862	0.757
IITC	0.925	0.925	0.755
EITC	0.910	0.911	0.773

Table 6.6: Chi-square difference tests for the information integration construct

Model	**Factor correlation constrained to be 1**	χ^2	*df*	**Chi-square difference tests against the base (unconstrained) model**			
				$\Delta\ \chi^2$	Δ *df*	p-value	Chi-Square critical

							values; p = 0.05
Base model	-	37.652	38	-	-	-	-
Model 1	IIS↔EIS	293.084	39	255.432	1	0.000	Significant
Model 2	IIS↔IITC	304.165	39	266.513	1	0.000	Significant
Model 3	IIS↔EITC	366.210	39	328.558	1	0.000	Significant
Model 4	EIS↔IITC	239.776	39	202.124	1	0.000	Significant
Model 5	EIS↔EITC	302.346	39	264.694	1	0.000	Significant
Model 6	IITC↔EITC	698.270	39	660.618	1	0.000	Significant

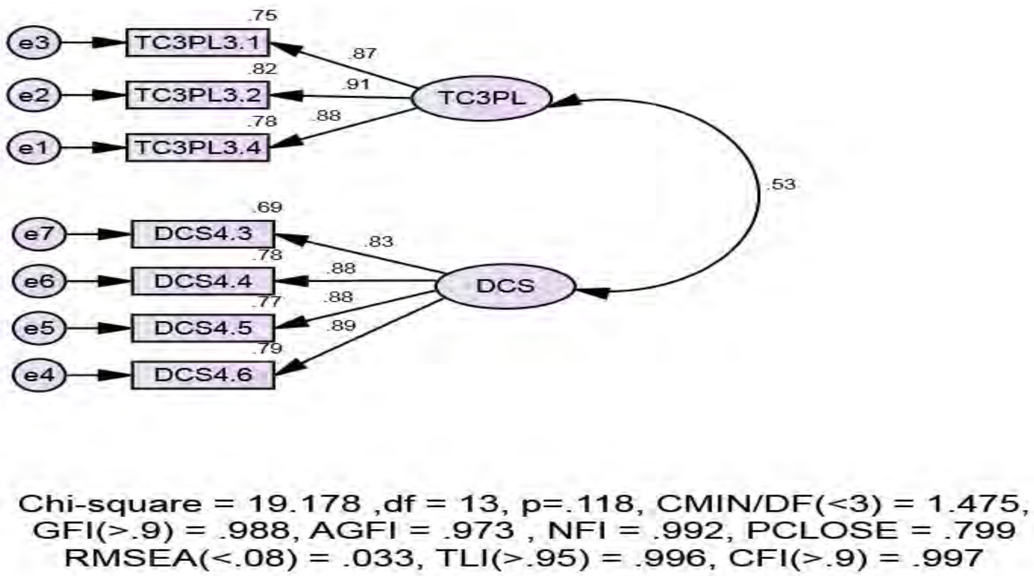
In summary, internal information sharing, external information sharing, internal IT capability, and external IT capability are reliable and valid measures of the information integration construct, since their composite reliability is 0.973, Cronbach's alpha is 0.916, and the AVE value is 0.764 (see Table 6.5). Moreover, the covariances between dimensions are not equal to 1 (as all are in the 0.451-0.681 range), which satisfies discriminant validity and unidimensionality criteria (see Table 6.4). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with each of six constrained models (by restricting each factor correlation t to 1.0; see Table 6.6) confirmed the significantly superior fit of the unconstrained model (with four factors) relative to the constrained models. The result demonstrated the discriminant validity of the information integration construct (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the χ^2= 37.652, df = 38, and p = 0.485 (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., χ^2/df = 0.991, GFI = 0.985, AGFI = 0.973, NFI = 0.993, PCLOSE = 1.000, RMSEA = 0.000, TLI = 1.000, CFI = 1.000 (Figure 6.2).

6.5 Measurement model of logistics operations coordination (LOC)

Figure 6.3 presents the initial model employed in the assessment of logistics operations coordination. From this model, some items were removed in order to achieve the best fit. Figure 6.4 depicts the modified model for logistics operations coordination. The standardised loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table

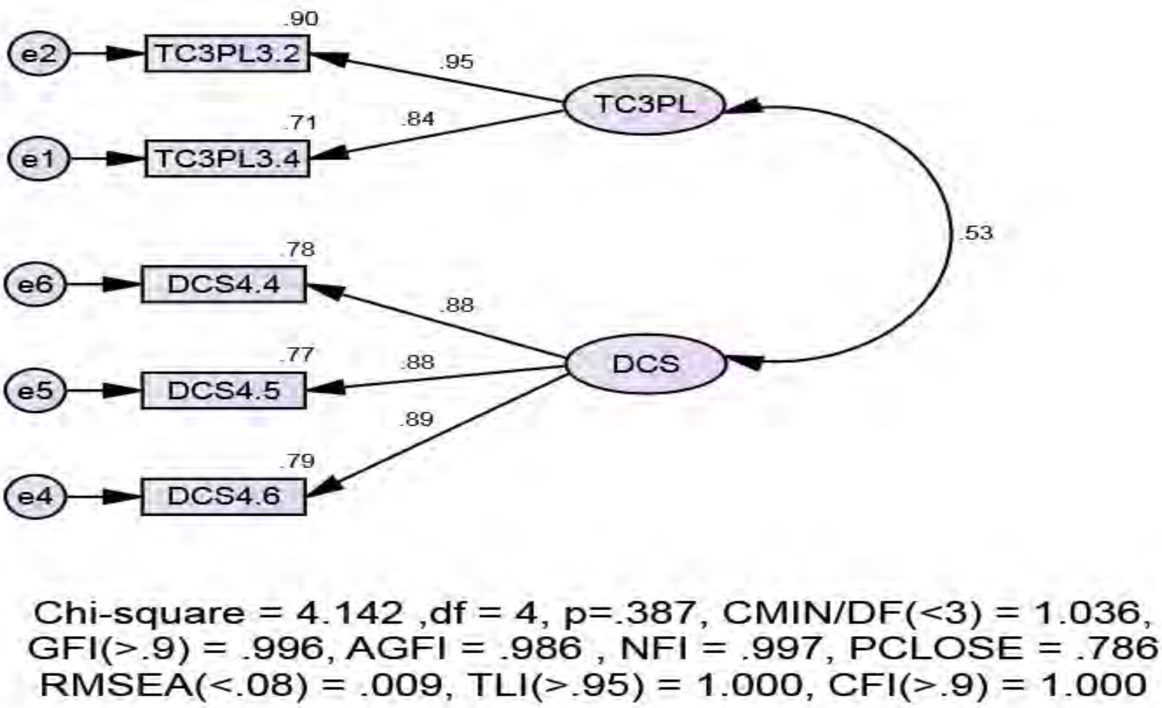
6.7-6.10, where the values of the figures presented are rounded by AMOS version 22. The transport cooperation with 3PL (TC3PL) dimension consists of two observed variables, TC3PL3.2 and TC3PL3.4, which ideally cannot explain the factor, as the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, the model was still useful, as it could establish if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Based on the results, it can be confirmed that a two-item factor is not an issue. Thus, the results can apply to the conditions presented in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 ($0.843 < \beta < 0.946$) ($p < 0.01$) (see Table 6.7). In addition, the value of CR (0.890) is greater than the value of AVE (0.803) (see Table 6.9). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions, with the covariance (0.532) (see Table 6.8). The observed variables TC3PL3.2 and TC3PL3.4 are thus reliable, since their SMC is greater than the minimum threshold of 0.3 (0.711-0.895) (see Table 6.7). These observed variables are also reliable because the Cronbach's alpha is 0.888, composite reliability is 0.890, and AVE is 0.803 (see Table 6.9).

The distribution centre/warehouse sharing (DCS) dimension consists of three observed variables, DCS4.4, DCS4.5 and DCS4.6. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.876-.886) ($p < 0.01$)(see Table 6.7). In addition, the value of CR (0.913) is greater than AVE (0.778) (see Table 6.9). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance (0.532) (see Table 6.8). It can be concluded that the observed variables DCS4.4, DCS4.5 and DCS4.6 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.768-0.786) (see Table 6.7). Their reliability is further ascertained by the Cronbach's alpha of 0.913, composite reliability of 0.913, and AVE of 0.778 (see Table 6.9).



Note: TC3PL = transportation cooperation (3PL), DCS = distribution centre sharing

Figure 6.3: Standardised estimates of initial model for logistics operations coordination



Note: TC3PL = transportation cooperation (3PL), DCS = distribution centre sharing

Figure 6.4: Standardised estimates of modified model for logistics operations coordination

Table 6.7: Standardised factor loading, squared multiple correlation, and p-value of the logistics operations coordination construct

Logistics Operations Coordination (LOC) factors				
Transport Cooperation with 3PL (TC3PL)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
TC3PL3.2	You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	0.946	0.895	0.001
TC3PL3.4	You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	0.843	0.711	0.001
Distribution Centre/warehouse Sharing (DCS)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
DCS4.4	You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	0.884	0.781	0.001
DCS4.5	You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	0.876	0.768	0.001
DCS4.6	You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	0.886	0.786	0.001

Note: ** $p < 0.01$

Table 6.8: Covariances and pattern coefficients of factors and their measurement items for logistics operations coordination construct

	DCS	TC3PL
DCS	1.000	
TC3PL	0.532	1.000
DCS4.4	**0.884**	0.470
DCS4.5	**0.876**	0.466
DCS4.6	**0.886**	0.472
TC3PL3.2	0.504	**0.946**
TC3PL3.4	0.449	**0.843**

Table 6.9: Validity and reliability test of the logistics operations coordination construct

	Cronbach's alpha (α)	**Composite reliability (CR)**	**Average variance extracted (AVE)**
Logistics operations coordination (LOC)	0.867	0.949	0.789
TC3PL	0.888	0.890	0.803
DCS	0.913	0.913	0.778

Table 6.10: Chi-square difference tests for the logistics operations coordination construct

Model	**Factor correlation constrained to be 1**	χ^2	***df***	**Chi-square difference tests against the base (unconstrained) model**			
				$\Delta\ \chi^2$	Δ *df*	p-value	Chi-Square critical values; p = 0.05
Base	-	4.142	4	-	-	-	-

model							
Model 1	TC3PL↔DCS	335.659	5	331.517	1	0.000	Significant

In summary, transport cooperation with 3PL, and distribution centre/warehouse sharing are reliable and valid measures of the logistics operations coordination construct, since their composite reliability is 0.949, Cronbach's alpha is 0.867, and the AVE value is 0.789 (see Table 6.9). Moreover, the covariance between dimensions is not equal to 1 (0.532), which satisfies discriminant validity and unidimensionality criteria (see Table 6.8). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with the constrained model (by restricting each factor correlation t to 1.0; see Table 6.10) confirmed the significantly superior fit of the unconstrained model (with two factors) relative to the constrained model. The result demonstrated the discriminant validity of the logistics operations coordination construct (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the χ^2 = 4.142, df = 4, and p = 0.387 (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., χ^2/df = 1.000, GFI = 0.996, AGFI = 0.986, NFI = 0.997, PCLOSE = 0.786, RMSEA = 0.009, TLI = 1.000, CFI = 1.000 (Figure 6.4).

6.6 Measurement model of organisational relationship (O_R)

Figure 6.5 presents the initial model employed in the assessment of organisational relationship. From this model, some items were removed in order to achieve the best fit. Figure 6.6 depicts the modified model for organizational relationship. The standardized loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table 6.11-6.14, where the values of the figures presented are rounded by AMOS version 22. The forging and maintaining long-term relationships (FMLR) dimension consists of four observed variables, FMLR5.1, FMLR5.2, FMLR5.4 and FMLR5.5. The results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.865-0.891) (p < 0.01)(see Table 6.11). In addition, the value of CR (0.933) is greater than AVE (0.776) (see Table 6.13). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.521-0.565 range (see Table 6.12). It can be concluded that the observed variables, FMLR5.1, FMLR5.2, FMLR5.4

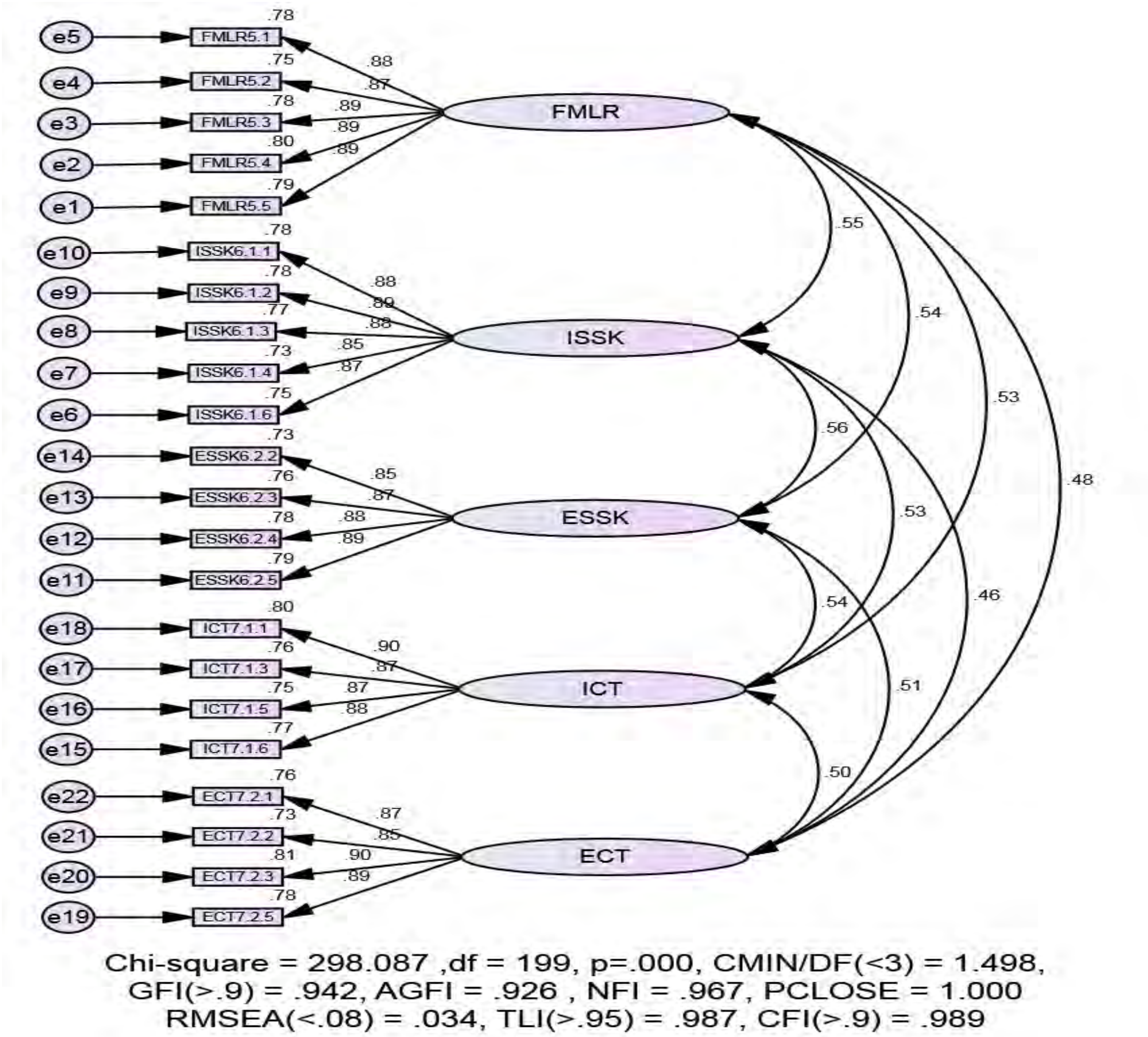
and FMLR5.5 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.748-0.795) (see Table 6.11). Their reliability is further ascertained by the Cronbach's alpha of 0.933, composite reliability of 0.933, and AVE of 0.776 (see Table 6.13).

The internal sharing of skills/ideas, knowledge/experience (ISSK) dimension consists of three observed variables, ISSK6.1.1, ISSK6.1.3, and ISSK6.1.6. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.865-0.886) ($p < 0.01$)(see Table 6.11). In addition, the value of CR (0.908) is greater than AVE (0.767) (see Table 6.13). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.479-0.565 range (see Table 6.12). It can be concluded that the observed variables, ISSK6.1.1, ISSK6.1.3, and ISSK6.1.6 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.748-0.785) (see Table 6.11). Their reliability is further ascertained by the Cronbach's alpha of 0.908, composite reliability of 0.908, and AVE of 0.767 (see Table 6.13).

The external sharing of skills/ideas, knowledge/experience (ESSK) dimension consists of two observed variables, ESSK6.2.3, and ESSK6.2.4. which ideally cannot explain the factor because the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, as above, through the use of this initial model, it was possible to ascertain if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Thus, two-item factor is not an issue, as can be seen in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.878-0.879) ($p < 0.01$) (see Table 6.11). Again, in line with the above, the value of CR (0.871) is greater than AVE (0.772) (see Table 6.13). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions with the covariance in the 0.459 to 0.565 range (see Table 6.12). The observed variables ESSK6.2.3, and ESSK6.2.4 are thus reliable, as their SMC is greater than the minimum threshold of 0.3 (0.771-0.772) (see Table 6.11). Moreover, their reliability is confirmed by the Cronbach's alpha of 0.871, composite reliability of 0.871, and AVE of 0.772 (see Table 6.13).

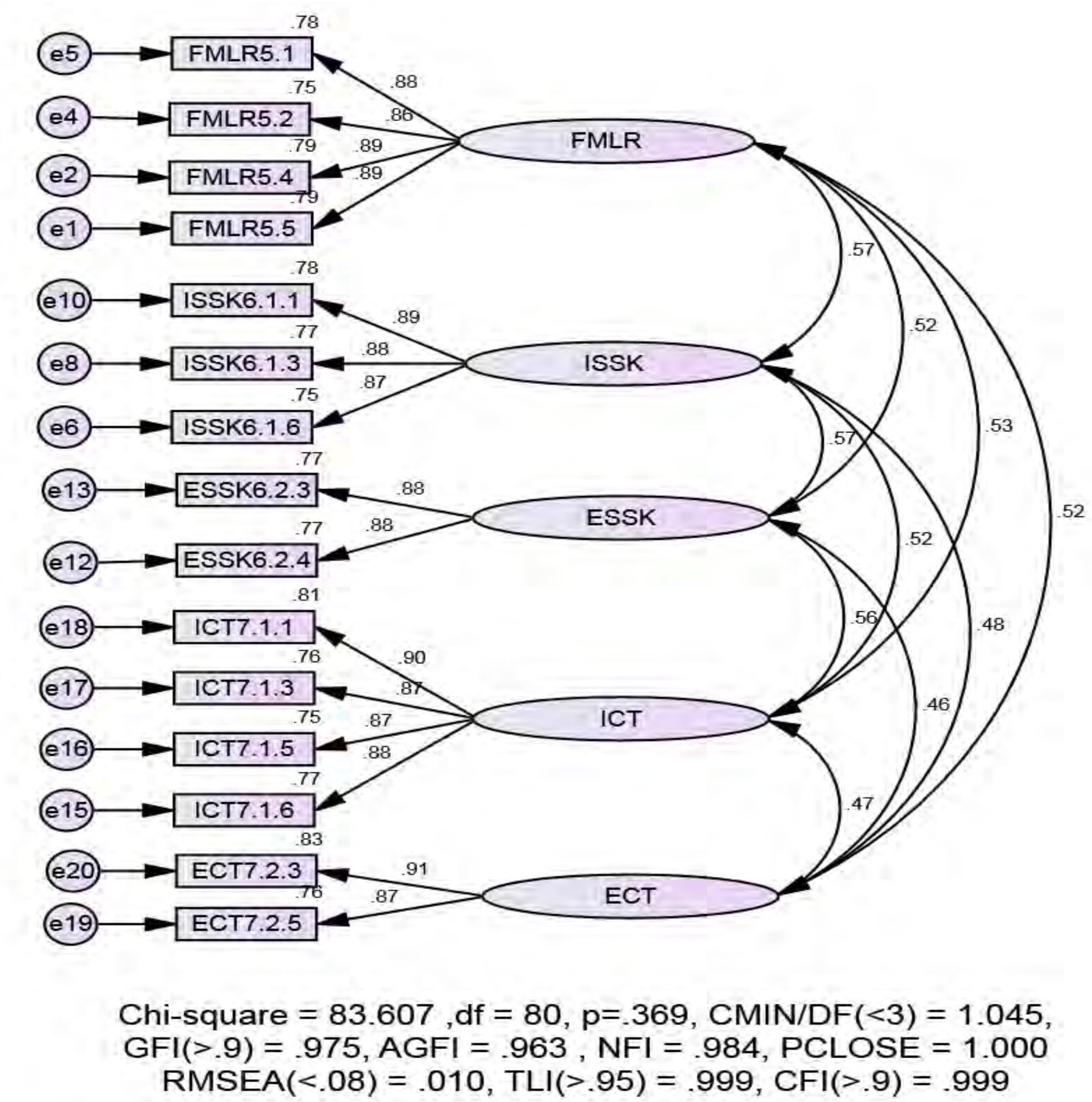
The internal creating teamwork along supply chain and cross-functional teams (ICT) dimension consists of four observed variables, ICT7.1.1, ICT7.1.3, ICT7.1.5 and ICT7.1.6. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.866-0.898) ($p < 0.01$)(see Table 6.11). In addition, the value of CR (0.930) is greater than AVE (0.769) (see Table 6.13). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.469-0.562 range (see Table 6.12). It can be concluded that the observed variables ICT7.1.1, ICT7.1.3, ICT7.1.5 and ICT7.1.6 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.750-0.806) (see Table 6.11). Their reliability is further ascertained by the Cronbach's alpha of 0.930, composite reliability of 0.930, and AVE of 0.769 (see Table 6.13).

The external creating teamwork along supply chain and cross-functional teams (ECT) dimension consists of two observed variables, ECT7.2.3 and ECT7.2.5, which ideally cannot explain the factor because the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, as above, through the use of this initial model, it was possible to ascertain if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Thus, two-item factor is not an issue, as can be seen in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.873-0.910) ($p < 0.01$) (see Table 6.11). Again, in line with the above, the value of CR (0.886) is greater than AVE (0.795) (see Table 6.13). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions with the covariance in the 0.459 to 0.521 range (see Table 6.12). The observed variables ECT7.2.3 and ECT7.2.5 are thus reliable, as their SMC is greater than the minimum threshold of 0.3 (0.762-0.829) (see Table 6.11). Moreover, their reliability is confirmed by the Cronbach's alpha of 0.886, composite reliability of 0.886, and AVE of 0.795 (see Table 6.13).



Note: FMLR = forging and maintaining long-term relationships, ISSK = internal sharing of skills/ideas, knowledge/experience, ESSK = external sharing of skills/ideas, knowledge/experience, ICT = internal creating teamwork along supply chain and cross-functional teams, ECT = external creating teamwork along supply chain and cross-functional teams.

Figure 6.5: Standardised estimates of initial model for organisational relationship (O_R)



Note: FMLR = forging and maintaining long-term relationships, ISSK = internal sharing of skills/ideas, knowledge/experience, ESSK = external sharing of skills/ideas, knowledge/experience, ICT = internal creating teamwork along supply chain and cross-functional teams, ECT = external creating teamwork along supply chain and cross-functional teams.

Figure 6.6: Standardised estimates of modified for organisational relationship (O_R)

Table 6.11: Standardised factor loading, squared multiple correlation, and p-value of the organisational relationship (O_R) construct

Organisational Relationship (O_R) Factors

Forging and Maintaining Long-term Relationships (FMLR)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
FMLR5.1	You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).	0.881	0.777	0.001
FMLR5.2	You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	0.865	0.748	0.001
FMLR5.4	You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	0.891	0.795	0.001
FMLR5.5	You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.	0.887	0.786	0.001

Internal Sharing of Skill/ideas, knowledge/experience (ISSK)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
ISSK6.1.1	To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	0.886	0.785	0.001
ISSK6.1.3	To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	0.876	0.768	0.001
ISSK6.1.6	To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	0.865	0.748	0.001

External Sharing of skill/ideas, Knowledge/experience (ESSK)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
ESSK6.2.3	To improve egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.	0.879	0.772	0.001
ESSK6.2.4	To improve egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers),	0.878	0.771	0.001

	you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.			

Internal Creating Teamwork along Supply Chain and Cross-functional teams (ICT)

Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
ICT7.1.1	Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	0.898	0.806	0.001
ICT7.1.3	Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	0.869	0.755	0.001
ICT7.1.5	Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	0.866	0.750	0.001
ICT7.1.6	Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	0.875	0.766	0.001

External Creating Teamwork along Supply Chain and Cross-functional teams (ECT)

Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**

ECT7.2.3	Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.	0.910	0.829	0.001
ECT7.2.5	Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.	0.873	0.762	0.001

Note: ** $p < 0.01$

Table 6.12: Covariances and pattern coefficients of factors and their measurement items for organisational relationship construct

	ECT	ICT	ESSK	ISSK	FMLR
ECT	1.000				
ICT	0.469	1.000			
ESSK	0.459	0.562	1.000		
ISSK	0.479	0.519	0.565	1.000	
FMLR	0.521	0.532	0.525	0.565	1.000
ECT7.2.3	**<u>0.910</u>**	0.427	0.418	0.436	0.474
ECT7.2.5	**<u>0.873</u>**	0.409	0.401	0.418	0.455
ICT7.1.1	0.421	**<u>0.898</u>**	0.505	0.466	0.477
ICT7.1.3	0.408	**<u>0.869</u>**	0.489	0.451	0.462
ICT7.1.5	0.406	**<u>0.866</u>**	0.487	0.449	0.460
ICT7.1.6	0.411	**<u>0.875</u>**	0.492	0.454	0.465
ESSK6.2.3	0.403	0.494	**<u>0.879</u>**	0.497	0.461
ESSK6.2.4	0.403	0.494	**<u>0.878</u>**	0.496	0.461
ISSK6.1.1	0.424	0.460	0.501	**<u>0.886</u>**	0.501
ISSK6.1.3	0.420	0.455	0.495	**<u>0.876</u>**	0.495
ISSK6.1.6	0.414	0.449	0.489	**<u>0.865</u>**	0.489

	ECT	ICT	ESSK	ISSK	FMLR
FMLR5.1	0.459	0.469	0.463	0.498	**0.881**
FMLR5.2	0.451	0.460	0.454	0.489	**0.865**
FMLR5.4	0.465	0.474	0.468	0.504	**0.891**
FMLR5.5	0.462	0.471	0.465	0.501	**0.887**

Table 6.13: Validity and reliability test of the organisational relationship construct

	Cronbach's alpha (α)	**Composite reliability (CR)**	**Average variance extracted (AVE)**
Organisational relationship (O_R)	0.929	0.981	0.774
FMLR	0.933	0.933	0.776
ISSK	0.908	0.908	0.767
ESSK	0.871	0.871	0.772
ICT	0.930	0.930	0.769
ECT	0.886	0.886	0.795

Table 6.14: Chi-square difference tests for the organisational relationship construct

Model	**Factor correlation constrained to be 1**	χ^2	***df***	**Chi-square difference tests against the base (unconstrained) model**			
				$\Delta\ \chi^2$	**Δ *df***	**p-value**	**Chi-Square critical values; p = 0.05**
Base model	-	83.607	80	-	-	-	-
Model 1	FMLR↔ISSK	690.345	81	606.738	1	0.000	Significant
Model 2	FMLR↔ESSK	378.437	81	294.83	1	0.000	Significant
Model 3	FMLR↔ICT	1103.056	81	1019.449	1	0.000	Significant

Model 4	FMLR↔ECT	415.854	81	332.247	1	0.000	Significant
Model 5	ISSK↔ESSK	358.771	81	275.164	1	0.000	Significant
Model 6	ISSK↔ICT	731.494	81	647.887	1	0.000	Significant
Model 7	ISSK↔ECT	429.011	81	345.404	1	0.000	Significant
Model 8	ESSK↔ICT	362.853	81	279.246	1	0.000	Significant
Model 9	ESSK↔ECT	397.487	81	313.88	1	0.000	Significant
Model 10	ICT↔ECT	435.509	81	351.902	1	0.000	Significant

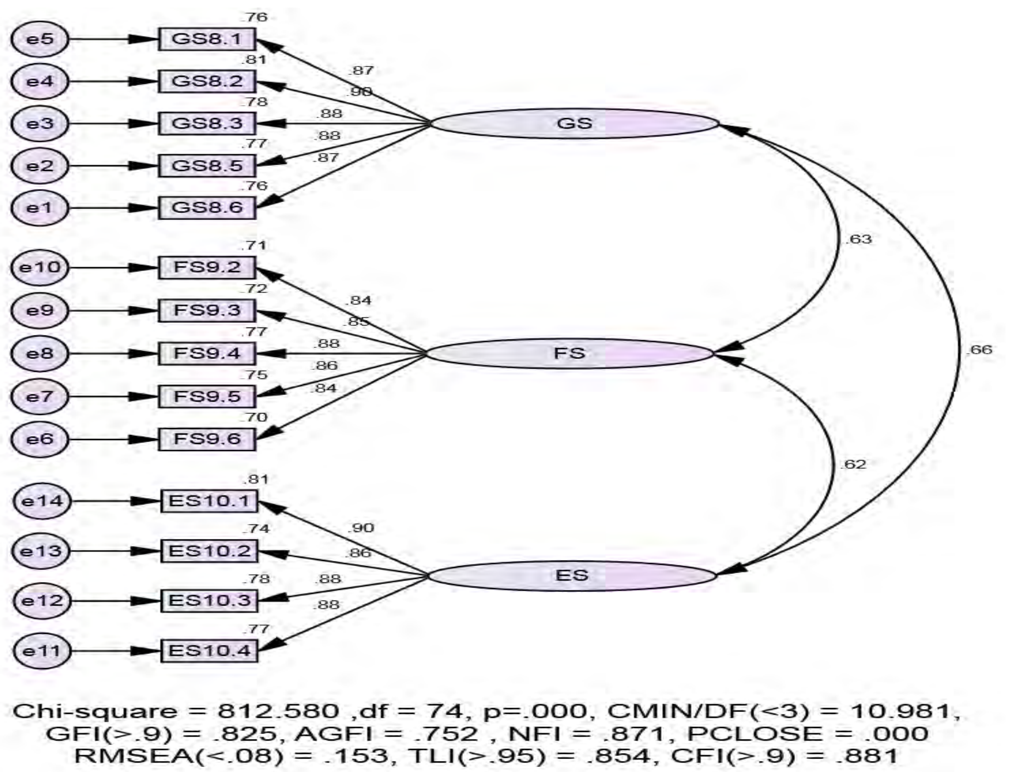
In summary, forging and maintaining long-term relationship, internal sharing of skills/ideas & knowledge/experience, external sharing of skills/ideas & knowledge/experience, internal creating teamwork along supply chain and cross-functional teams, and external creating teamwork along supply chain and cross-functional teams are reliable and valid measures of the organizational relationship construct, since their composite reliability is 0.981, Cronbach's alpha is 0.929, and the AVE value is 0.774 (see Table 6.13). Moreover, the covariances between dimensions are not equal to 1 (as all are in the 0.459-0.565 range), which satisfies discriminant validity and unidimensionality criteria (see Table 6.12). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with each of ten constrained models (by restricting each factor correlation t to 1.0; see Table 6.14) confirmed the significantly superior fit of the unconstrained model (with five factors) relative to the constrained model. The result demonstrated the discriminant validity of the organisational relationship construct (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the χ^2 = 83.607, df = 80, and p = 0.369 (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., χ^2/df = 1.045, GFI = 0.975, AGFI = 0.963, NFI = 0.984, PCLOSE = 1.000, RMSEA = 0.010, TLI = 0.999, CFI = 0.999 (Figure 6.6).

6.7 Measurement model of institutional support (IS)

Figure 6.7 presents the initial model employed in the assessment of institutional support. In this model, some items were removed in order to achieve the best fit. Figure 6.8 depicts the modified model for institutional support. The standardised loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table 6.15-6.18, where the values of the figures presented are rounded by AMOS version 22. The government support, incentive or policy (GS) dimension consists of two observed variables, GS8.3 and GS8.6, which ideally cannot explain the factor, as the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, the model was still useful, as it could establish if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Based on the results, it can be confirmed that a two-item factor is not an issue. Thus, the results can apply to the conditions presented in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 ($0.870 < \beta < 0.882$) ($p < 0.01$) (see Table 6.15). In addition, the value of CR (0.868) is greater than the value of AVE (0.767) (see Table 6.17). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions, with the covariance in the 0.629-0.670 range (see Table 6.16). The observed variables GS8.3 and GS8.6 are thus reliable, since their SMC is greater than the minimum threshold of 0.3 (0.756-0.777) (see Table 6.15). These observed variables are also reliable because the Cronbach's alpha is 0.868, composite reliability is 0.868, and AVE is 0.767 (see Table 6.17).

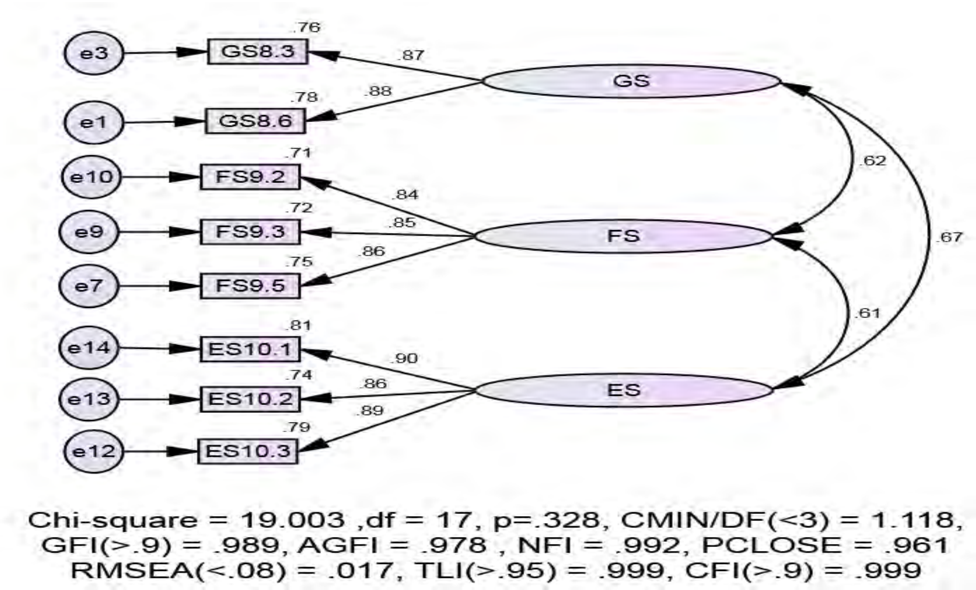
The role of banks/financial services dimension consists of three observed variables, FS9.2, FS9.3, and FS9.5. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.843-0.864) ($p < 0.01$)(see Table 6.15). In addition, the value of CR (0.888) is greater than AVE (0.725) (see Table 6.17). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.608-0.619 range (see Table 6.16). It can be concluded that the observed variables FS9.2, FS9.3, and FS9.5 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.711-0.747) (see Table 6.15). Their reliability is further ascertained by the Cronbach's alpha of 0.888, composite reliability of 0.888, and AVE of 0.725 (see Table 6.17).

The knowledge support from boards and associations, and educational institutions/educational support dimension consists of three observed variables, ES10.1, ES10.2, and ES10.3. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.862-0.898) ($p < 0.01$)(see Table 6.15). In addition, the value of CR (0.913) is greater than AVE (0.778) (see Table 6.17). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.608-0.670 range (see Table 6.16). It can be concluded that the observed variables ES10.1, ES10.2, and ES10.3 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.743-0.807) (see Table 6.15). Their reliability is further ascertained by the Cronbach’s alpha of 0.913, composite reliability of 0.913, and AVE of 0.778 (see Table 6.17).



Note: GS = government support, incentive or policy, FS = the role of banks/financial services, ES = knowledge support from boards and associations, and educational institutions/educational support

Figure 6.7: Standardised estimates of initial model for institutional support



Note: GS = government support, incentive or policy, FS = the role of banks/financial services, ES = knowledge support from boards and associations, and educational institutions/educational support

Figure 6.8: Standardised estimates of modified model for institutional support

Table 6.15: Standardised factor loading, squared multiple correlation, and p-value of the institutional support construct

Institutional Support (IS) Factors				
Government support, incentive or policy (GS)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
GS8.3	Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.	0.870	0.756	0.001
GS8.6	Government support, incentive or policy that supports education system in incorporating the logistics	0.882	0.777	0.001
The role of banks/financial services (FS)				

Items	Item descriptions	Standardised Loading (β)**	Squared Multiple Correlation (SMC)	P-value
FS9.2	For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	0.843	0.711	0.001
FS9.3	For Egg business, Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).	0.847	0.718	0.001
FS9.5	For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	0.864	0.747	0.001

Knowledge support from boards and associations, and educational institutions/educational support (ES)

Items	Item descriptions	Standardised Loading (β)**	Squared Multiple Correlation (SMC)	P-value
ES10.1	Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	0.898	0.807	0.001
ES10.2	Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.	0.862	0.743	0.001

ES10.3	Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics models.	0.886	0.786	0.001

Note: ** $p < 0.01$

Table 6.16: Covariances and pattern coefficients of factors and their measurement items for institutional support construct

	ES	FS	GS
ES	1.000		
FS	0.608	1.000	
GS	0.670	0.619	1.000
ES10.1	**0.898**	0.547	0.602
ES10.2	**0.862**	0.525	0.578
ES10.3	**0.886**	0.539	0.594
FS9.2	0.513	**0.843**	0.522
FS9.3	0.516	**0.847**	0.524
FS9.5	0.526	**0.864**	0.535
GS8.3	0.583	0.538	**0.870**
GS8.6	0.591	0.545	**0.882**

Table 6.17: Validity and reliability test of the institutional support construct

	Cronbach's alpha (α)	**Composite reliability (CR)**	**Average variance extracted (AVE)**
Institutional support (IS) construct	0.906	0.961	0.755
GS	0.868	0.868	0.767
FS	0.888	0.888	0.725
ES	0.913	0.913	0.778

Table 6.18: Chi-square difference tests for the institutional support construct

Model	**Factor correlation constrained to be 1**	χ^2	***df***	**Chi-square difference tests against the base (unconstrained) model**			
				$\Delta\ \chi^2$	Δ *df*	p-value	Chi-Square critical values; p = 0.05
Base model	-	19.003	17	-	-	-	-
Model 1	GS↔FS	259.492	18	240.489	1	0.000	Significant
Model 2	GS↔ES	235.907	18	216.904	1	0.000	Significant
Model 3	FS↔ES	470.074	18	451.071	1	0.000	Significant

In summary, government support, the role of banks/financial services, and knowledge support from boards and associations, and educational institutions/educational support are reliable and valid measures of the institutional support construct, since their composite reliability is 0.961, Cronbach's alpha is 0.906, and the AVE value is 0.755 (see Table 6.17). Moreover, the covariances between dimensions are not equal to 1 (as all are in the 0.608-0.670 range), which satisfies discriminant validity and unidimensionality criteria (see Table 6.17). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with the three constrained models (by restricting each factor correlation t to 1.0; see Table 6.18) confirmed the significantly superior fit of the unconstrained model (with three factors) relative to the constrained models. The result demonstrated the discriminant validity of the institutional support construct (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the χ^2 = 19.003, *df* = 17, and *p* = 0.328 (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., χ^2/df = 1.118, GFI = 0.989, AGFI = 0.978, NFI = 0.992, PCLOSE = 0.961, RMSEA = 0.017, TLI = 0.999, CFI = 0.999 (Figure 6.8).

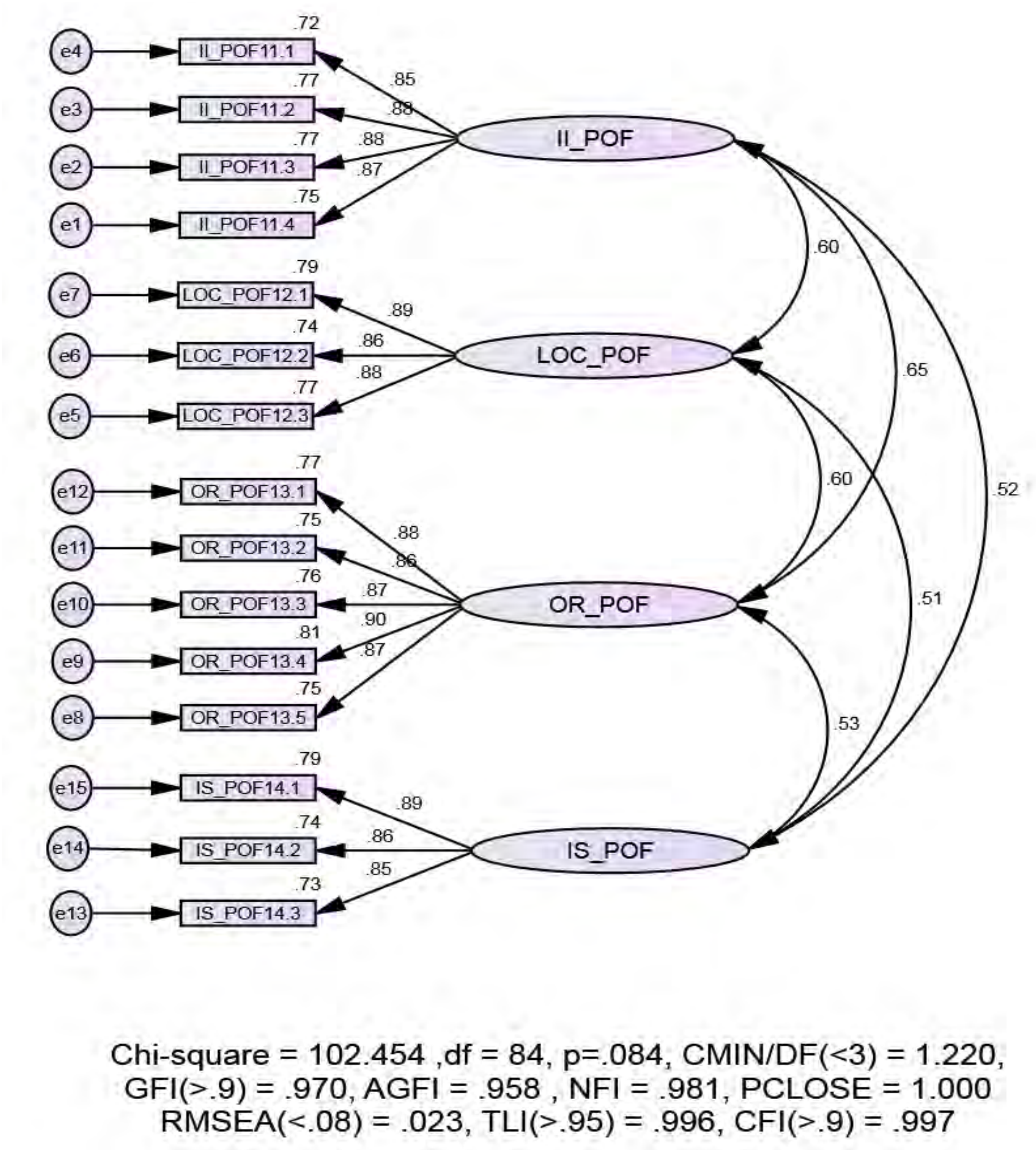
6.8 Measurement model of perfect order fulfilment (POF)

Figure 6.9 presents the initial model employed in the assessment of perfect order fulfilment. In this model, some items were removed in order to achieve the best fit. Figure 6.10 depicts the modified model for perfect order fulfilment. The standardised loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table 6.19-6.22, where the values of the figures presented are rounded by AMOS version 22. The information integration through perfect order fulfilment (II_POF) dimension consists of four observed variables, II_POF11.1, II_POF11.2, II_POF11.3, and II_POF11.4. The results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.851-0.879) ($p < 0.01$)(see Table 6.19). In addition, the value of CR (0.925) is greater than AVE (0.754) (see Table 6.21). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.518-0.655 range (see Table 6.20). It can be concluded that the observed variables, II_POF11.1, II_POF11.2, II_POF11.3, and II_POF11.4 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.724-0.773) (see Table 6.19). Their reliability is further ascertained by the Cronbach's alpha of 0.925, composite reliability of 0.925, and AVE of 0.754 (see Table 6.21).

The logistics operations coordination through perfect order fulfilment (LOC_POF) dimension consists of three observed variables, LOC_POF12.1, LOC_POF12.2, and LOC_POF12.3. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.859-0.889) ($p < 0.01$)(see Table 6.19). In addition, the value of CR (0.908) is greater than AVE (0.767) (see Table 6.21). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.508-0.600 range (see Table 6.20). It can be concluded that the observed variables, LOC_POF12.1, LOC_POF12.2, and LOC_POF12.3 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.738-0.791) (see Table 6.19). Their reliability is further ascertained by the Cronbach's alpha of 0.908, composite reliability of 0.908, and AVE of 0.767 (see Table 6.21).

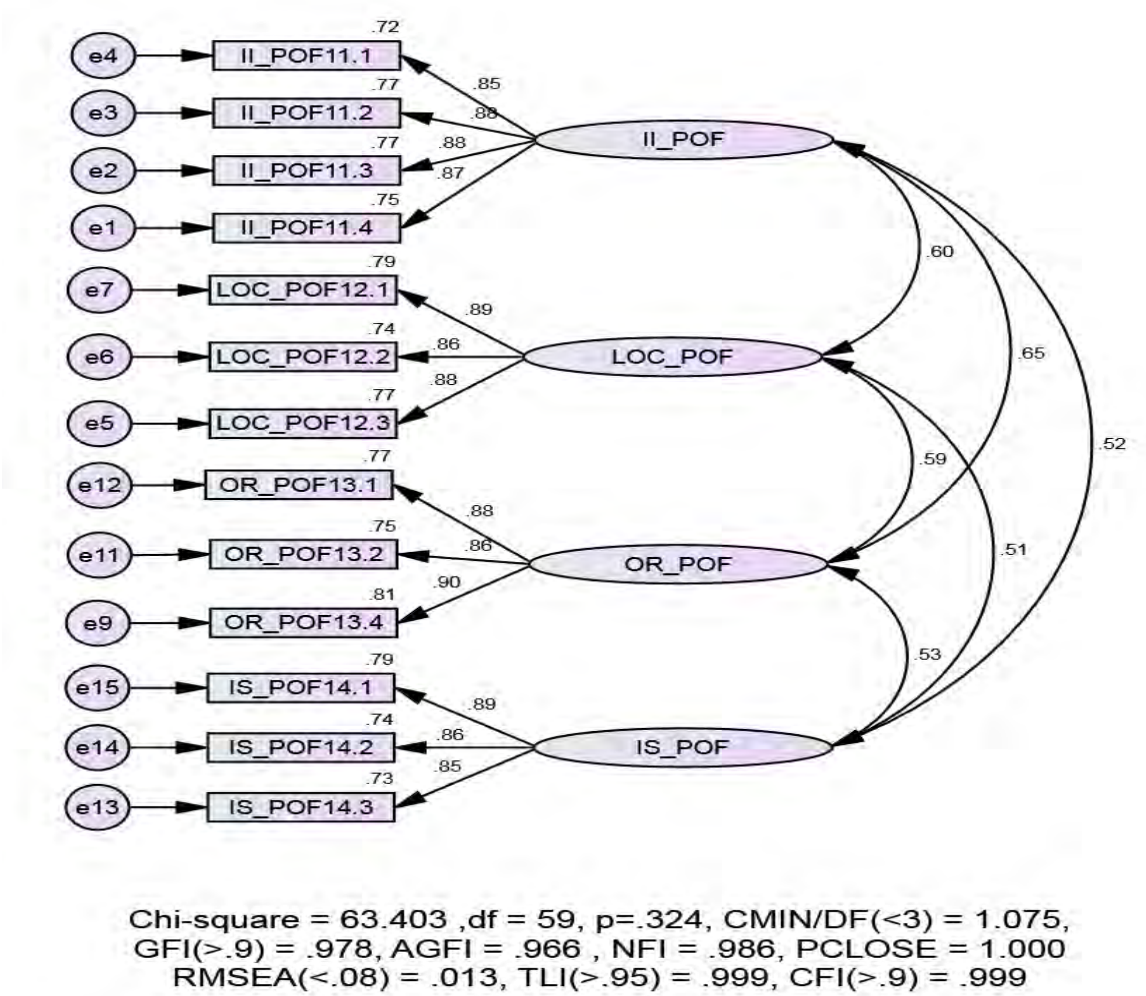
The organisational relationship through perfect order fulfilment (OR_POF) dimension consists of three observed variables, OR_POF13.1, OR_POF13.2, and OR_POF13.4. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.863-0.902) ($p < 0.01$)(see Table 6.19). In addition, the value of CR (0.912) is greater than AVE (0.776) (see Table 6.21). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.533-0.655 range (see Table 6.20). It can be concluded that the observed variables, OR_POF13.1, OR_POF13.2, and OR_POF13.4 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.745-0.813) (see Table 6.19). Their reliability is further ascertained by the Cronbach's alpha of 0.912, composite reliability of 0.912, and AVE of 0.776 (see Table 6.21).

The institutional support through perfect order fulfilment (IS_POF) dimension consists of three observed variables, IS_POF14.1, IS_POF14.2, and IS_POF14.3. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.853-0.890) ($p < 0.01$)(see Table 6.19). In addition, the value of CR (0.902) is greater than AVE (0.754) (see Table 6.21). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.508-0.533 range (see Table 6.20). It can be concluded that the observed variables, IS_POF14.1, IS_POF14.2, and IS_POF14.3 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.727-0.791) (see Table 6.19). Their reliability is further ascertained by the Cronbach's alpha of 0.902, composite reliability of 0.902, and AVE of 0.754 (see Table 6.21).



Note: II_POF = information integration through perfect order fulfilment, LOC_POF = logistics operations coordination through perfect order fulfilment, OR_POF = organisational relationship through perfect order fulfilment, IS_POF = institutional support through perfect order fulfilment

Figure 6.9: Standardised estimates of initial model for perfect order fulfilment



Note: II_POF = information integration through perfect order fulfilment, LOC_POF = logistics operations coordination through perfect order fulfilment, OR_POF = organisational relationship through perfect order fulfilment, IS_POF = institutional support through perfect order fulfilment

Figure 6.10: Standardised estimates of modified model for perfect order fulfilment

Table 6.19: Standardised factor loading, squared multiple correlation, and p-value of the perfect order fulfilment (POF) construct

Perfect Order Fulfilment (POF) Factors				
Information integration through perfect order fulfilment (II_POF)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**

II_POF11.1	11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	0.851	0.724	0.001
II_POF11.2	11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	0.879	0.772	0.001
II_POF11.3	11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.	0.879	0.773	0.001
II_POF11.4	11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	0.865	0.748	0.001

Logistics operations coordination through perfect order fulfilment (LOC_POF)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
LOC_POF12.1	12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	0.889	0.791	0.001
LOC_POF12.2	12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	0.859	0.738	0.001
LOC_POF12.3	12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	0.879	0.772	0.001

Organisational relationship through perfect order fulfilment (OR_POF)				
Items	Item descriptions	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	P-value
OR_POF13.1	13.1 Logistic provider will be capable of delivery with the right quality and the	0.878	0.770	0.001

	right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.			
OR_POF13.2	13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.	0.863	0.745	0.001
OR_POF13.4	13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	0.902	0.813	0.001
Institutional support through perfect order fulfilment (IS_POF)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
IS_POF14.1	14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.	0.890	0.791	0.001
IS_POF14.2	14.2 Logistic provider will be capable of delivery with	0.862	0.743	0.001

	the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.			
IS_POF14.3	14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	0.853	0.727	0.001

Note: ** $p < 0.01$

Table 6.20: Covariances and pattern coefficients of factors and their measurement items for perfect order fulfilment (POF) construct

	IS_POF	OR_POF	LOC_POF	II_POF
IS_POF	1.000			
OR_POF	0.533	1.000		
LOC_POF	0.508	0.588	1.000	
II_POF	0.518	0.655	0.600	1.000
IS_POF14.1	**0.890**	0.474	0.452	0.461
IS_POF14.2	**0.862**	0.459	0.438	0.447
IS_POF14.3	**0.853**	0.454	0.433	0.442
OR_POF13.1	0.467	**0.878**	0.516	0.574
OR_POF13.2	0.460	**0.863**	0.508	0.565
OR_POF13.4	0.480	**0.902**	0.530	0.590
LOC_POF12.1	0.452	0.523	**0.889**	0.534
LOC_POF12.2	0.436	0.505	**0.859**	0.516
LOC_POF12.3	0.447	0.517	**0.879**	0.528
II_POF11.1	0.441	0.557	0.511	**0.851**

II_POF11.2	0.455	0.575	0.527	**0.879**
II_POF11.3	0.456	0.576	0.528	**0.879**
II_POF11.4	0.448	0.566	0.519	**0.865**

Table 6.21: Validity and reliability test of the perfect order fulfilment construct

	Cronbach's alpha (α)	**Composite reliability (CR)**	**Average variance extracted (AVE)**
Perfect order fulfilment (POF)	0.928	0.977	0.762
II_POF	0.925	0.925	0.754
LOC_POF	0.908	0.908	0.767
OR_POF	0.912	0.912	0.776
IS_POF	0.902	0.902	0.754

Table 6.22: Chi-square difference tests for the perfect order fulfilment construct

Model	**Factor correlation constrained to be 1**	χ^2	***df***	**Chi-square difference tests against the base (unconstrained) model**			
				Δ χ^2	**Δ *df***	**p-value**	**Chi-Square critical values; p = 0.05**
Base model	-	63.403	59	-	-	-	-
Model 1	II_POF↔LOC_POF	630.928	60	567.525	1	0.000	Significant

Model 2	II_POF↔OR_POF	591.098	60	527.695	1	0.000	Significant
Model 3	II_POF↔IS_POF	676.209	60	612.806	1	0.000	Significant
Model 4	LOC_POF↔OR_POF	628.938	60	565.535	1	0.000	Significant
Model 5	LOC_POF↔IS_POF	673.462	60	610.059	1	0.000	Significant
Model 6	OR_POF↔IS_POF	655.188	60	591.785	1	0.000	Significant

In summary, information integration through perfect order fulfilment, logistics operations coordination through perfect order fulfilment, organisational relationship through perfect order fulfilment, and institutional support through perfect order fulfilment are reliable and valid measures of the perfect order fulfilment construct, since their composite reliability is 0.977, Cronbach's alpha is 0.928, and the AVE value is 0.762 (see Table 6.21). Moreover, the Pearson's correlations between dimensions are not equal to 1 (as all are in the 0.508-0.655 range), which satisfies discriminant validity and unidimensionality criteria (see Table 6.20). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with the six constrained models (by restricting each factor correlation and equating it to 1.0; see Table 6.22) confirmed the significantly superior fit of the unconstrained model (with four factors) relative to the constrained models. The result demonstrated the discriminant validity of the perfect order fulfilment construct (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the $\chi^2 = 63.403$, $df = 59$, and $p = 0.324$ (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., CMIN/DF = 1.075, GFI = 0.978, AGFI = 0.966, NFI = 0.986, PCLOSE = 1.000, RMSEA = 0.013, TLI = 0.999, CFI = 0.999 (Figure 6.10).

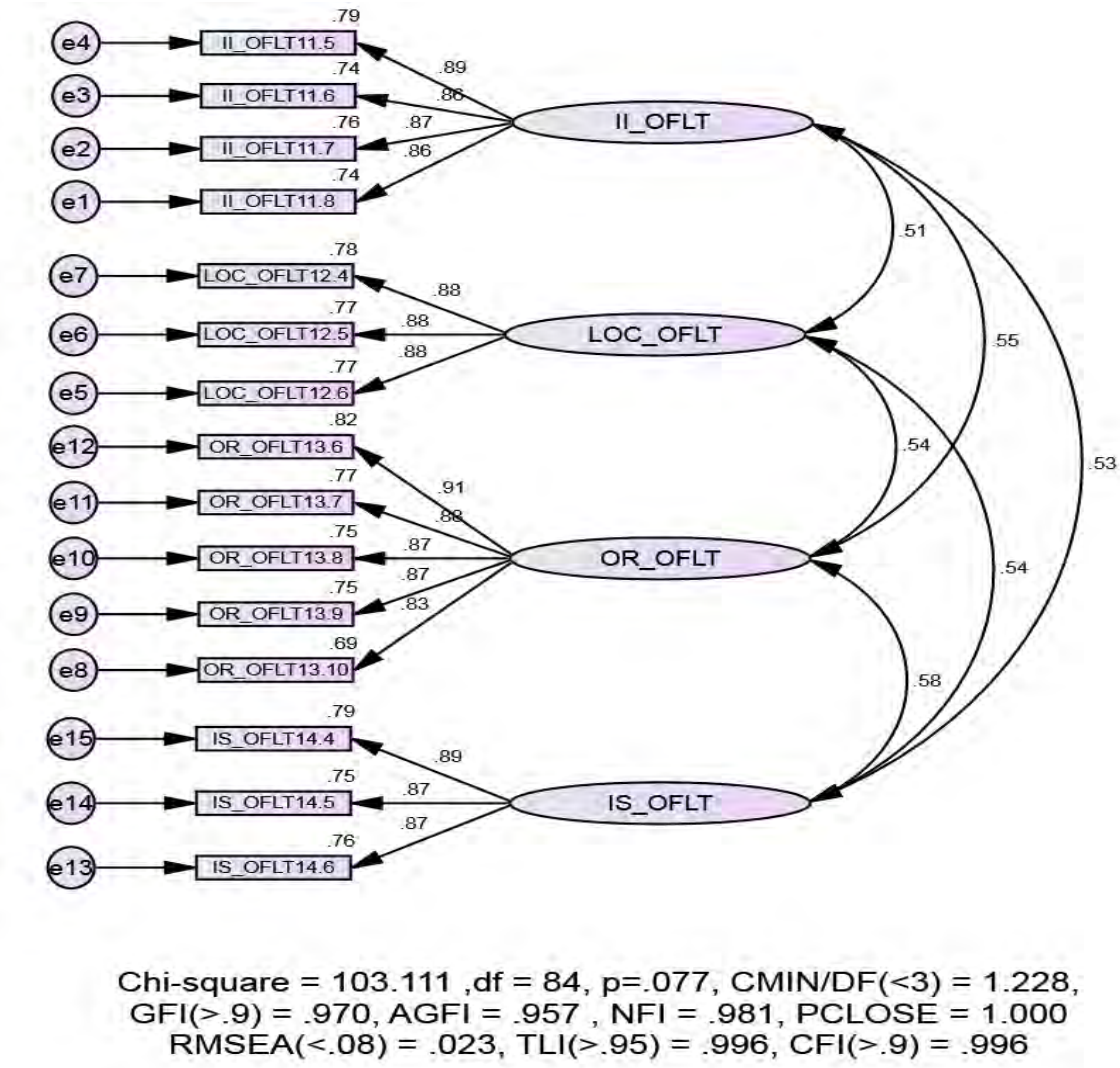
6.9 Measurement model of order fulfilment lead times (OFLT)

Figure 6.11 presents the initial model employed in the assessment of order fulfilment lead times. In this model, some items were removed in order to achieve the best fit. Figure 6.12 depicts the modified model for order fulfilment lead times. The standardised loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table 6.23-6.26, where the values of the figures presented are rounded by AMOS version 22. The information integration through order fulfilment lead times (II_OFLT) dimension consists of two observed variables, II_OFLT11.6, and II_OFLT11.7, which ideally cannot explain the factor, as the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, the model was still useful, as it could establish if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Based on the results, it can be confirmed that a two-item factor is not an issue. Thus, the results can apply to the conditions presented in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 ($0.853 < \beta < 0.882$) ($p < 0.01$) (see Table 6.23). In addition, the value of CR (0.859) is greater than the value of AVE (0.753) (see Table 6.25). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions, with the covariance ranging from 0.522 to 0.556 (see Table 6.24). The observed variables, II_OFLT11.6, and II_OFLT11.7 are thus reliable, since their SMC is greater than the minimum threshold of 0.3 (0.728-0.779) (see Table 6.23). These observed variables are also reliable because the Cronbach's alpha is 0.859, composite reliability is 0.859, and AVE is 0.753 (see Table 6.25).

The logistics operations coordination through order fulfilment lead times (LOC_OFLT) dimension consists of two observed variables, LOC_OFLT12.4 and LOC_OFLT12.5, which ideally cannot explain the factor because the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, as above, through the use of this initial model, it was possible to ascertain if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Thus, two-item factor is not an issue, as can be seen in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.869-0.893) ($p < 0.01$) (see Table 6.23). Again, in line with the above, the value of CR (0.874) is greater than AVE (0.776) (see Table 6.25). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions with the covariance in the 0.522 to 0.539 range (see Table 6.24). The observed variables, LOC_OFLT12.4 and LOC_OFLT12.5 are thus reliable, as their SMC is greater than the minimum threshold of 0.3 (0.756-0.797) (see Table 6.23). Moreover, their reliability is confirmed by the Cronbach's alpha of 0.874, composite reliability of 0.874, and AVE of 0.776 (see Table 6.25).

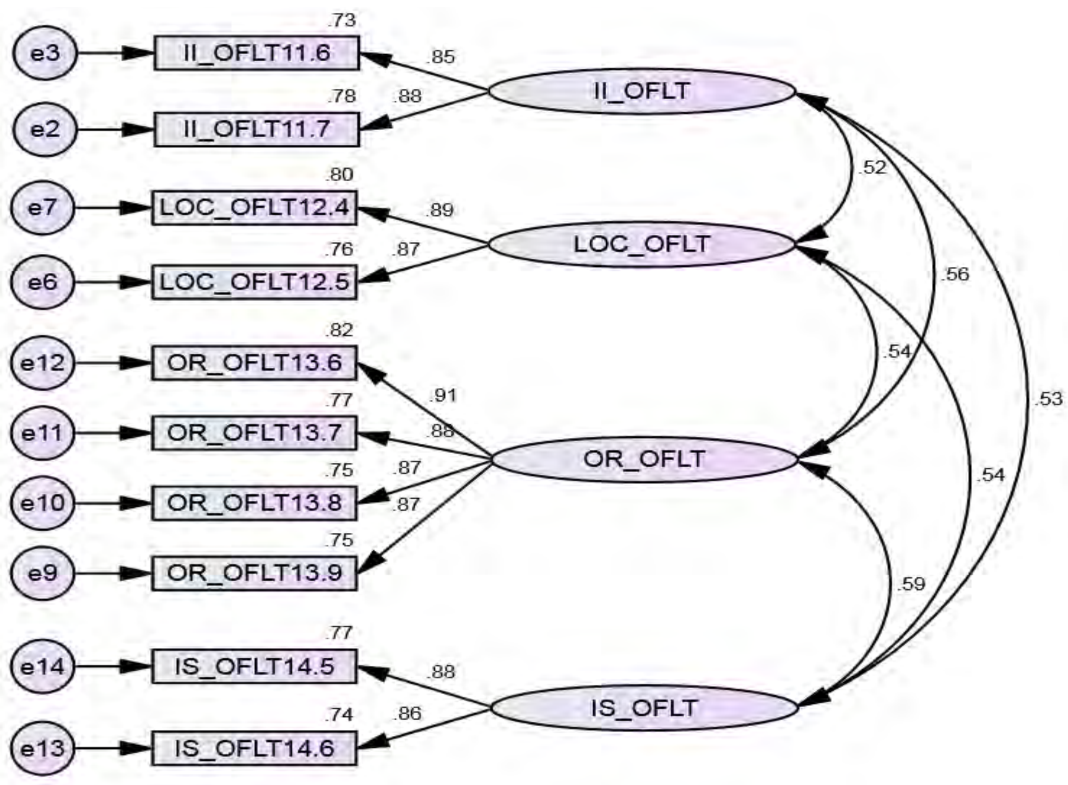
The organisational relationship through order fulfilment lead times (OR_OFLT) dimension consists of four observed variables, OR_OFLT13.6, OR_OFLT13.7, OR_OFLT13.8, and OR_OFLT13.9. Again, the results can be suitable in certain conditions (see in Table 6.1), as these observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.867-0.907) (p < 0.01)(see Table 6.23). In addition, the value of CR (0.932) is greater than AVE (0.774) (see Table 6.25). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective dimensions with the covariance in the 0.537-0.585 range (see Table 6.24). It can be concluded that the observed variables, OR_OFLT13.6, OR_OFLT13.7, OR_OFLT13.8, and OR_OFLT13.9 are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.752-0.822) (see Table 6.23). Their reliability is further ascertained by the Cronbach's alpha of 0.932, composite reliability of 0.932, and AVE of 0.774 (see Table 6.25).

The institutional support through order fulfilment lead times (IS_OFLT) dimension consists of two observed variables, IS_OFLT14.5 and IS_OFLT14.6, which ideally cannot explain the factor because the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, as above, through the use of this initial model, it was possible to ascertain if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Thus, two-item factor is not an issue, as can be seen in Table 6.1. These observed variables are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.859-0.877) (p <0.01) (see Table 6.23). Again, in line with the above, the value of CR (0.859) is greater than AVE (0.754) (see Table 6.25). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective dimensions with the covariance in the 0.530 to 0.585 range (see Table 6.24). The observed variables, IS_OFLT14.5 and IS_OFLT14.6 are thus reliable, as their SMC is greater than the minimum threshold of 0.3 (0.737-0.769) (see Table 6.23). Moreover, their reliability is confirmed by the Cronbach's alpha of 0.859, composite reliability of 0.859, and AVE of 0.754 (see Table 6.25).



Note: II_OFLT = information integration through order fulfilment lead times, LOC_OFLT = logistics operations coordination through order fulfilment lead times, OR_OFLT = organisational relationship through order fulfilment lead times, IS_OFLT = institutional support through order fulfilment lead times.

Figure 6.11: Standardised estimates of initial model for order fulfilment lead times



Chi-square = 29.391 ,df = 29, p=.445, CMIN/DF(<3) = 1.013,
GFI(>.9) = .986, AGFI = .974 , NFI = .990, PCLOSE = .996
RMSEA(<.08) = .006, TLI(>.95) = 1.000, CFI(>.9) = 1.000

Note: II_OFLT = information integration through order fulfilment lead times, LOC_OFLT = logistics operations coordination through order fulfilment lead times, OR_OFLT = organisational relationship through order fulfilment lead times, IS_OFLT = institutional support through order fulfilment lead times.

Figure 6.12: Standardised estimates of modified model for order fulfilment lead times

Table 6.23: Standardised factor loading, squared multiple correlation, and p value of the order fulfilment lead times (OFLT) construct

Order Fulfilment Lead Times Factors				
Information integration through order fulfilment lead times (II_OFLT)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**

II_OFLT11.6	11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.	0.853	0.728	0.001
II_OFLT11.7	11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	0.882	0.779	0.001
Logistics operations coordination through order fulfilment lead times (LOC_OFLT)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
LOC_OFLT12.4	12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	0.893	0.797	0.001
LOC_OFLT12.5	12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	0.869	0.756	0.001
Organisational relationship through order fulfilment lead times (OR_OFLT)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple**	**P-value**

			Correlation (SMC)	
OR_OFLT13.6	13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	0.907	0.822	0.001
OR_OFLT13.7	13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	0.876	0.768	0.001
OR_OFLT13.8	13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	0.869	0.754	0.001
OR_OFLT13.9	13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	0.867	0.752	0.001
Institutional support through order fulfilment lead times (IS_OFLT)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation**	**P-value**

			(SMC)	
IS_OFLT14.5	14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	0.877	0.769	0.001
IS_OFLT14.6	14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	0.859	0.737	0.001

Note: ** $p < 0.01$

Table 6.24: Covariances and pattern coefficients of factors and their measurement items for order fulfilment lead times (OFLT) construct

	IS_OFLT	OR_OFLT	LOC_OFLT	II_OFLT
IS_OFLT	1.000			
OR_OFLT	0.585	1.000		
LOC_OFLT	0.539	0.537	1.000	
II_OFLT	0.530	0.556	0.522	1.000
IS_OFLT14.5	**0.877**	0.513	0.473	0.465
IS_OFLT14.6	**0.859**	0.502	0.463	0.455
OR_OFLT13.6	0.531	**0.907**	0.487	0.504
OR_OFLT13.7	0.513	**0.876**	0.470	0.487
OR_OFLT13.8	0.508	**0.869**	0.466	0.483
OR_OFLT13.9	0.508	**0.867**	0.466	0.482
LOC_OFLT12.4	0.481	0.479	**0.893**	0.466
LOC_OFLT12.5	0.469	0.467	**0.869**	0.454
II_OFLT11.6	0.452	0.474	0.445	**0.853**

II_OFLT11.7	0.468	0.491	0.460	**0.882**

Table 6.25: Validity and reliability test of the order fulfilment lead times (OFLT) construct

	Cronbach's alpha (α)	**Composite reliability (CR)**	**Average variance extracted (AVE)**
Order fulfilment lead times (OFLT)	0.906	0.970	0.766
II_OFLT	0.859	0.859	0.753
LOC_OFLT	0.874	0.874	0.776
OR_OFLT	0.932	0.932	0.774
IS_OFLT	0.859	0.859	0.754

Table 6.26: Chi-square difference tests for the order fulfilment lead times (OFLT) construct

Model	**Factor correlation constrained to be 1**	χ^2	***df***	**Chi-square difference tests against the base (unconstrained) model**			
				$\Delta\ \chi^2$	Δ *df*	p-value	Chi-Square critical values; p = 0.05
Base model	-	29.391	29	-	-	-	-
Model 1	II_OFLT↔LOC_OFLT	294.072	30	264.681	1	0.000	Significant
Model 2	II_OFLT↔OR_OFLT	287.280	30	257.889	1	0.000	Significant
Model 3	II_OFLT↔IS_OFLT	289.070	30	259.679	1	0.000	Significant
Model 4	LOC_OFLT↔OR_OFLT	326.555	30	297.164	1	0.000	Significant
Model 5	LOC_OFLT↔IS_OFLT	285.528	30	256.137	1	0.000	Significant
Model 6	OR_OFLT↔IS_OFLT	275.285	30	245.894	1	0.000	Significant

In summary, information integration through order fulfilment lead times, logistics operations coordination through order fulfilment lead times, organisational relationship through order fulfilment lead times, and institutional support through order fulfilment lead times are reliable and valid measures of the order fulfilment lead times construct, since their composite reliability is 0.970, Cronbach's alpha is 0.906, and the AVE value is 0.766 (see Table 6.25). Moreover, the covariances between dimensions are not equal to 1 (as all are in the 0.522-0.585 range), which satisfies discriminant validity and unidimensionality criteria (see Table 6.24). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with the six constrained models (by restricting each factor correlation t to 1.0; see Table 6.26) confirmed the significantly superior fit of the unconstrained model (with four factors) relative to the constrained models. The result demonstrated the discriminant validity of the order fulfilment lead times construct (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the χ^2 = 29.391, *df* = 29, and *p* = 0.445 (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., χ^2/df = 1.013, GFI = 0.986, AGFI = 0.974, NFI = 0.990, PCLOSE = 0.996, RMSEA = 0.006, TLI = 1.000, CFI = 1.000 (Figure 6.12).

6.10 Measurement model of all constructs

Figure 6.13 presents the final measurement model of all research constructs, including information integration (II), logistics operations coordination (LOC), organisational relationship (O_R), institutional support (IS), perfect order fulfilment (POF), and order fulfilment lead times (OFLT). The model was produced to test validity and reliability of measurement dimensions and research constructs prior to for structural modelling. The standardized loading, squared multiple correlation, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), and the Chi-square difference test results are presented in Table 6.27-6.30, where the values of the figures presented are rounded by AMOS version 22. In model, mean values of measurement items (observed variables) yield able to use in CFA. The observe variables from previous analysis were aggregated to the measurement dimension level (Byrne, 2009). Thus, the measurement dimension level (second order) was derived from the mean value of measure items (first order) (i.e. the internal information sharing (IIS) dimension was derived from the mean value of measurement items IIS1.1.1 and IIS1.14.).

Information integration (II) construct consists of four measurement dimensions, including internal information sharing (IIS), external information sharing (EIS), internal IT capability

(IITC), and external IT capability (EITC). The results can be suitable in certain conditions (see in Table 6.1), as these measurement dimensions are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.626-0.799) ($p < 0.01$)(see Table 6.27). In addition, the value of CR (0.822) is greater than AVE (0.538) (see Table 6.29). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective constructs with the covariance in the 0.505-0.728 range (see Table 6.28). It can be concluded that these measurement dimensions are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.392-0.639) (see Table 6.27). Their reliability is further ascertained by the Cronbach's alpha of 0.818, composite reliability of 0.822, and AVE of 0.538 (see Table 6.29).

Logistics operations coordination (LOC) construct consists of two measurement dimensions, transportation cooperation with 3PL (TC3PL) and distribution centre sharing (DCS), which ideally cannot explain the factor because the measurement of the model fitness for CFA and the structural model should be justified by three indicators (Hair et al. 2010). However, the model was still useful, as it could establish if a standard model with two or more factors has at least two indicators per factor (Kline 2005). Based on the results, it can be confirmed that a two-item factor is not an issue. Thus, the results can apply to the conditions presented in Table 6.1. These measurement dimensions are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.737-0.752) ($p < 0.01$) (see Table 6.27). Again, in line with the above, the value of CR (0.713) is greater than AVE (0.554) (see Table 6.29). Moreover, the variables are shown to exhibit discriminant validity, as they are clustered into their respective constructs with the covariance in the 0.399 to 0.710 range (see Table 6.28). These measurement dimensions are thus reliable, as their SMC is greater than the minimum threshold of 0.3 (0.542-0.565) (see Table 6.27). Moreover, their reliability is confirmed by the Cronbach's alpha of 0.713, composite reliability of 0.713, and AVE of 0.554 (see Table 6.29).

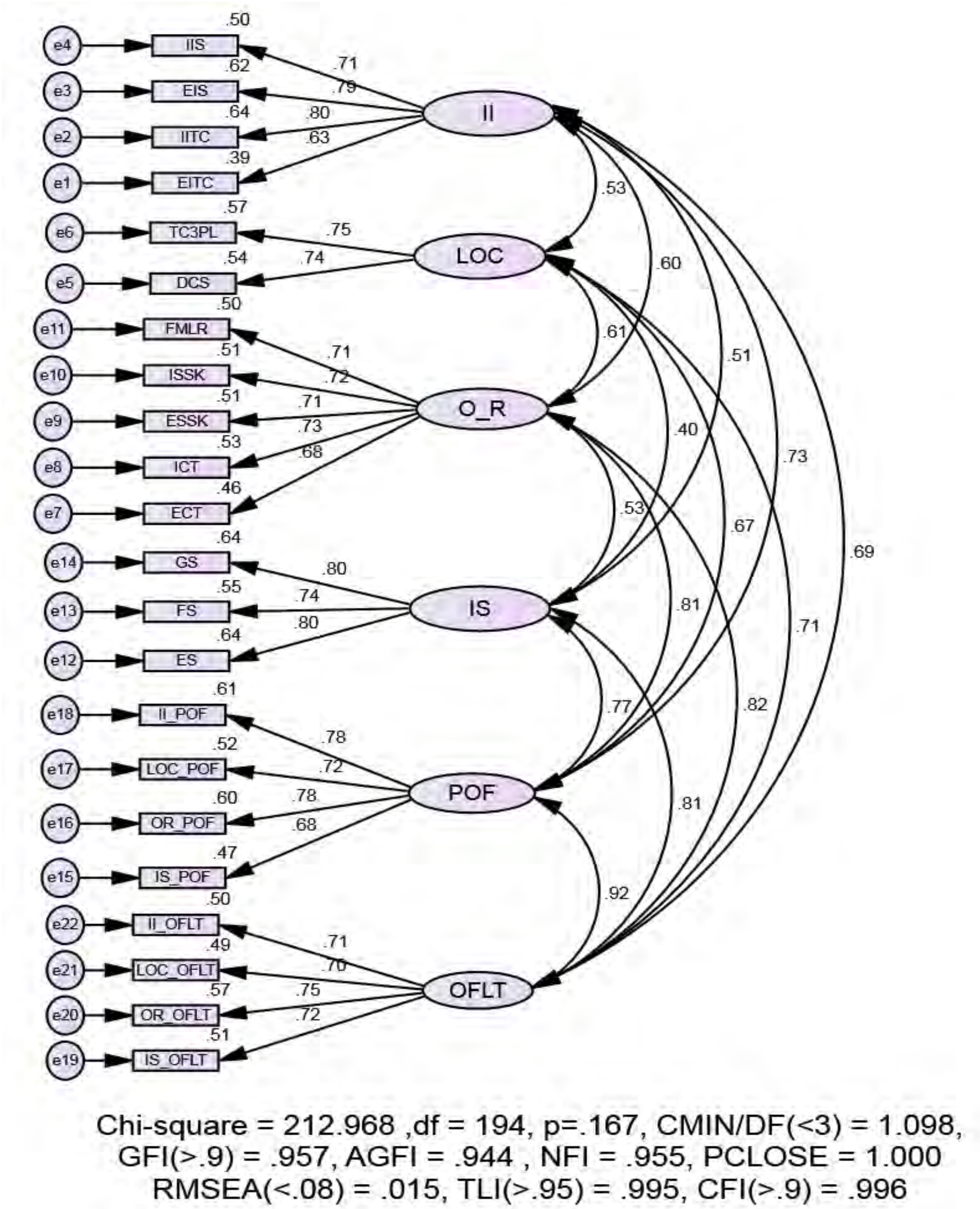
Organisational relationship (O_R) construct consists of five measurement dimensions, including forging and maintaining long-term relationships (FMLR), internal sharing of skills/ideas, knowledge/experience (ISSK), external sharing of skills/ideas, knowledge/experience (ESSK), internal creating teamwork along supply chain and cross-functional teams (ICT), and external creating teamwork along supply chain and cross-functional teams (ECT). The results can be suitable in certain conditions (see in Table 6.1), as these measurement dimensions are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.677-0.728) (p < 0.01)(see Table 6.27). In addition, the value of CR (0.835) is greater than AVE (0.502) (see Table 6.29). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective constructs with the covariance in the 0.535-0.818 range (see Table 6.28). It can be concluded that these measurement dimensions are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.459-0.531) (see Table 6.27). Their reliability is further ascertained by the Cronbach's alpha of 0.834, composite reliability of 0.835, and AVE of 0.502 (see Table 6.29).

Institutional support (IS) construct consists of three measurement dimensions, including government support (GS), the role of banks/financial services (FS), and knowledge support from boards and associations, and educational institutions/educational support (ES). The results can be suitable in certain conditions (see in Table 6.1), as these measurement dimensions are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.743-0.803) (p < 0.01) (see Table 6.27). In addition, the value of CR (0.826) is greater than AVE (0.613) (see Table 6.29). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective constructs with the covariance in the 0.399-0.809 range (see Table 6.28). It can be concluded that these measurement dimensions are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.551-0.645) (see Table 6.27). Their reliability is further ascertained by the Cronbach's alpha of 0.826, composite reliability of 0.826, and AVE of 0.613 (see Table 6.29).

Perfect order fulfilment (POF) construct consists of four measurement dimensions, including information integration through perfect order fulfilment (II_POF), logistics operations coordination through perfect order fulfilment (LOC_POF), organisational relationship through perfect order fulfilment (OR_POF), and institutional support through perfect order fulfilment (IS_POF) .The results can be suitable in certain conditions (see in Table 6.1), as these measurement dimensions are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.684-0.783) (p < 0.01) (see Table 6.27). In addition, the value of CR (0.831) is greater than AVE (0.552) (see Table 6.29). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective constructs with the covariance in the 0.399-0.809 range (see Table 6.28). It can be concluded that these measurement dimensions are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.467-0.613) (see Table 6.27). Their reliability is further ascertained by the

Cronbach's alpha of 0.829, composite reliability of 0.831, and AVE of 0.552 (see Table 6.29).

Order fulfilment lead times (OFLT) construct consists of four measurement dimensions, including information integration through order fulfilment lead times (II_OFLT), logistics operations coordination through order fulfilment lead times (LOC_OFLT), organisational relationship through order fulfilment lead times (OR_OFLT), and institutional support through order fulfilment lead times (IS_OFLT) .The results can be suitable in certain conditions (see in Table 6.1), as these measurement dimensions are shown to exhibit convergent validity with standardised loadings exceeding the threshold value of 0.5 (0.703-0.753) ($p < 0.01$) (see Table 6.27). In addition, the value of CR (0.812) is greater than AVE (0.519) (see Table 6.29). Moreover, they are shown to exhibit discriminant validity, due to clustering into their respective constructs with the covariance in the 0.690-0.922 range that are not equal to 1 (see Table 6.28). It can be concluded that these measurement dimensions are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.494-0.567) (see Table 6.27). Their reliability is further ascertained by the Cronbach's alpha of 0.811, composite reliability of 0.812, and AVE of 0.519 (see Table 6.29).



Note: II = information integration, LOC = logistics operations coordination, O_R = organisational relationship, IS = institutional support, POF = perfect order fulfilment, OFLT = order fulfilment lead times.

Figure 6.13: Standardised estimates measurement model

Table 6.27: Standardised factor loading, squared multiple correlation, and p-value of the research constructs

Information integration (II)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
IIS	Internal information sharing	0.706	0.499	0.001
EIS	External information sharing	0.790	0.625	0.001
IITC	Internal IT capability	0.799	0.639	0.001
EITC	External IT capability	0.626	0.392	0.001
Logistics operations coordination (LOC)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
TC3PL	Transportation cooperation with 3PL	0.752	0.565	0.001
DCS	Distribution centre sharing	0.737	0.542	0.001
Organisational relationship (O_R)				
Items	**Item descriptions**	**Standardised Loading (β)****	**Squared Multiple Correlation (SMC)**	**P-value**
FMLR	Forging and maintaining long-term relationships	0.707	0.499	0.001
ISSK	Internal sharing of skills/ideas, knowledge/experience	0.717	0.514	0.001
ESSK	External sharing of skills/ideas, knowledge/experience	0.714	0.510	0.001
ICT	Internal creating teamwork along supply chain and cross-functional teams	0.728	0.531	0.001

ECT	External creating teamwork along supply chain and cross-functional teams	0.677	0.459	0.001

Institutional support (IS)

Items	Item descriptions	Standardised Loading (β)**	Squared Multiple Correlation (SMC)	P-value
GS	Government support, incentive or policy	0.803	0.645	0.001
FS	The role of banks/financial services	0.743	0.551	0.001
ES	Knowledge support from boards and associations, and educational institutions/educational support	0.802	0.643	0.001

Perfect order fulfilment (POF)

Items	Item descriptions	Standardised Loading (β)**	Squared Multiple Correlation (SMC)	P-value
II_POF	Information integration through perfect order fulfilment	0.783	0.613	0.001
LOC_POF	Logistics operations coordination through perfect order fulfilment	0.724	0.525	0.001
OR_POF	Organisational relationship through perfect order fulfilment	0.776	0.602	0.001
IS_POF	Institutional support through perfect order fulfilment	0.684	0.467	0.001

Order fulfilment lead times (OFLT)

Items	Item descriptions	Standardised Loading (β)**	Squared Multiple Correlation	P-value

			(SMC)	
II_OFLT	Information integration through order fulfilment lead times	0.708	0.501	0.001
LOC_OFLT	Logistics operations coordination through order fulfilment lead times	0.703	0.494	0.001
OR_OFLT	Organisational relationship through order fulfilment lead times	0.753	0.567	0.001
IS_OFLT	Institutional support through order fulfilment lead times	0.716	0.513	0.001

Note: ** $p < 0.01$

Table 6.28: Covariances and pattern coefficients of factors and their measurement items for research constructs

	OFLT	POF	IS	O_R	LOC	II
OFLT	1.000					
POF	0.922	1.000				
IS	0.809	0.773	1.000			
O_R	0.818	0.811	0.535	1.000		
LOC	0.710	0.675	0.399	0.614	1.000	
II	0.690	0.728	0.505	0.599	0.526	1.000
II_OFLT	**0.708**	0.653	0.573	0.579	0.503	0.488
LOC_OFLT	**0.703**	0.648	0.569	0.575	0.499	0.485
OR_OFLT	**0.753**	0.695	0.609	0.616	0.535	0.520
IS_OFLT	**0.716**	0.661	0.580	0.586	0.509	0.494
II_POF	0.722	**0.783**	0.605	0.635	0.528	0.570
LOC_POF	0.668	**0.724**	0.560	0.587	0.489	0.528
OR_POF	0.715	**0.776**	0.600	0.629	0.524	0.565
IS_POF	0.630	**0.684**	0.529	0.554	0.461	0.498
GS	0.650	0.621	**0.803**	0.429	0.320	0.406

	OFLT	POF	IS	O_R	LOC	II
FS	0.601	0.574	**0.743**	0.397	0.296	0.375
ES	0.649	0.620	**0.802**	0.429	0.320	0.405
FMLR	0.578	0.573	0.378	**0.707**	0.434	0.423
ISSK	0.586	0.581	0.383	**0.717**	0.440	0.429
ESSK	0.584	0.579	0.382	**0.714**	0.438	0.428
ICT	0.596	0.590	0.389	**0.728**	0.447	0.436
ECT	0.554	0.549	0.362	**0.677**	0.416	0.406
TC3PL	0.534	0.507	0.300	0.462	**0.752**	0.396
DCS	0.523	0.497	0.294	0.452	**0.737**	0.388
IIS	0.487	0.514	0.357	0.423	0.372	**0.706**
EIS	0.545	0.576	0.399	0.473	0.416	**0.790**
IITC	0.551	0.582	0.404	0.479	0.421	**0.799**
EITC	0.432	0.456	0.316	0.375	0.329	**0.626**

Table 6.29: Validity and reliability test of the research constructs construct

	Cronbach's alpha (α)	**Composite reliability (CR)**	**Average variance extracted (AVE)**
II	0.818	0.822	0.538
LOC	0.713	0.713	0.554
O_R	0.834	0.835	0.502
IS	0.826	0.826	0.613
POF	0.829	0.831	0.552
OFLT	0.811	0.812	0.519

Table 6.30: Chi-square difference tests for the research constructs construct

Model	**Factor correlation constrained to be 1**	χ^2	***df***	**Chi-square difference tests against the base (unconstrained) model**			
				$\Delta \chi^2$	Δ *df*	p-value	Chi-Square

							critical values; p = 0.05
Base model	-	212.968	194	-	-	-	-
Model 1	II↔LOC	315.791	195	102.823	1	0.000	Significant
Model 2	II↔O_R	492.143	195	279.175	1	0.000	Significant
Model 3	II↔IS	526.033	195	313.065	1	0.000	Significant
Model 4	II↔POF	371.313	195	158.345	1	0.000	Significant
Model 5	II↔OFLT	384.937	195	171.969	1	0.000	Significant
Model 6	LOC↔O_R	296.552	195	83.584	1	0.000	Significant
Model 7	LOC↔IS	338.875	195	125.907	1	0.000	Significant
Model 8	LOC↔POF	281.286	195	68.318	1	0.000	Significant
Model 9	LOC↔OFLT	270.547	195	57.579	1	0.000	Significant
Model 10	O_R↔IS	510.904	195	297.936	1	0.000	Significant
Model 11	O_R↔POF	310.682	195	97.714	1	0.000	Significant
Model 12	O_R↔OFLT	294.082	195	81.114	1	0.000	Significant
Model 13	IS↔POF	327.620	195	114.652	1	0.000	Significant
Model 14	IS↔OFLT	291.891	195	78.923	1	0.000	Significant
Model 15	POF↔OFLT	231.442	195	18.474	1	0.000	Significant

In summary, information integration (II), logistics operations coordination (LOC), organisational relationship (O_R), institutional support (IS), perfect order fulfilment (POF), and order fulfilment lead times (OFLT) are reliable and valid to be used in structural equation modelling (SEM). The Pearson's correlations between dimensions are with the covariance in the 0.399-0.922 range, which satisfies discriminant validity and unidimensionality criteria (see Table 6.28). The results of chi-square difference tests that compared the unconstrained model (i.e., the original CFA model) with the fifteen constrained models (by restricting each factor correlation and equating it to 1.0; see Table 6.30) confirmed the significantly superior fit of the unconstrained model (with six constructs) relative to the constrained models. All constructs are significantly different. The result demonstrated the discriminant validity of the measurement dimensions (Anderson & Gerbing, 1988, Hair et al. 2009). In addition, the measurement model fits the data very well, since the χ^2 = 212.968, *df* = 194, and *p* = 0.167 (which is not significant at the 0.05 level). The other fit measures further confirm the goodness of fit of the model to the data, i.e., CMIN/DF = 1.098, GFI = 0.957, AGFI = 0.944, NFI = 0.955, PCLOSE = 1.000, RMSEA = 0.015, TLI = 0.995, CFI = 0.996 (Figure 6.13). As results, CFA confirmed that all measurement dimensions of each latent construct are reliable and valid, and are thus ready to be employed for path analysis using AMOS 22.

6.11 Structural model of conceptual framework

The final measurement models of information integration (II), logistics operations coordination (LOC), organisational relationship (O_R), institutional support (IS), perfect order fulfilment (POF) and order fulfilment lead times (OFLT) were employed to generate the structural model. Mean values of measurement items (observed variables) yielded by CFA could be used to develop the structural model (Bryrne 2009). Thus, mean values of measurement items were used in the combination of dimensions to be six constructs (II, LOC, O_R, IS, POF and OFLT).

As show in Figure 6.2, information integration (II) consists of four dimensions, including (1) internal information sharing (IIS), (2) external information sharing (EIS), (3) internal IT capability (IITC), and (4) external IT capability (EITC). IIS was derived from the mean value of measurement items IIS1.1.1 and IIS1.1.4. EIS was derived from the mean value of measurement items EIS1.2.1 and EIS 1.2.5. IITC was derived from the mean value of measurement items IITC2.1.1, IITC2.1.2, IITC2.1.3, and IITC2.1.4. EITC was derived from the mean value of EITC2.2.1, EITC2.2.3, and EITC2.2.5.

As shown in Figure 6.4, logistics operations coordination (LOC) consists of two dimensions, including (1) transportation cooperation with 3PL (TC3PL), and (2) distribution centre sharing (DCS). TC3PL was derived from the mean value of measurement items TC3PL3.2 and TC3PL3.4. DCS was derived from the mean value of measurement items DCS4.4, DCS4.5 and DCS4.6.

As shown in Figure 6.6, organisational relationship (O_R) consist of five dimensions, including (1) forging and maintaining long-term relationships (FMLR), (2) internal sharing of skills/ideas, knowledge/experience (ISSK), (3) external sharing of skills/ideas, knowledge/experience (ESSK), (4) internal creating teamwork along supply chain and cross-functional teams (ICT), (5) external creating teamwork along supply chain and cross-functional teams (ECT). FMLR was derived from the mean value of measurement items FMLR5.1, FMLR5.2, FMLR5.4, and FMLR5.5. ISSK was derived from the mean value of measurement items ISSK6.1.1, ISSK6.1.3, and ISSK6.1.6. ESSK was derived from the mean value of measurement items ESSK6.2.3, and ESSK6.2.4. ICT was derived from the mean value of measurement items ICT7.1.1, ICT7.1.3, ICT7.1.5, and ICT7.1.6. ECT was derived from the mean value of measurement items ECT7.2.3, and ECT7.2.5.

As show in Figure 6.8, institutional support (IS) consists of three dimensions, including 1) government support, incentive or policy (GS), 2) the role of banks/financial services (FS), and 3) knowledge support from boards and associations, and educational institutions/educational support (ES). GS was derived from the mean value of measurement items GS8.3, and GS8.6. FS was derived from the mean value of measurement items FS9.2, FS9.3, and FS9.5. ES was derived from the mean value of measurement items ES10.1, ES10.2, and ES10.3.

As shown in Figure 6.10, perfect order fulfilment (POF) consists of four dimensions, including 1) information integration through perfect order fulfilment (II_POF), 2) logistics operations coordination through perfect order fulfilment (LOC_POF), 3) organisational relationship through perfect order fulfilment (OR_POF), and 4) institutional support through perfect order fulfilment (IS_POF). II_POF was derived from the mean value of measurement items II_POF11.1, II_POF11.2, II_POF11.3, and II_POF11.4. LOC_POF was derived from the mean value of measurement items LOC_POF12.1, LOC_POF12.2, and LOC_POF12.3. OR__POF was derived from the mean value of measurement items OR_POF13.1, OR_POF13.2, and OR_POF 13.4. IS__POF was derived from the mean value of measurement items IS_POF14.1, IS_POF14.2, and IS_POF14.3.

As shown in Figure 6.12, order fulfilment lead times (OFLT) consists of four dimensions, including 1) information integration through order fulfilment lead times (II_OFLT), 2) logistics operations coordination through order fulfilment lead times (LOC_OFLT), 3) organizational relationship through order fulfilment lead times (OR_OFLT), and 4) institutional support through order fulfilment lead times (IS_OFLT). II_OFLT was derived from the mean value of measurement items II_OFLT11.6, and II_OFLT11.7. LOC_OFLT was derived from the mean value of measurement items LOC_OFLT12.4, and LOC_OFLT12.5. OR_OFLT was derived from the mean value of measurement items

OR_OFLT13.6, OR_OFLT13.7, OR_OFLT13.8 and OR_OFLT13.9. IS_OFLT was derived from the mean value of measurement items IS_OFLT14.5, and IS_OFLT14.6.

As show in Figure 6.14, AMOS version 22 was used to analyse model fit that presents the structural path model in the form of structural path model. If the structural path model yields the best fit to the data, alternative models could be evaluated by excluding one of the paths at a time (Li et al. 2006) that assume to find the best of fit models. Thus, the structural path model was evaluated by dropping one of links between the constructs at a time that resulted in eight competing model (see in Figure 6.15 to 6.22).

6.11.1 The structural path model

Figure 6.14 presents the path model and the coefficients are rounded up by AMOS version 22. All measurements have standardized loading significant at 0.01 and 0.05(see in Table 6.31). The data fits the model very well, with χ^2 = 214.961, *df* = 195, *p* = 0.156, χ^2/ *df* (<3) = 1.102, GFI = 0.957, AGFI (>0.9) = 0.944, NFI = 0.954, PCLOSE = 1, RMSEA (<0.08) = 0.015, RMSR= 0.006, TLI (>0.95) = 0.995, and CFI (>0.9) = 0.996. Based on the goodness-of-fit indices (see in Table 6.2), it can be concluded that the path model has an adequate level of fit.

In terms of the variances explained in the outcome variables, the predictor variables (information integration (II), logistics operations coordination (LOC), organisational relationship (O_R), and institutional support (IS)) explain 89 % of the variance in perfect order fulfilment (POF), and 93 % in order fulfilment lead times (OFLT).

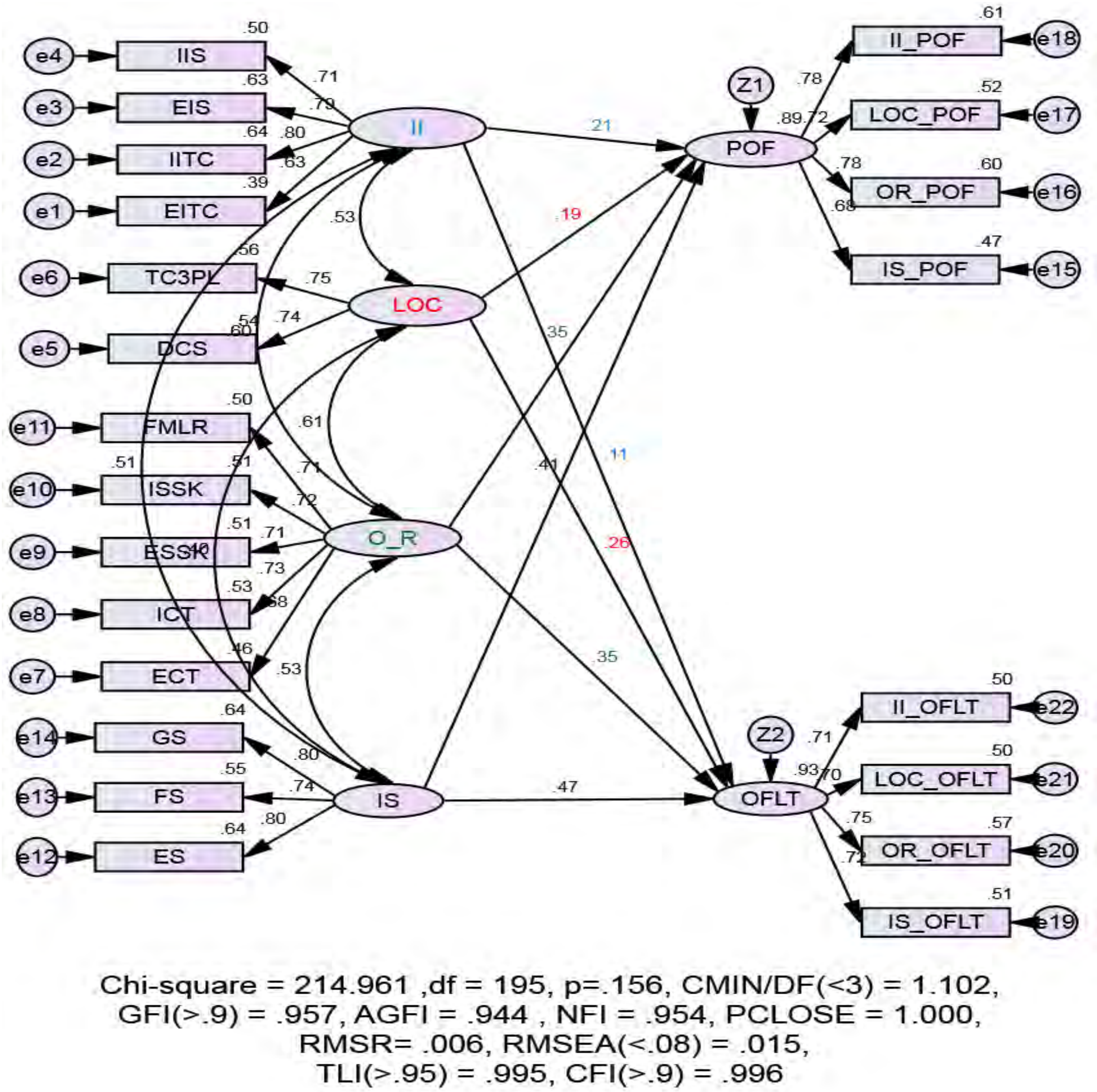


Figure 6.14: Structural Path model

Table 6.31: Standardised loading and p-value of the structural path model

Factor relationship			Standardised loading	P value
OFLT	<---	IS	0.472	0.001**
POF	<---	II	0.211	0.001**
OFLT	<---	II	0.111	0.026*
POF	<---	LOC	0.192	0.001**
OFLT	<---	LOC	0.258	0.001**
POF	<---	O_R	0.352	0.001**
OFLT	<---	O_R	0.345	0.001**
POF	<---	IS	0.409	0.001**

EITC	<---	II	0.626	0.001**
IITC	<---	II	0.798	0.001**
EIS	<---	II	0.791	0.001**
IIS	<---	II	0.706	0.001**
DCS	<---	LOC	0.735	0.001**
TC3PL	<---	LOC	0.749	0.001**
ECT	<---	O_R	0.677	0.001**
ICT	<---	O_R	0.728	0.001**
ESSK	<---	O_R	0.713	0.001**
ISSK	<---	O_R	0.716	0.001**
FMLR	<---	O_R	0.706	0.001**
ES	<---	IS	0.800	0.001**
FS	<---	IS	0.741	0.001**
GS	<---	IS	0.801	0.001**
IS_POF	<---	POF	0.683	0.001**
OR_POF	<---	POF	0.776	0.001**
LOC_POF	<---	POF	0.724	0.001**
II_POF	<---	POF	0.784	0.001**
IS_OFLT	<---	OFLT	0.717	0.001**
OR_OFLT	<---	OFLT	0.754	0.001**
LOC_OFLT	<---	OFLT	0.704	0.001**
II_OFLT	<---	OFLT	0.706	0.001**

Note: ** $p < 0.01$, * $p < 0.05$

6.11.2 Alternative model 1 (excluding path between II and POF)

Figure 6.15 shows the alternative model 1 and the value of the figure is rounded up by AMOS version 22. The non-significant path between II and POF was removed. As can be seen in Table 6.32, all path coefficients were statistically significant at the 0.01 and 0.05. However, relationship between II and OFLT is found to be non-significant (p = 0.345, p > 0.05). Comparing with the structural path model, the path coefficient between LOC and POF, LOC and OFLT, O_R and POF, O_R and OFLT, IS and POF, and IS and OFLT became stronger except the path coefficient between II and OFLT. The data fitted the model very well, with χ^2 = 232.371, df = 196, p = 0.039, χ^2/df (<3) = 1.186, GFI = 0.953, AGFI (>0.9) = 0.939, NFI = 0.950, PCLOSE = 1, RMSEA (<0.08) = 0.021, RMSR=0.007, TLI (>0.95) = 0.990, and CFI (>0.9)= 0.992. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 1 had not an adequate level of empirical support because Chi-square probability level (χ^2) was less than 0.05(p = 0.039).

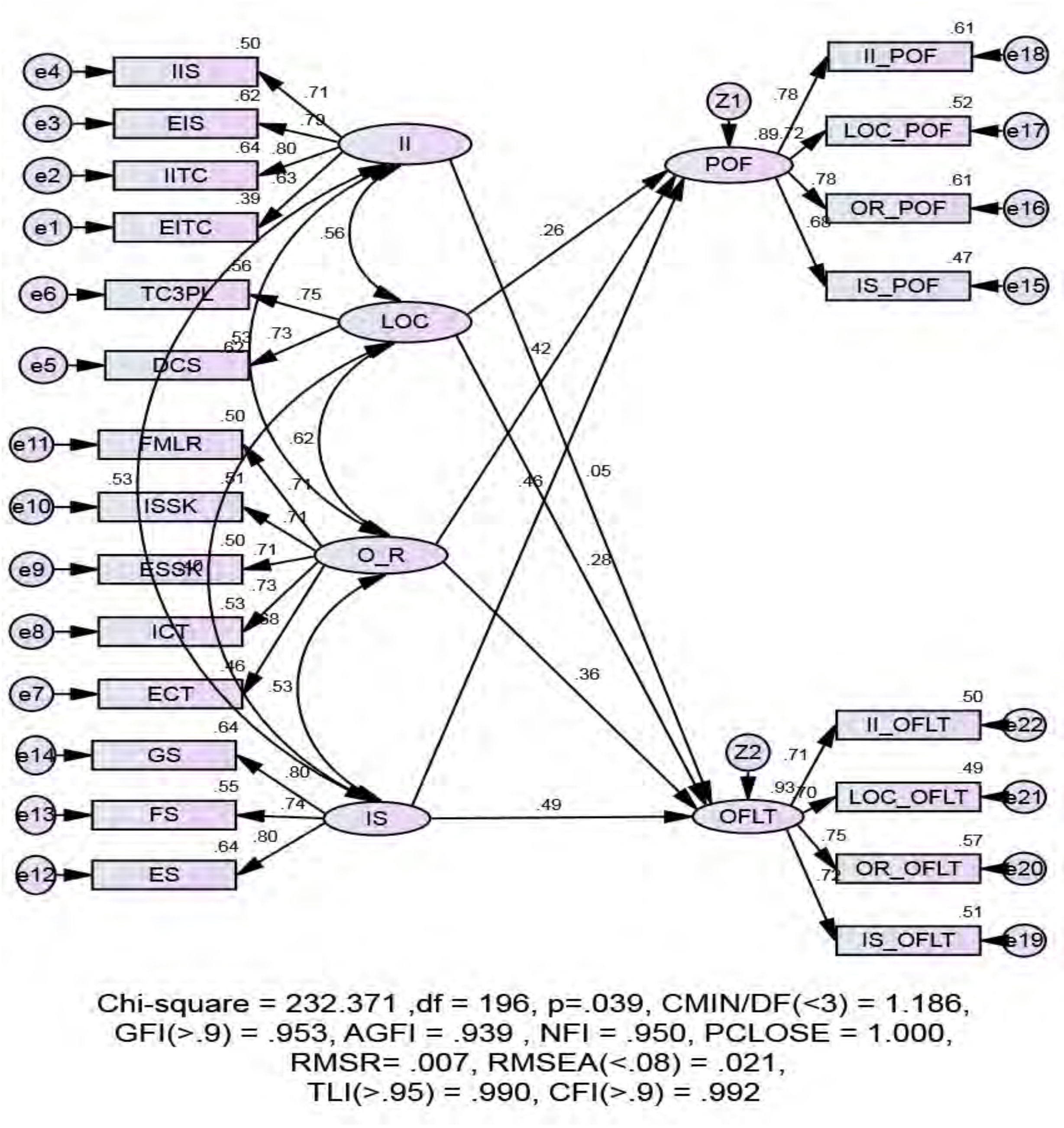


Figure 6.15: Alternative model 1

Table 6.32: Standardised loading and p-value of alternative model 1

Factor relationship			Standardised loading	P value
OFLT	<---	IS	0.487	0.001**
OFLT	<---	II	0.048	0.345*
POF	<---	LOC	0.259	0.001**
OFLT	<---	LOC	0.280	0.001**
POF	<---	O_R	0.418	0.001**

OFLT	<---	O_R	0.362	0.001**
POF	<---	IS	0.461	0.001**
EITC	<---	II	0.628	0.001**
IITC	<---	II	0.801	0.001**
EIS	<---	II	0.787	0.001**
IIS	<---	II	0.706	0.001**
DCS	<---	LOC	0.726	0.001**
TC3PL	<---	LOC	0.745	0.001**
ECT	<---	O_R	0.676	0.001**
ICT	<---	O_R	0.727	0.001**
ESSK	<---	O_R	0.709	0.001**
ISSK	<---	O_R	0.714	0.001**
FMLR	<---	O_R	0.706	0.001**
ES	<---	IS	0.799	0.001**
FS	<---	IS	0.739	0.001**
GS	<---	IS	0.798	0.001**
IS_POF	<---	POF	0.685	0.001**
OR_POF	<---	POF	0.779	0.001**
LOC_POF	<---	POF	0.722	0.001**
II_POF	<---	POF	0.781	0.001**
IS_OFLT	<---	OFLT	0.716	0.001**
OR_OFLT	<---	OFLT	0.754	0.001**
LOC_OFLT	<---	OFLT	0.704	0.001**
II_OFLT	<---	OFLT	0.707	0.001**

Note: ** $p < 0.01$, * $p < 0.05$

6.11.3 Alternative model 2 (excluding path between II and OFLT)

Figure 6.16 presents the alternative model 2 and the value of the figure is rounded up by AMOS version 22. The non-significant path between II and OFLT was removed. As can be seen in Table 6.33, all path coefficients were statistically significant at the 0.01. Comparing with the structural path model, the path coefficient between LOC and POF, LOC and OFLT, O_R and POF, O_R and OFLT, IS and POF, and IS and OFLT became stronger except the path coefficient between II and POF. The data fitted the model very well, with χ^2 = 219.659, df = 196, p = 0.118, χ^2/df (<3) = 1.121, GFI = 0.956, AGFI (>0.9) = 0.943, NFI = 0.953, PCLOSE = 1, RMSEA (<0.08) = 0.017, RMSR = 0.007, TLI (>0.95) = 0.994, and CFI (>0.9)= 0.995. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 2 had an adequate level of empirical support.

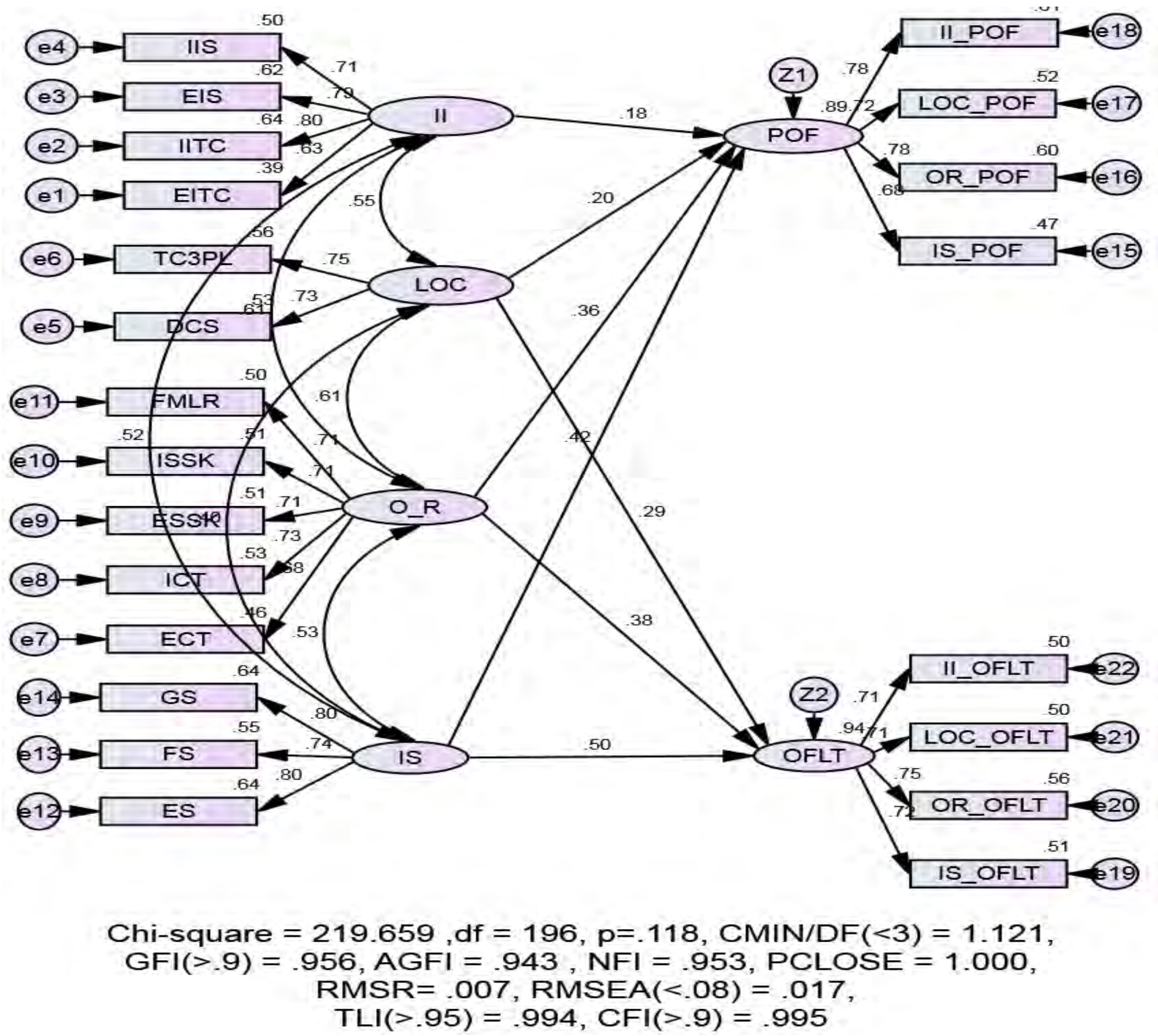


Figure 6.16: Alternative model 2

Table 6.33: Standardised loading and p-value of alternative model 2

Factor relationship			Standardised loading	P-value
OFLT	<---	IS	0.500	0.001**
POF	<---	II	0.182	0.001**
POF	<---	LOC	0.202	0.001**
OFLT	<---	LOC	0.294	0.001**
POF	<---	O_R	0.360	0.001**
OFLT	<---	O_R	0.379	0.001**
POF	<---	IS	0.415	0.001**
EITC	<---	II	0.626	0.001**
IITC	<---	II	0.801	0.001**
EIS	<---	II	0.788	0.001**
IIS	<---	II	0.707	0.001**

DCS	<---	LOC	0.731	0.001**
TC3PL	<---	LOC	0.746	0.001**
ECT	<---	O_R	0.676	0.001**
ICT	<---	O_R	0.727	0.001**
ESSK	<---	O_R	0.711	0.001**
ISSK	<---	O_R	0.715	0.001**
FMLR	<---	O_R	0.706	0.001**
ES	<---	IS	0.800	0.001**
FS	<---	IS	0.740	0.001**
GS	<---	IS	0.799	0.001**
IS_POF	<---	POF	0.683	0.001**
OR_POF	<---	POF	0.776	0.001**
LOC_POF	<---	POF	0.724	0.001**
II_POF	<---	POF	0.784	0.001**
IS_OFLT	<---	OFLT	0.716	0.001**
OR_OFLT	<---	OFLT	0.750	0.001**
LOC_OFLT	<---	OFLT	0.707	0.001**
II_OFLT	<---	OFLT	0.707	0.001**

Note: ** $p < 0.01$

6.11.4 Alternative model 3 (excluding path between LOC and POF)

Figure 6.17 shows the alternative model 3 and the value of the figure is rounded up by AMOS version 22. The non-significant path between LOC and POF was removed. As can be seen in Table 6.34, all path coefficients were statistically significant at the 0.01 and 0.05. Comparing with the structural path model, the path coefficient between II and POF, II and OFLT, O_R and POF, O_R and OFLT became stronger except the path coefficient between LOC and OFLT. The path coefficient between IS and POF, and IS and OFLT were similar with the structural path model. The data fitted the model very well, with χ^2 = 227.54, *df* = 196, *p* = 0.061, χ^2/df (<3) = 1.161, GFI = 0.955, AGFI (>0.9) = 0.942, NFI = 0.951, PCLOSE = 1, RMSEA (<0.08) = 0.019, RMSR = 0.007, TLI (>0.95) = 0.992, and CFI (>0.9)= 0.993. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 3 had an adequate level of empirical support.

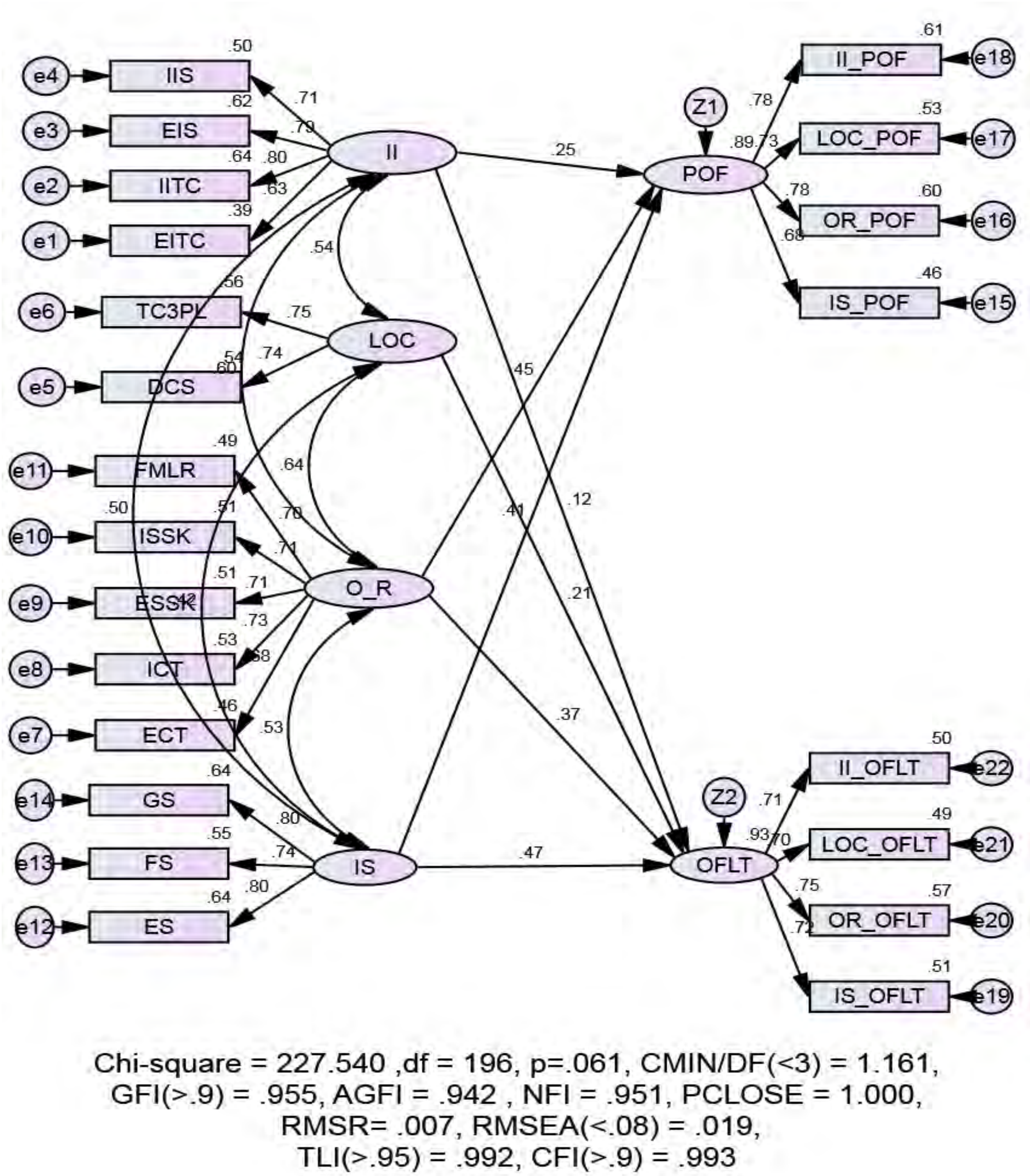


Figure 6.17: Alternative model 3

Table 6.34: Standardised loading and p-value of alternative model 3

Factor relationship			Standardised loading	P-value
OFLT	<---	IS	0.472	0.001**
POF	<---	II	0.254	0.001**
OFLT	<---	II	0.122	0.015*

OFLT	<---	LOC	0.208	0.001**
POF	<---	O_R	0.455	0.001**
OFLT	<---	O_R	0.373	0.001**
POF	<---	IS	0.412	0.001**
EITC	<---	II	0.626	0.001**
IITC	<---	II	0.798	0.001**
EIS	<---	II	0.789	0.001**
IIS	<---	II	0.706	0.001**
DCS	<---	LOC	0.738	0.001**
TC3PL	<---	LOC	0.751	0.001**
ECT	<---	O_R	0.675	0.001**
ICT	<---	O_R	0.726	0.001**
ESSK	<---	O_R	0.711	0.001**
ISSK	<---	O_R	0.712	0.001**
FMLR	<---	O_R	0.703	0.001**
ES	<---	IS	0.799	0.001**
FS	<---	IS	0.740	0.001**
GS	<---	IS	0.801	0.001**
IS_POF	<---	POF	0.680	0.001**
OR_POF	<---	POF	0.776	0.001**
LOC_POF	<---	POF	0.729	0.001**
II_POF	<---	POF	0.782	0.001**
IS_OFLT	<---	OFLT	0.717	0.001**
OR_OFLT	<---	OFLT	0.755	0.001**
LOC_OFLT	<---	OFLT	0.703	0.001**
II_OFLT	<---	OFLT	0.705	0.001**

Note: ** $p < 0.01$, * $p < 0.05$

6.11.5 Alternative model 4 (excluding path between LOC and OFLT)

Figure 6.18 shows the alternative model 4 and the value of the figure is rounded up by AMOS version 22. The non-significant path between LOC and OFLT was removed. As can be seen in Table 6.35, all path coefficients were statistically significant at the 0.01 and 0.05. Comparing with the structural path model, the path coefficient between II and POF, II and OFLT, O_R and POF, and O_R and OFLT became stronger except the path coefficient between LOC and POF. The path coefficient between IS and POF, and IS and OFLT were similar with the structural path model. The data fitted the model very well, with χ^2 = 236.554, df = 196, p = 0.025, χ^2/df (<3) = 1.207, GFI = 0.953, AGFI (>0.9) = 0.939, NFI = 0.950, PCLOSE = 1, RMSEA (<0.08) = 0.022, RMSR = 0.007, TLI (>0.95) = 0.989, and CFI (>0.9)= 0.991. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 4 had not an adequate level of empirical support because Chi-square probability level (χ^2) was less than 0.05(p = 0.025).

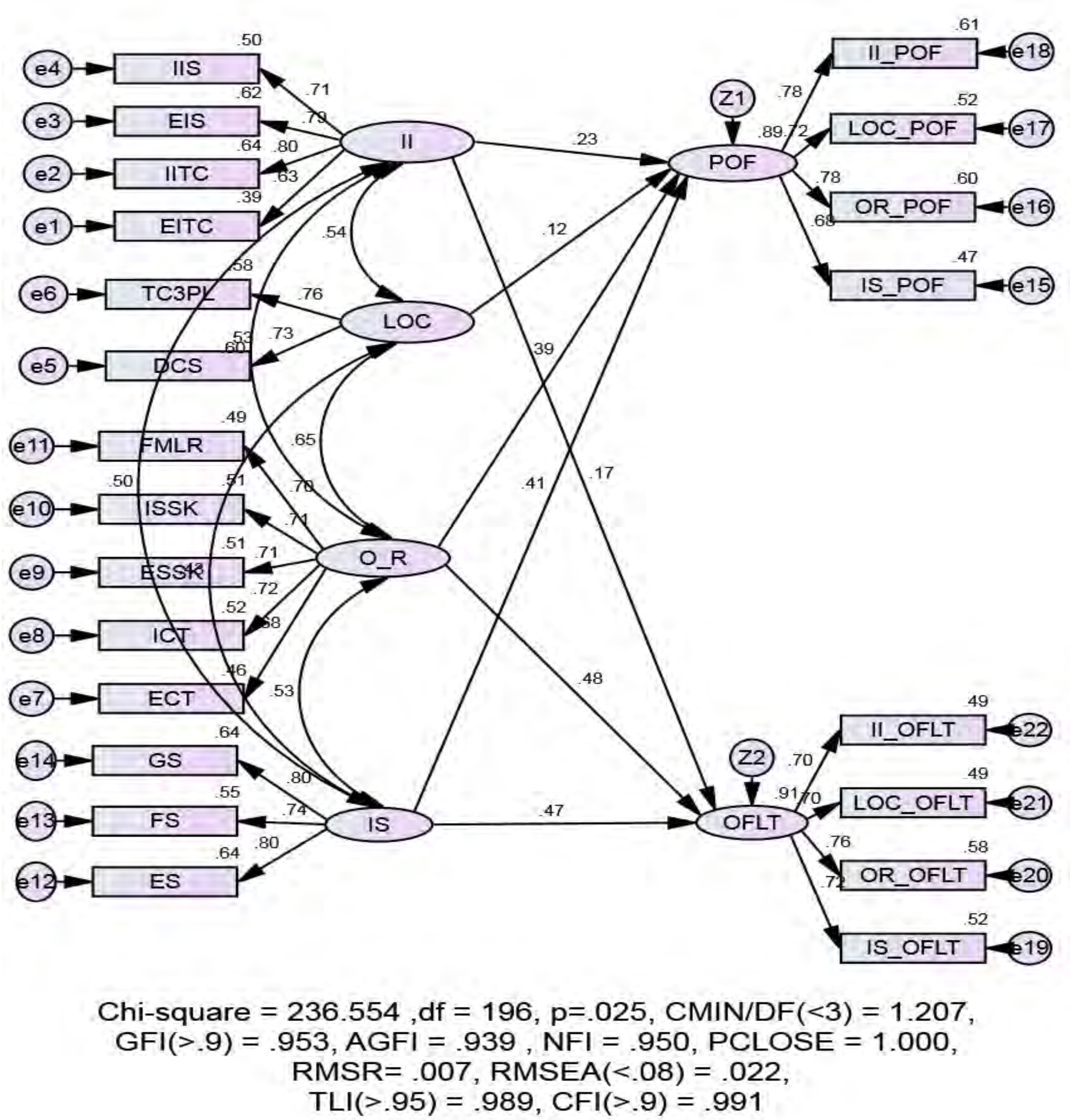


Figure 6.18: Alternative model 4

Table 6.35: Standardised loading and p-value of alternative model 4

Factor relationship			Standardised loading	P-value
OFLT	<---	IS	0.475	0.001**
POF	<---	II	0.225	0.001**
OFLT	<---	II	0.170	0.001**

POF	<---	LOC	0.125	0.023*
POF	<---	O_R	0.390	0.001**
OFLT	<---	O_R	0.483	0.001**
POF	<---	IS	0.409	0.001**
EITC	<---	II	0.626	0.001**
IITC	<---	II	0.797	0.001**
EIS	<---	II	0.789	0.001**
IIS	<---	II	0.706	0.001**
DCS	<---	LOC	0.727	0.001**
TC3PL	<---	LOC	0.762	0.001**
ECT	<---	O_R	0.675	0.001**
ICT	<---	O_R	0.725	0.001**
ESSK	<---	O_R	0.711	0.001**
ISSK	<---	O_R	0.711	0.001**
FMLR	<---	O_R	0.701	0.001**
ES	<---	IS	0.798	0.001**
FS	<---	IS	0.740	0.001**
GS	<---	IS	0.802	0.001**
IS_POF	<---	POF	0.682	0.001**
OR_POF	<---	POF	0.777	0.001**
LOC_POF	<---	POF	0.724	0.001**
II_POF	<---	POF	0.783	0.001**
IS_OFLT	<---	OFLT	0.719	0.001**
OR_OFLT	<---	OFLT	0.760	0.001**
LOC_OFLT	<---	OFLT	0.700	0.001**
II_OFLT	<---	OFLT	0.702	0.001**

Note: ** $p < 0.01$, * $p < 0.05$

6.11.6 Alternative model 5 (excluding path between O_R and POF)

Figure 6.19 shows the alternative model 5 and the value of the figure is rounded up by AMOS version 22. The non-significant path between O_R and POF was removed. As can be seen in Table 6.36, all path coefficients were statistically significant at the 0.01 and 0.05. Comparing with the structural path model, the path coefficient between II and POF, II and OFLT, LOC and POF, and LOC and OFLT, IS and POF, and IS and OFLT became stronger except the path coefficient between O_R and OFLT. The data fitted the model very well, with $\chi^2 = 247.971$, $df = 196$, $p = 0.007$, χ^2/df (<3) = 1.265, GFI = 0.950, AGFI (>0.9) = 0.936, NFI = 0.947, PCLOSE = 1, RMSEA (<0.08) = 0.025, RMSR = 0.007 TLI (>0.95) = 0.986, and CFI (>0.9)= 0.988. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 5 had not an adequate level of empirical support because Chi-square probability level (χ^2) was less than 0.05 (p = 0.007).

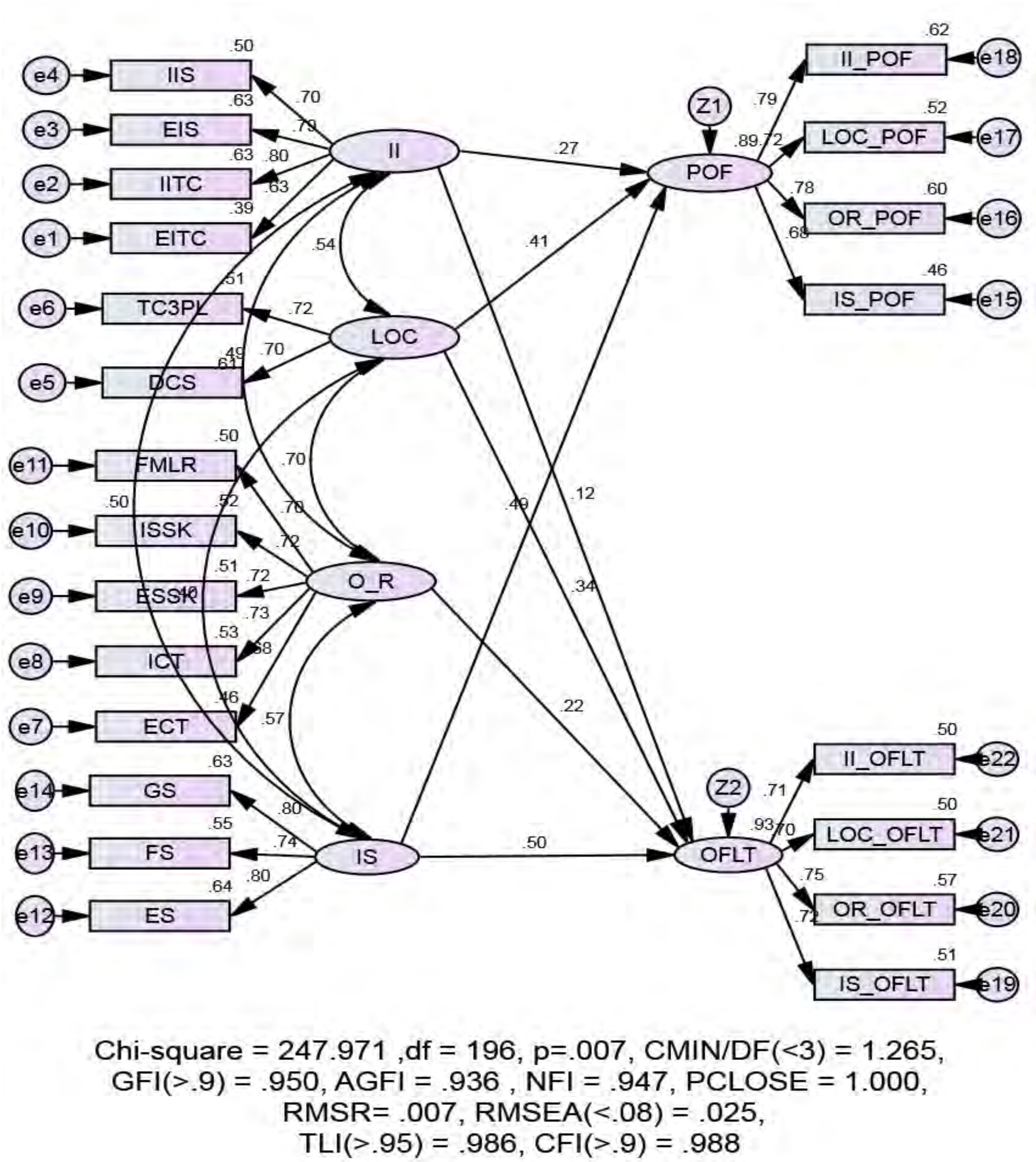


Figure 6.19: Alternative model 5

Table 6.36 Standardised loading and p-value of alternative model 5

Factor relationship			Standardised loading	P-value
OFLT	<---	IS	0.497	0.001**

POF	<---	II	0.269	0.001**
OFLT	<---	II	0.123	0.016*
POF	<---	LOC	0.406	0.001**
OFLT	<---	LOC	0.338	0.001**
OFLT	<---	O_R	0.224	0.001**
POF	<---	IS	0.491	0.001**
EITC	<---	II	0.625	0.001**
IITC	<---	II	0.796	0.001**
EIS	<---	II	0.791	0.001**
IIS	<---	II	0.704	0.001**
DCS	<---	LOC	0.701	0.001**
TC3PL	<---	LOC	0.715	0.001**
ECT	<---	O_R	0.680	0.001**
ICT	<---	O_R	0.725	0.001**
ESSK	<---	O_R	0.717	0.001**
ISSK	<---	O_R	0.718	0.001**
FMLR	<---	O_R	0.704	0.001**
ES	<---	IS	0.797	0.001**
FS	<---	IS	0.740	0.001**
GS	<---	IS	0.797	0.001**
IS_POF	<---	POF	0.681	0.001**
OR_POF	<---	POF	0.775	0.001**
LOC_POF	<---	POF	0.723	0.001**
II_POF	<---	POF	0.786	0.001**
IS_OFLT	<---	OFLT	0.716	0.001**
OR_OFLT	<---	OFLT	0.754	0.001**
LOC_OFLT	<---	OFLT	0.704	0.001**
II_OFLT	<---	OFLT	0.707	0.001**

Note: ** $p < 0.01$, * $p < 0.05$

6.11.7 Alternative model 6 (excluding path between O_R and OFLT)

Figure 6.20 shows the alternative model 6 and the value of the figure is rounded up by AMOS version 22. The non-significant path between O_R and OFLT was removed. As can be seen in Table 6.37, all path coefficients were statistically significant at the 0.01. Comparing with the structural path model, the path coefficient between II and POF, II and OFLT, LOC and POF, and LOC and OFLT, IS and POF, and IS and OFLT became stronger except the path coefficient between O_R and POF. The data fitted the model very well, with $\chi^2 = 244.924$, $df = 196$, $p = 0.010$, χ^2/df (<3) = 1.250, GFI = 0.951, AGFI (>0.9) = 0.937, NFI = 0.948, PCLOSE = 1, RMSEA (<0.08) = 0.024, RMSR = 0.007, TLI (>0.95) = 0.987, and

CFI (>0.9)= 0.989. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 6 had not an adequate level of empirical support because Chi-square probability level (χ^2) was less than 0.05(p=0.010).

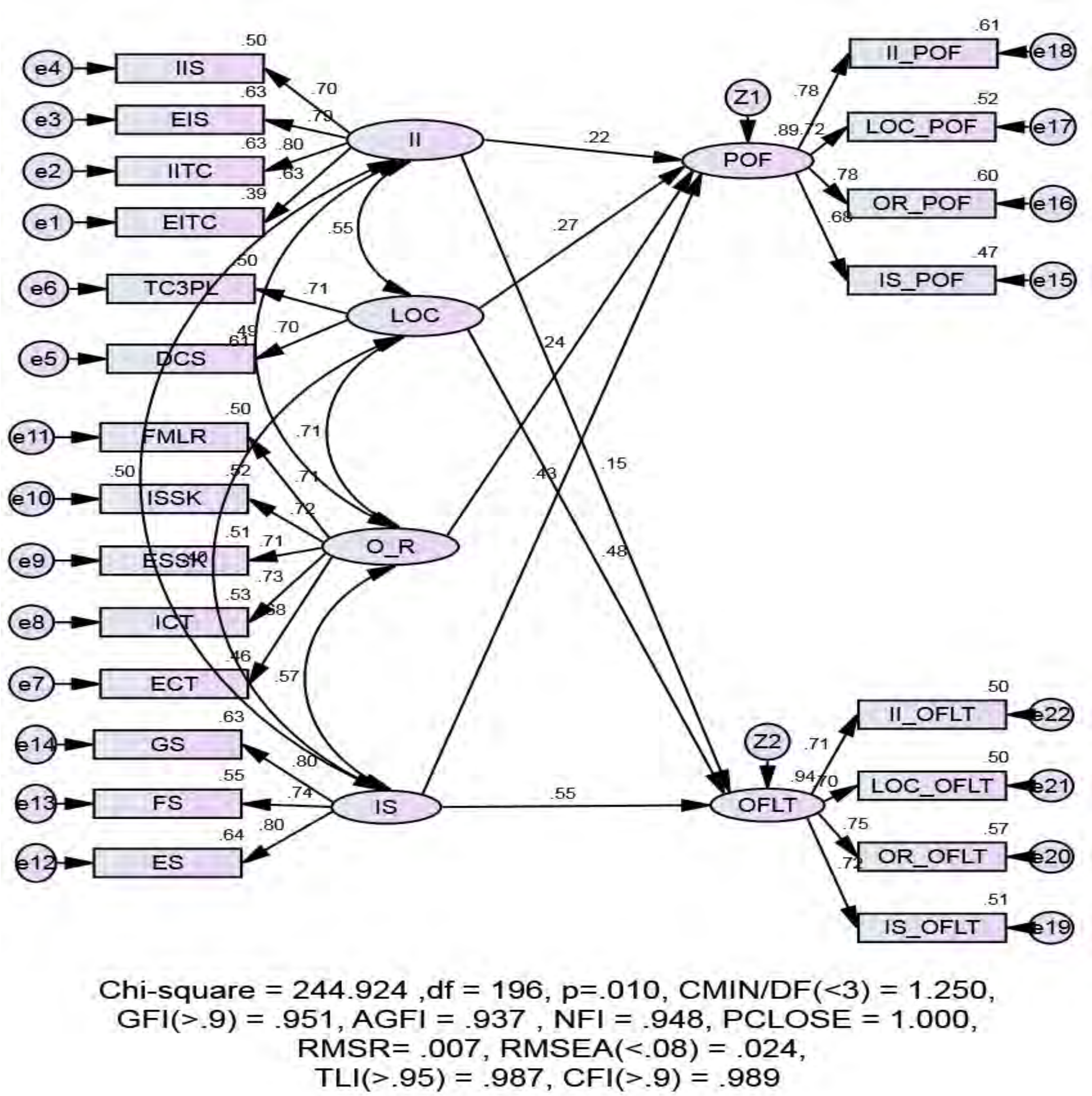


Figure 6.20: Alternative model 6

Table 6.37: Standardised loading and p-value of alternative model 6

Factor relationship			Standardised loading	P-value
OFLT	<---	IS	0.553	0.001**
POF	<---	II	0.220	0.001**
OFLT	<---	II	0.153	0.005**

POF	<---	LOC	0.267	0.001**
OFLT	<---	LOC	0.482	0.001**
POF	<---	O_R	0.243	0.001**
POF	<---	IS	0.430	0.001**
EITC	<---	II	0.626	0.001**
IITC	<---	II	0.796	0.001**
EIS	<---	II	0.792	0.001**
IIS	<---	II	0.705	0.001**
DCS	<---	LOC	0.697	0.001**
TC3PL	<---	LOC	0.707	0.001**
ECT	<---	O_R	0.678	0.001**
ICT	<---	O_R	0.726	0.001**
ESSK	<---	O_R	0.714	0.001**
ISSK	<---	O_R	0.720	0.001**
FMLR	<---	O_R	0.706	0.001**
ES	<---	IS	0.797	0.001**
FS	<---	IS	0.740	0.001**
GS	<---	IS	0.796	0.001**
IS_POF	<---	POF	0.683	0.001**
OR_POF	<---	POF	0.776	0.001**
LOC_POF	<---	POF	0.724	0.001**
II_POF	<---	POF	0.784	0.001**
IS_OFLT	<---	OFLT	0.717	0.001**
OR_OFLT	<---	OFLT	0.752	0.001**
LOC_OFLT	<---	OFLT	0.704	0.001**
II_OFLT	<---	OFLT	0.708	0.001**

Note: ** $p < 0.01$

6.11.8 Alternative model 7 (excluding path between IS and POF)

Figure 6.21 shows the alternative model 7 and the value of the figure is rounded up by AMOS version 22. The non-significant path between IS and POF was removed. As can be seen in Table 6.38, all path coefficients were statistically significant at the 0.01. Comparing with the structural path model, the path coefficient between II and POF, II and OFLT, LOC and POF, and LOC and OFLT, O_R and POF, and O_R and OFLT became stronger except the path coefficient between IS and OFLT. The data fitted the model very well, with χ^2 = 294.645, df = 196, p = 0.000, χ^2/df (<3) = 1.503, GFI = 0.941, AGFI (>0.9) = 0.924, NFI = 0.937, PCLOSE = 1, RMSEA (<0.08) = 0.034, RMSR = 0.009, TLI (>0.95) = 0.974, and CFI (>0.9)= 0.978. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 7 had not an adequate level of empirical support because Chi-square probability level (χ^2) was less than 0.05 (p = 0.000).

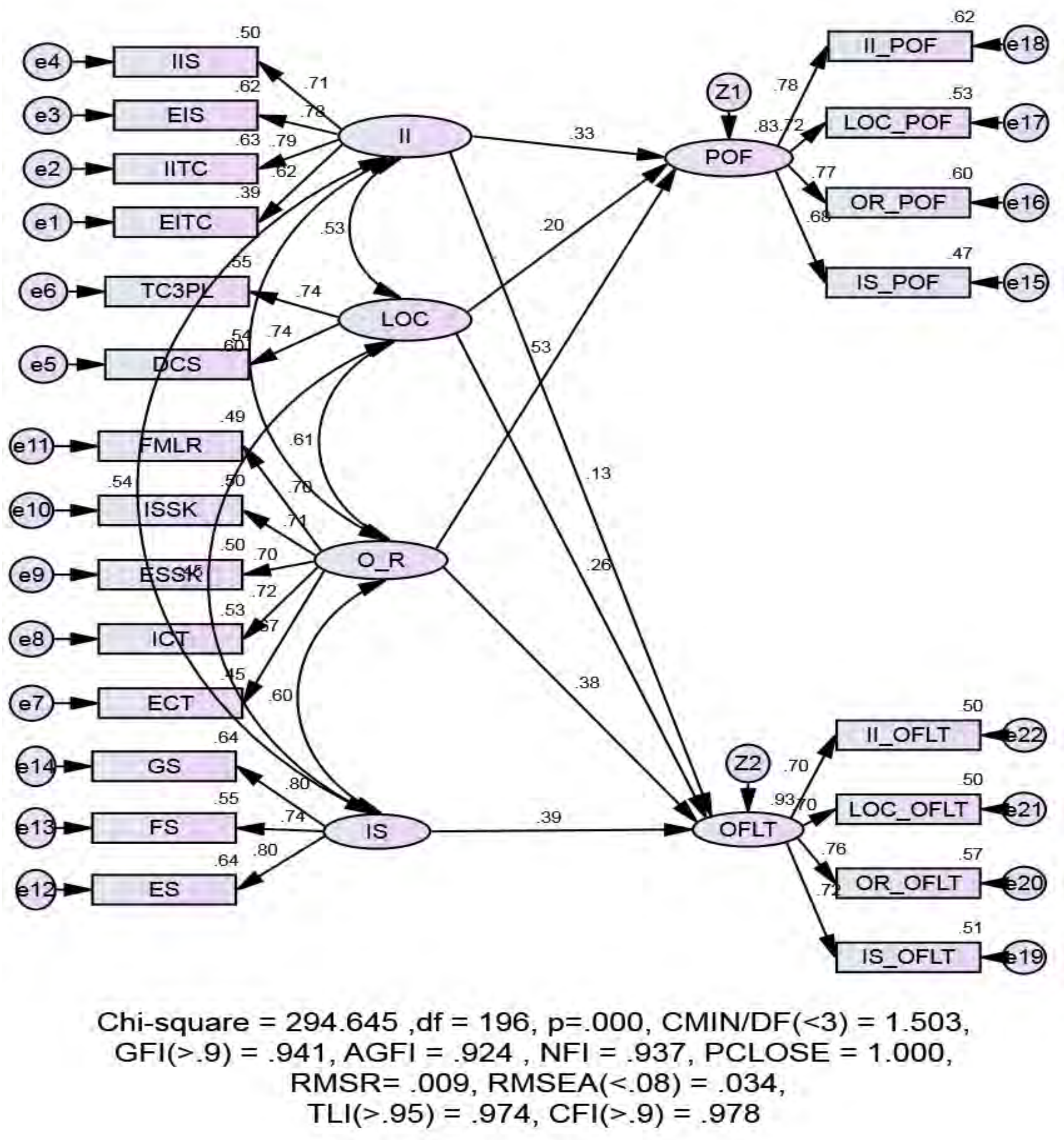


Figure 6.21: Alternative model 7

Table 6.38: Standardised loading and p-value of alternative model 7

Factor relationship			Standardised loading	P-value
OFLT	<---	IS	0.395	0.001**
POF	<---	II	0.326	0.001**
OFLT	<---	II	0.132	0.009**

POF	<---	LOC	0.201	0.001**
OFLT	<---	LOC	0.258	0.001**
POF	<---	O_R	0.529	0.001**
OFLT	<---	O_R	0.380	0.001**
EITC	<---	II	0.624	0.001**
IITC	<---	II	0.794	0.001**
EIS	<---	II	0.784	0.001**
IIS	<---	II	0.708	0.001**
DCS	<---	LOC	0.736	0.001**
TC3PL	<---	LOC	0.740	0.001**
ECT	<---	O_R	0.671	0.001**
ICT	<---	O_R	0.725	0.001**
ESSK	<---	O_R	0.704	0.001**
ISSK	<---	O_R	0.708	0.001**
FMLR	<---	O_R	0.698	0.001**
ES	<---	IS	0.801	0.001**
FS	<---	IS	0.744	0.001**
GS	<---	IS	0.802	0.001**
IS_POF	<---	POF	0.682	0.001**
OR_POF	<---	POF	0.775	0.001**
LOC_POF	<---	POF	0.725	0.001**
II_POF	<---	POF	0.785	0.001**
IS_OFLT	<---	OFLT	0.717	0.001**
OR_OFLT	<---	OFLT	0.755	0.001**
LOC_OFLT	<---	OFLT	0.704	0.001**
II_OFLT	<---	OFLT	0.704	0.001**

Note: ** $p < 0.01$

6.11.9 Alternative model 8 (excluding path between IS and OFLT)

Figure 6.22 shows the alternative model 8 and the value of the figure is rounded up by AMOS version 22. The non-significant path between IS and OFLT was removed. As can be seen in Table 6.39, all path coefficients were statistically significant at the 0.01. Comparing with the structural path model, the path coefficient between II and POF, II and OFLT, LOC and POF, and LOC and OFLT, O_R and POF, and O_R and OFLT became stronger except the path coefficient between IS and POF. The data fitted the model very well, with χ^2 = 316.018, df = 196, p = 0.000, χ^2/df (<3) = 1.612, GFI = 0.938, AGFI (>0.9) = 0.920, NFI = 0.933, PCLOSE = 0.997, RMSEA (<0.08) = 0.038, RMSR = 0.010, TLI (>0.95) = 0.968, and CFI (>0.9)= 0.973. Based on the goodness-of-fit indices (see in Table 6.2), it able to be concluded that the alternative model 8 had not an adequate level of empirical support because Chi-square probability level (χ^2) was less than 0.05 (p = 0.000).

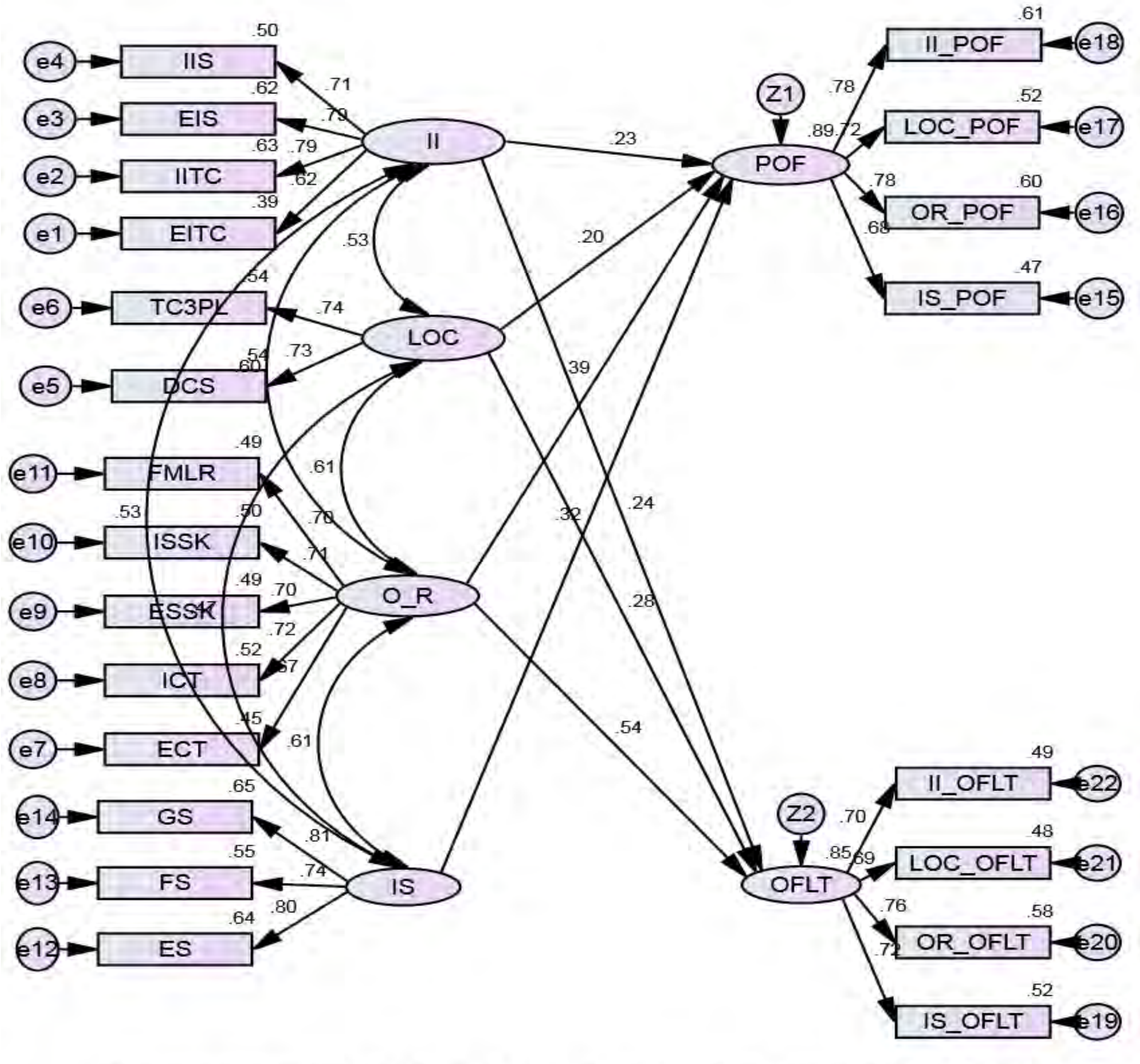


Figure 6.22: Alternative model 8

Table 6.39: Standardised loading and p-value of alternative model 8

Factor relationship			Standardised loading	P-value
POF	<---	II	0.234	0.001**
OFLT	<---	II	0.240	0.001**
POF	<---	LOC	0.197	0.001**

OFLT	<---	LOC	0.280	0.001**
POF	<---	O_R	0.392	0.001**
OFLT	<---	O_R	0.544	0.001**
POF	<---	IS	0.318	0.001**
EITC	<---	II	0.625	0.001**
IITC	<---	II	0.794	0.001**
EIS	<---	II	0.787	0.001**
IIS	<---	II	0.707	0.001**
DCS	<---	LOC	0.733	0.001**
TC3PL	<---	LOC	0.736	0.001**
ECT	<---	O_R	0.671	0.001**
ICT	<---	O_R	0.725	0.001**
ESSK	<---	O_R	0.703	0.001**
ISSK	<---	O_R	0.707	0.001**
FMLR	<---	O_R	0.697	0.001**
ES	<---	IS	0.798	0.001**
FS	<---	IS	0.744	0.001**
GS	<---	IS	0.806	0.001**
IS_POF	<---	POF	0.682	0.001**
OR_POF	<---	POF	0.776	0.001**
LOC_POF	<---	POF	0.724	0.001**
II_POF	<---	POF	0.784	0.001**
IS_OFLT	<---	OFLT	0.720	0.001**
OR_OFLT	<---	OFLT	0.762	0.001**
LOC_OFLT	<---	OFLT	0.694	0.001**
II_OFLT	<---	OFLT	0.703	0.001**

Note: ** $p < 0.01$

Table 6.40: The comparison of alternative models using Chi-square difference test

Model	Chi-square	df	Chi-square difference	df difference	P-value	Chi-square difference tests, α = 0.05
Figure 6.14 Structural Path model	214.961	195	-	-	-	-
Figure 6.15 Alternative model 1	232.371	196	17.410	1	0.000	Significant
Figure 6.16 Alternative model 2	219.659	196	4.698	1	0.030	Significant

Figure 6.17 Alternative model 3	227.540	196	12.579	1	0.000	Significant
Figure 6. 18 Alternative model 4	236.554	196	21.593	1	0.000	Significant
Figure 6.19 Alternative model 5	247.971	196	33.010	1	0.000	Significant
Figure 6.20 Alternative model 6	244.924	196	29.963	1	0.000	Significant
Figure 6.21 Alternative model 7	294.645	196	79.684	1	0.000	Significant
Figure 6.22 Alternative model 8	316.018	196	101.057	1	0.000	Significant

Note: P-values can be calculate in MS Excel formula [= CHIDIST (Chi-square difference, df difference]. If the chi-square difference is significant, p-value is less than 0.05 (Werner & Schermelleh-Enge 2010).

Table 6.41: The comparison of alternative models in the goodness-of-fit indices

Model	χ^2	*df*	*p*	χ^2/df	**RMSEA**	**GFI**	**TLI**	**CFI**	**Conclusion**
Structural Path model	214.961	195	0.156, 0.463*	1.102	0.015	0.957	0.995	0.996	Fit supported
Alternative model 1	232.371	196	0.039, 0.279*	1.186	0.021	0.953	0.990	0.992	Fit supported
Alternative model 2	219.659	196	0.118, 0.408*	1.121	0.017	0.956	0.994	0.995	Fit supported
Alternative model 3	227.540	196	0.061, 0.348*	1.161	0.019	0.955	0.992	0.993	Fit supported
Alternative model 4	236.554	196	0.025, 0.234*	1.207	0.022	0.953	0.989	0.991	Fit supported
Alternative model 5	247.971	196	0.007, 0.129*	1.265	0.025	0.950	0.986	0.988	Fit supported
Alternative model 6	244.924	196	0.010, 0.149*	1.250	0.024	0.951	0.987	0.989	Fit supported
Alternative model 7	294.645	196	0.000, 0.020*	1.503	0.034	0.941	0.974	0.978	**Fit not supported**
Alternative model 8	316.018	196	0.000, 0.005*	1.612	0.038	0.938	0.968	0.973	**Fit not supported**

Note: * Bollen-Stine p-value [it should be greater than 0.05 to accept the model (Byrne 2001)]

In summary, alternative models consist of nine models that include a structural path model and eight alternative models. Chi-square difference test between structural path model and alternative models is presented in Table 6.40. The results can be concluded that alternative models are NOT significantly different than the structural path model. The structural path model therefore is preferred in this research. Moreover, Table 6.41 also confirms that the structural path model is the best-fit path model. The model has a satisfactory fit with χ^2 = 214.961, df = 195, p = 0.156, χ^2/df (<3) = 1.102, GFI = 0.957, AGFI (>.9) = 0.944, NFI = 0.954, PCLOSE = 1, RMSEA (<0.08) = 0.015, RMSR= 0.006, TLI (>.095) = 0.995, and CFI (>.9) = 0.996 (Figure 6.14).

6.12 Research hypotheses testing

Based on the results presented in Table 6.42, several conclusions can be drawn.

Hypothesis 1 is supported, as the results confirm that information integration (II) has a direct impact on perfect order fulfilment (POF). The standardised coefficient is 0.21, which is statistically significant at $p < 0.01$ (t = 4.12).

Hypothesis 2 is supported, i.e., information integration (II) has a direct impact on order fulfilment lead times (OFLT). The standardised coefficient is 0.11, which is statistically significant at $p < 0.05$ (t = 2.22).

Hypothesis 3 is supported, as the results obtained in the study confirmed that logistics operations coordination (LOC) has a direct impact on perfect order fulfilment (POF). The standardised coefficient is 0.19, which is statistically significant at $p < 0.01$ (t = 3.51).

Hypothesis 4 is supported, i.e., logistics operations coordination (LOC) has a direct impact on order fulfilment lead times (OFLT). In addition, the standardised coefficient is 0.26, which is statistically significant at $p < 0.01$ (t = 4.51).

Hypothesis 5 is supported, which indicates that organisational relationship (O_R) has a direct impact on perfect order fulfilment (POF). The standardised coefficient is 0.35, which is statistically significant at $p < 0.01$ (t = 5.73).

Hypothesis 6 is supported, as the study findings confirm that organisational relationship (O_R) has a direct impact on order fulfilment lead times (OFLT). Moreover, the standardised coefficient is 0.35, which is statistically significant at $p < 0.01$ ($t = 5.61$).

Hypothesis 7 is supported, i.e., institutional support (IS) has a direct impact on perfect order fulfilment (POF). The standardised coefficient is 0.41, which is statistically significant at $p < 0.01$ ($t = 8.14$).

Hypothesis 8 is supported, as the analyses results confirm that institutional support (IS) has a direct impact on order fulfilment lead times (OFLT). The standardised coefficient is 0.47, which is statistically significant at $p < 0.01$ ($t = 9.14$).

Table 6.42: Summary of results of hypotheses testing

Hypothesis	**Relationship**	**Total effect (t-value)**	**Direct effects (t-value)**	**Indirect effect**	**Hypothesis testing results**
H1	II→POF	0.21** (4.12)	0.21** (4.12)	0	Supported
H2	II →OFLT	0.11* (2.22)	0.11* (2.22)	0	Supported
H3	LOC→POF	0.19** (3.51)	0.19** (3.51)	0	Supported
H4	LOC→OFLT	0.26** (4.51)	0.26** (4.51)	0	Supported
H5	O_R→POF	0.35** (5.71)	0.35** (5.71)	0	Supported
H6	O_R→OFLT	0.35** (5.61)	0.35** (5.61)	0	Supported
H7	IS→POF	0.41** (8.14)	0.41** (8.14)	0	Supported
H8	IS→OFLT	0.47** (9.14)	0.47** (9.14)	0	Supported

Note: ** $p < 0.01$, * $p < 0.05$

6.13 Summary

This chapter presents SEM analyses that were conducted in this study in order to answer the research questions. First, CFA was performed to confirm the validity and reliability of the measurement items (observed variables) of each construct using AMOS 22. The measurement models pertaining to each construct were finalised by considering model fit indices and construct reliability and validity assessment. In the next step, the final measurement model, comprising general structural path models, was described, resulting in the SEM model. The modelling procedure was finalised by comparing the structural path model with the eight models that were developed as alternatives. The findings confirmed that none of the alternative models produced output that was significantly different to that obtained through the structural path model. Thus, the structural path model is confirmed to provide the best fit to the data. Consequently, this model was used to test the hypothesised relationship among the study constructs. The analysis results confirmed that information integration (II), logistics operations coordination (LOC), organisational relationships (O_R), and institutional support (IS) can have a direct effect on perfect order fulfilment (POF). Moreover, information integration (II), logistics operations coordination (LOC), organisational relationships (O_R), and institutional support (IS) can directly impact on order fulfilment lead times (OFLT).

CHAPTER 7

DISCUSSION

7.0 Introduction

This chapter discusses the research results reported in Chapter 5 and 6. It commences by briefly revisiting the research framework adopted, before presenting the results of hypothesis testing and stating theoretical and practical implications of the research findings. In particular, the results yielded by structural equation modelling are discussed in detail, as these can be employed in practice, as a means of improving logistics distribution in the Thai egg semi-industrial setting and other industries related to perishable goods.

7.1 Research framework

The conceptual framework underpinning this study is based on four extant theories: resource dependence theory (RDT), resource-based view (RBV), institutional and SCM theory. The study objective was to examine the relationship among information integration, logistics operations coordination, organisational relationships, institutional support, and logistics performance measurement (as indicated by perfect order fulfilment and order fulfilment lead times), aiming to identify the organisational changes and strategies for improving the logistics performance in the Thai semi-industrial egg distribution chain.

In order to meet these objectives, a research framework was developed based on the following six variables (constructs) obtained from extant literature and theory. The framework consists of four independent and two dependent variables (see Figure 3.5). The independent variables are: (1) information integration (based on RDT, RBV, and SCM), (2) logistics operations coordination (based on RDT, RBV, and SCM), (3) organisational relationships (RDT, RBV, and SCM), and (4) institutional support (based on RDT, and institutional theory). The dependent variables consist of (1) delivery reliability (perfect order fulfilment), and (2) responsiveness (order fulfilment lead times) (see Figure 3.1).

These constructs were utilised in the development of the final model, which is analytically proven to provide the best fit to the data. This has been ascertained by developing eight alternative models against which the final model has been tested as a part of this research. In addition, the final model yielded results that were aligned with the theories underpinning this research. Most importantly, its application could assist in improving logistics performance in the Thai semi-industrial egg distribution chain. In sum, the present study examined the conceptual framework based on RDT, RBV, SCM and institutional theory to provide the final model (path model) that represents logistics integration strategy underpinned by the aforementioned theories. Thus, it can be implemented in order to improve logistics performance in Thai semi-industrial egg distribution. The model presents the relationships among constructs that are discussed in the next section.

7.2 Discussion on research questions and hypotheses

The findings of this study aim to reveal the relationship among information integration, logistics operations coordination, organisational relationships, institutional support, and logistics performance measurement (perfect order fulfilment, order fulfilment lead times) in the Thai semi-industrial egg distribution chain logistics operations. The specific research questions of this study is:

- Which factors have the potential to significantly affect information integration, logistics operations coordination, organisational relationships, institutional support, perfect order fulfilment, and order fulfilment lead times with the goal of improving logistics distribution?

In order to answer these questions, this study examines the following hypotheses:

I. Does information integration influence perfect order fulfilment and order fulfilment lead times?

II. Does logistics operations coordination influence perfect order fulfilment and order fulfilment lead times?

III. Does organisational relationship influence perfect order fulfilment and order fulfilment lead times?

IV. Does institutional support influence perfect order fulfilment and order fulfilment lead times?

The study findings confirm that the path model (the best-fit model) is able to answer the above research questions. It reveals that information integration, logistics operations coordination, organisational relationships and institutional support have influence on perfect order fulfilment and order fulfilment lead times.

7.2.1 The best fit conceptual framework

Structural equation modelling (SEM) was discussed in Chapter 6, where the model depicted in Figure 6.14 was shown to be the best-fit model for logistics integration for improving distribution performance in the context of Thai egg industry. This comprehensive foundation allowed creating a model that fully explains the relationship that information integration, logistics operations coordination, organisational relationship and institutional support have with the delivery reliability/perfect order fulfilment and responsiveness, commonly referred to as order fulfilment lead times. The fit indices (i.e., CFI, TLI, χ^2, *CMIN/df*, GFI, RMSEA, PCLOSE, AGFI, and NFI) of the statistical results presented in Chapter 6 and depicted in Figure 6.14 pertain to the best-fit conceptual framework. Parameters χ^2 (214.961), *CMIN/df* (1.102), GFI (0.957), RMSEA (0.015), and PCLOSE (1.000) of the model confirm that the theories underpinning this study (RDT, RBV, and SCM) are a very good fit for the data pertaining to the Thai semi-industrial egg production and distribution (McDonald & Ho 2002, Hair et al. 2010). NFI (0.954), TLI (0.995) and CFI (0.996) identify all measured variables in the best fit model (IIS, EIS, IITC, EITC, TC3PL, DCS, FMLR, ISSK, ESSK, ICT, ECT, GS, FS, ES, II_POF, LOC_POF, OR_POF, IS_POF, II_OFLT, LOC_OFLT, OR_OFLT, IS_OFLT, II, LOC, O_R, IS, POF, and OFLT) and confirm that they are unrelated to each other (Miles & Shevlin 2007, Hair et al. 2010). In addition, AGFI (0.944) indicates that the best fit model is not similar to any other model developed as a part of this investigation. In addition, it captures all Thai semi-industrial egg production elements (Byrne 2010, Hair et al. 2010). It should also be noted that, in order to verify that the final model yields the best fit to the data, an additional check is conducted by excluding one of the links at a time between the constructs (Li et al. 2006). The results presented in Table 6.31 and depicted in Figure 6.14 (structural path model) demonstrate that final model is indeed the best fit model for this study. Thus, by confirming that the structural path model is the best fit for the study, it is viable to answer the research questions and describe the relationship among the key constructs. This, in turn, provided support for the hypotheses tested in this study.

7.2.2 Factors significantly improve logistics distribution

(i) Information integration

The research results revealed that information integration is significantly explained by four dimensions, namely internal IT capability (standardised loading, $\beta = 0.798$, $p < 0.01$), external information sharing (standardised loading, $\beta = 0.791$, $p < 0.01$), internal information sharing (standardised loading, $\beta = 0.706$, $p < 0.01$), and external IT capability (standardised loading, $\beta = 0.626$, $p < 0.01$).

The questionnaire responses given by farmers, wholesalers, and retailers participating in the semi-industrial Thai egg distribution chain revealed that, in terms of the internal and external IT capability, they mostly rely on the information and communication technologies and devices (e.g., landline phone, fax, mobile, smart phone, computer, software, etc.). In Thailand, these resources are used to receive orders or to communicate with their staff/employees, and their business partners (farmers, wholesalers, transporters, and/or retailers). Thus, it can be conclude that more effective use of these information technology resources could improve logistics distribution performance such as reduction of customer order lead time and improvement of customer order responsiveness. This finding for agricultural logistics integration is in line with the findings reported for other sectors (i.e. electronic, machinery, automotive, chemical, food processing, construction, logistics, wholesaler trading, and other manufactures) by Piccoli and Ives (2005), Wong et al. (2011), Prajogo and Olhager (2012) and Rai et al. (2012); which suggest that both internal and external IT capabilities are of vital importance in supply chain management. In this context, IT capabilities refer to technical skills on IT, IT management skills, and relationship assets of all relevant employees/staff, as well as business partners. Thus, possessing the necessary resources and ability to utilize them effectively able to improve the performance of organisations. In addition, IT capability is posited to help create great relational value in the logistics process by facilitating the flows of physical goods, information, and finances across locations. However, in order for technology to be utilised to its full potential, employees/staff and business partners need to be familiar with, and have access to, telephone and fax, mobile, the Internet, e-mail, etc. (Evangelista & Kilpala 2007). When utilized effectively, IT capabilities can help create competitive advantages by increasing profits while reducing costs (Piccoli & Ives 2005). However, firms aiming to expand their IT resources need to consider some disadvantages, such as cost of acquisition and implementation and training staff in new technical skills. Firms need to consider suitability of technology with respect to meeting the company needs, such as functions it would improve, costs that could potentially reduce, and the ability of IT users to fully benefit from new systems (Piccoli & Ives 2005).

Regarding internal and external information sharing, the survey respondents indicated that they provide their staff/employees with any egg distribution information (such as share product planning, exchange distribution information, and share sensitive information (financial, service, design, research, and/or competition) with staffs and business partners (farmers, wholesalers, transporters, and/or retailers)) that is deemed helpful in improving logistics performance. They also noted that they willingly share sensitive information (financial, service, design, research, and/or competition) with their business partners (e.g., farmers, wholesalers, transporters, and/or retailers). They also keep each other informed about any current or foreseen changes in the egg distribution system. This finding provides empirical validation previous studies, such as those conducted by Germaim and Lyer (2006) and Prajogo and Olhager (2012), whose results indicated that both internal and external information are significant in logistics performance. The intra-organizational information sharing, at company, department and employee level is also essential if the aim is to increase the effectiveness of logistic performance. Business partners must be aware of the importance of information exchange, as only full cooperation will allow all parties in the distribution chain to fully benefit from logistics distribution. However, sensitive information must be safeguarded from unauthorised access, in order to protect all chain participants (Prajogo & Olhager 2012).

Information integration refers to the sharing of key information along the supply chain network, enabled by the use of information technology (IT) in logistic integration, aimed at enhancing performance of all chain participants (Prajogo & Olhager 2012). In this work, that strategy was based on RDT, RBV, and SCM theories. From the SCM perspective, this approach can be defined as an integrated supply chain that allows information sharing, allowing all functions to be performed more efficiently. This, in turn, ensures timely and efficient system flows across the supply chain by utilization of information technology (Peterson 2002, Reyes et al. 2002). This study revealed that the information integration achieved via the use of IT and information sharing can assist with better logistics integration and thus support Thai egg industry members in terms of both intra- and extra-organisational logistic performance. Moreover, RBV emphasises the role of resources that must be valuable, rare, inimitable and capable of achieving a sustained competitive advantage (Barney 1991). In the context of this study, when firms use IT support, they can improve their performance and, in turn, enhance their competitive advantage (Rivard et al. 2006). The results yielded by this study confirmed that IT plays a significant role in improving information flow within the egg distribution chain. This increased efficiency help farmers, wholesalers and retailers with improving their respective operations due to being able to receive all information and communicate any changes/needs in a timely manner. Finally, from the RDT theory perspective, as firms depend on their environment for success and survival, they must react to changes in the supply of resources (Pfeffer & Salancik 1978). Thus, as farmers, wholesalers and retailers share information in the egg distribution chain for operational success, they are more likely to respond to any changes in resource availability, which in turn minimises the risk of not being able to meet customer needs.

In summary, in terms of the ability to affect the logistics distribution performance, internal IT capability is much more significant than external IT capability, because the knowledge and functions involved are different and information is often much more sensitive. However, chain participants must understand that their technical skills and costs involved in adopting technology may affect not only their performance but also that of their partners (Piccoli & Ives 2005). This effect is less significant in internal IT implementation, as company staff/employees tend to use similar technology and those that are not familiar with it can be given support and advice. On the other hand, farmers, wholesalers, and retailers typically use different IT and if their approaches to solutions are not aligned, they cannot derive the full benefit from IT. This view is confirmed by the survey respondents, most of whom believe that internal IT capability is the most significant in egg logistic distribution. On the other hand, internal and external information sharing are given similar importance. Finally, the respondents agreed that information sharing is essential if the individual firm (employees/staff) and the chain as a whole (farmers, wholesalers, retailers and 3PL) is to improve egg distribution effectiveness.

(ii) Logistics operations coordination

Logistics operations coordination is significantly explained by two dimensions: namely transportation cooperation with 3PL (standardised loading, $\beta = 0.749$, $p < 0.01$), and distribution centre sharing (standardised loading, $\beta = 0.735$, $p < 0.01$).

Regarding transportation cooperation with 3PL in egg supply chain, the survey respondents indicated that they aimed to use transport cooperation with 3PL for egg distribution. Because of economies of scale and financial capacity, semi-industrial egg firms of small and medium size prefer not to have their own transport. Hence, for these firms, collaboration with 3PL is particularly beneficial, as it can reduce investment costs, while improving operations. This finding provides empirical validation for several previous studies, such as those conducted by

Fabbe-Costes et al. (2009), Fabbe-Costes & Roussat (2011) . These papers indicated that firms needed to use 3PL in order to improve customer satisfaction and logistic performance. In their view, this can help reduce investment costs, inventory levels, order cycle time and lead times.

When asked to share their views on distribution centre sharing, the respondents indicated their willingness to share distribution centres/warehouses in order to improve egg distribution effectiveness. This finding is consistent with those reported by the studies of Vereecke et al. (2008), they suggested that firms share distribution centres with other firms. In particular, the authors indicated that sharing order management, transportation, warehousing activities, and value-added logistics is essential for enhancing the physical distribution operations.

Logistics operations coordination refers to the cooperation in the context of logistic operations between firms and logistic providers/other firms. When executed correctly, it is expected to result in more standardised services, more segmented markets, as well as more intense competition, as the products and services provided can be more versatile, efficient and cost-effective (Mortensen & Lemoine 2008). In this work, the strategy for achieving optimal logistics operations coordination was based on the RDT, RBV, and SCM theories. From the perspective of the SCM theory, the aim is to achieve coordination of the traditional business functions and activities across all business functions included in the supply chain (Mentzer et al. 2001). In the context of the present study, this implies that the farmers, wholesalers, and retailers should focus on sharing the warehouse with other organisations and cooperate in the logistics activities with 3PLs in the egg distribution chain. On the other hand, from the RBV perspective organisations should start from the position that resources are valuable, inimitable, rare, and non-substitutable for creating competitive advantages (Barney 1991). In case, the organisations are the lack of effectiveness resources that they have to cooperate with the outsourcing provider/other organisations for achievement competitive advantage(Bustinza et al. 2010). For example, using 3PL service and external operations cooperation (Rungtusanatham et al. 2003, Wong & Karia 2010). In this study, this means that farmers, wholesalers and retailers should coordinate with firms to create more effective warehouse management. Moreover, as they tend to lack the necessary resources (i.e., financial means and equipment) for accomplishing optimal logistics performance, in order to create competitive advantage they should focus on cooperation with 3PLs. Finally, from the perspective of the RDT theory, firms should strive toward vertical integration and joint ventures with other firms, as this maximises their survival potential (Pfeffer & Salancik

1978). When this theory is applied to the present study, it implies that small- and medium-sized egg farms should strive to cooperate with 3PLs and share warehouse resources, as this will assist them in improving logistics effectiveness and reducing logistics costs. In summary, the survey respondents intend to collaborate with the 3PL and share distribution centres with their partners for improving egg distribution.

In the Thai context, 3PL still lags behind the equivalent initiatives in the USA and European countries that have been using 3PL for many years. As a result, in these regions, 3PL has already gained maturity, while in Thailand, 3PL is still in treated as an emerging industry (Setthakaset & Basnet 2005). The 3PL providers in Thailand that took part in the study conducted by Natejumnong et al. (2002) indicated that majority of the outsourced logistics contracts focused on physical processes, such as materials handling, storage, cycle counting, picking and packing, dispatching, customer delivery, and returns collection. Most Thai companies employing 3PL are of medium to small size and tend to operate in the manufacturing sector. According to Setthakaset and Basnet (2005), the most frequently utilized services are transportation, packaging and warehousing operations. The authors also noted that Thai firms rarely rely on 3PL for provision of inventory management and information systems. However, in the Thai agricultural sector (especially in businesses dealing with highly perishable goods, such as poultry, prawns, pork, and eggs), several large companies, such as Charoen Pokphand Group (CP group), Tesco, Carrefour, and Big C, are already using 3PL, primarily employing well-established service providers, such as Linfox and Toll. While these modern trade retailers can capitalize on their extant resources and connections to keep the cost of 3PL to a manageable level, others can benefit from their experience and outsource at least part of their operations. For example, Thailand has a very well developed road system, and sharing transport operations with the chain partners can lead to a dramatic reduction in logistics-related costs, while also ensuring quicker turnaround times (Lovell 2011). As this study has shown, farmers, wholesalers, and retailers operating in the Thai semi-industrial egg sector aim to use 3PL to improve egg distribution for reducing logistics cost. However, while this statement was given by 429 organizations, only 72 (17.2%) actually used 3PL prior to the participation in this research. This low utilisation of 3PL is likely due to the limited awareness of providers in their area, while many participants might also be concerned about the quality of services such companies would offer. It is thus recommended that they utilize Linfox and Toll, as both companies already have good reputation in this field and are providing 3PL services for the CP group and all their retailers across Thailand (Lovell 2011).

(iii) Organisational relationship

The study findings indicated that organisational relationship is significantly explained by the following five dimensions: promoting teamwork internally along the supply chain and crating cross-functional teams (standardised loading, $\beta = 0.728$, $p < 0.01$), internal sharing of skills/ideas, knowledge/experience (standardised loading, $\beta = 0.716$, $p < 0.01$), external sharing of skills/ideas, knowledge/experience (standardised loading, $\beta = 0.713$, $p < 0.01$), forging and maintaining long-term relationships (standardised loading, $\beta = 0.706$, $p < 0.01$), and creating teamwork externally, along the supply chain and cross-functional teams (standardised loading, $\beta = 0.677$, $p < 0.01$).

For creating teamwork, both internally and externally, along the supply chain and cross-functional teams, the respondents suggested (1) providing training for their employees, (2) enhancing cooperation in logistics distribution by placing a new employee into an existing team whose members are experienced, (3) encouraging staff members to help each other to improve their skills related to logistics performance, and (4) frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making. Moreover, the respondents indicated that their respective organisations enhanced teamwork among all supply chain partners (farmers, wholesalers, 3PL, and/or retailers) through encouraging joint problem solving in egg distribution, and clearly identifying partners' roles and responsibilities. This finding is in line with those reported by several previous studies, including those conducted by Shi and Liao (2013). These authors indicated that creating teamwork along the supply chain and cross-functional teams can improve performance through increased competency, skill development, improved communication, managing diversity, and greater team synergy.

Regarding internal and external sharing of skills/ideas and knowledge/experiences, the respondents indicated that, in order to improve egg distribution efficiency, they were keen to share the skills/ideas and knowledge/experiences with their employees/staff, as well as supply chain partners (farmers, wholesalers, 3PL, and/or retailers). These results are in line with studies conducted by Christopher and Gaudenzi (2009), and Shih et al. (2012). The results yielded by this and similar research confirm that knowledge sharing with customers, suppliers, partners and employees can have significant influence on company performance. However, while knowledge sharing contributes to effective and efficient decision-making, it can only be achieved if a trusting relationship is established among the all parties involved.

When asked about their plans for forging and maintaining long-term relationships, the respondents indicated their willingness to build interpersonal trust to maintain long-term relationships with other egg distribution partners (farmers, wholesalers, 3PL, and/or retailers). More specifically, they intend to do so through sharing confidential information, keeping promises and respecting agreements, keeping interests of all stakeholders in mind, and making frequent social/business contacts with their partners. These findings are consistent with those reported in the study of Kwon (2004). As noted by these authors, firms create trust through forging and maintaining long-term relationships among supply chain partners. In particular, effective logistic delivery is achieved when they share confidential information, keep promises and respect agreements. This level of trust helps firms maintain good working relationships with business partners, thus ensuring effective performance in the long-term.

Organisational relationship is an important aspect of any business operation, as being able to establish trust, stable interactions and transparent relationships among all supply chain partners is crucial for the performance of the entire chain. In particular, this pertains to maintaining long-term relationships, creating teamwork, and sharing of knowledge, skills and ideas based on the RDT, RBV, and SCM theories. (Alfalla-Luque et al. 2013). From the perspective of the SCM theory, the focus should be on managing a network of relationships within individual firms, as well as among interdependent organisations (Stock & Boyer 2009). In other words, effective SCM is built on the foundation of trust, with the latter conveyed through faith, confidence, belief, or reliance (Tyndall et al. 1998). The results obtained in this study revealed that, in the Thai egg supply chain, the participating organisations create trust by maintaining long-term relationships, creating teamwork, and sharing of knowledge, skills and ideas. They do so within individual organisations, as well as with their partners at all levels of the egg distribution chain, as they all aim to achieve effective SCM. Logistics performance is positively impacted by SCM that, it turn, has a positive effect on financial performance (Jr et al. 2008). From the perspective of the RBV theory, firms consist of a collection of heterogeneous resources, which are the main source of competitive advantage (Barney 1991, Peteraf 1993). In that respect, firms seek to increase the competitiveness of their supply chains by working closely and building relationships with their partners (customer and suppliers) (Wang & Chan 2010). In the context of the present study, this means that farmers, wholesalers and retailers can create competitive advantage by building relationships with their partners (themselves) in the egg distribution chain. Finally, according to the RDT postulates, firms can survive or attain a greater success in their sector if they can exploit their dependence on other firms or other firms' dependence on them to attain necessary resources (Ulrich & Barney 1984). Again, with respect to the present study, this indicates that farmers, wholesalers, and retailers must focus on sharing the necessary skills/ideas and knowledge/experiences with their supply chain partners (farmers, wholesalers, and retailers). Only when this is achieved correctly, they will be able to improve SCM through logistics SCI and ensure their survival in the increasingly competitive Thai egg market.

In summary, the respondents maintain internal and external organisational relationships through forging and maintaining long-term relationships, sharing of skills/ideas and knowledge/experience, as well as by creating teamwork along the supply chain and cross-functional teams. In Thai egg distribution, ability to build organisational relationships plays a significant role in enhancing firm's distribution performance. These dimensions of organisational relationship were found to have similar importance in terms of improving logistics performance. On the other hand, creating teamwork externally along the supply chain and cross-functional teams was found to be least significant. This finding is possibly due to the difficulty respondents encounter when trying to create teamwork with business partners. Among potential barriers to creating teamwork along the supply chain, poor alliance management practices and differences in organisational culture and structure of participating firms are likely to be most significant (Fawcett & Magan 2001).

(iv) Institutional support

Institutional support is significantly explained by three dimensions: government support, incentive or policy (standardised loading, $\beta = 0.801$, $p < 0.01$), knowledge support from boards and associations, and educational institutions/educational support (standardised loading, $\beta = 0.800$, $p < 0.01$), and the role of banks/financial services (standardised loading, $\beta = 0.741$, $p < 0.01$).

Regarding government support, incentive or policy, the respondents expect the government to provide programs/research and educational system that can support developing more efficient logistics in Thai egg industry. This result finds empirical validation in several previous studies, in particular those conducted by Ferreira and Tetther (2004) and Elkhouly and Hamdy (2012). These authors indicated that governments play a significant role in the development of different industry sectors. Thus, they are encouraged to undertake policy reform, in particular those pertaining to educational system, training programs and finance, to enable firms along the chain to improve their logistics performance.

Regarding knowledge support from boards and associations, and educational institutions/educational support, the respondents indicated that, in their view, educational institutions should offer vocational education or certificate courses for egg logistics distribution participants. This result is consistent with the findings yielded by the study of Lutz and Birou (2013), which revealed that educational institutions play a significant role in supporting relevant logistics programs aimed at improving knowledge among logistic providers.

With respect of role of banks/financial services, the respondents believe that local banks could assist in making the egg logistics distribution more effective by introducing efficient financial services (i.e., bills of exchange for cash needs, credit/debit cards, facilitating leases) aimed at the distribution chain participants. These findings can be compared with the view of Gregory (2008), whose study indicated that banks should provide credit/debit cards, facilitate leases, and exchange commercial bills for cash needs in order to improve small and medium-sized business performance.

Institutional support is achieved through the relevant institutions and legislative bodies offering help and support to organisations, by instituting rules and laws that assist in more effective business operations, as well as with social and environmental issues. They also offer practical advice and information, education, social networks, etc. This type of assistance is usually offered by state and local government and other powerful organisations (Lau et al. 2002, Cai et al. 2010). In this work, this strategy was based on the RDT and institutional theories. From the RDT perspective, many external factors can have significant influence on organisational behaviour. Consequently, if firms are to prosper and remain competitive in the market, they should collaborate and assist one another (Pfeffer & Salancik 1978). In the context of the present study, this implies that farmers, wholesalers, and retailers should aim to obtain the required resources (financial, logistics, knowledge, policies, laws, etc.) from external organisations (i.e. banks, educational institutions, governmental bodies). The more effective the utilisation of these resources, the greater the likelihood that the partners in the egg distribution chain will remain competitive in the Thai market that is becoming increasingly dominated by large companies. From the institutional theory perspective, by conforming to the rules (i.e., regulatory structures, government agencies, cultural practices, conformance pressures from relevant professional bodies) and norms of the institutional environment, firms are in a better position to secure their position and legitimacy (DiMaggio & Powell 1983, Powell & DiMaggio 1991). In the context of the present study, this indicates that farmers, wholesalers, and retailers should identify the institutions (banks, government, and educational institutions) that can support the egg distribution and approach them for help and assistance. These institutional forces can also impose rules and standards that firms must conform to in order to improve their performance.

In summary, the respondents require the institutions (i.e., banks, educational institutions, government) to provide the services/policies aimed at egg logistics distribution. However, based on the analysis of their survey responses, the role of financial services is the least significant in this respect. This can also be viewed as a barrier, especially in developing countries, where banks tend to provide a lower share of investment loans and to charge higher fees and interest rates to small businesses (Beck et al. 2008).

7.2.3 Logistics performance measurement

The findings of logistics performance measurement pertain to perfect order fulfilment (reliability) and order fulfilment lead times (responsiveness), both of which are treated as dependent variables in the analysis.

(i) Perfect order fulfilment

Perfect order fulfilment is significantly explained by the following four dimensions: information integration through perfect order fulfilment (standardised loading, β =0.784, $p <$ 0.01), organisational relationship through perfect order fulfilment (standardised loading, β = 0.776, $p < 0.01$), logistics operation coordination through perfect order fulfilment (standardised loading, $\beta = 0.724$, $p < 0.01$), and institutional support through perfect order fulfilment (standardised loading, $\beta = 0.683$, $p < 0.01$).

With respect to information integration through perfect order fulfilment, the respondents indicated that they intend to share information with their staff or employees and supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) to ensure that the right quality and quantity of product of products are delivered to the right customer and to the right place (perfect order fulfilment). Moreover, the respondents intend to use appropriate IT resources (mobile phone, smart phone, landline phone, fax, computer & internet) with their staff or employees in order to succeed in perfect order fulfilment in egg distribution. These findings are in line with those reported by Fawcett et al. (2007), who indicated that both internal and external information sharing and IT capability with staff/employees and partners are essential for a company to achieve perfect order fulfilment.

Regarding organisational relationship through perfect order fulfilment, the respondents intend to make sure the perfect order fulfilment by forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers), internal sharing of knowledge and skills, and creating teamwork with their staff/employees and cross-functional teams. This result is consistent with the findings yielded by the studies conducted by Bagchi et al.(2005), as the authors reported that these efforts can significantly improve perfect order fulfilment.

For logistics operations coordination through perfect order fulfilment, the respondents intend to reach perfect order fulfilment by sharing transportation with 3PL, as well as distribution centre/warehouse management and transportation with their partners (farmers, wholesalers, retailers). This is in line with the results reported by Selviaridis et al. (2008) and Wang et al. (2010), who indicated that firms use 3PL to reach perfect order fulfilment in delivery. Similarly, distribution centre sharing has the potential to improve logistic performance and helps achieve perfect order fulfilment (Franklin & Spinler 2011).

Regarding institutional support aimed at perfect order fulfilment, the respondents indicated that support from banks or financial services, government and educational institutions can help them achieve perfect order fulfilment. This finding provides empirical validation for several extant studies in this field. For example, when educational institutions provide logistics management courses aimed at logistics providers, they can help staff/employees improve their knowledge and thus assist companies in reaching the goal of perfect order fulfilment (SCL 2012). Similarly, banks can provide assistance through integration of financial services offered to supply chain partners (e.g., matching financial information, invoice management, cash management, credit assessment, authorising payment with the flows of physical goods), as this can help perfect order fulfilment in transportation (Silvestro

& Lustrato 2014). Firms also need government to provide support through policy by, for example, sponsoring relevant research and ensuring that high quality processes and infrastructure are in place. This will improve logistics for effectiveness and thus its overall performance (Ferreira & Tetther 2004).

Based on SCM theory, in this study, a strategy based on SCM was adopted, as this was deemed the most effective way to support firms in making the key strategic decisions regarding their operations, especially those that can contribute to the perfect order fulfilment. As was previously noted, this goal is most effectively achieved when the firms collaborate with their supply chain partners, as they can share knowledge, skills and resources required for delivering the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer (Supply Chain Council 2010). Based on the findings yielded by the analyses conducted as a part of this study, farmers, wholesalers, and retailers already use SCM through various SCI strategies (information integration, organisational relationship, logistics operations coordination and institutional support) in order to improve their performance and thus achieve perfect order fulfilment.

In summary, perfect order fulfilment in egg distribution can be achieved through information integration, organisational relationship, logistics operations coordination and institutional support.

(ii) Order fulfilment lead times

Order fulfilment lead times are significantly explained by four dimensions: organisational relationship through order fulfilment lead times (standardised loading, $\beta = 0.754$, $p < 0.01$), institutional support through order fulfilment lead times (standardised loading, $\beta = 0.717$, $p < 0.01$), information integration through order fulfilment lead times (standardised loading, $\beta = 0.706$, $p < 0.01$), logistics operations coordination through order fulfilment lead times (standardised loading, $\beta = 0.704$, $p < 0.01$).

Regarding organisational relationship through order fulfilment lead times, the respondents believe that they would be able to decrease the time from receipt of customer order to delivery (order fulfilment lead times) by forging and maintaining long-term relationships with their partners (customers, 3PLs, farmers, wholesalers, retailers); through internal and external sharing of knowledge & skills in logistic distribution chain; and by creating teamwork cross-functional teams with their staff/employees. This result is consistent with the findings reported by Bagchi et al.(2005), Msimangira (2010) whereby these efforts where shown to play s significant role in chain partners' ability to improve order fulfilment lead times.

In terms of the importance of institutional support for improving order fulfilment lead times, the respondents indicated that banks/financial and educational institutional support is essential in achieving this aim. This finding provides empirical validation for previous studies. For example, when educational institutions provide logistics educational services (i.e. courses, research actives, conferences and seminar) logistics providers can gain the necessary knowledge needed to improve/reduce their order fulfilment lead times (SCL 2012). Similarly, through better integration of financial services aimed at supply chains (i.e., matching financial information, invoice management, cash management, credit assessment, authorizing payment with the flows of physical goods) banks can help shorten order fulfilment lead times in transportation (Silvestro & Lustrato 2014). In Thailand, Bank for Agriculture and Agricultural Cooperatives (BAAC) is a specialised agricultural credit institution that was established November 1, 1966. BAAC aims to promote the improved social and economic wellbeing of Thailand's farming population through the provision of financial assistance in the form of loans for agricultural production, investment and marketing purposes. BAAC carries out its agricultural credit and banking mandate by means of a three-tier organisational structure: head office, branch offices (all regions of Thailand) and field offices. BAAC makes various types of loans available to both individual client farmers (i.e., egg farmers) and farmers' institutions such as agricultural cooperatives and farmers associations (BAAC 2015). Moreover, BAAC also provides loans for non-farm activities; for example, BAAC cooperated with Kasertsart University in the research and development of agricultural operational performance. BAAC extends credit to eliminate or reduce informal debt owed by farmers or debt owed to non-financial institutions which may be faced with rising interest rates or locked into complicated contracts. BAAC provides advance cash (emergency cash for household expenses), electronic cards (capable of being used globally), and a new savings scheme, altered from the previously-offered innovative plan (BAAC 2004). As a result, farmers identify the bank as having a significant role in services (credit, loan, cards, and online services) that support their logistics and performance, i.e., buying a vehicle or equipment, improving warehouses and cash flow in their operations. There are egg farmers that used the services of BAAC to invest in their operations (Sriboonchitta & Wiboonpoongse 2008).

Regarding the role of information integration in improving order fulfilment lead times, the respondents indicated that using appropriate IT capability in communication with their staff/employees, as well as information sharing with the supply chain partners (customers, 3PLs, farmers, wholesalers, retailers) is essential in meeting this objective. These findings are comparable with the results of the study conducted by Fawcett et al. (2007), who indicated that information sharing with business partners and optimal IT capability offered to staff/employees can help companies improve order fulfilment lead times.

Finally, the respondents indicated that they aim to use logistics operations coordination by warehouse centre sharing with farmers, wholesalers, and retailers, as well as logistics cooperation with 3PL, as this can improve their logistics performance while reducing order fulfilment lead times. This finding is in line with those reported by Selviaridis et al. (2008) and Wang et al. (2010), who indicated that firms using 3PL can improve their order fulfilment lead times in product delivery. In addition, distribution centre sharing can improve logistic performance, and thus shorten order fulfilment lead times (Franklin & Spinler 2011).

Based on SCM theory, in this study a strategy based on SCM is adopted, as this was deemed the most effective way to support firms in making the key strategic decisions regarding their operations, especially those that can contribute to the order fulfilment lead times. As was previously noted, this goal is most effectively achieved when the firms collaborate with their supply chain partners, as they can share knowledge, skills and resources required for shorter period of logistics to provide products to the customer (Supply Chain Council 2010). Based on the findings yielded by the analyses conducted as a part of this study, farmers, wholesalers, and retailers already use SCM through various SCI strategies (information integration, organisational relationships, logistics operations coordination and institutional support) in order to improve their performance and thus achieve order fulfilment lead time.

In summary, information integration, organisational relationship, logistics operation coordination and institutional support can help distribution chain partners improve order fulfilment lead times.

7.2.4 Key findings to answer the research questions

(i) *Does information integration influence perfect order fulfilment and order fulfilment lead times?*

From analysis it can be seen that, the survey respondents believe that information integration has a positive influence on perfect order fulfilment. This implies that organisations can achieve perfect order fulfilment through more effective information integration. This result can be compareable with the findings reported in the study conducted by Fawcett et al. (2007) using a sample of industrial companies in the US. The authors indicated that information integration has a positive impact on perfect order fulfilment. Even though similar results can be drawn between participants in the Thai egg semi-industrial distribution chain and industrial companies in the US, it is evident that information integration is beneficial in any setting. However, in the context considered in the present study, there are also some notable barriers to sharing information, such as the cost and complexity of implementing advanced systems and systems incompatibility, which can exacerbate the costs (Ives & Junglas 2006, Fabian & Dhillon 2007). There could also be issues with connectivity and lack of understanding among decision-makers regarding the importance of information sharing. In that case, it is unlikely that they would be willing to invest in the necessary resources to achieve more effective information sharing.

Based on their survey responses, the study participants believe that information integration has a positive influence on order fulfilment lead times. This finding indicates that, by information integration, the distribution chain partners can minimise order fulfilment lead times. This finding is supported by the results reported in the study conducted by Fawcett et al. (2007), who indicated that information integration has a positive impact on order fulfilment lead times. Although these authors focused on industrial companies, their findings are still relevant for Thai egg semi-industrial distribution chain, as better utilisation of information can certainly improve order fulfilment lead times. Once again, logistics performance can also be affected by some barriers, which are similar to those affecting the relationship between information integration and perfect order fulfilment, including systems incompatibility and limited willingness of executives to invest in information sharing.

(ii) *Does logistics operations coordination influence perfect order fulfilment and order fulfilment lead times?*

Respondents shared the view that logistics operations coordination has a positive influence on perfect order fulfilment. Thus, it is evident that logistics operations coordination, in terms of sharing warehouse and using 3PLs, can help the partner firms in achieving perfect order fulfilment. Similar findings were reported by Selviaridis et al. (2008), who indicated that logistics operations coordination with 3PL has a positive effect on the firm's ability to achieve perfect order fulfilment. Relying on 3PL improves logistics performance, due to order cycle reduction, volume flexibility, and better capacity utilisation. However, there are some risks in using 3PL, such as disruption to inbound flows, compromised service performance, inadequate provider expertise, loss of customer feedback and inability of the 3PL provider to deal with special product needs. In addition, reliance on 3PL may not bring optimal results in emergency circumstances due to inadequately trained employees, and unwillingness to put sustained time and effort into logistics improvements (Selviaridis & Spring 2007). As a result, the relationship between logistics operations coordination and perfect order fulfilment is not particularly high in this study, as disruptions to inbound flows and inability of 3PL providers to deal with eggs (as a highly perishable product) are notable obstacles.

Based on their survey responses, the study participants believe that logistics operations coordination has a positive influence on order fulfilment lead times. This result confirms that logistics operations coordination plays a significant role in the firms' ability to reduce order fulfilment lead times in logistics operations. This is in line with the findings reported by Selviaridis et al. (2008), who indicated that logistics operations coordination with 3PL can have a positive impact on the company's ability to shorten order fulfilment lead times. While making use of 3PL can improve logistics performance through lead-time reduction, it also exposes the company to some notable risks, such as loss of customer feedback, inadequate provider expertise, and disruption of operations. This is important to farmers, wholesalers and retailers, as eggs are highly perishable and rely on high quality logistics delivery.

(*iii)* *Does organisational relationship influence perfect order fulfilment and order fulfilment lead times?*

Respondents shared the view that organisational relationship has a positive influence on perfect order fulfilment. This means that perfect order fulfilment can be achieved by building and capitalising on organisational relationships. Similar findings were reported by Msimangira (2010), who noted that organisational relationship has a positive impact on the ability to achieve perfect order fulfilment. Firms tend to develop and maintain shared mental framework (ideas/skills) among their employees. While it is more challenging to promote teamwork along the supply chain and cross-functional teams with business partners, this is imperative in order to improve order and delivery flexibility, as well as increase order fill capability. In the context of Thai egg semi-industrial distribution, the link between organisational relationship and perfect order fulfilment is significant, as eggs are highly perishable and must be handled with care throughout the entire chain. Similar requirements were reported by logistics firms in North America, Europe and the Pacific Rim (Bagchi et al. 2005).

The survey respondents are of opinion that organisational relationship has a positive influence on order fulfilment lead times. According to this finding, creating organisational relationship can support the logistics performance and, in turn, lead to shorter order fulfilment lead times. In the studies of Bagchi et al.(2005) similar findings were reported, as the authors found that organisational relationship has a positive impact on the firm’s ability to achieve optimal order fulfilment lead times. As noted above, firms have to strive to promote teamwork both among their staff, as well as with their partners throughout the entire logistics chain, as this is the only way to achieve their goals.

(iv) *Does institutional support influence perfect order fulfilment and order fulfilment lead times?*

Survey responses revealed that the study participants are in agreement that institutional support has a positive influence on perfect order fulfillment. This result indicates that institutional support (banks, educational institutions, and state and local government) is instrumental in organisations’ ability to achieve perfect order fulfilment. This finding provides empirical validation for several previous studies, including those conducted by SCL (2012), and Silvestro and Lustrato (2014), where institutional support (i.e., government, financial institutions, and educational institutions) was positively related to the ability to achieve perfect order fulfilment.

Respondents believed that institutional support has a positive influence on order fulfilment lead times. This finding confirms that order fulfilment lead times in logistics can be achieved by firms that obtain the right type of institutional support. Similar findings are reported in studies conducted by Ferreira and Tetther (2004) and Silvestro and Lustrato (2014), as the authors found that institutional support (namely that provided by financial and educational institutions) was positively related to the firm's ability to improve upon order fulfilment lead times.

7.3 New relationships evolved from this research

Based on the findings discussed in the preceding sections, for agricultural supply chain several new relationships among the constructs are/could be established, and summary of the findings are indicated below.

i) Information integration is related to logistics operations coordination. This findings are in line with the findings reported by Olorunniwo and Li (2010), who noted that firms' ability to share information is significantly and positively related to the extent of their collaboration.

ii) Information integration is related to organisational relationship. This result confirms the findings reported by Cambra-Fierro and Polo-Redondo (2011), who indicated that communication is significantly and positively related to the level of trust among business partners.

iii) Information integration is affected by institutional support. This result is in line with the findings reported by Silvestro and Lustrato (2014), indicating that the role of banks is significantly and positively related to the extent of financial information flow in the supply chain.

iv) Logistics operations coordination is related to organisational relationship. This result confirms the findings of the study conducted by Cambra-Fierro and Polo-Redondo (2011), whereby coordination was significantly and positively related to the level of trust among business partners.

v) Logistics operations coordination is affected by institutional support. This is in keeping with the conclusions of Silvestro and Lustrato (2014), whose study revealed that banks play a significant role in the coordination of financial flows among business partners.

vi) Organisational relationship is influenced by the level of institutional support. The findings of the study conducted by Lutz and Birou (2013) provide support for this result, as the authors indicated that educational institutions providing programs for cross-functional coordination can assist the chain partners in developing skills necessary for creating teamwork.

7.4 Logistics integration factors for Thai Semi-industrial egg production and distribution

This study has yielded some useful results that can inform both researchers and practitioners on the factors affecting the Thai Egg logistics integration and efficiency development. Currently, the semi-industrial egg production and distribution sector is operating in a highly competitive market, dominated by large companies, such as Charoen Pokphand Group (CP) and Betagro Co. Ltd (Singh 2006, Adir 2012), where semi-industrial egg firms presence is declining. For example, in 2011, there were over 47,000 farms (Department of Livestock Development 2011), while only 1,600 commercial farms registered with Department of Livestock Development remained in 2013 (Bureau of Livestock Standards and Certification 2013). In terms of logistics, it is evident that the Thai semi-industrial egg production and distribution lacks integration between internal and external logistics. The main contributor to this shortcoming is inadequate utilisation of information technology (Suthiwartnarueput 2007, Heft-Neal et al. 2008). However, the present study has identified the key factors (information integration, logistics operations cooperation, organisational relationship, and institutional support) required for effective logistic integration, which can improve egg distribution performance (in particular perfect order fulfilment and order fulfilment lead times). For example, institutional support is instrumental in the firms' ability to shorten the order fulfilment lead times and achieve perfect order fulfilment. Thus, governments, banks and educational institutions should use these findings in order to undertake policy reforms, in particular those pertaining to logistics. Additional focus should be on ensuring that the education system is aligned with the industry needs. Further training or short course programs should also be offered on business and finance, in to enable organisations (farms, wholesalers, and retailers) along the egg distribution chain to better structure their operations and fully benefit from the current knowledge in these areas. This, in turn, would allow the industry participants to improve their relationships with customers, as they will be able to supply eggs in the right quality and quantity, to the right customer, within a shorter period, at a lower cost. Moreover, as current study findings have shown, building organisational relationships plays a key role in the firms' ability to improve their performance in egg distribution. Farmers are thus encouraged to create teamwork along the supply chain partners and capitalize on the cross-functional teams, as this would enable sharing of skills and knowledge in egg distribution with staff and partners. Such initiatives also assist with maintaining long-term relationships with all members of the distribution chain, allowing them to establish trust and sense of common purpose. Ultimately, all chain partners strive to deliver eggs in the right quality and quantity, to the right customer, within a shorter period, at a lower cost, as this ensures their competitiveness in the market and guarantees income. The study revealed some additional factors that affect logistics integration and thus support egg distribution performance, aiming to achieve perfect order fulfilment and minimise order fulfilment lead times. The most notable are logistics operations coordination by distribution centre sharing and using cooperation with 3PL, and information integration by information sharing and IT capability. Firms that are using suitable IT (e.g., landline, Fax, mobile, smart phone, computer, software) in communication and sharing information along the egg distribution chain can achieve their goal of delivering the product (eggs) in the right quality and quantity, to the right customer, within a shorter period, at a lower cost.

The findings of this study are also relevant for other food sectors, especially agricultural products with short shelf life (e.g., livestock/fish/poultry and their produce, including fluid milk and milk products, and fresh bakery products) (OTA 1979). Thus, the suggestions for cooperation and integration, especially usage of 3PL, are highly applicable to firms operating in these sectors. For example, CP Group is the parent company of 7-eleven in Thailand and they already benefit from many aspects of logistics integration (such as warehouse sharing, using 3PLs, information sharing and IT capability). This has increased the company’s potential for success as enhanced logistic performance ensures that short shelf life goods (i.e., fluid milk, milk products, fresh bakery products) reach retailers in the most optimal condition (Supasansanee & Kasiphongphaisan 2009). However, large companies can achieve logistics supply integration in their operations, and thus maximise their logistic performance, without much effort and reliance on other parties, due to their size and ample resources. Nonetheless, this strategy can also be implemented by smaller companies willing to collaborate. Indeed, as this study has shown, small and medium organisations can benefit from the same factors (information integration, logistics operations cooperation, organisational relationship, and institutional support) in logistics supply integration and thus improve logistics distribution in other short shelf life products.

This study also revealed that institutional support plays the key role in the ability of small- and medium-sized firms to achieve supply chain integration and improve logistics distribution. In the extant agricultural supply chain integration studies, authors tended to examine factors that affect supply chain integration, including information integration, operations coordination, organisational relationship, institutional support, internal integration and external integration, all of which are significant in achieving supply chain integration (see in Table 2.4, Chapter 2). However, these factors have rarely been studied together, in the context of egg distribution, which makes this research unique. The results of this study are, nonetheless, well aligned with those reported in extant literature. In addition, they also reveal that firms that aim to achieve supply chain integration must address all relevant factors and seek institutional support. They must also be aware of the government regulations and policies in order to remain operational and competitive (Bastian & Zentes 2013, Seed et al. 2013, Codron et al. 2014). In addition, other institutions can be of immense value to companies striving toward agri-supply chain integration, especially financial and educational institutions, as they can provide the products and information needed for achieving this goal. Finally, governments should not adopt only monitoring and control functions, but should aim to assist small- and medium-sized companies in remaining competitive in the agricultural sector, which is becoming increasingly dominated by large corporations.

7.5 Summary

This chapter discussed the key findings of the study with respect to the research objectives, research hypotheses and the conceptual framework underpinning the study. The discussion focused on the significance of relationships among information integration, logistics operations coordination, organisational relationship, institutional support, perfect order fulfilment and order fulfilment lead times.

CHAPTER 8

CONCLUSIONS, IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS

8.0 Introduction

The aim of this final chapter is to provide an overview of the research, as well as summarise the main study findings (CFA, SEM), along with their theoretical and practical implications. The limitations of the study and some suggestions for future research are also discussed.

8.1 Overview of the research

Supply chain management integration has become a competitive advantage tool in many industries. However, agricultural supply chain management integration is often challenging to accomplish in practice, even though such an approach would result in greater effectiveness and improved outcomes. Agricultural products are unique in that they are often perishable; whereby the agricultural logistics integration ensures effective distribution of foods through management of time, temperature and food safety. Hence, the purpose of this research is to develop an approach for effective agricultural supply chain management integration by understanding the factors that affect the agricultural supply chain processes. This is achieved across four key dimensions (information integration, logistics operations coordination, organisational relationship, and institutional support) that influence agricultural logistics integration and have the potential for improving distribution performance such as quick response and reduction of delivery lead-time. This study aims to answer following research questions:

- Which factors have the potential to significantly affect information integration, logistics operations coordination, organisational relationship, institutional support, perfect order fulfilment, and order fulfilment lead times with the goal of improving logistics distribution?
- Would information integration influence perfect order fulfilment and order fulfilment lead times?
- Would logistics operations coordination influence perfect order fulfilment and order fulfilment lead times?

- Would organisational relationship influence perfect order fulfilment and order fulfilment lead times? and
- Would institutional support influence perfect order fulfilment and order fulfilment lead times?.

The study commenced by conducting a comprehensive literature review that focused on the conceptual framework and the key factors that influence logistic distribution performance through supply chain integration. This helped identify the gaps in the extant knowledge in this field and also provided justification for the choice of the study topic. This also enabled choosing the most suitable study methodology, which is quantitative method that incorporated a survey as a data collection instrument. The survey included the key Thai egg semi-industrial parties (farmers, wholesalers, and retailers), who were asked to share their views on the factors that influenced agricultural logistic distribution. The items included in the questionnaire are chosen based on the literature review. The data yielded by the survey was subsequently analysed by mathematical software programs (i.e., SPSS AMOS 22). The study findings were based on the results of CFA and SEM analyses. Thus, the study provided clear understanding of the elements that contributed or hindered supply chain integration in the Thai semi-industrial egg production. The finding can be used for improving logistic performance in this sector. This research assumes importance of perishable agricultural products, specifically eggs, and its findings are expected to fill the gaps in the knowledge of agricultural supply chain management and integration. Most importantly, the results and recommendations yielded can be adopted with the aim of improving agricultural logistics performance. Industry practitioners can benefit from this study, as they can utilize the information presented to design and implement a complete supply chain integration strategy and thus improve logistics performance of the Thai semi-industrial egg production. Finally, it is envisaged that the framework and findings reported here might benefit other agricultural sectors that have similar logistics requirements to those of the egg industry (primarily fresh food items or short shelf-life products).

8.2 Research investigation and results

This empirical exploratory study aimed to explore the relationship among information integration, logistics operations coordination, organisational relationship, institutional support, perfect order fulfilment and order fulfilment lead times in order to design a strategy that could help improve semi-industrial egg production in Thailand. A quantitative research method was employed, whereby a mail questionnaire survey was used as a data collection instrument. The pilot test of the survey was conducted, in which 150 individuals took part, allowing the research instrument to be tested for clarity, completeness and relevance to the phenomenon being investigated. The mailed survey of the pilot study resulted in 44 completed questionnaires, representing a 29.33% response rate. Moreover, the questionnaire was reviewed by the professionals, farmers, wholesalers, retailers and translators in the field to assure its consistency. The data yielded by the pilot survey was analysed in terms of the missing values, multivariate outliers, multivariate normality, multicollinearity, unidimensionality and EFA; for the purpose of data cleaning, and assessing the reliability and validity. The findings were used to modify the original data collection instrument. Finally, the revised version of the questionnaire was mailed to the participants that included farmers, wholesalers and retailers partaking in the Thai semi-industrial egg distribution chain. This survey had the response rate of 26.1%.

The data set obtained from the main survey was analysed in two stages using SPSS and AMOS version 22. In the first stage, the data set was checked for consistency via the missing value, multivariate outliers and multivariate normality assessment, in addition to multicollinearity and unidimensionality tests. The respondents' characteristics were compared and the non-response bias and common method variance assessments were performed, with the aim of data cleaning and data management. EFA was subsequently performed for the purpose of data exploration. In the second stage, the data set was analysed by CFA and SEM. These analyses were employed for the purpose of identifying the latent variables and establishing the relationship (if any) among information integration, logistics operations coordination, organisational relationship, institutional support, perfect order fulfilment and order fulfilment lead times.

8.2.1 Confirmatory factor analysis (CFA) results

The study identified critical factors for achieving information integration, logistics operations coordination, organisational relationship, institutional support, perfect order fulfilment and order fulfilment lead times. Internal information sharing, external information sharing, internal IT capability, and external IT capability are identified as critical factors in achieving information integration, as perceived by the respondents (farmers, wholesalers, and retailers). For logistics operations coordination, transportation cooperation with the 3PL and distribution centre sharing were the most influential. For organisational relationship, forging and maintaining long-term relationships, internal sharing of skills/ideas & knowledge/experience, external sharing of skills/ideas & knowledge/experience, creating internal teamwork along the supply chain and cross-functional teams, and creating external teamwork along the supply chain and cross-functional teams were identified as the key factors. For institutional support, government support, incentive or policy, the role of banks/financial services, and educational institutions/knowledge support from boards and associations were found as most influential. For perfect order fulfilment, information integration through perfect order fulfilment, logistics operations coordination through perfect order fulfilment, organisational relationship through perfect order fulfilment, and institutional support through perfect order fulfilment were identified as the key factors. Lastly, information integration through order fulfilment lead times, logistics operations coordination through order fulfilment lead times, organisational relationships through order fulfilment lead times, and institutional support through order fulfilment lead times were identified as critical factors for improving order fulfilment lead times.

The results of this research also revealed some elements that explained each critical factor, as perceived by the study participants (farmers, wholesalers, and retailers participating in the Thai egg semi-industrial chain). Thus, according to the study findings, under the information integration construct**,** internal and external information sharing should be considered in information integration. In addition, farmers, wholesalers, and retailers should share information with their partners (i.e., staff/employees, farmers, wholesalers, and retailers). Moreover, internal and external IT capability should be incorporated into the information integration strategies. Finally, the participants (i.e., staff/employees, farmers, wholesalers, and retailers) of the egg distribution chain expressed that suitable information and communication technologies (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) are important for improving logistics distribution.

Under logistics operations coordination**,** farmers, wholesalers, and retailers should share the distribution centre/warehouse and transportation with 3PL, other supply chain members for improving logistics distribution.

Under organisational relationship, the participants **(**farmers, wholesalers, and retailers) should build interpersonal trust to maintain long-term relationships with other egg distribution partners (farmers, wholesalers, 3PL, and/or retailers) through sharing business information, keeping promises and respecting agreements, keeping interests of all stakeholders in mind, and making frequent social/business contacts with their partners. In addition, the participants should encourage teamwork within internal cross-functional teams through providing training to their employees, enhancing teamwork in logistics distribution by placing a new employee into an existing team whose members are experienced, encouraging staff members to help each other to improve their skills pertaining to logistics performance, and frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making. The participants should enhance teamwork across the supply chain network (comprising farmers, wholesalers, 3PL, and/or retailers) through encouraging joint problem-solving in egg distribution, and clearly identifying partners' roles and responsibilities. Moreover, the participants should share their skills/ideas and knowledge/experience with their supply chain partners (employees/staff, farmers, wholesalers, 3PL, and/or retailers) for improving egg distribution.

Under institutional support, government and other institutions should provide support to egg industry on capacity building in logistics. Educational institutions should offer vocational education or certificate courses for those aiming to work or currently partaking in the egg logistics distribution. Similarly, banks should introduce efficient financial services (i.e., bills of exchange for cash needs, credit/debit cards, facilitating leases) for improving egg logistics distribution.

Under perfect order fulfilment, the participants should consider information integration as a key aspect of perfect order fulfilment. In addition, all supply chain members should use information sharing and appropriate capability (mobile, smart phone, landline phone, Fax, computer & Internet) in communication with their staff/employees and partners (customers, 3PLs, farmers, wholesalers, and retailers). The aim should be ensuring delivery of the right quality and the quantity of product to the right customer (perfect order fulfilment). Moreover, the participants should be able to achieve perfect order fulfilment by forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers), internal sharing of knowledge & skills and creating teamwork among cross-functional teams that include their staff/employees. The participants should also be able to accomplish perfect order fulfilment by sharing transportation with 3PL, and sharing distribution centre/warehouse management and transportation with their partners (farmers, wholesalers, retailers). In addition, perfect order fulfilment can be assisted by obtaining support from banks, government and educational institutions.

In terms of order fulfilment lead times, the participants (farmers, wholesalers, retailers) should be able to decrease the period from the receipt of customer order to its delivery (i.e., minimise order fulfilment lead times) by forging and maintaining long-term relationships with their partners (customers, 3PLs, farmers, wholesalers, retailers), internal & external sharing of knowledge & skills in logistic distribution chain, and creating teamwork among cross-functional teams that comprise their staff/employees. Moreover, the participants expressed to improve order fulfilment lead times by obtaining support from banks, as well as financial and educational institutions. In addition, it was emphasised to shorten the order fulfilment lead times by using appropriate IT capability when communicating with their staff/employees, in addition to information sharing with their supply chain partners (customers, 3PLs, farmers, wholesalers, retailers). Moreover, egg distribution logistics partners could minimise their order fulfilment lead times by sharing the transportation and distribution centre management with the 3PL, farmers, wholesalers, retailers.

8.2.2 Structural equation modelling results

The SEM approach was employed to generate the best-fit structural model. As presented in Chapter 6, the final structural model (the hypothesised model) indicates that, in the context of the Thai semi-industrial egg logistics distribution, information integration is positively related to perfect order fulfilment (H1). In addition, information integration is positively related to order fulfilment lead times (H2). Logistics operations coordination also has a positive relationship with perfect order fulfilment (H3). Moreover, logistics operations coordination is positively related to order fulfilment lead times (H4). Similarly, organisational relationship has a positive relationship with perfect order fulfilment (H5). In addition, organisational relationship has a positive relationship with order fulfilment lead times (H6). Moreover, institutional support is positively related to perfect order fulfilment (H7). Lastly, institutional support has a positive relationship with order fulfilment lead times (H8). Thus, the final structural model supports all hypotheses (H1-H8) that were tested as a part of this study.

These results indicate that information integration, logistics operations coordination, organisational relationship and institutional support have a positive influence on perfect order fulfilment. Moreover, information integration, logistics operations coordination, organisational relationship and institutional support have a positive influence on order fulfilment lead times in Thai semi-industrial egg distribution.

8.3 Implications for theory and practice

The research findings have significant implications for the theory of supply chain management and the Thai egg semi-industrial distribution practices and can also be informative for other perishable food industries.

8.3.1 Theoretical implications

Previous studies on supply chain integration have yielded very few published articles that address agricultural supply chain integration and there is not enough empirical evidence to prove that extended supply chain integration leads to improved performance (Naslund & Hulthen 2012). Moreover, most extant studies have focused on the relationship between factors affecting supply chain integration and logistics performance in general (such as Stank et al. (2001a), Boon-itt & Paul (2006), Wong et al. (2011), Alfalla-Luque et al.(2013), Prajogo & Olhager (2012)), failing to consider specific demands placed on the agricultural sector and specifically egg production. The strategic fit of supply chain integration leads to the improvement of firms' capability to meet customer requirements (order fulfilment and promised lead time), which implicitly leads to the creation of competitive advantages in the industry (Sha et al. 2008). Therefore, this study attempted to fill the gap in the extant knowledge in this field by focusing on identifying the significant factors in sustainable supply chain integration that affect logistics distribution performance of Thai semi-industrial egg production.

The findings of this study will benefit academic communities, supply chain management & logistics researchers, logisticians and practitioners in related industries. The results reported here provide valuable information that enables the Thai egg industry participants to improve their logistical strategy for integration. The model developed and verified as a part of this study presented a viable strategy for improving logistics performance. The key factors in four dimensions can thus help enhance logistic performance (order fulfilment and promised lead time). The four constructs that are identified as instrumental in meeting this objective are: (1) Information integration, (2) Logistics operations coordination, (3) Organisational relationship, and (4) Institutional support. The results of this study reveal that these four dimensions are essential in improving the logistics performance (order fulfilment and promised lead time). This information thus contributes to the extant knowledge pertaining to the optimal supply chain management strategies, as it offers guidelines for implementing changes and improvements in the supply chain integration in order to achieve effective logistics distribution in Thailand's semi-industrial egg production.

8.3.2 Practical implications

Practical implications arising from the study findings include better logistics performance due to logistic integration, thus benefitting all stakeholders (farmers, distributors, wholesalers and retailers) in the Thai semi-industrial egg supply chain. Logistics integration can also help improve the operational and strategic management of the entire egg supply chain. This, in turn, will enhance order fulfilment capacity, and result in more effective logistics performance. As the study revealed, these industry practitioners can use information integration, logistics operations coordination, organisational relationships, and institutional support as the key elements in improving logistics performance. Institutional support is important for capacity building and running day-to-day logistics operations. Similarly, appropriate information technology utilization can enhance logistics integration by ensuring timely and accurate information flow throughout the entire chain. These small- and medium-sized companies are not vertically integrated. Thus, in order for all stakeholders in the Thai semi-industrial egg production and distribution to benefit from smooth logistics operations, they must be integrated, which can only be achieved through cooperation with 3PLs and other members of the supply chain.

The knowledge gained through this study will help improve logistics performance within the entire supply chain, thus reducing costs, bolstering response to customers' needs, and developing a competitive advantage in Thai egg logistics distribution. Moreover, effective logistics performance in Thailand's semi-industrial egg production system will reduce total logistics costs, as well as increase profits and improve the response to customer needs (order fulfilment). Adoption of these ideas creates competitive advantage to the firms involved in the supply of eggs (in particular those in semi-industrial settings). This semi-industrial egg industry is currently under performing; the number of registered businesses (particularly egg farmers) is decreasing. Through this study, it can be seen that there are room for improvements and particularly this sector can perform better through integration of various dimensions (information integration, logistics operations coordination, organisational relationship, and institutional support) of logistics integration factors. In addition, the outcome is also beneficial to other agricultural sectors that have similar logistics requirements to those of egg distribution (primarily fresh food items or short shelf-life products). This study provides information and knowledge that can be used to improve logistics strategy in many contexts. Hence, recommendations made in this thesis can help achieve marked improvements in efficiency and effectiveness of the participants in the perishable food industries (meat, poultry, fish, dairy products and all cooked leftovers, including eggs).

8.4 Limitations of the study

The findings of this study are significant for academic researchers and practitioners in supply chain management. However, as any study of this type, this research is subject to five key limitations that need to be borne in mind when interpreting its findings.

The first limitation stems from the sample size and analysis methods employed. More specifically, the study participants included farmers, wholesalers, and retailers. Despite their diversity, the respondents' characteristics were compared to ensure that the survey data could be combined in the subsequent analyses. Thus, SEM could be used in interpreting the data, as sample sizes as small as 50 have been previously found to yield valid results in SEM (Hair et al. 2006). Meeting this requirement was essential. Thus, separating the participants into their respective groups would result in very small subsamples, making it inappropriate to use SEM in the analysis. More specifically, only 429 organisations took part in the study, of which 370 were farmers, 24 wholesalers, and 35 retailers. Consequently, although three distinct entities, they formed one study sample for analytical purposes.

Second, the sampling method employed was driven by the relatively small population of interest to this study (1,645 organisations). As the population size was small, it was important to include all its members as potential study participants (Sekaran 2003). Thus, a specific sampling procedure was not employed, as all members of the target population were invited to take part in the study.

The third limitation pertains to the theoretical foundations of the final model developed in the study. The results of the data analyses conducted in this study were used to develop several models against which the final model of supply chain management in the semi-industrial egg production and distribution was tested. As it provided the best fit to the data gathered in the survey, it was deemed suitable for implementation in not only this specific context, but also in other industries that share the conditions and characteristics of the Thai agricultural sector. As Carral and Kajanto (2008) argued, no industry is stable. Thus, it is possible that, as the conditions change, the model developed in this study will no longer yield the same outcomes. In addition, if this strategy is replicated in other industries, it may result in different logistics performance.

The fourth limitation results from the conceptual framework adopted in the study, as empirical evidence indicates that many other factors that have not be included in the model developed in this study can also result in effective logistics performance (Alfalla-Luque et al. 2013). This premise is rooted in the supply chain integration theory. More specifically, the final model of this study revealed that the supply logistics integration was affected by fourteen factors (grouped into four specific dimensions), all of which can help improve the logistics performance in Thai egg-semi industry (see Figure 6.14).

Lastly, this study aimed to improve only order fulfilment, as a key aspect of logistics performance. This is clearly a limitation, as logistics performance pertains to many other aspects, such as production cycle time and cash-to-cash cycle, cost per shipment and cost per warehouse pick-up, on-time shipments and defective products, and inventories, among other factors reported in extant literature (Supply-Chain Council 2004)

8.5 Recommendations for future research

The final model that was constructed and validated in this study can help improve the logistics performance in the egg industry. In future research, this framework can be adopted in other industries, as it might yield different outcomes with respect to its ability to enhance logistics performance. However, reliability and validity need to be tested. Moreover, the framework of this study consisted of four constructs, each of which included several significant dimensions that were deemed capable of improving logistics performance. In future studies in this field, additional factors related to logistics performance could be tested, in order to assess their significance. If proven relevant, such factors could help develop new strategies for improving logistics distribution. In addition, other factors (such as, for example, demographic profiles of the respondents) could be examined in relation to the survey responses provided, as this could assist in establishing any effects of these variables on the significance participants assign to various aspects of logistics integration. As this study aimed to identify the key supply chain integration factors related to logistics performance, the effects of respondents' demographic background were outside the scope of the investigation. Future studies could thus expand on this research by assessing the potential influence of the respondent characteristics on the logistics performance.

8.6 Summary

The aim of the present study was to identify the key factors that can contribute to the logistics integration and thus improve logistics distribution in the Thai egg semi-industrial egg production and distribution chain. This quantitative study was grounded in extant empirical research and has utilized survey as a data collection tool in order to obtain views of the key stakeholders in the Thai egg supply chain (farmers, wholesalers, and retailers). The subsequent data analysis included EFA and CFA, which were employed in order to ensure reliability and validity of constructs. SEM was employed to establish the hypothesised relationships among the variables in the model that provided the best fit to the study data. The findings yielded by the study have made a significant contribution to the extant knowledge on supply chain management and logistics. Their theoretical and practical implications can benefit researchers, academics, farmers, wholesalers, and retailers, all of whom will be able to utilize the recommendations made in their everyday practice. However, owing to the study limitations, its findings should be interpreted with caution, especially if an attempt is made to generalize them beyond the study population. On the other hand, these also open many fruitful avenues for future research in this field.

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Appendix 1:

Questionnaire Survey

CONSENT FORM FOR PARTICIPANTS INVOLVED IN RESEARCH

INFORMATION TO PARTICIPANTS:

The purpose of this research is to identify the factors that influence agricultural logistics integration in order to improve distribution performance in the Thai egg industry. Effective supply chain integration can create benefits in terms of on-time delivery, customer satisfaction, response to customer requests, order fulfillment lead times, inventory costs, cost of purchased items and transportation costs. This research provides the conceptual framework based on the key antecedent factors that influence logistic distribution performance through supply-chain integration. The key four factors – information integration, logistics operations coordination, organisational relationship, and institutional support – are perceived to influence agricultural logistics integration, leading to improved distribution performance. The study findings will increase the current understanding of agricultural supply chain integration in Thailand, particularly in the egg industry. It will help practitioners to achieve a supply-chain integration strategy, thus improving the logistics performance of Thai semi-industrial egg production.

Because you are leading an organisation, we would like to invite you to be a part of this study of "The Key Factors Influencing Distribution Logistics Integration in the Thai Egg Industry". Participation in the study will involve approximately 30-40 minutes of your time to complete the questionnaire provided. All information you give will be kept confidential and will not be linked to you personally. The completed questionnaire will be destroyed within five years of completion of the project. You may refuse to answer any question in the questionnaire. Your participation poses no risk to you, and withdrawing from the study will not result in any negative consequences.

To sum up, I am examining the factors that are critical to improving logistics distribution, and would appreciate your participation in this study. I would like you to consider the factors that influence logistic distribution performance through supply chain integration (information integration, logistics operations coordination, organisational relationship, and institutional support).

CERTIFICATION BY SUBJECT

I,

of

certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study:

"The Key Factors Influencing Distribution Logistics Integration in the Thai Egg Industry" being conducted at Victoria University by: Dr. Kamrul Ahsan.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Saichon Pinmanee

and that I freely consent to participation involving the below mentioned procedures:

- In sections A, B, C, D and E, please choose just one point on each scale that best describes your evaluation of the factor under examination. In sections F, G and H, please fill the gap and circle the choice that best describes you and your organization. If possible, please do not skip any question.
- Section A seeks your view on factors that are critical for information sharing.
- Section B seeks your view on factors that are critical for logistics operations coordination.
- Section C seeks your view on factors that are critical for organisational relationship.
- Section D seeks your view on factors that are critical for institutional support.
- Section E seeks your view on factors that are critical for distribution logistics integration through delivery reliability, responsiveness (expedience) and flexibility.
- Section F seeks general information about your organisation.
- Section G seeks general information about you.
- Section H allows you to express any additional comments.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed:

Date:

Any queries about your participation in this project may be directed to the researcher

Principle Investigator: Dr. Kamrul Ahsan.

School of Management and Information Systems, Victoria University of Technology, Melbourne, Australia.

Phone: +613-9919-1174

Email: Kamrul.ahsan@vu.edu.au

If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001 or phone (03) 9919 4781.

[*Please note: Where the participant/s are aged under 18, separate parental consent is required; where the participant/s are unable to answer for themselves due to mental illness or disability, parental or guardian consent may be required.]

INFORMATION TO PARTICIPANTS INVOLVED IN RESEARCH

You are invited to participate

You are invited to participate in a research project entitled "The Key Factors Influencing Distribution Logistics Integration in The Thai Egg Industry". This project is being conducted by a student researcher, Saichon Pinmanee, as part of a Doctor of Business Administration (DBA) study at Victoria University under the supervision of Dr. Kamrul Ahsan and Dr. Himanshu Shee from The Faculty of Business and Law/ School of Management and Information Systems, Victoria University, Melbourne, Australia.

Project explanation

This study explores the relationship between information integration, logistics operations coordination, organisational relationships, institutional support, and logistics performance in semi-industrial egg production in Thailand. This study will examine:

- Whether information integration has a positive influence on the logistics performance
- Whether logistics operations coordination has a positive influence on the logistics performance
- Whether organisational relationship has a positive influence on the logistics performance
- Whether institutional support has a positive influence on the logistics performance

The study findings and proposed strategies will support Thai egg distributors in their attempt to achieve complete supply chain integration aimed at improving their logistics performance throughout the entire supply chain, thus reducing costs, bolstering response to customers' needs, and developing a competitive advantage.

What will I be asked to do?

You are kindly asked to complete the questionnaire seeking your views on the factors affecting the Thai egg industry supply chain, which should only take approximately 40 minutes of your time. Please also complete the general questions at the end of the questionnaire. This part of the survey questionnaire consists of the following sections:

A. Factors critical to information sharing
B. Factors critical to logistics operations coordination
C. Factors critical to organisational relationship
D. Factors critical to institutional support
E. Factors critical to distribution logistics integration through delivery reliability, and responsiveness
F. General information about your organization

G. General information about your profession
H. Additional comments (if any)

Once the questionnaire is completed, please post it back using the envelope provided.

What will gain from participating?

You are giving valuable time and information for this research. The study findings will increase the current understanding of agricultural supply chain integration in Thailand, particularly in the egg industry. This knowledge will help practitioners to identify and implement a more effective supply chain integration strategy, thus improving the logistics performance of Thai semi-industrial egg production. Interested participants will receive a copy of the final report upon request. My contact details are given below.

How will the information I give be used?

All information is treated strictly confidentially and will only be used in the writing of thesis and academic journal articles. No references will be made to any individual or their organisations. Survey questionnaire will be coded by using SPSS package for statistic analysis to identify the correlation and regression on critical factors for distribution logistics integration through delivery reliability, and responsiveness (expedience). The responses indicated on the 5-point scale and some demographic information will be summarised without revealing identity of respondents or any other sensitive information.

What are the potential risks of participating in this project?

There are no physical, social, psychological or legal risks involved for the participation in this research project. We assure you that the completed questionnaire will be kept safe and all information provided within will be treated as confidential. The study findings will not be linked to your organization or to you personally. The questionnaire will be destroyed 5 years after the completion of the project. Essentially, your participation poses no risk to you and withdrawing from the study will not result in any negative consequences.

How will this project be conducted?

This project will be based on the survey conducted in a form of a questionnaire, which will be mailed to the participants, together with a self-addressed return envelope. This will be followed up by a telephonic reminder two weeks after the initial mailing. If required, non-respondents will receive a second reminder. The completed questionnaire and the participant consent form should be returned using the envelope provided. The researcher has rented a mailbox in local post office for questionnaire collection.

Who is conducting the study?

Principle Investigator : Dr. Kamrul Ahsan.

Supply Chain and Management Discipline, College of Business, Victoria University, City Flinders Campus, Melbourne, Victoria 3000, Australia.

Phone: +61-3-9919-1174

Email: Kamrul.ahsan@vu.edu.au

Co-investigator: Dr. Himanshu K. Shee.

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Address: 3/1 M. 11, T. Klongpreng, A. Muang, Chachoengsao, 24000, Thailand

Phone: +663-884-5900

Mobile Phone: +66-81-821-6676

Email: Saichon.pinmanee@live.vu.edu.au

Any queries about your participation in this project may be directed to the Chief Investigator listed above.

If you have any queries or complaints about the way you have been treated, you may contact the Research Ethics and Biosafety Manager, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 or phone (03) 9919 4148.

THE KEY FACTORS INFLUENCING DISTRIBUTION LOGISTICS INTEGRATION IN THAI EGG INDUSTRY

This survey examines the key antecedent factors that influence logistic distribution performance within the Thai egg industry through supply chain integration. I would like you to consider information integration, logistics operations coordination, organisational relationship, and institutional support—widely perceived as the key four factors influencing agricultural logistics integration, capable of improving distribution performance.

Please answer the questions. In sections A, B, C, D and E, please choose only one point on each scale that best describes your evaluation of the factor being judged. For sections F, G and H, please fill the gap and circle the choice that best describes you and your organization. If possible, please do not skip any questions.

Mr. Saichon Pinmanee

Research Doctorate Student

Victoria University

Melbourne

Australia

➢ ***Please Start Here***

Section A – Driving Factors for Information Integration

This section seeks your views on factors critical for information integration in Egg distribution. Please tick the box to indicate the extent to which you **AGREE or DISAGREE** with the following statements.

1 Information Sharing

"Information sharing in logistics is making the exchange of information as efficient and as streamlined as possible and thus allows collaborative planning, resulting in a joint demand forecast for the supply chain as a whole"

1.1 Do you share information with your employees/staffs?

(1) Yes ☐ (2) No ☐

Irrespective of your answer to the above question, please tick the box to indicate the extent to which you AGREE or DISAGREE with the following statements.

Internal information sharing	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	☐	☐	☐	☐	☐
1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	☐	☐	☐	☐	☐
1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	☐	☐	☐	☐	☐
1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	☐	☐	☐	☐	☐

1.2 Do you share information with your business partners (i.e. farmers, wholesalers, retailers, transporters)?

(1) Yes ☐ (2) No ☐

Irrespective of your answer to the above question, please tick the box to indicate the extent to which you AGREE or DISAGREE with the following statements.

External information sharing	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	☐	☐	☐	☐	☐
1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that takes place frequently, informally, and in timely manner.	☐	☐	☐	☐	☐
1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	☐	☐	☐	☐	☐
1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	☐	☐	☐	☐	☐
1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).	☐	☐	☐	☐	☐
1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	☐	☐	☐	☐	☐

2 IT capability

IT capability refers to the ability to implement and use IT assets or functionalities in combination with other resources to execute everyday business processes.

2.1 Do you use appropriate IT capability information (for examples, landline phone, fax, mobile, smart phone, computer) with your staffs/employees in logistic distribution?

(1) Yes ☐ (2) **No** ☐

Irrespective of your answer to the above question. Please answer the following questions:

Internal IT capability	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
You intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staffs/employees with the objective of:					
2.1.1 Can help to fulfil customer demand more accurately to improve service level.	☐	☐	☐	☐	☐
2.1.2 Develop IT solutions can significantly reduce the production or delivery lead time.	☐	☐	☐	☐	☐
2.1.3 Latest /appropriate ICT allows integration of operational functions that support egg distribution.	☐	☐	☐	☐	☐
2.1.4 Use of ICT can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.	☐	☐	☐	☐	☐

2.2 Do you use appropriate information technologies (for examples, landline phone, fax, mobile, smart phone, computer) with your business partners (e.g. farmers, wholesalers, and/or retailers) in logistic distribution?

(1) Yes ☐ (2) **No** ☐

Irrespective of your answer to the above question. Please answer the following questions:

External IT capability	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of:					
2.2.1 Further improving the business information sharing with chain partners.	☐	☐	☐	☐	☐
2.2.2 Improving customer service by sharing the information with all SCM parties	☐	☐	☐	☐	☐
2.2.3 Improving IT support that are suitable for egg distribution within chain partners.	☐	☐	☐	☐	☐
2.2.4 Develop IT capabilities that focus on optimizing the scheduling and routing of transportation	☐	☐	☐	☐	☐
2.2.5 Allow integration of IT functions that support egg distribution within the egg supply chain.	☐	☐	☐	☐	☐

Section B – Driving Factors for Logistics Operations Coordination

This section seeks your views on factors critical for logistics operations coordination. Please tick the box to indicate the extent to which you **AGREE or DISAGREE** with the following statements

3 Transportation cooperation with Third Party Logistics (3PL)

The 3PL is referred to as logistics outsourcing and thus implies relying on external companies to perform logistics functions that have traditionally been performed within a firm.

3. Do you collaborate with the 3PL? (Such as delivery, inventory, and truck/employee hire in egg distribution)?

(1) Yes ☐ (2) **No** ☐

Irrespective of your answer to the above question. Please go through the following questions:

Transportation cooperation (3PL)	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	☐	☐	☐	☐	☐
3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	☐	☐	☐	☐	☐
3.3 You are anticipating to collaborate with 3PL or freight truck firms on investment (buying/hiring vehicles).	☐	☐	☐	☐	☐
3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	☐	☐	☐	☐	☐
3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	☐	☐	☐	☐	☐

4 Distribution centre/warehouse sharing

Distribution centre or warehouse sharing is widely recognized as beneficial. As shared services (e.g. order management, transportation, warehousing activities, and value-added logistics) in the field of physical distribution, it offers great advantages, such as significant reduction in distribution cost, better marketing position, and improved customer service.

4. Do you share distribution centre with your partners?

(1) Yes ☐ (2) **No** ☐

Irrespective of your answer to the above question. Please go through the following points:

Distribution centre/warehouse sharing	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	☐	☐	☐	☐	☐
4.2 You are aiming to share shipping processes and resources (trucks, trolley, equipments and employees/staffs) in egg distribution.	☐	☐	☐	☐	☐

4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	☐	☐	☐	☐	☐
4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	☐	☐	☐	☐	☐
4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	☐	☐	☐	☐	☐
4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	☐	☐	☐	☐	☐

Section C– Driving factors for Organisational relationship

This section seeks your views on factors critical for organisational relationship. Please tick the box to indicate the extent to which you **AGREE or DISAGREE** with the following statements.

5 Forging and maintaining long-term relationships

Forging and maintaining long-term relationships implies developing a trusting and effective organisational relationship. It refers to stable interactions and transparent relationships between all chain partners and entails common visions and objectives, incentive realignment and sharing of skills.

5. Do you have forging and long-term relationships in the logistics distribution chain?

(1) Yes ☐ (2) No ☐

Irrespective of your answer to the above question. Please go through the following questions:

Forging and maintaining long-term relationships	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through:					
5.1 Sharing confidential information with your chain partners (your partner has often provided information	☐	☐	☐	☐	☐

that was later proven to be inaccurate).					
5.2 Keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	☐	☐	☐	☐	☐
5.3 Being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	☐	☐	☐	☐	☐
5.4 Keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	☐	☐	☐	☐	☐
5.5 Making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.	☐	☐	☐	☐	☐

6 Sharing of skill/ideas, knowledge/experience

Sharing of knowledge & skills assumes finding ways to successfully coordinate partner efforts in order to efficiently generate new knowledge and capabilities. It is essential in the dissemination of the best practices among the various members of the supply chain.

6.1 Do you have sharing of skill/ideas, knowledge/experience with your employee/staff in the logistics distribution?

(1) Yes ☐ (2) **No** ☐

Irrespective of your answer to the above question. Please go through the following questions:

Internal sharing of knowledge & skills;	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
To improve egg distribution with your employee/staff (internal firm), you are intending to share (please tick the following):					
6.1.1 Sufficient and up-to-date knowledge sharing with your employee/staff.	☐	☐	☐	☐	☐
6.1.2 Skill to handle the shipping processes in egg distribution with your employee/staff.	☐	☐	☐	☐	☐

6.1.3 Expertise for order receiving services in egg distribution with your employee/staff.	☐	☐	☐	☐	☐
6.1.4 Experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	☐	☐	☐	☐	☐
6.1.5 Skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	☐	☐	☐	☐	☐
6.1.6 Knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	☐	☐	☐	☐	☐

6.2 Do you have sharing of skill/ideas, knowledge/experience with your business partners (e.g. farmers, wholesalers, 3PL, and/or retailers) in the logistics distribution?

(1) Yes ☐ (2) **No** ☐

Irrespective of your answer to the above question. Please go through the following questions:

External sharing of knowledge & skills;	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share the following with them:					
6.2.1 Sufficient and up-to-date knowledge on egg distribution shared with partners.	☐	☐	☐	☐	☐
6.2.2 Skill to handle the shipping processes in egg distribution shared with partners.	☐	☐	☐	☐	☐
6.2.3 Necessary skill for order receiving services in egg distribution shared with partners.	☐	☐	☐	☐	☐
6.2.4 Skills related to order processing in egg distribution through centre/warehouse management shared with partners.					

6.2.5 Skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	☐	☐	☐	☐	☐

7 Creating/encouraging teamwork along the supply chain and cross-functional teams

Creating teamwork along the supply chain and cross-functional teams is based on the ability to encourage team-building that allows for coordination and active cooperation between all affected parties.

7.1 Are you encouraging among the cross-functional teams in your firm?

(1) Yes ☐ (2) No ☐

Irrespective of your answer to the above question. Please go through the following questions:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Encouraging teamwork within internal cross-functional teams through:					
7.1.1 Providing training your employees, so that they can work under diverse situation.	☐	☐	☐	☐	☐
7.1.2 Creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	☐	☐	☐	☐	☐
7.1.3 Enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	☐	☐	☐	☐	☐
7.1.4 Creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	☐	☐	☐	☐	☐
7.1.5 Encouraging staff members to help each other to improve their skills to improve logistics performances.	☐	☐	☐	☐	☐
7.1.6 Frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	☐	☐	☐	☐	☐

7.2 Are you encouraging teamwork along the supply chain with your partners (farmers, wholesalers, 3PL, and/or retailers) in the logistics distribution?

Yes ☐ No ☐

Irrespective of your answer to the above question. Please go through the following questions:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through:					
7.2.1 Empowering decision-making and operation rights to the team.	☐	☐	☐	☐	☐
7.2.2 Enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	☐	☐	☐	☐	☐
7.2.3 Encouraging joint problem-solving in egg distribution.	☐	☐	☐	☐	☐
7.2.4 Specifying acceptable team cooperation in the egg distribution.	☐	☐	☐	☐	☐
7.2.5 Clearly identifying partners roles and responsibilities.	☐	☐	☐	☐	☐
7.2.6 Appreciating partners cooperation in the egg distribution.	☐	☐	☐	☐	☐

Section D– Driving Factors for Institutional Support

This section seeks your views on factors critical for institutional support. Please tick the box to indicate the extent to which you **AGREE or DISAGREE** with the following statements

8 Government support, incentive or policy

Government support, incentive, or policy refers to developing and implementing policies with the aim to induce active collaboration within and across logistic distribution sectors.

8. Do you receive the government support, incentive or policy in logistics distribution?

(1) Yes ☐ (2) No ☐

Irrespective of your answer to the above question. Please go through the following questions:

Government support, incentive or policy:	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
8.1 Good-quality roads within the delivery route.	☐	☐	☐	☐	☐
8.2 New technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	☐	☐	☐	☐	☐
8.3 Programs/research for identifying and implementing the best practices in freight transport.	☐	☐	☐	☐	☐
8.4 Policy that ensures food safety control in delivery.	☐	☐	☐	☐	☐
8.5 Financial support for logistics providers to build new facilities and to purchase vehicles.	☐	☐	☐	☐	☐
8.6 Policy that supports education system in incorporating the logistics for egg industry in curricula.	☐	☐	☐	☐	☐

9 The role of banks/financial services

The role of banks/financial services is in provision of preferential loans and structured repayment systems that can help budget-constrained retailers that are under increasing pressure to improve cash flow during financial crises. It is widely recognized that limited budget hinders the development of many start-ups and fast-growing companies.

9. Do you receive the services from banks/financial institutions in the logistics distribution?

(1) Yes ☐ **(2) No** ☐

Irrespective of your answer to the above question. Please go through the following questions:

The role of banks/financial service;	Strongly Disagree	Disagree	Neither Agree nor	Agree	Strongly Agree

			Disagree		
For Egg business, Banks should introduce efficient services in:					
9.1 Converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).	☐	☐	☐	☐	☐
9.2 Introducing commercial bills (the bills of exchange for cash needs) as means of financing.	☐	☐	☐	☐	☐
9.3 Implementing modern card-payment technologies (i.e., credit/debit cards).	☐	☐	☐	☐	☐
9.4 Approving business loans/microcredit facilities with lower interest for SMEs.	☐	☐	☐	☐	☐
9.5 Facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	☐	☐	☐	☐	☐
9.6 Streamlining one-stop financial service delivery.	☐	☐	☐	☐	☐

10 Knowledge support from boards and associations, and educational institutions/educational support

Knowledge support from boards and associations, and educational institutions/educational support refers to the necessary support, as well as education and training by educational institutions.

10. Do you receive the knowledge support from boards and associations, and educational institutions/educational support in logistics distribution?

(1) Yes ☐ **(2) No** ☐

Irrespective of your answer to the above question. Please go through the following questions:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Educational institutions should offer/ provide vocational education or, certificate courses:					
10.1 For understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	☐	☐	☐	☐	☐
10.2 Identifying and defining logistic strategies in egg logistics distribution.	☐	☐	☐	☐	☐
10.3 Understanding of the purpose and appropriateness of existing business logistics models.	☐	☐	☐	☐	☐
10.4 Organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	☐	☐	☐	☐	☐

Section E– Driving factors for distribution logistic integration through delivery reliability, and responsiveness (expedience)

This section seeks your views on factors critical for distribution logistic integration through delivery reliability, and responsiveness (expedience). Please tick the box to indicate the extent to which you **AGREE or DISAGREE** with the following statements

11 Information integration through delivery reliability and responsiveness (expedience)

Information integration through delivery reliability and responsiveness (expedience) is the relationship of information sharing, IT capability through perfect order fulfilment and order fulfilment lead times.

Information integration through delivery reliability;	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,…………					
11.1 if information sharing with your staffs/employees.	☐	☐	☐	☐	☐

11.2 if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	☐	☐	☐	☐	☐
11.3 if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.	☐	☐	☐	☐	☐
11.4 if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	☐	☐	☐	☐	☐

Information integration through responsiveness (expedience);	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The time from receipt of customer order to delivery will decrease,…………..					
11.5 if information sharing with your staffs/employees is used in Egg distribution is used.	☐	☐	☐	☐	☐
11.6 if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.	☐	☐	☐	☐	☐
11.7 if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	☐	☐	☐	☐	☐
11.8 if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	☐	☐	☐	☐	☐

12 Logistics operations coordination through delivery reliability and responsiveness (expedience)

Logistics operations coordination through delivery reliability and responsiveness (expedience) is the relationship between transportation cooperation (3PL) and distribution centre sharing, achieved through perfect order fulfilment and order fulfilment lead times.

Logistics operation coordination through delivery reliability;	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,…………					
12.1 if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	☐	☐	☐	☐	☐
12.2 if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	☐	☐	☐	☐	☐
12.3 if transportation is shared with partners (farmers, wholesalers, retailers).	☐	☐	☐	☐	☐

Logistics operation coordination through responsiveness (expedience);	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The time from receipt of customer order to delivery will decrease,…………..					
12.4 if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	☐	☐	☐	☐	☐
12.5 if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	☐	☐	☐	☐	☐
12.6 if transportation is shared with partners (farmers, wholesalers, retailers).	☐	☐	☐	☐	☐

13 Organisational relationship through delivery reliability and responsiveness (expedience)

Organizational relationship through delivery reliability and responsiveness (expedience) is characterized by forging and maintaining long-term relationships, sharing skills/ideas and *knowledge/experience, as well as creating teamwork along the supply chain and cross-functional teams through perfect order fulfilment order fulfilment lead times.*

Organisational relationship through delivery reliability;	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,………….					
13.1 if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	☐	☐	☐	☐	☐
13.2 if internal sharing of knowledge & skills is maintained with your staffs/employees.	☐	☐	☐	☐	☐
13.3 if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).	☐	☐	☐	☐	☐
13.4 if creating teamwork cross-functional teams is continued with your staffs/employees.	☐	☐	☐	☐	☐
13.5 if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	☐	☐	☐	☐	☐

Organisational relationship through responsiveness (expedience);	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The time from receipt of customer order to delivery will decrease,…………..					
13.6 if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	☐	☐	☐	☐	☐
13.7 if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	☐	☐	☐	☐	☐

13.8 if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	☐	☐	☐	☐	☐
13.9 if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	☐	☐	☐	☐	☐
13.10 if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	☐	☐	☐	☐	☐

14 Institutional support through delivery reliability and responsiveness (expedience)

Institutional support through delivery reliability and responsiveness (expedience) refers to the relationship between governmental support and incentive or policy, as well as the role of banks/financial services, educational institution/knowledge support from boards and association through perfect order fulfilment and order fulfilment lead times.

Institutional support through delivery reliability;	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer,……………					
14.1 if government is providing support through incentives or better policy in Egg distribution.	☐	☐	☐	☐	☐
14.2 if banks/financial services institutions are supporting the Egg distribution.	☐	☐	☐	☐	☐
14.3 if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	☐	☐	☐	☐	☐

Institutional support through responsiveness (expedience);	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The time from receipt of customer order to delivery will decrease,…………..					

14.4 if government is providing support through incentives or better policy in Egg distribution.	☐	☐	☐	☐	☐
14.5 if banks/financial services institutions are supporting the Egg distribution.	☐	☐	☐	☐	☐
14.6 if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	☐	☐	☐	☐	☐

Section F –About your organisation

This section seeks general information about your organisation.

Please fill the gap and circle the choice that best describes your organisation.

(F1) Please indicate the role your organisation play in egg logistics distribution that best describes your organisation.

(1) Farmer
(2) Wholesaler
(3) Retailer
(4) Farmer and Wholesaler
(5) Wholesaler and Retailer
(6) Farmer and Retailer
(7) Farmer, Wholesaler and Retailer

(F2) Does your organisation provide egg logistics distribution?

(1) Yes (2) No

If your answer is "No", please respond to the item F3. If your answer is "Yes", please move on to F4

(F3) Who does egg logistics distribution for your organisation?

(1) Farmer
(2) Wholesaler
(3) Retailer
(4) Other ………….

(F4) How many eggs does your organisation buy/sell per day?

(1) Less than 5,001
(2) 5,001-25,000
(3) 25,001-45,000
(4) 45,001-65,000

(5) 65,001-85,000
(6) 85,001-105,000
(7) 105,001-125,000
(8) 125,001-145,000
(9) Above 145,000

(F5) How long has your organisation been operational within the egg industry?

(1) Less than 6 years
(2) 6-10 years
(3) 11-15 years
(4) 16-20 years
(5) 21-25 years
(6) 26-30 years
(7) Above 30 years

Section G –About yourself

This section seeks general information about you.

Please fill the gap and circle the choice that best describes you.

(G1) Your position – or your current job title

(1) Chief Executive Officer
(2) Executive Director
(3) Chairperson / President
(4) Coordinator
(5) Director
(6) Chief Distribution Officer
(7) Chief Logistics Officer
(8) Chief Marketing Officer
(9) Distribution Director
(10) Logistics Director
(11) Marketing Director
(12) Other_______________

(G2) How many years have you worked for this organisation?

(1) Less than 6 years
(2) 6-10 years
(3) 11-15 years
(4) 16-20 years
(5) 21-25 years
(6) 26-30 years
(7) Above 30 years

(G3) Total number of years in the egg industry

(1) Less than 6 years
(2) 6-10 years
(3) 11-15 years
(4) 16-20 years
(5) 21-25 years
(6) 26-30 years
(7) Above 30 years

(G4) What is the highest level of education you have attained?

(1) Primary school
(2) High school
(3) Certificate
(4) Diploma
(5) Bachelor Degree
(6) Graduate Diploma
(7) Master Degree
(8) Doctorate Degree

Section H –Additional comments

Thank you very much for your participation.

(H1) If you wish to add any comments or further observations, please use the space below.

Comments:

(H2) Would you like to receive a summary of the results from this study for your personal use of for your organisation?

(1) Yes
(2) No

If yes, please provide contact person and mailing address in the above space or include your business card when you return this survey.

Thank you very much for your assistance.

Appendix 2:

Preliminary and SEM Data Analysis

Appendix 2.1: Coding of measurement scale

Coding of Measurement Scale		
Constructs	**Codes**	**Statements**
Information Integration (II) Factors		
Internal Information Sharing (IIS)	IIS1.1.1	1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.
	IIS1.1.2	1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.
	IIS1.1.3	1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.
	IIS1.1.4	1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.
External Information Sharing (EIS)	EIS1.2.1	1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).
	EIS1.2.2	1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that take place frequently, informally, and in timely manner.
	EIS1.2.3	1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.
	EIS1.2.4	1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).
	EIS1.2.5	1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).
	EIS1.2.6	1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).
Internal IT Capability (IITC)	IITC2.1.1	2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.
	IITC2.1.2	2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.

	IITC2.1.3	2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.
	IITC2.1.4	2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.
External IT Capability (EITC)	EITC2.2.1	2.2.1 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.
	EITC2.2.2	2.2.2 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.
	EITC2.2.3	2.2.3 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.
	EITC2.2.4	2.2.4 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation within the egg supply chain.
	EITC2.2.5	2.2.5 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.
Logistics Operations Coordination (LOC) Factors		
Transport Cooperation (3PL) (TC3PL)	TC3PL3.1	3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.
	TC3PL3.2	3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.
	TC3PL3.3	3.3 You are anticipating to collaborate with 3PL or freight truck firms on investment (buying/hiring

		vehicles).
	TC3PL3.4	3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.
	TC3PL3.5	3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.
Distribution Centre/warehouse Sharing (DCS)	DCS4.1	4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.
	DCS4.2	4.2 You are aiming to share shipping processes and resources (trucks, trolley, equipments and employees/staffs) in egg distribution.
	DCS4.3	4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.
	DCS4.4	4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.
	DCS4.5	4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.
	DCS4.6	4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.
Organisational Relationship (O_R) Factors		
Forging and Maintaining Long-term Relationships (FMLR)	FMLR5.1	5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).
	FMLR5.2	5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.
	FMLR5.3	5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).
	FMLR5.4	5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).
	FMLR5.5	5.5 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.
Internal sharing of skills/ideas, knowledge/experience (ISSK)	ISSK6.1.1	6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.

	ISSK6.1.2	6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.
	ISSK6.1.3	6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.
	ISSK6.1.4	6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.
	ISSK6.1.5	6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.
	ISSK6.1.6	6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.
External Sharing of skills/ideas, Knowledge/experience (ESSK)	ESSK6.2.1	6.2.1 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.
	ESSK6.2.2	6.2.2 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skill to handle the shipping processes in egg distribution shared with partners.
	ESSK6.2.3	6.2.3 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.
	ESSK6.2.4	6.2.4 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.
	ESSK6.2.5	6.2.5 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.
Internal creating teamwork along supply chain and cross-functional teams (ICT)	ICT7.1.1	7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.
	ICT7.1.2	7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.
	ICT7.1.3	7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an

		existing team whose members are experienced.
	ICT7.1.4	7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.
	ICT7.1.5	7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.
	ICT7.1.6	7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.
External creating teamwork along supply chain and cross-functional teams (ECT)	ECT7.2.1	7.2.1 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through Empowering decision-making and operation rights to the team.
	ECT7.2.2	7.2.2 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).
	ECT7.2.3	7.2.3 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.
	ECT7.2.4	7.2.4 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.
	ECT7.2.5	7.2.5 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.
	ECT7.2.6	7.2.6 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.
Institutional Support (IS) Factors		
Government support, incentive or policy (GS)	GS8.1	8.1 Government support, incentive or policy good-quality roads within the delivery route.
	GS8.2	8.2 Government support, incentive or policy new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.
	GS8.3	8.3 Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.
	GS8.4	8.4 Government support, incentive or policy that ensures food safety control in delivery.
	GS8.5	8.5 Government support, incentive or policy financial support for logistics providers to build new facilities and to purchase vehicles.
	GS8.6	8.6 Government support, incentive or policy that supports education system in incorporating the logistics for egg industry in curricula.
The role of banks/financial services (FS)	FS9.1	9.1 For Egg business, Banks should introduce efficient services in converting to electronic payment methods

		(e.g., online banking, electronic payment systems, Tele banking).
	FS9.2	9.2 For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.
	FS9.3	9.3 For Egg business, Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).
	FS9.4	9.4 For Egg business, Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.
	FS9.5	9.5 For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.
	FS9.6	9.6 For Egg business, Banks should introduce efficient services in streamlining one-stop financial service delivery.
Knowledge support from boards and associations, and educational institutions/educational support (ES)	ES10.1	10.1 Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).
	ES10.2	10.2 Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.
	ES10.3	10.3 Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics models.
	ES10.4	10.4 Educational institutions should offer/ provide vocational education or, certificate courses organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.
Delivery Reliability (Perfect Order Fulfilment (POF)) Factors		
Information Integration through Perfect Order Fulfilment (II_POF)	II_POF11.1	11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.
	II_POF11.2	11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.
	II_POF11.3	11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.
	II_POF11.4	11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.
Logistics Operations Coordination through Perfect	LOC_POF12.1	12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the

Order Fulfilment (LOC_POF)		right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.
	LOC_POF12.2	12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).
	LOC_POF12.3	12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).
Organisational Relationship through Perfect Order Fulfilment (OR_POF)	OR_POF13.1	13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.
	OR_POF13.2	13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.
	OR_POF13.3	13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).
	OR_POF13.4	13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.
	OR_POF13.5	13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).
Institutional Support through Perfect Order Fulfilment (IS_POF)	IS_POF14.1	14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.
	IS_POF14.2	14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.
	IS_POF14.3	14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.
Responsiveness (Order Fulfilment Lead Times (OFLT)) Factors		
Information Integration through Order Fulfilment Lead Times (II_OFLT)	II_OFLT11.5	11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.
	II_OFLT11.6	11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.
	II_OFLT11.7	11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.

	II_OFLT11.8	11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.
Logistics Operations Coordination through Order Fulfilment Lead Times (LOC_OFLT)	LOC_OFLT12.4	12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.
	LOC_OFLT12.5	12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).
	LOC_OFLT12.6	12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).
Organisational Relationship through Order Fulfilment Lead Times (OR_OFLT)	OR_OFLT13.6	13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.
	OR_OFLT13.7	13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.
	OR_OFLT13.8	13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.
	OR_OFLT13.9	13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.
	OR_OFLT13.10	13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.
Institutional Support through Order Fulfilment Lead Times (IS_OFLT)	IS_OFLT14.4	14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.
	IS_OFLT14.5	14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.
	IS_OFLT14.6	14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.

Appendix 2.2: Missing value assessment

Items	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	429	100.00%	0	0.00%	429	100.00%
1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	429	100.00%	0	0.00%	429	100.00%
1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	429	100.00%	0	0.00%	429	100.00%
1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	429	100.00%	0	0.00%	429	100.00%
1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	429	100.00%	0	0.00%	429	100.00%
1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that take place frequently, informally, and in timely manner.	429	100.00%	0	0.00%	429	100.00%
1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	429	100.00%	0	0.00%	429	100.00%
1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	429	100.00%	0	0.00%	429	100.00%
1.2.5 You are intending to keep each other informed	429	100.00%	0	0.00%	429	100.00%

about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).						
1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	429	100.00%	0	0.00%	429	100.00%
2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	429	100.00%	0	0.00%	429	100.00%
2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.	429	100.00%	0	0.00%	429	100.00%
2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	429	100.00%	0	0.00%	429	100.00%
2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution	429	100.00%	0	0.00%	429	100.00%

more visible to know exact customer demand and hence making egg distribution more cost-effective.						
2.2.1 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.	429	100.00%	0	0.00%	429	100.00%
2.2.2 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.	429	100.00%	0	0.00%	429	100.00%
2.2.3 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.	429	100.00%	0	0.00%	429	100.00%
2.2.4 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation	429	100.00%	0	0.00%	429	100.00%

within the egg supply chain.						
2.2.5 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.	429	100.00%	0	0.00%	429	100.00%
3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	429	100.00%	0	0.00%	429	100.00%
3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	429	100.00%	0	0.00%	429	100.00%
3.3 You are anticipating to collaborate with 3PL or freight truck firms on investment (buying/hiring vehicles).	429	100.00%	0	0.00%	429	100.00%
3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	429	100.00%	0	0.00%	429	100.00%
3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	429	100.00%	0	0.00%	429	100.00%
4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	429	100.00%	0	0.00%	429	100.00%
4.2 You are aiming to share shipping processes and resources (trucks, trolley, equipments and employees/staffs) in egg distribution.	429	100.00%	0	0.00%	429	100.00%
4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	429	100.00%	0	0.00%	429	100.00%
4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through	429	100.00%	0	0.00%	429	100.00%

centre/warehouse management.						
4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	429	100.00%	0	0.00%	429	100.00%
4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	429	100.00%	0	0.00%	429	100.00%
5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).	429	100.00%	0	0.00%	429	100.00%
5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	429	100.00%	0	0.00%	429	100.00%
5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	429	100.00%	0	0.00%	429	100.00%
5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	429	100.00%	0	0.00%	429	100.00%
5.5 You are intending to build interpersonal trust to create/	429	100.00%	0	0.00%	429	100.00%

maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.						
6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	429	100.00%	0	0.00%	429	100.00%
6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.	429	100.00%	0	0.00%	429	100.00%
6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	429	100.00%	0	0.00%	429	100.00%
6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	429	100.00%	0	0.00%	429	100.00%
6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	429	100.00%	0	0.00%	429	100.00%
6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	429	100.00%	0	0.00%	429	100.00%
6.2.1 To improve Egg distribution with supply chain partners (farmers, wholesalers,	429	100.00%	0	0.00%	429	100.00%

3PL, and/or retailers), you are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.						
6.2.2 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skill to handle the shipping processes in egg distribution shared with partners.	429	100.00%	0	0.00%	429	100.00%
6.2.3 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.	429	100.00%	0	0.00%	429	100.00%
6.2.4 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.	429	100.00%	0	0.00%	429	100.00%
6.2.5 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	429	100.00%	0	0.00%	429	100.00%
7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	429	100.00%	0	0.00%	429	100.00%
7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	429	100.00%	0	0.00%	429	100.00%
7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in	429	100.00%	0	0.00%	429	100.00%

logistic distribution by placing a new employee into an existing team whose members are experienced.						
7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	429	100.00%	0	0.00%	429	100.00%
7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	429	100.00%	0	0.00%	429	100.00%
7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	429	100.00%	0	0.00%	429	100.00%
7.2.1 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through Empowering decision-making and operation rights to the team.	429	100.00%	0	0.00%	429	100.00%
7.2.2 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	429	100.00%	0	0.00%	429	100.00%
7.2.3 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.	429	100.00%	0	0.00%	429	100.00%
7.2.4 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.	429	100.00%	0	0.00%	429	100.00%
7.2.5 Your firm and your partners (farmers, wholesalers,	429	100.00%	0	0.00%	429	100.00%

3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.						
7.2.6 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.	429	100.00%	0	0.00%	429	100.00%
8.1 Government support, incentive or policy good-quality roads within the delivery route.	429	100.00%	0	0.00%	429	100.00%
8.2 Government support, incentive or policy new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	429	100.00%	0	0.00%	429	100.00%
8.3 Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.	429	100.00%	0	0.00%	429	100.00%
8.4 Government support, incentive or policy that ensures food safety control in delivery.	429	100.00%	0	0.00%	429	100.00%
8.5 Government support, incentive or policy financial support for logistics providers to build new facilities and to purchase vehicles.	429	100.00%	0	0.00%	429	100.00%
8.6 Government support, incentive or policy that supports education system in incorporating the logistics for egg industry in curricula.	429	100.00%	0	0.00%	429	100.00%
9.1 For Egg business, Banks should introduce efficient services in converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).	429	100.00%	0	0.00%	429	100.00%
9.2 For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	429	100.00%	0	0.00%	429	100.00%
9.3 For Egg business, Banks should introduce efficient services in implementing modern card-payment	429	100.00%	0	0.00%	429	100.00%

technologies (i.e., credit/debit cards).						
9.4 For Egg business, Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.	429	100.00%	0	0.00%	429	100.00%
9.5 For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	429	100.00%	0	0.00%	429	100.00%
9.6 For Egg business, Banks should introduce efficient services in streamlining one-stop financial service delivery.	429	100.00%	0	0.00%	429	100.00%
10.1 Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	429	100.00%	0	0.00%	429	100.00%
10.2 Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.	429	100.00%	0	0.00%	429	100.00%
10.3 Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics models.	429	100.00%	0	0.00%	429	100.00%
10.4 Educational institutions should offer/ provide vocational education or, certificate courses organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	429	100.00%	0	0.00%	429	100.00%
11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	429	100.00%	0	0.00%	429	100.00%
11.2 Logistic provider will be capable of delivery with the right quality and the right	429	100.00%	0	0.00%	429	100.00%

quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.						
11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.	429	100.00%	0	0.00%	429	100.00%
11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	429	100.00%	0	0.00%	429	100.00%
11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.	429	100.00%	0	0.00%	429	100.00%
11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.	429	100.00%	0	0.00%	429	100.00%
11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	429	100.00%	0	0.00%	429	100.00%
11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	429	100.00%	0	0.00%	429	100.00%
12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right	429	100.00%	0	0.00%	429	100.00%

customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.						
12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	429	100.00%	0	0.00%	429	100.00%
12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	429	100.00%	0	0.00%	429	100.00%
12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	429	100.00%	0	0.00%	429	100.00%
12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	429	100.00%	0	0.00%	429	100.00%
12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).	429	100.00%	0	0.00%	429	100.00%
13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	429	100.00%	0	0.00%	429	100.00%
13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.	429	100.00%	0	0.00%	429	100.00%
13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right	429	100.00%	0	0.00%	429	100.00%

customer, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).						
13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	429	100.00%	0	0.00%	429	100.00%
13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	429	100.00%	0	0.00%	429	100.00%
13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	429	100.00%	0	0.00%	429	100.00%
13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	429	100.00%	0	0.00%	429	100.00%
13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	429	100.00%	0	0.00%	429	100.00%
13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	429	100.00%	0	0.00%	429	100.00%
13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	429	100.00%	0	0.00%	429	100.00%

14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.	429	100.00%	0	0.00%	429	100.00%
14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.	429	100.00%	0	0.00%	429	100.00%
14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	429	100.00%	0	0.00%	429	100.00%
14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.	429	100.00%	0	0.00%	429	100.00%
14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	429	100.00%	0	0.00%	429	100.00%
14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	429	100.00%	0	0.00%	429	100.00%

Appendix 2.3 Standard score for testing multivariate outliers

	N	Minimum	Maximum	Mean
Zscore: 1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	429	-1.20917	.82508	.0000000
Zscore: 1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	429	-1.28231	.77803	.0000000
Zscore: 1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	429	-1.22094	.81713	.0000000
Zscore: 1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	429	-1.19756	.83308	.0000000
Zscore: 1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	429	-1.14710	.86973	.0000000
Zscore: 1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that takes place frequently, informally, and in timely manner.	429	-1.14167	.87387	.0000000
Zscore: 1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	429	-1.16361	.85739	.0000000
Zscore: 1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	429	-1.13090	.88219	.0000000
Zscore: 1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party	429	-1.18610	.84114	.0000000

(farmers, wholesalers, transporters, and/or retailers).				
Zscore: 1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	429	-1.17478	.84924	.0000000
Zscore: 2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	429	-1.14167	.87387	.0000000
Zscore: 2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.	429	-1.17478	.84924	.0000000
Zscore: 2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	429	-1.15257	.86560	.0000000
Zscore: 2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.	429	-1.16918	.85331	.0000000
Zscore: 2.2.1 You intend to use the modern	429	-1.30160	.76650	.0000000

information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.				
Zscore: 2.2.2 You intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.	429	-1.31470	.75885	.0000000
Zscore: 2.2.3 You intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.	429	-1.32133	.75505	.0000000
Zcore: 2.2.4 You intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation within the egg supply chain.	429	-1.07886	.92474	.0000000
Zscore: 2.2.5 You intend to use the modern information and communication technologies and devices with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.	429	-1.34154	.74368	.0000000
Zscore: 3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	429	-.92909	1.07382	.0000000
Zscore: 3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	429	-.90327	1.10451	.0000000
Zscore: 3.3 You are anticipating to collaborate with 3PL or freight truck firms on investment (buying/hiring vehicles).	429	-3.31818	1.78397	.0000000
Zscore: 3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	429	-.91610	1.08904	.0000000

Zscore: 3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	429	-.75885	1.31470	.0000000
Zscore: 4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	429	-.78189	1.27597	.0000000
Zscore: 4.2 You are aiming to share shipping processes and resources (trucks, trolley, equipments and employees/staffs) in egg distribution.	429	-3.97208	.52402	.0000000
Zscore: 4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	429	-.97354	1.02478	.0000000
Zscore: 4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	429	-.92909	1.07382	.0000000
Zscore: 4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	429	-.93345	1.06880	.0000000
Zscore: 4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	429	-.92041	1.08394	.0000000
Zscore: 5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners.	429	-1.00584	.99187	.0000000
Zscore: 5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners.	429	-1.02001	.97809	.0000000
Zscore: 5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct.	429	-1.00116	.99651	.0000000
Zscore: 5.4 You are intending to build	429	-.99651	1.00116	.0000000

interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind.				
Zscore: 5.5 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's facilities with the aim of establishing trust	429	-1.00116	.99651	.0000000
Zscore: 6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	429	-.99651	1.00116	.0000000
Zscore: 6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.	429	-.99187	1.00584	.0000000
Zscore: 6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	429	-.99187	1.00584	.0000000
Zscore: 6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	429	-1.02001	.97809	.0000000
Zscore: 6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	429	-.89058	1.12025	.0000000
Zscore: 6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions in egg distribution through centre/warehouse management with your employee/staff.	429	-1.01054	.98726	.0000000
Zscore: 6.2.1 You are intending to share sufficient and up-to-date knowledge on egg	429	-.83308	1.19756	.0000000

distribution shared with partners.				
Zscore: 6.2.2 You are intending to share skill to handle the shipping processes in egg distribution shared with partners.	429	-1.02001	.97809	.0000000
Zscore: 6.2.3 You are intending to share necessary skill for order receiving services in egg distribution shared with partners.	429	-1.00116	.99651	.0000000
Zscore: 6.2.4 You are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.	429	-.98726	1.01054	.0000000
Zscore: 6.2.5 You are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	429	-.98267	1.01527	.0000000
Zscore: 7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	429	-.98726	1.01054	.0000000
Zscore: 7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	429	-.80529	1.23890	.0000000
Zscore: 7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	429	-1.01054	.98726	.0000000
Zscore: 7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	429	-.82110	1.21504	.0000000
Zscore: 7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	429	-1.01527	.98267	.0000000
Zscore: 7.1.6 Encouraging teamwork within	429	-1.00584	.99187	.0000000

internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.				
Zscore: 7.2.1 Your firm and your partners enhance teamwork across supply chain partners through empowering decision-making and operation rights to the team.	429	-1.02957	.96901	.0000000
Zscore: 7.2.2 Your firm and your partners enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	429	-1.05390	.94664	.0000000
Zscore: 7.2.3 Your firm and your partners enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.	429	-1.01054	.98726	.0000000
Zscore: 7.2.4 Your firm and your partners enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.	429	-.82110	1.21504	.0000000
Zscore: 7.2.5 Your firm and your partners enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.	429	-1.02001	.97809	.0000000
Zscore: 7.2.6 Your firm and your partners enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.	429	-.83308	1.19756	.0000000
Zscore: 8.1 Government support, incentive or policy: good-quality roads within the delivery route.	429	-.86560	1.15257	.0000000
Zscore: 8.2 Government support, incentive or policy: new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	429	-.84518	1.18042	.0000000
Zscore: 8.3 Government support, incentive or policy: programs/research for identifying and implementing the best practices in freight transport.	429	-.85739	1.16361	.0000000
Zscore: 8.4 Government support, incentive or policy: policy that ensures food safety control in delivery.	429	-.70999	1.40519	.0000000

Zscore: 8.5 Government support, incentive or policy: financial support for logistics providers to build new facilities and to purchase vehicles.	429	-.86149	1.15807	.0000000
Zscore: 8.6 Government support, incentive or policy: policy that supports education system in incorporating the logistics for egg industry in curricula.	429	-.86973	1.14710	.0000000
Zscore: 9.1 Banks should introduce efficient services in converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).	429	-.75885	1.31470	.0000000
Zscore: 9.2 Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	429	-.93783	1.06381	.0000000
Zscore: 9.3 Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).	429	-.93345	1.06880	.0000000
Zscore: 9.4 Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.	429	-.90753	1.09933	.0000000
Zscore: 9.5 Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	429	-.92041	1.08394	.0000000
Zscore: 9.6 Banks should introduce efficient services in streamlining one-stop financial service delivery.	429	-.94664	1.05390	.0000000
Zscore: 10.1 Educational institutions should offer/ provide vocational education or, certificate courses: for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	429	-.85331	1.16918	.0000000
Zscore: 10.2 Educational institutions should offer/ provide vocational education or, certificate courses: identifying and defining logistic strategies in egg logistics distribution.	429	-.88219	1.13090	.0000000
Zscore: 10.3 Educational institutions should offer/ provide vocational education or, certificate courses: understanding of the purpose and appropriateness of existing	429	-.86560	1.15257	.0000000

business logistics models.				
Zscore: 10.4 Educational institutions should offer/ provide vocational education or, certificate courses: organise, invite and assist to participate in Seminars, conferences and symposia.	429	-.86973	1.14710	.0000000
Zscore: 11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	429	-.97809	1.02001	.0000000
Zscore: 11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	429	-.95553	1.04410	.0000000
Zscore: 11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers).	429	-.95108	1.04899	.0000000
Zscore: 11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet).	429	-.96450	1.03439	.0000000
Zscore: 11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.	429	-.99651	1.00116	.0000000
Zscore: 11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.	429	-1.02001	.97809	.0000000
Zscore: 11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	429	-1.00584	.99187	.0000000

Zscore: 11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	429	-1.02957	.96901	.0000000
Zscore: 12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	429	-.97809	1.02001	.0000000
Zscore: 12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	429	-.99651	1.00116	.0000000
Zscore: 12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	429	-.98267	1.01527	.0000000
Zscore: 12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	429	-1.00116	.99651	.0000000
Zscore: 12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	429	-1.00116	.99651	.0000000
Zscore: 12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).	429	-1.00584	.99187	.0000000
Zscore: 13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners are retained.	429	-.95108	1.04899	.0000000
Zscore: 13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is	429	-.96001	1.03923	.0000000

maintained with your staffs/employees.				
Zscore: 13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if external sharing of knowledge & skills is maintained with partners.	429	-.95553	1.04410	.0000000
Zscore: 13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	429	-.92909	1.07382	.0000000
Zscore: 13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners.	429	-.96450	1.03439	.0000000
Zscore: 13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	429	-.93783	1.06381	.0000000
Zscore: 13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	429	-.96450	1.03439	.0000000
Zscore: 13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	429	-.96901	1.02957	.0000000
Zscore: 13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	429	-.97354	1.02478	.0000000
Zscore: 13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic	429	-1.00584	.99187	.0000000

distribution chain.				
Zscore: 14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.	429	-1.04410	.95553	.0000000
Zscore: 14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.	429	-1.06381	.93783	.0000000
Zscore: 14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	429	-1.07382	.92909	.0000000
Zscore: 14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.	429	-.96450	1.03439	.0000000
Zscore: 14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	429	-.98726	1.01054	.0000000
Zscore: 14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	429	-.98267	1.01527	.0000000

Appendix 2.4 The skewness and kurtosis values of multivariate normality assessment

Items	N	Mean	Std. Deviation	Skewness	Std. Error of Skewness	Kurtosis	Std. Error Of Kurtosis
1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	429	4.59	.492	-.386	.118	-1.860	.235
1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	429	4.62	.485	-.507	.118	-1.752	.235
1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	429	4.60	.491	-.406	.118	-1.844	.235
1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	429	4.59	.492	-.366	.118	-1.875	.235
1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	429	4.57	.496	-.279	.118	-1.931	.235
1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that take place frequently, informally, and in timely manner.	429	4.57	.496	-.269	.118	-1.937	.235
1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	429	4.58	.495	-.308	.118	-1.914	.235
1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners	429	4.56	.497	-.250	.118	-1.947	.235

(farmers, wholesalers, transporters, and/or retailers).							
1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).	429	4.59	.493	-.347	.118	-1.889	.235
1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	429	4.58	.494	-.327	.118	-1.902	.235
2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	429	4.57	.496	-.269	.118	-1.937	.235
2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.	429	4.58	.494	-.327	.118	-1.902	.235
2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	429	4.57	.495	-.288	.118	-1.926	.235
2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline	429	4.58	.494	-.317	.118	-1.908	.235

phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.							
2.2.1 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.	429	4.63	.484	-.538	.118	-1.719	.235
2.2.2 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.	429	4.63	.482	-.558	.118	-1.696	.235
2.2.3 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.	429	4.64	.482	-.569	.118	-1.684	.235
2.2.4 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies	429	4.54	.499	-.155	.118	-1.985	.235

and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation within the egg supply chain.							
2.2.5 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.	429	4.64	.480	-.601	.118	-1.647	.235
3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	429	4.46	.499	.145	.118	-1.988	.235
3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	429	4.45	.498	.202	.118	-1.968	.235
3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	429	4.46	.499	.174	.118	-1.979	.235
3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	429	4.37	.482	.558	.118	-1.696	.235
4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	429	4.38	.486	.496	.118	-1.762	.235
4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	429	4.49	.500	.051	.118	-2.007	.235
4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	429	4.46	.499	.145	.118	-1.988	.235

4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	429	4.47	.499	.136	.118	-1.991	.235
4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	429	4.46	.499	.164	.118	-1.982	.235
5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).	429	4.50	.501	-.014	.118	-2.009	.235
5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	429	4.51	.500	-.042	.118	-2.008	.235
5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	429	4.50	.501	-.005	.118	-2.009	.235
5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	429	4.50	.501	.005	.118	-2.009	.235
5.5 You are intending to build interpersonal trust to create/ maintain long-term	429	4.50	.501	-.005	.118	-2.009	.235

relationships with other egg distribution partners through making frequent social/business contacts with your partner’s (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.							
6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	429	4.50	.501	.005	.118	-2.009	.235
6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.	429	4.50	.501	.014	.118	-2.009	.235
6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	429	4.50	.501	.014	.118	-2.009	.235
6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	429	4.51	.500	-.042	.118	-2.008	.235
6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	429	4.44	.497	.231	.118	-1.956	.235
6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	429	4.51	.501	-.023	.118	-2.009	.235

6.2.1 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.	429	4.41	.492	.366	.118	-1.875	.235
6.2.2 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skill to handle the shipping processes in egg distribution shared with partners.	429	4.51	.500	-.042	.118	-2.008	.235
6.2.3 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.	429	4.50	.501	-.005	.118	-2.009	.235
6.2.4 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.	429	4.49	.501	.023	.118	-2.009	.235
6.2.5 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	429	4.49	.501	.033	.118	-2.008	.235
7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	429	4.49	.501	.023	.118	-2.009	.235
7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share	429	4.39	.489	.436	.118	-1.819	.235

housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.							
7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	429	4.51	.501	-.023	.118	-2.009	.235
7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	429	4.40	.491	.396	.118	-1.852	.235
7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	429	4.51	.501	-.033	.118	-2.008	.235
7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	429	4.50	.501	-.014	.118	-2.009	.235
7.2.1 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through Empowering decision-making and operation rights to the team.	429	4.52	.500	-.061	.118	-2.006	.235
7.2.2 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	429	4.53	.500	-.108	.118	-1.998	.235
7.2.3 Your firm and your partners (farmers, wholesalers, 3PL, and/or	429	4.51	.501	-.023	.118	-2.009	.235

retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.							
7.2.4 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.	429	4.40	.491	.396	.118	-1.852	.235
7.2.5 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.	429	4.51	.500	-.042	.118	-2.008	.235
7.2.6 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.	429	4.41	.492	.366	.118	-1.875	.235
8.1 Government support, incentive or policy good-quality roads within the delivery route.	429	4.43	.495	.288	.118	-1.926	.235
8.2 Government support, incentive or policy new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	429	4.42	.494	.337	.118	-1.895	.235
8.3 Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.	429	4.42	.495	.308	.118	-1.914	.235
8.4 Government support, incentive or policy that ensures food safety control in delivery.	429	4.34	.473	.698	.118	-1.519	.235
8.5 Government support, incentive or policy financial support for logistics providers to build new facilities and to purchase vehicles.	429	4.43	.495	.298	.118	-1.920	.235
8.6 Government support, incentive or policy that supports education system in incorporating the logistics for	429	4.43	.496	.279	.118	-1.931	.235

egg industry in curricula.							
9.1 For Egg business, Banks should introduce efficient services in converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).	429	4.37	.482	.558	.118	-1.696	.235
9.2 For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	429	4.47	.500	.127	.118	-1.993	.235
9.3 For Egg business, Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).	429	4.47	.499	.136	.118	-1.991	.235
9.4 For Egg business, Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.	429	4.45	.498	.193	.118	-1.972	.235
9.5 For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	429	4.46	.499	.164	.118	-1.982	.235
9.6 For Egg business, Banks should introduce efficient services in streamlining one-stop financial service delivery.	429	4.47	.500	.108	.118	-1.998	.235
10.1 Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	429	4.42	.494	.317	.118	-1.908	.235
10.2 Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.	429	4.44	.497	.250	.118	-1.947	.235
10.3 Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics	429	4.43	.495	.288	.118	-1.926	.235

models.							
10.4 Educational institutions should offer/ provide vocational education or, certificate courses organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	429	4.43	.496	.279	.118	-1.931	.235
11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	429	4.49	.500	.042	.118	-2.008	.235
11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	429	4.48	.500	.089	.118	-2.001	.235
11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.	429	4.48	.500	.098	.118	-2.000	.235
11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	429	4.48	.500	.070	.118	-2.004	.235
11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.	429	4.50	.501	.005	.118	-2.009	.235
11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax,	429	4.51	.500	-.042	.118	-2.008	.235

computer & internet) by your staffs/employees in Egg distribution is used.							
11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	429	4.50	.501	-.014	.118	-2.009	.235
11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	429	4.52	.500	-.061	.118	-2.006	.235
12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	429	4.49	.500	.042	.118	-2.008	.235
12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	429	4.50	.501	.005	.118	-2.009	.235
12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	429	4.49	.501	.033	.118	-2.008	.235
12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	429	4.50	.501	-.005	.118	-2.009	.235
12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	429	4.50	.501	-.005	.118	-2.009	.235
12.6 The time from receipt of customer order to delivery	429	4.50	.501	-.014	.118	-2.009	.235

will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).							
13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	429	4.48	.500	.098	.118	-2.000	.235
13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.	429	4.48	.500	.080	.118	-2.003	.235
13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).	429	4.48	.500	.089	.118	-2.001	.235
13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	429	4.46	.499	.145	.118	-1.988	.235
13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	429	4.48	.500	.070	.118	-2.004	.235
13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	429	4.47	.500	.127	.118	-1.993	.235
13.7 The time from receipt of customer order to delivery	429	4.48	.500	.070	.118	-2.004	.235

will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.							
13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	429	4.48	.500	.061	.118	-2.006	.235
13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	429	4.49	.500	.051	.118	-2.007	.235
13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	429	4.50	.501	-.014	.118	-2.009	.235
14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.	429	4.52	.500	-.089	.118	-2.001	.235
14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.	429	4.53	.500	-.127	.118	-1.993	.235
14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	429	4.54	.499	-.145	.118	-1.988	.235
14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in	429	4.48	.500	.070	.118	-2.004	.235

Egg distribution.							
14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	429	4.49	.501	.023	.118	-2.009	.235
14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	429	4.49	.501	.033	.118	-2.008	.235

Appendix 2.5: 5% Trimmed Mean Descriptions

Items	Mean	5% Trimmed Mean	Difference between Mean and 5% Trimmed Mean
1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	4.59	4.60	-0.01
1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	4.62	4.64	-0.02
1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	4.60	4.61	-0.01
1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	4.59	4.60	-0.01
1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	4.57	4.58	-0.01
1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that take place frequently, informally, and in timely manner.	4.57	4.57	0
1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	4.58	4.58	0
1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	4.56	4.57	-0.01
1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).	4.59	4.59	0
1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	4.58	4.59	-0.01
2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	4.57	4.57	0
2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.	4.58	4.59	-0.01
2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	4.57	4.58	-0.01
2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the	4.58	4.59	-0.01

objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.			
2.2.1 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.	4.63	4.64	-0.01
2.2.2 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.	4.63	4.65	-0.02
2.2.3 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.	4.64	4.65	-0.01
2.2.4 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation within the egg supply chain.	4.54	4.54	0
2.2.5 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.	4.64	4.66	-0.02
3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	4.46	4.46	0
3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	4.45	4.44	0.01
3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	4.46	4.45	0.01
3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	4.37	4.35	0.02
4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	4.38	4.37	0.01
4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	4.49	4.49	0
4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	4.46	4.46	0
4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	4.47	4.46	0.01
4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	4.46	4.45	0.01
5.1 You are intending to build interpersonal trust to create/	4.50	4.50	0

maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).			
5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	4.51	4.51	0
5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	4.50	4.50	0
5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	4.50	4.50	0
5.5 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.	4.50	4.50	0
6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	4.50	4.50	0
6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.	4.50	4.50	0
6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	4.50	4.50	0
6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	4.51	4.51	0
6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	4.44	4.44	0
6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	4.51	4.51	0
6.2.1 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.	4.41	4.40	0.01
6.2.2 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skill to handle the shipping processes in egg distribution shared with partners.	4.51	4.51	0
6.2.3 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.	4.50	4.50	0

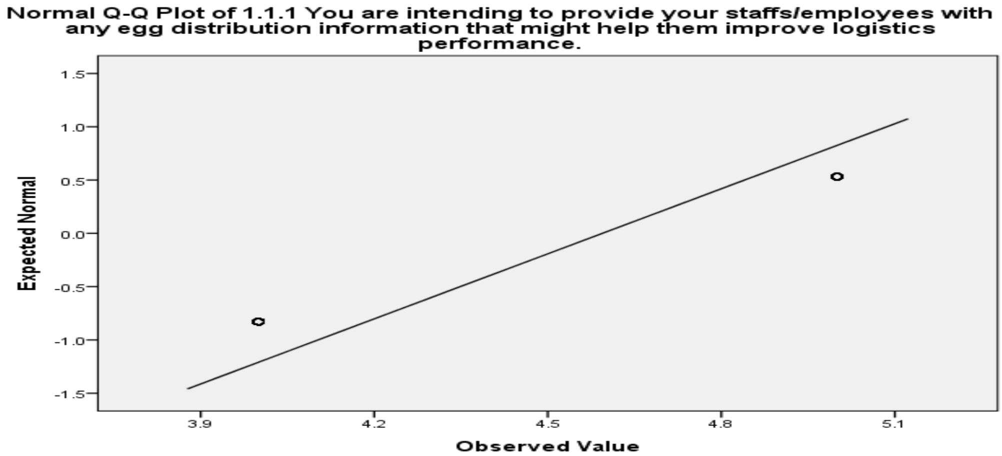
6.2.4 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.	4.49	4.49	0
6.2.5 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	4.49	4.49	0
7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	4.49	4.49	0
7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	4.39	4.38	0.01
7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	4.51	4.51	0
7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	4.40	4.39	0.01
7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	4.51	4.51	0
7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	4.50	4.50	0
7.2.1 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through Empowering decision-making and operation rights to the team.	4.52	4.52	0
7.2.2 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	4.53	4.53	0
7.2.3 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.	4.51	4.51	0
7.2.4 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.	4.40	4.39	0.01
7.2.5 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.	4.51	4.51	0
7.2.6 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.	4.41	4.40	0.01
8.1 Government support, incentive or policy good-quality roads within the delivery route.	4.43	4.42	0.01
8.2 Government support, incentive or policy new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	4.42	4.41	0.01
8.3 Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.	4.42	4.42	0

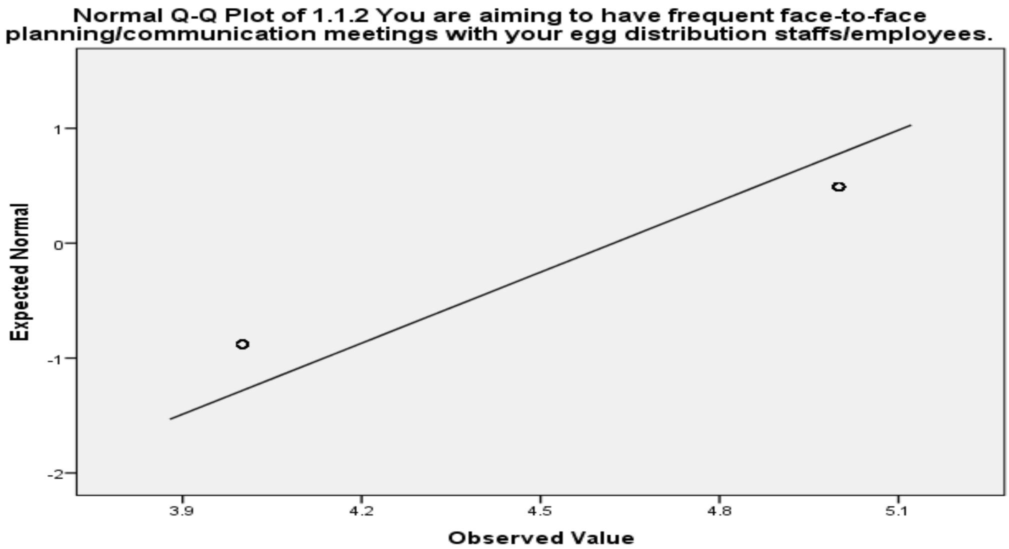
8.4 Government support, incentive or policy that ensures food safety control in delivery.	4.34	4.32	0.02
8.5 Government support, incentive or policy financial support for logistics providers to build new facilities and to purchase vehicles.	4.43	4.42	0.01
8.6 Government support, incentive or policy that supports education system in incorporating the logistics for egg industry in curricula.	4.43	4.42	0.01
9.1 For Egg business, Banks should introduce efficient services in converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).	4.37	4.35	0.02
9.2 For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	4.47	4.47	0
9.3 For Egg business, Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).	4.47	4.46	0.01
9.4 For Egg business, Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.	4.45	4.45	0
9.5 For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	4.46	4.45	0.01
9.6 For Egg business, Banks should introduce efficient services in streamlining one-stop financial service delivery.	4.47	4.47	0
10.1 Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	4.42	4.41	0.01
10.2 Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.	4.44	4.43	0.01
10.3 Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics models.	4.43	4.42	0.01
10.4 Educational institutions should offer/ provide vocational education or, certificate courses organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	4.43	4.42	0.01
11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	4.49	4.49	0
11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	4.48	4.48	0
11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in egg distribution for reliability.	4.48	4.47	0.01
11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in egg distribution.	4.48	4.48	0
11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.	4.50	4.50	0

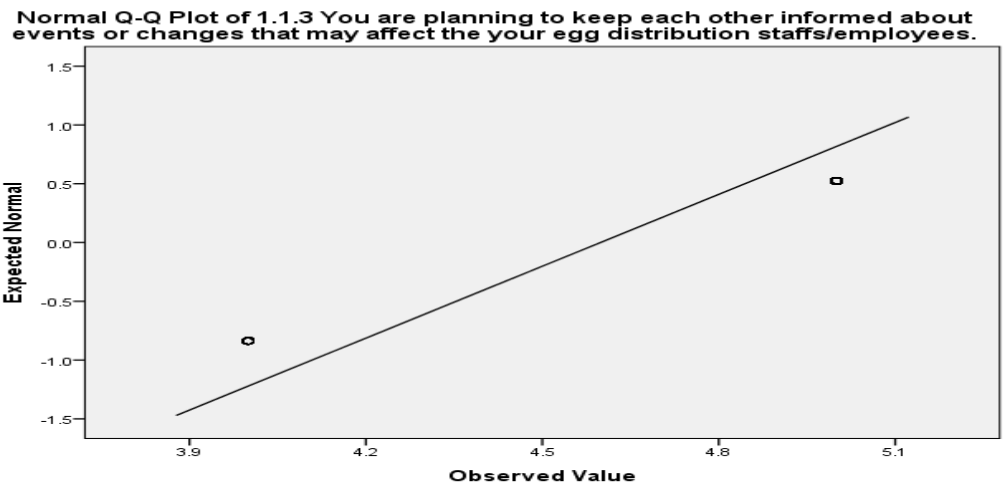
11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in egg distribution is used.	4.51	4.51	0
11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	4.50	4.50	0
11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	4.52	4.52	0
12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	4.49	4.49	0
12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	4.50	4.50	0
12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	4.49	4.49	0
12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	4.50	4.50	0
12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	4.50	4.50	0
12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).	4.50	4.50	0
13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	4.48	4.47	0.01
13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.	4.48	4.48	0
13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).	4.48	4.48	0
13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	4.46	4.46	0
13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	4.48	4.48	0
13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	4.47	4.47	0
13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with	4.48	4.48	0

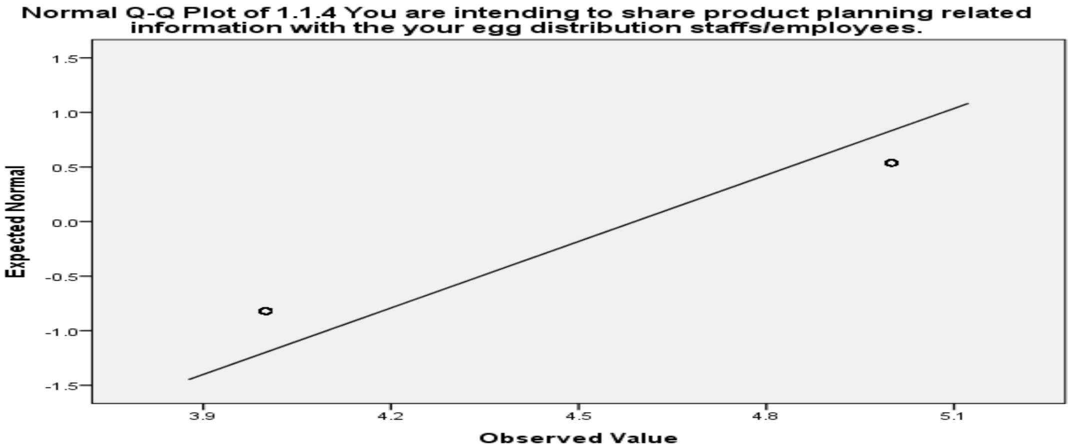
your staffs/employees in logistic distribution chain.			
13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	4.48	4.48	0
13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	4.49	4.49	0
13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	4.50	4.50	0
14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.	4.52	4.52	0
14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.	4.53	4.53	0
14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	4.54	4.54	0
14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.	4.48	4.48	0
14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	4.49	4.49	0
14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	4.49	4.49	0

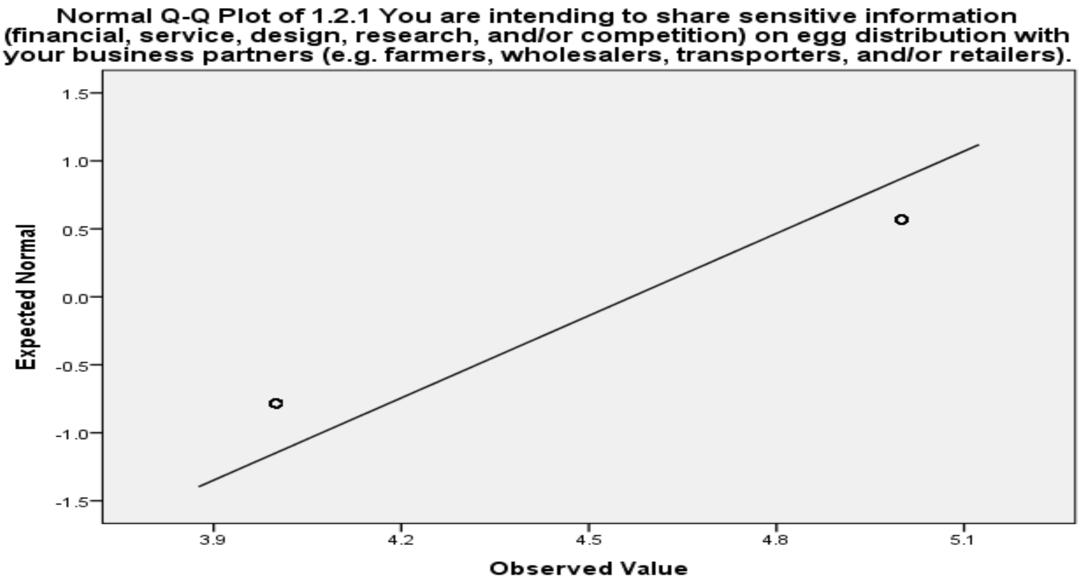
Appendix 2.6 Q-Q plot of measurement items

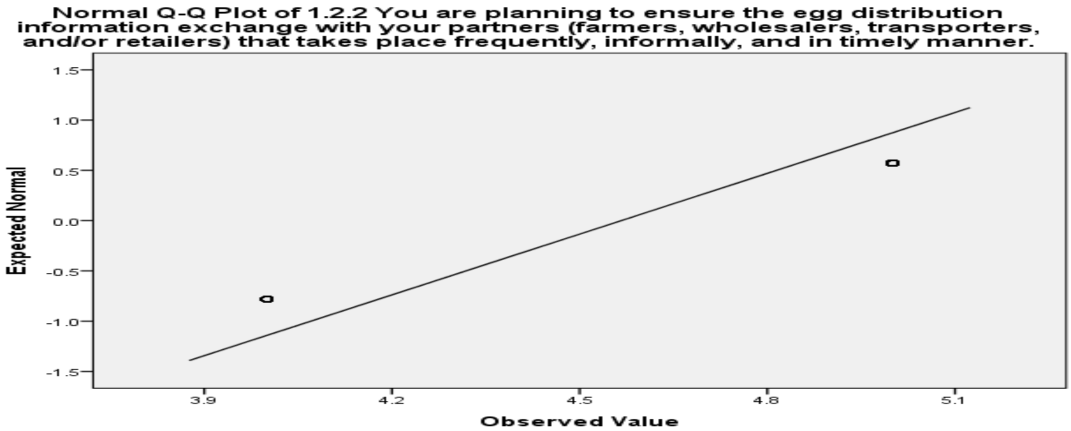


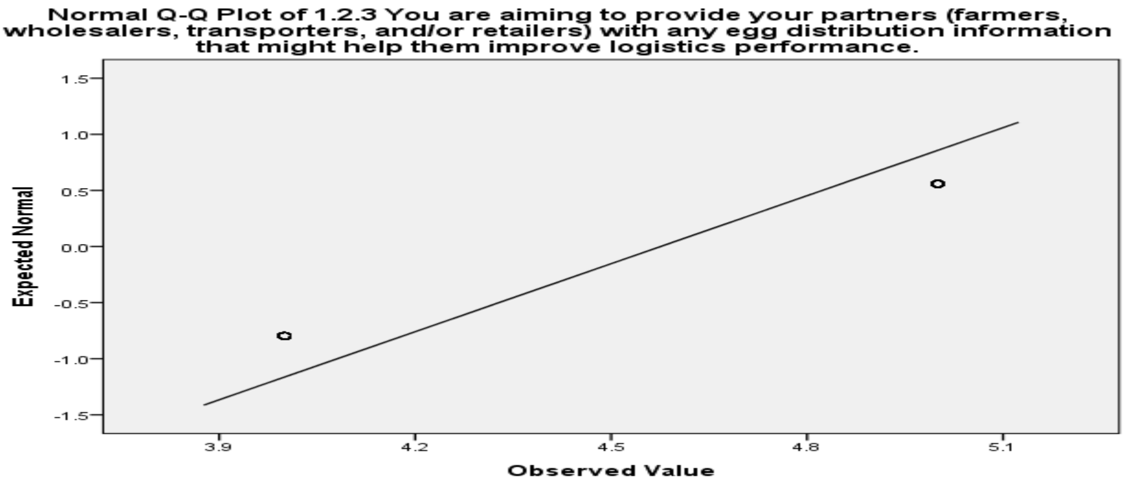


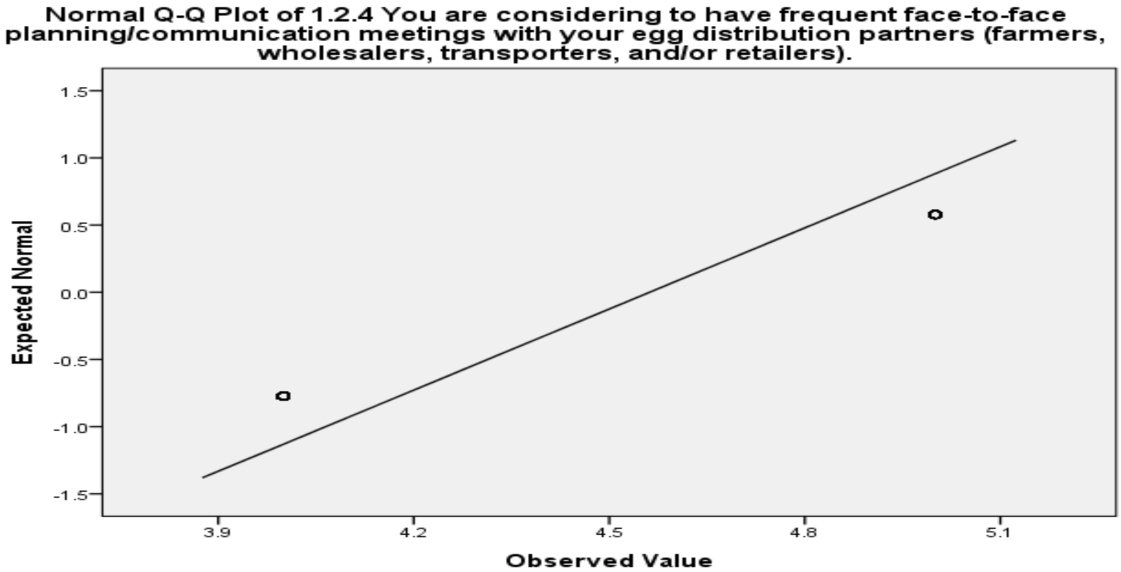


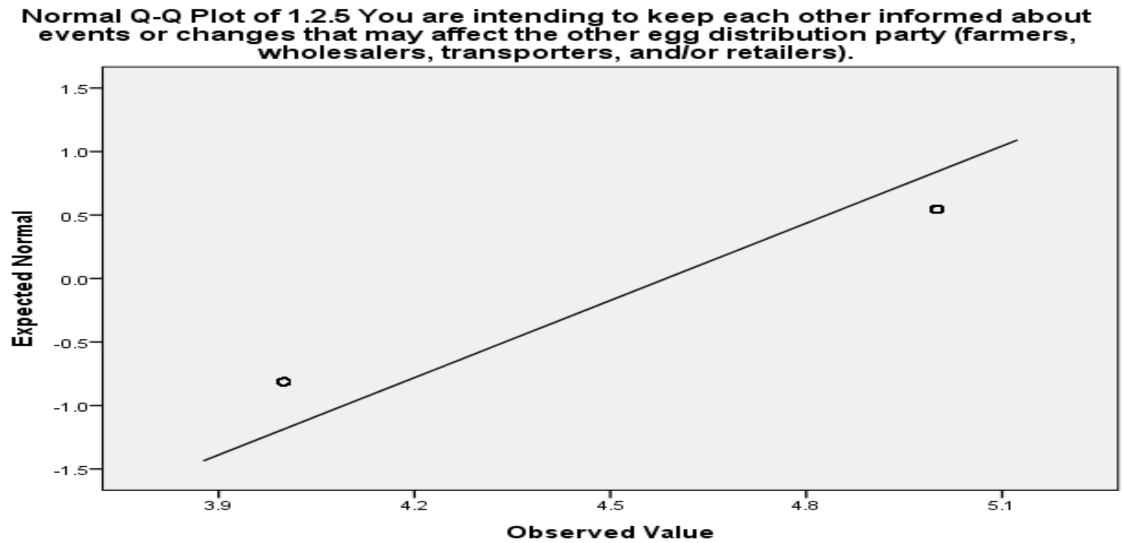

Normal Q-Q Plot of 1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

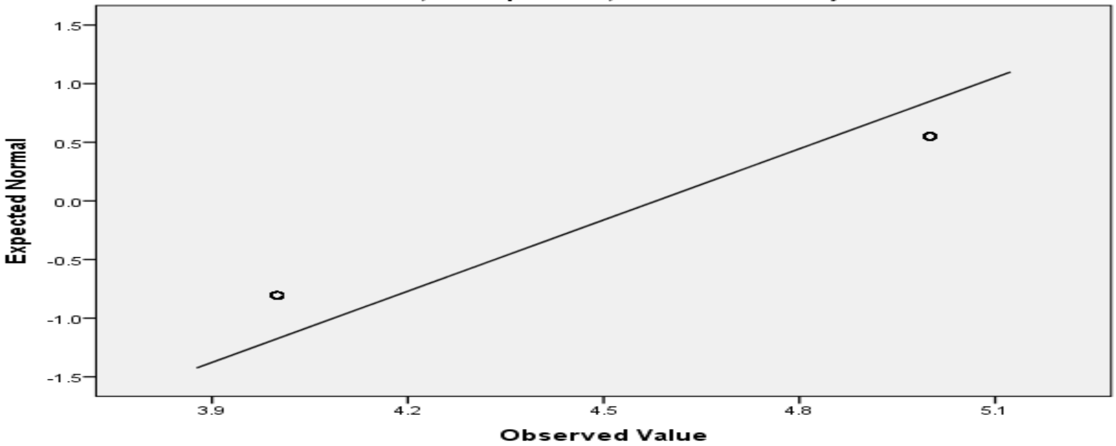

Normal Q-Q Plot of 1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that takes place frequently, informally, and in timely manner.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

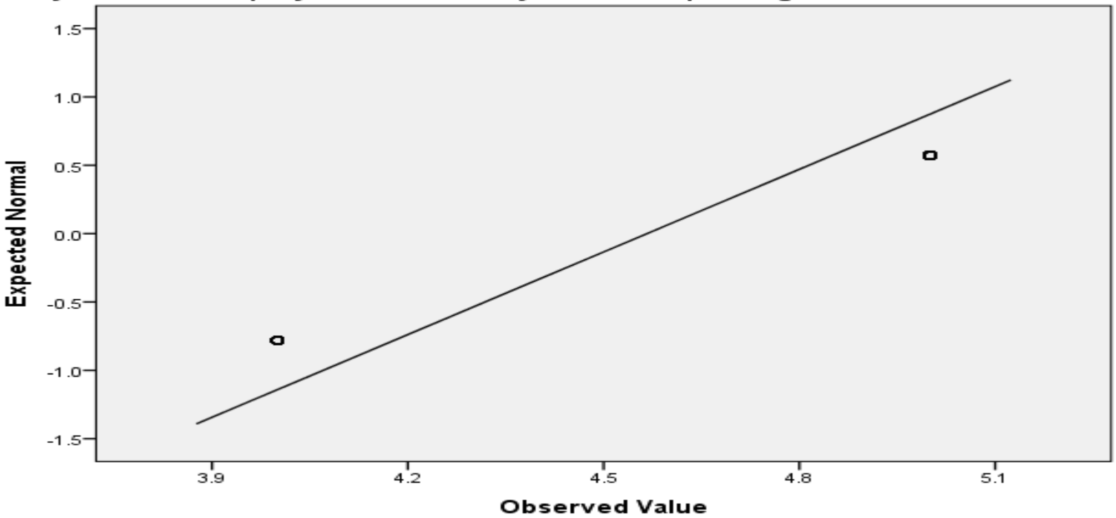

Normal Q-Q Plot of 1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

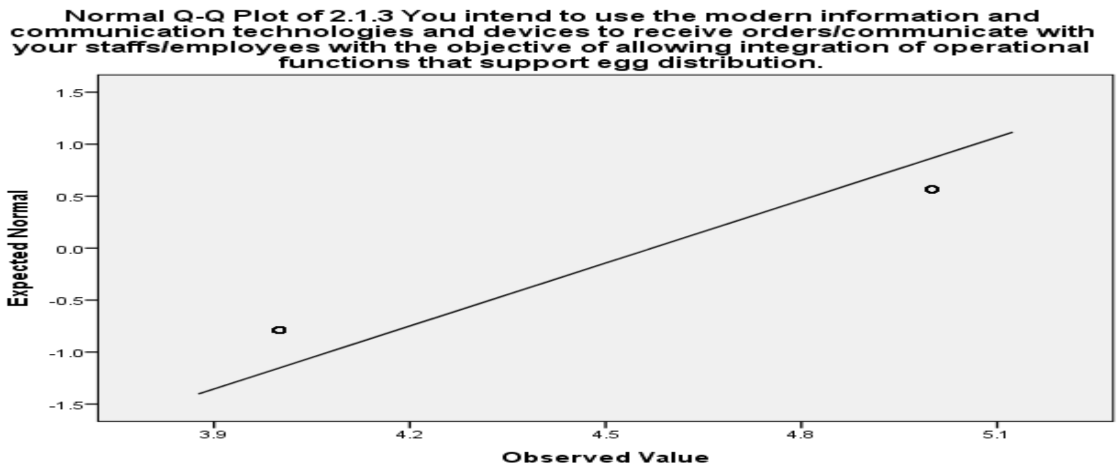
Normal Q-Q Plot of 1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).

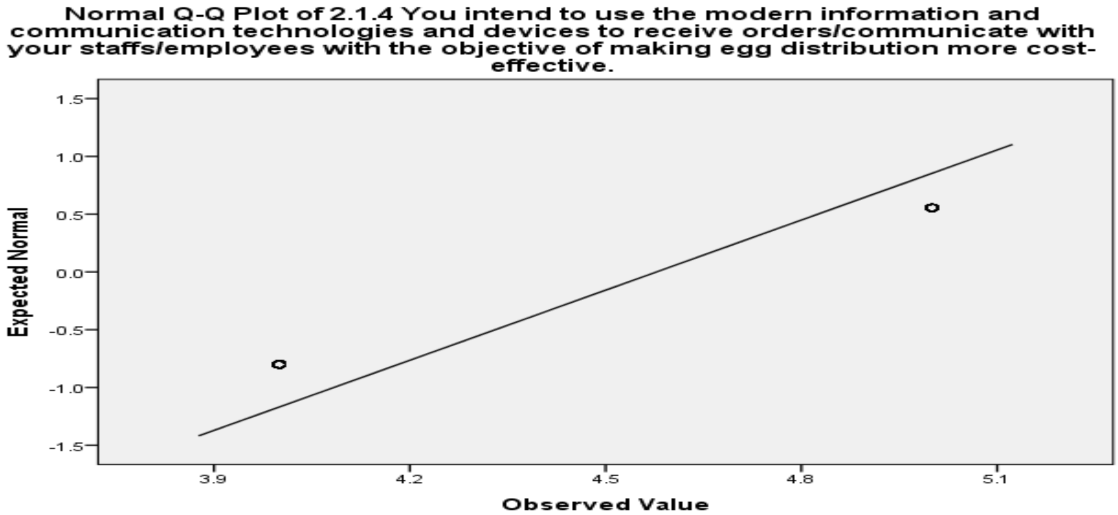


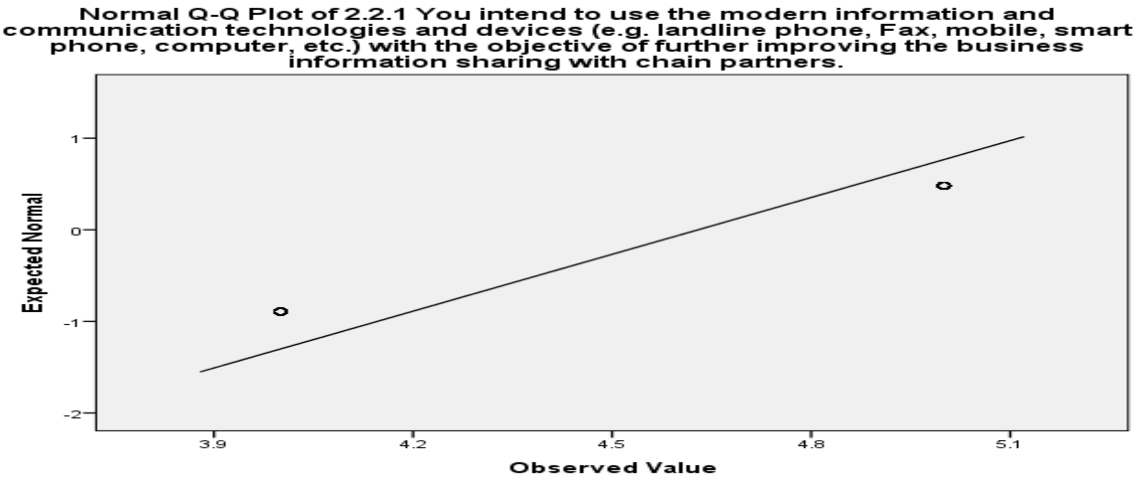
Normal Q-Q Plot of 2.1.1 You intend to use the modern information and communication technologies and devices to receive orders/communicate with your staffs/employees with the objective of improving customer service.

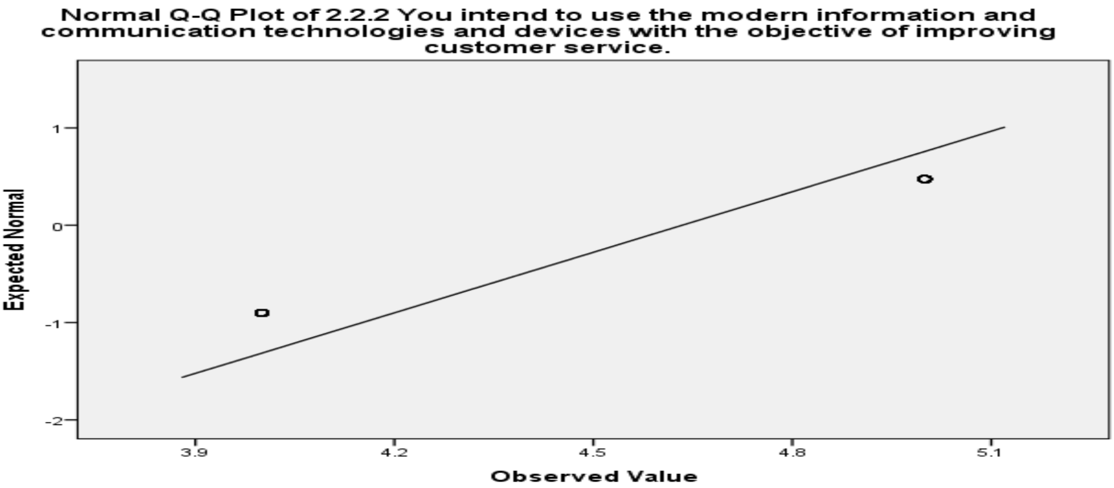


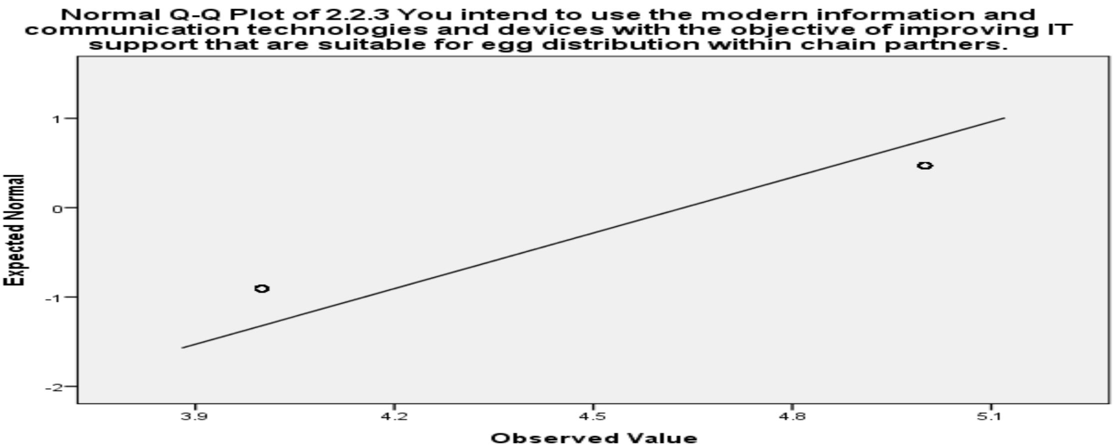
Normal Q-Q Plot of 2.1.2 You intend to use the modern information and communication technologies and devices to receive orders/communicate with your staffs/employees with the objective of develop IT solutions that can significantly reduce the delivery lead time.

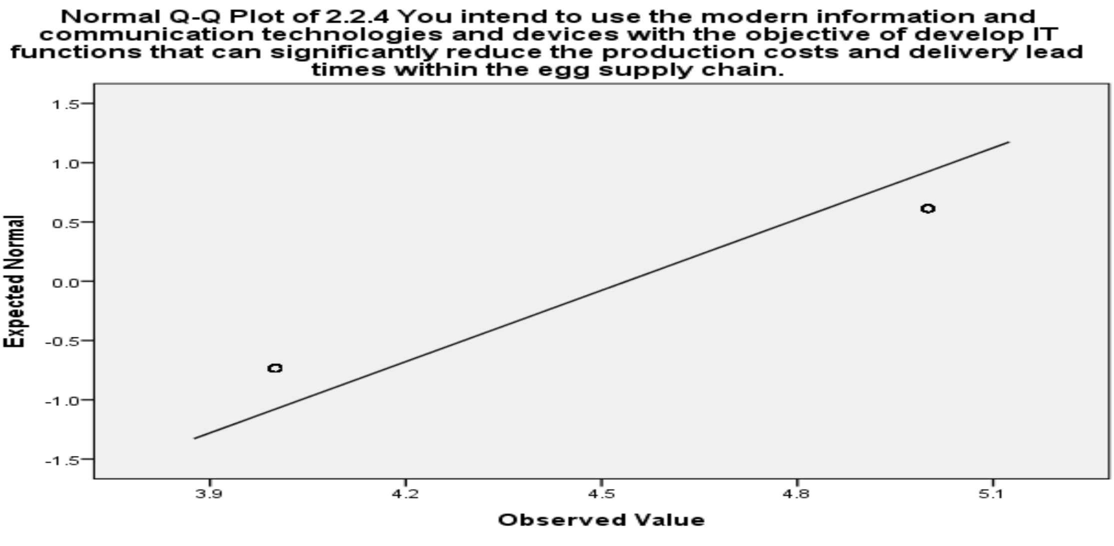

Normal Q-Q Plot of 2.1.3 You intend to use the modern information and communication technologies and devices to receive orders/communicate with your staffs/employees with the objective of allowing integration of operational functions that support egg distribution.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 2.1.4 You intend to use the modern information and communication technologies and devices to receive orders/communicate with your staffs/employees with the objective of making egg distribution more cost-effective.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

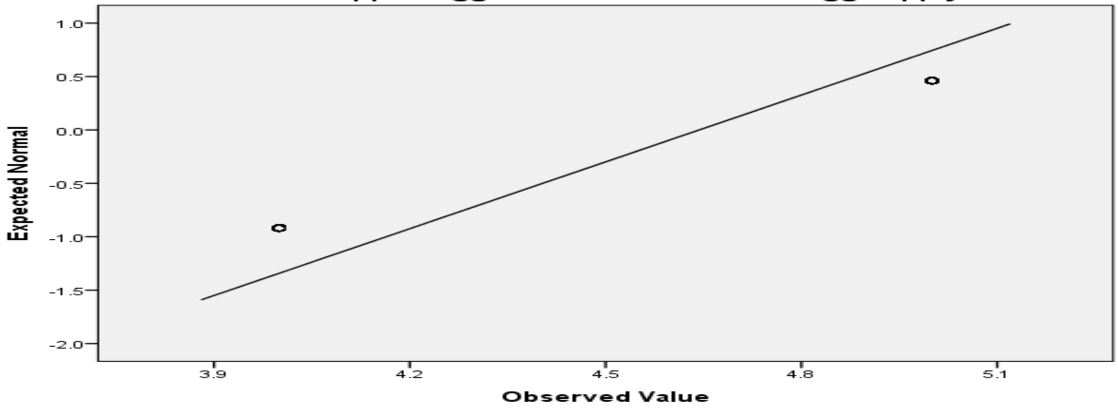

Normal Q-Q Plot of 2.2.1 You intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.
Expected Normal
1
0
-1
-2
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 2.2.2 You intend to use the modern information and communication technologies and devices with the objective of improving customer service.
Expected Normal
1
0
-1
-2
3.9
4.2
4.5
4.8
5.1
Observed Value

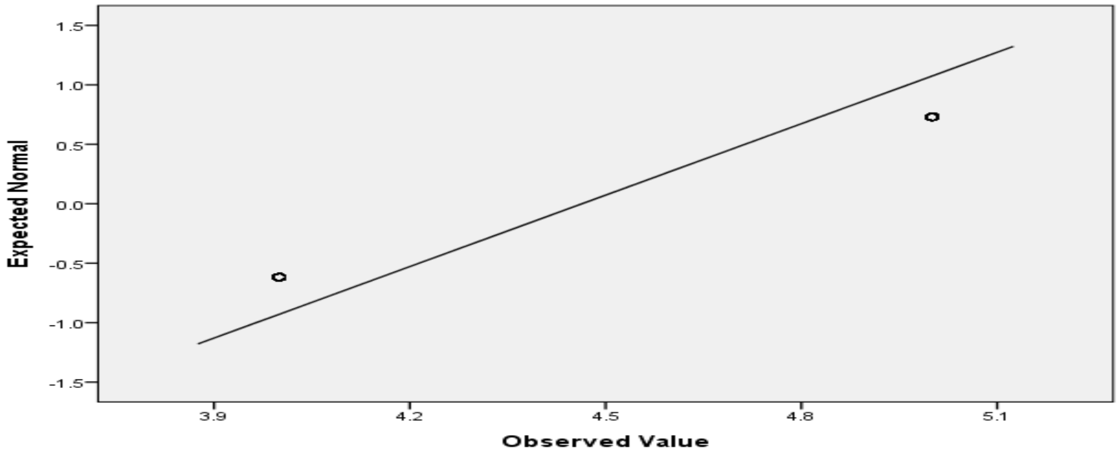

Normal Q-Q Plot of 2.2.3 You intend to use the modern information and communication technologies and devices with the objective of improving IT support that are suitable for egg distribution within chain partners.
Expected Normal
1
0
-1
-2
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 2.2.4 You intend to use the modern information and communication technologies and devices with the objective of develop IT functions that can significantly reduce the production costs and delivery lead times within the egg supply chain.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

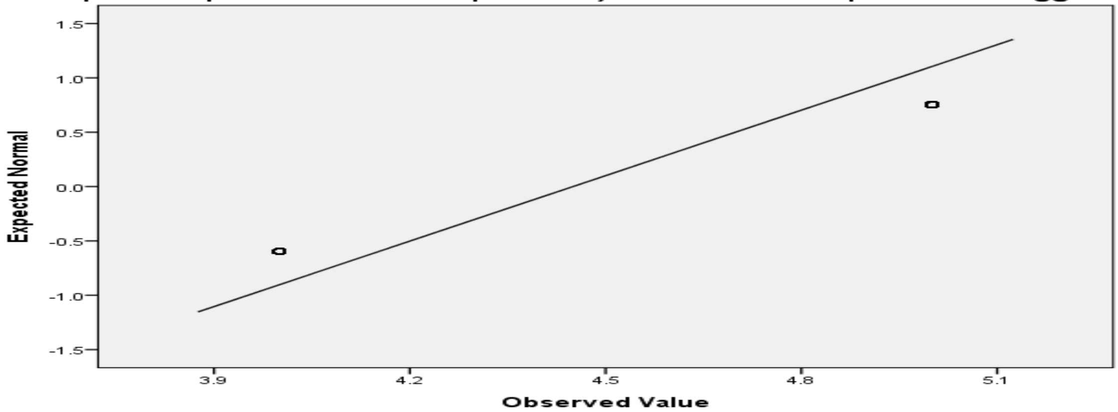
Normal Q-Q Plot of 2.2.5 You intend to use the modern information and communication technologies and devices with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.

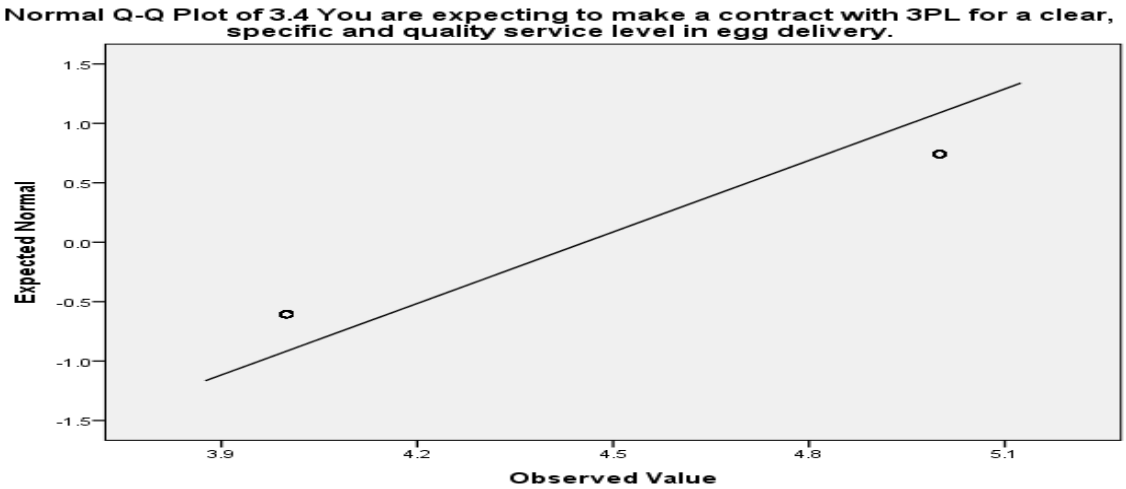


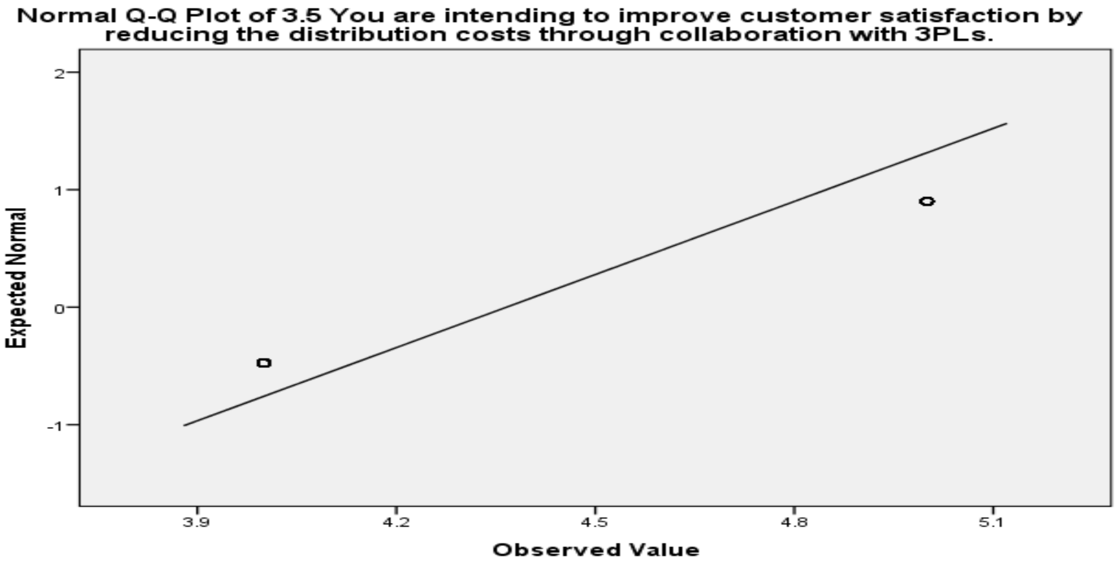
Normal Q-Q Plot of 3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.

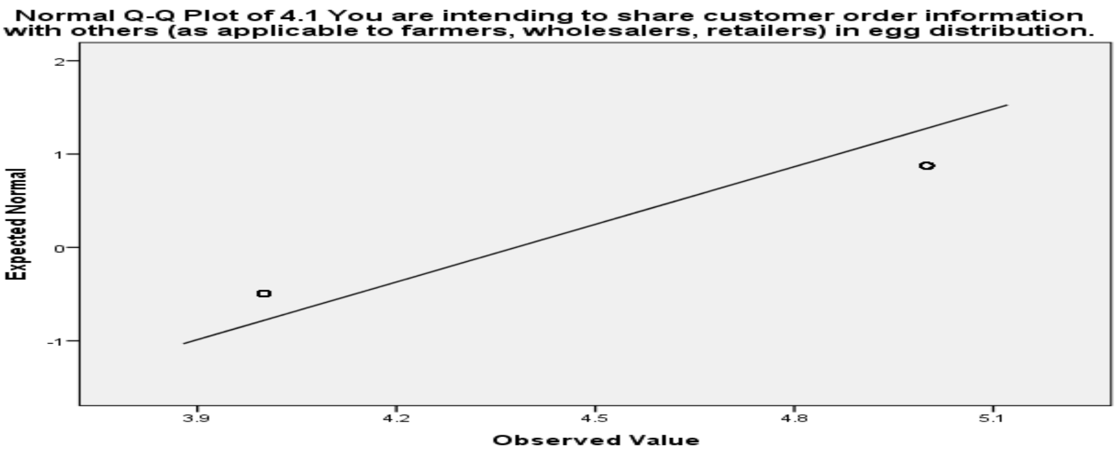


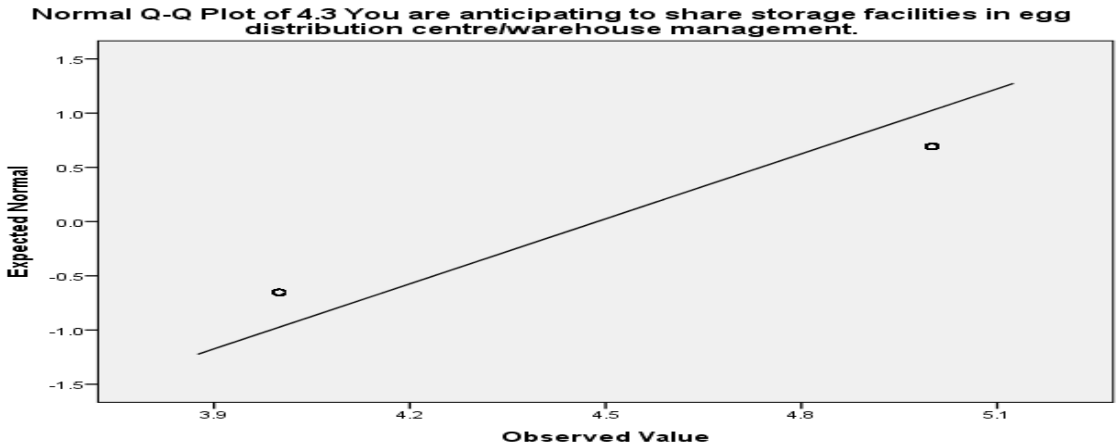
Normal Q-Q Plot of 3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.

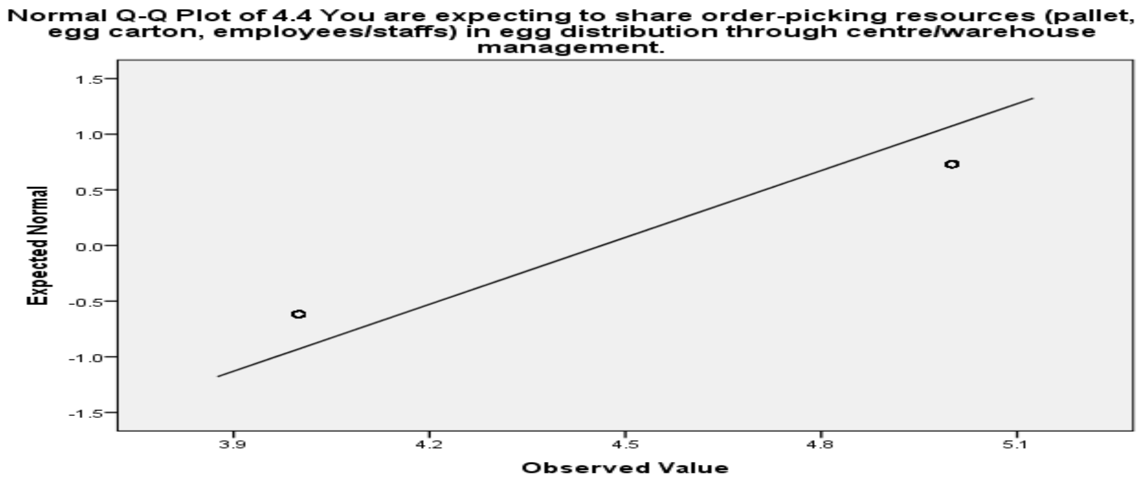


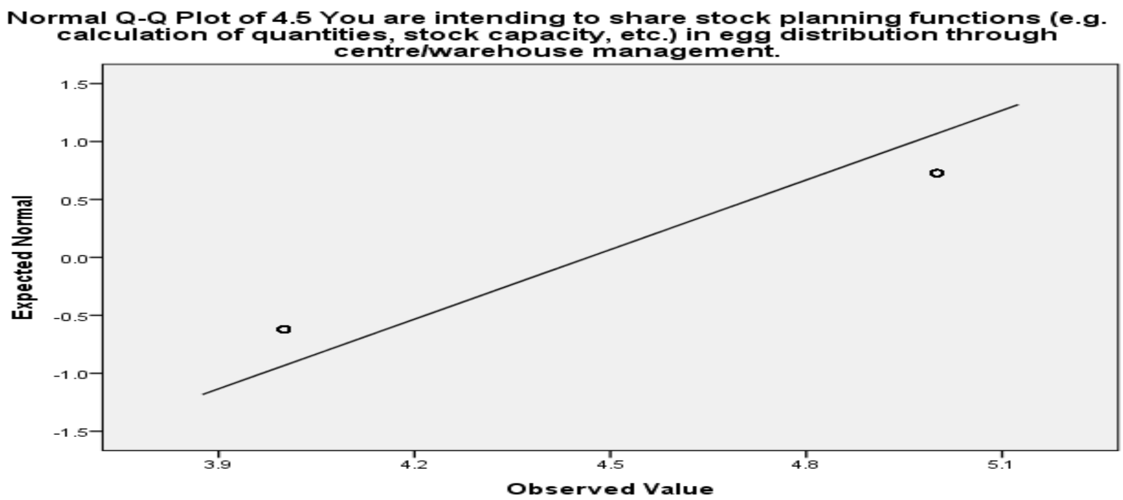

Normal Q-Q Plot of 3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
Expected Normal
3.9
4.2
4.5
4.8
5.1
Observed Value

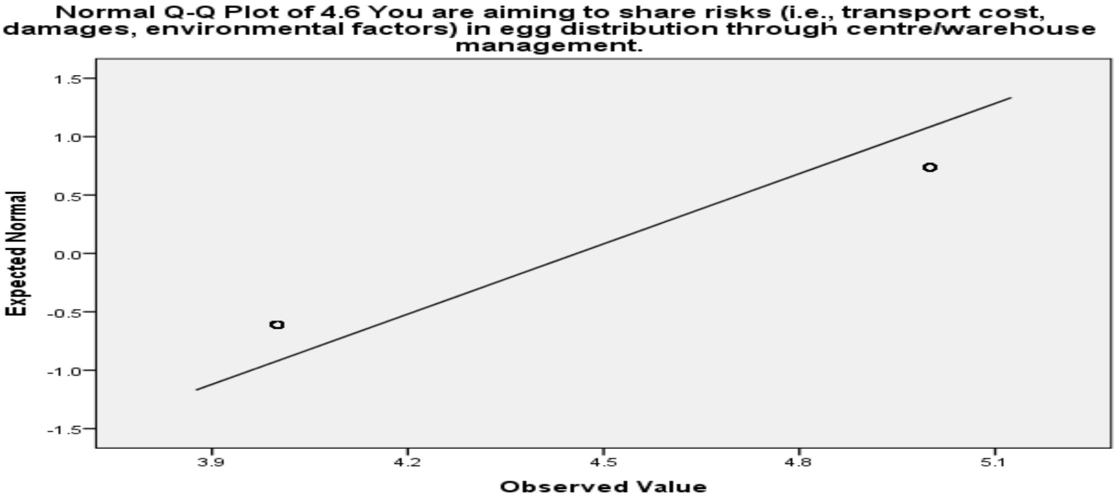

Normal Q-Q Plot of 3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.
2
1
0
-1
Expected Normal
3.9
4.2
4.5
4.8
5.1
Observed Value

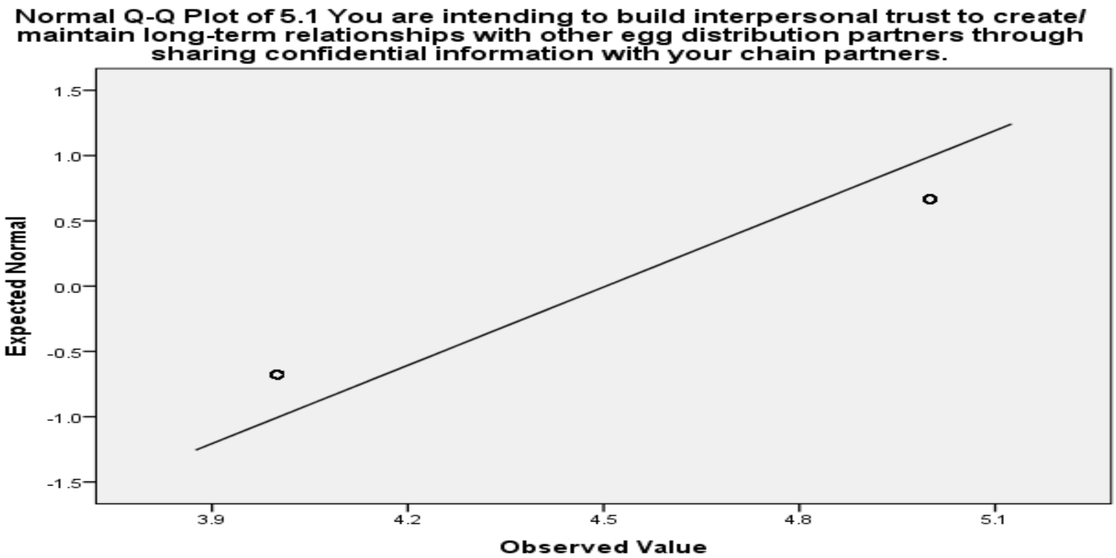

Normal Q-Q Plot of 4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.
2
1
0
-1
Expected Normal
3.9
4.2
4.5
4.8
5.1
Observed Value

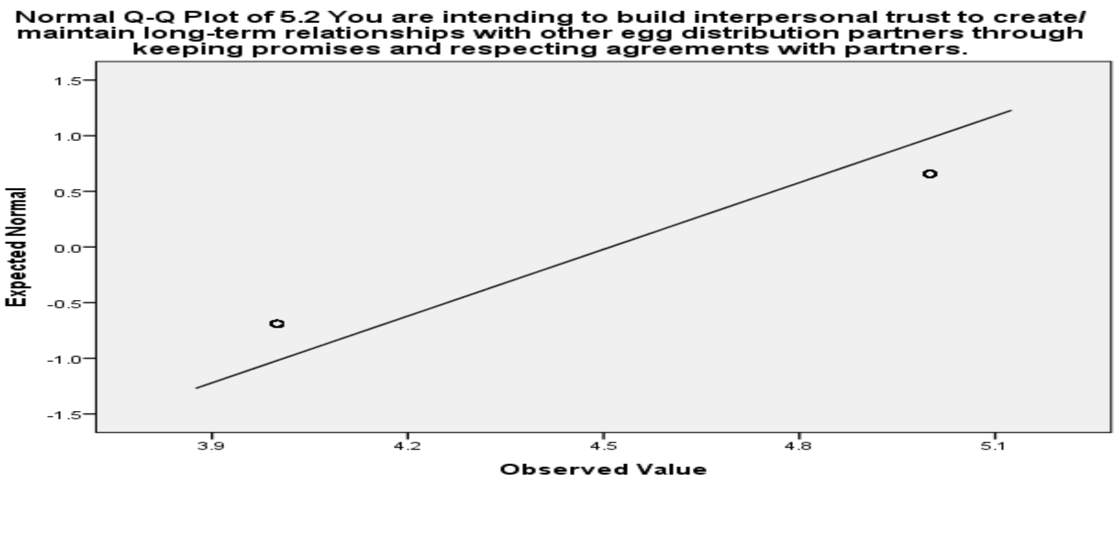

Normal Q-Q Plot of 4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

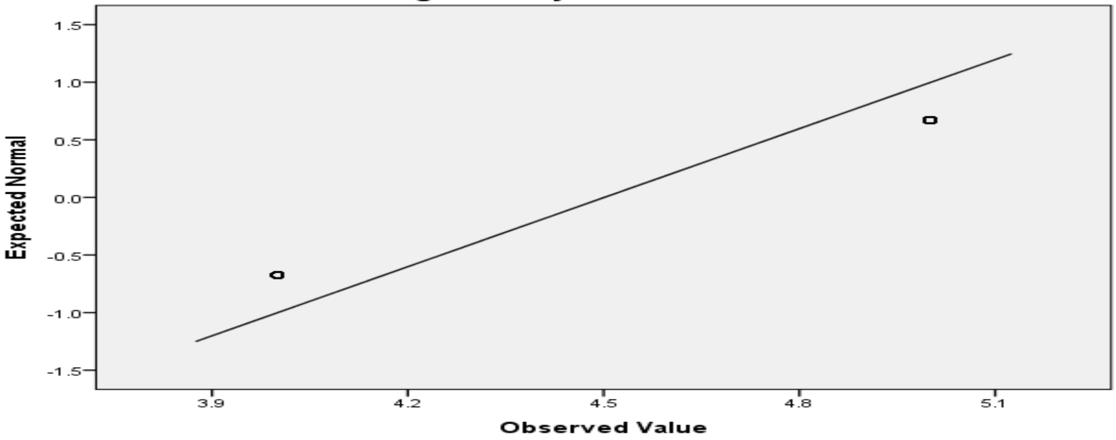

Normal Q-Q Plot of 4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

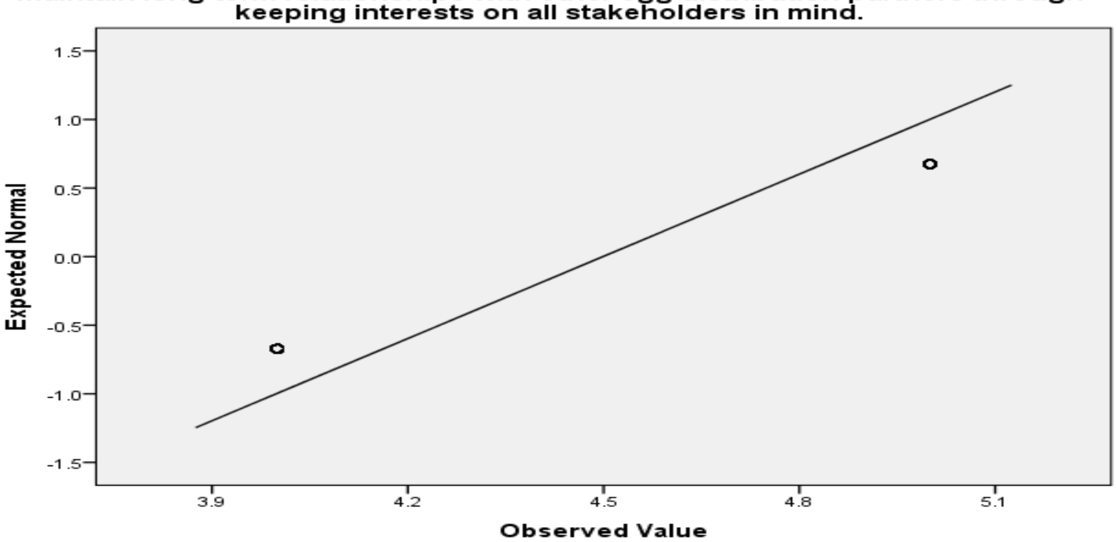

Normal Q-Q Plot of 5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

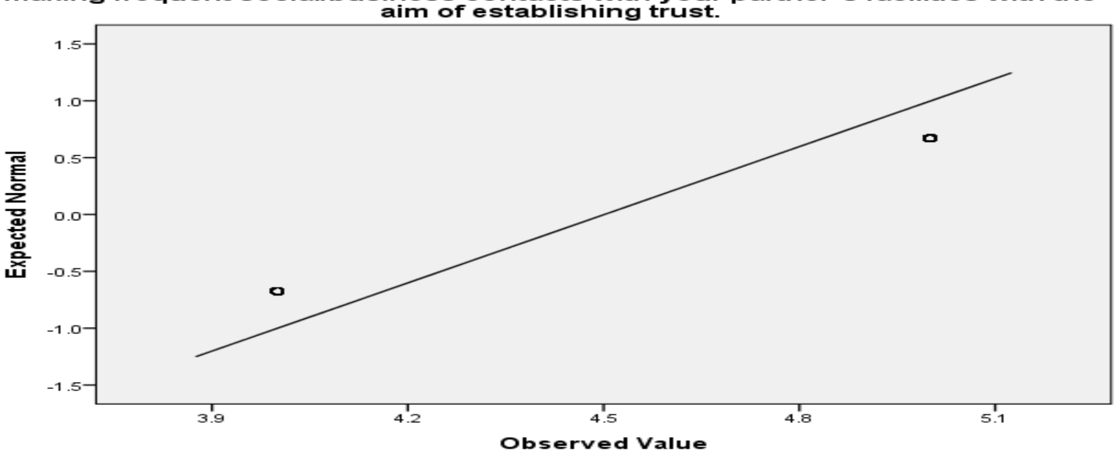
Normal Q-Q Plot of 5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct.



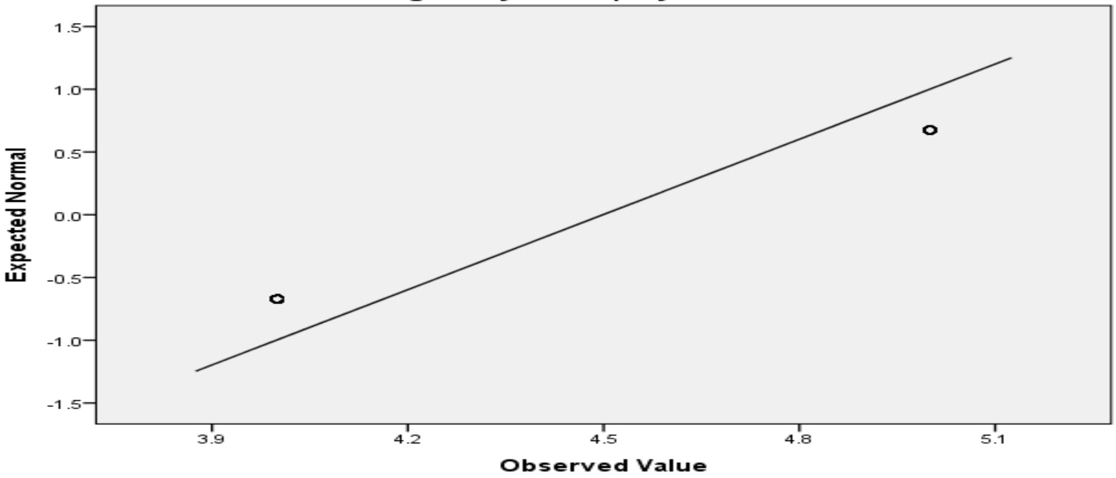
Normal Q-Q Plot of 5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind.



Normal Q-Q Plot of 5.5 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's facilities with the aim of establishing trust.



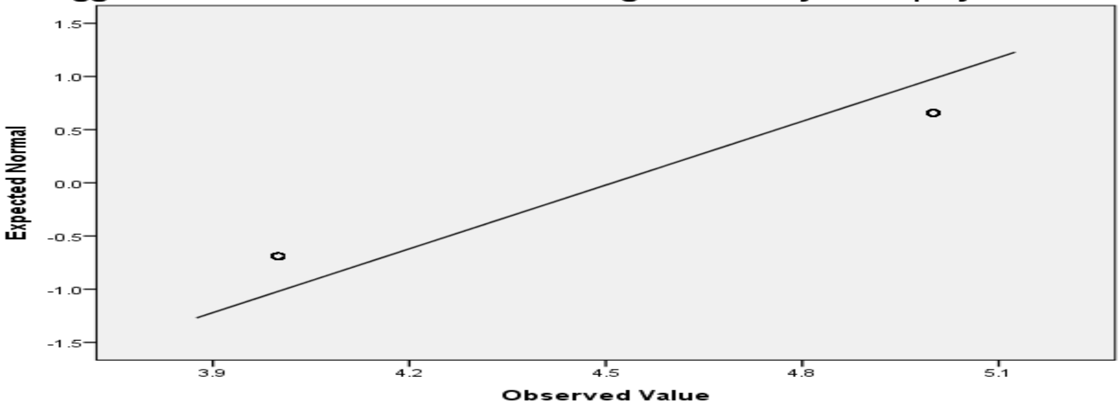
Normal Q-Q Plot of 6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.



Normal Q-Q Plot of 6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.

Normal Q-Q Plot of 6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.

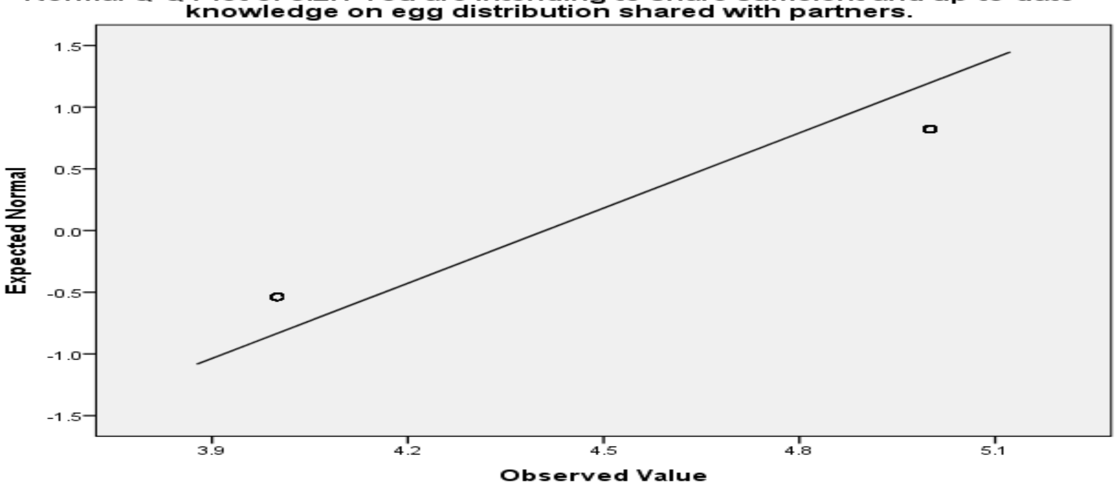
Normal Q-Q Plot of 6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.



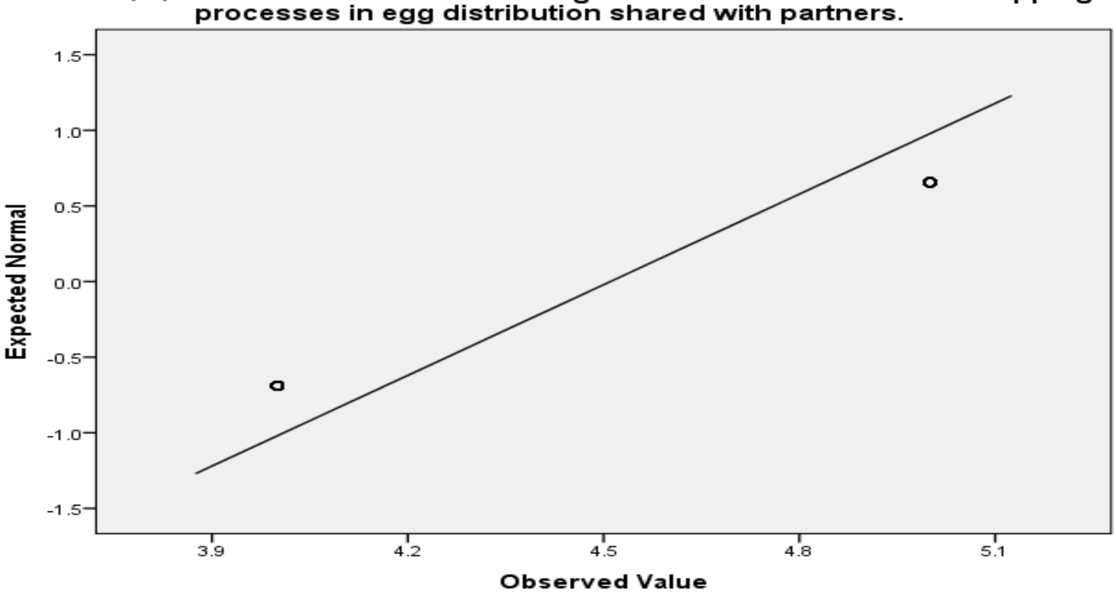
Normal Q-Q Plot of 6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.

Normal Q-Q Plot of 6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions in egg distribution through centre/warehouse management with your employee/staff.

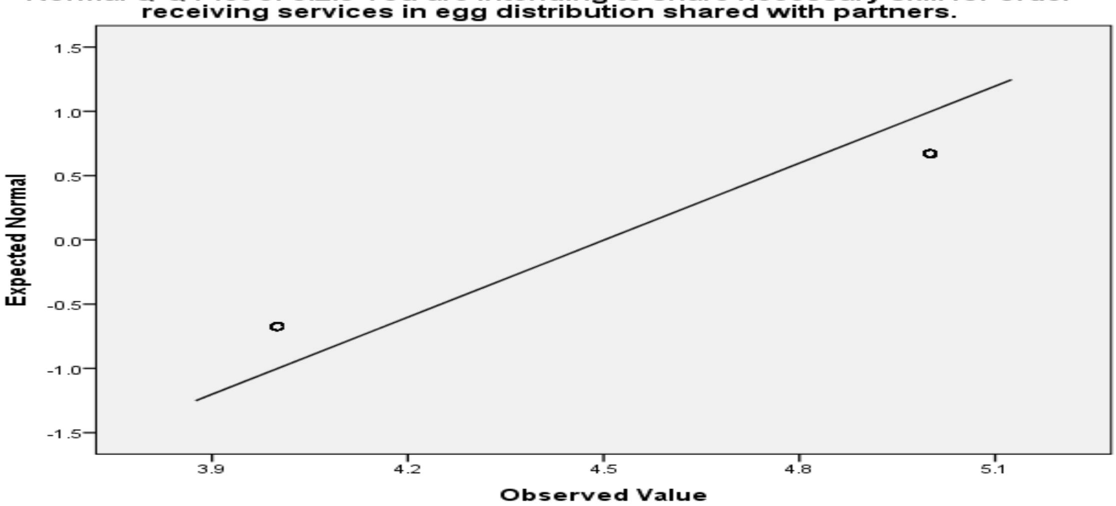
Normal Q-Q Plot of 6.2.1 You are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.



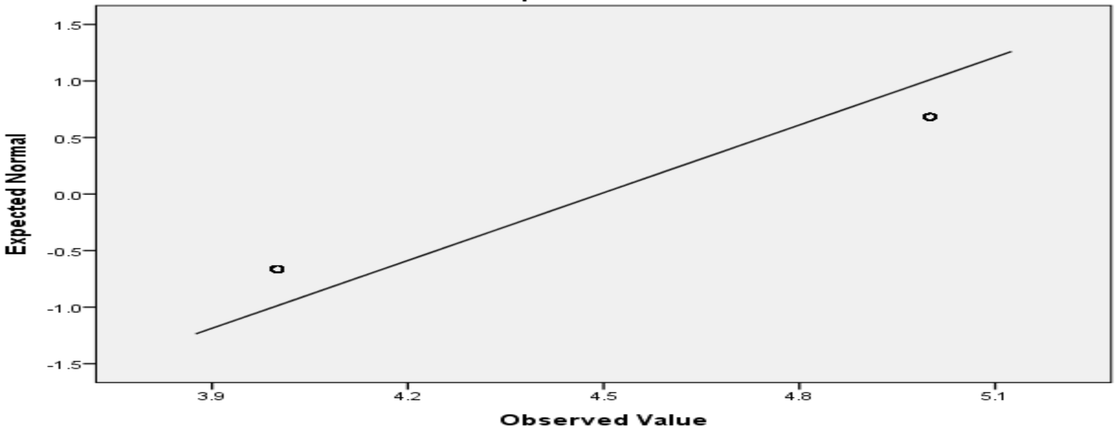
Normal Q-Q Plot of 6.2.2 You are intending to share skill to handle the shipping processes in egg distribution shared with partners.



Normal Q-Q Plot of 6.2.3 You are intending to share necessary skill for order receiving services in egg distribution shared with partners.

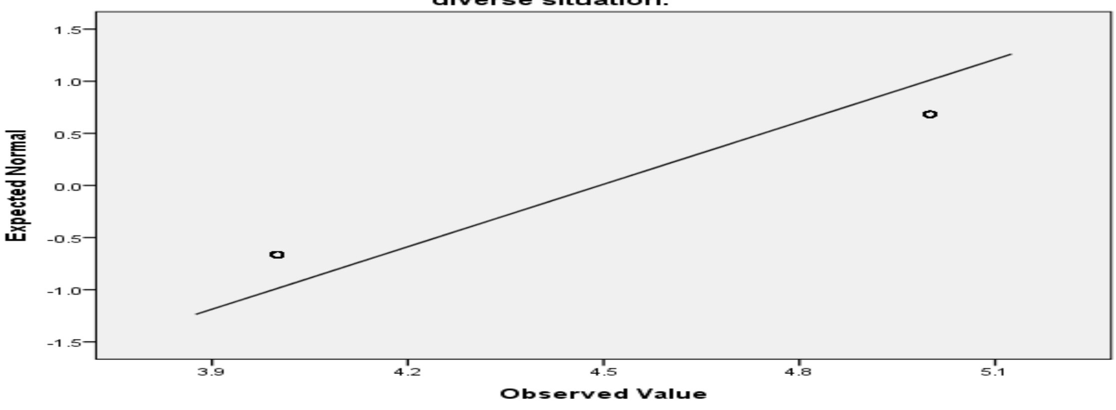


Normal Q-Q Plot of 6.2.4 You are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.

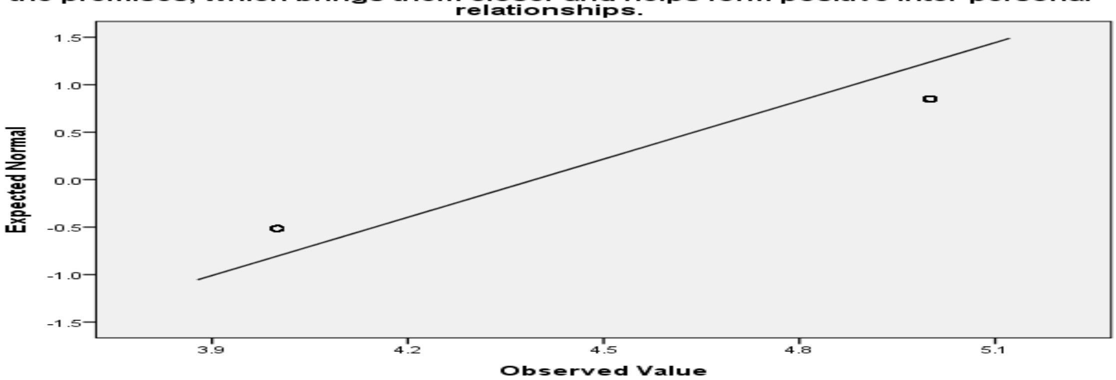


Normal Q-Q Plot of 6.2.5 You are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.

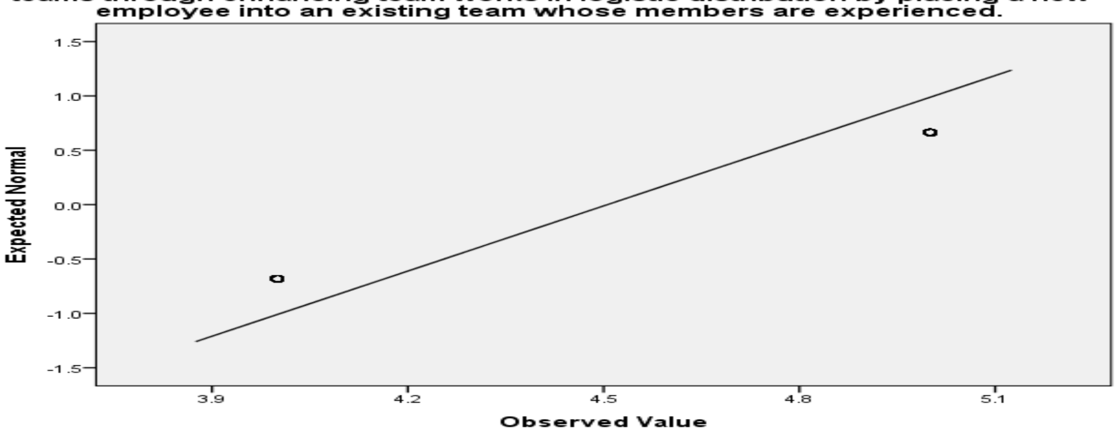
Normal Q-Q Plot of 7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.



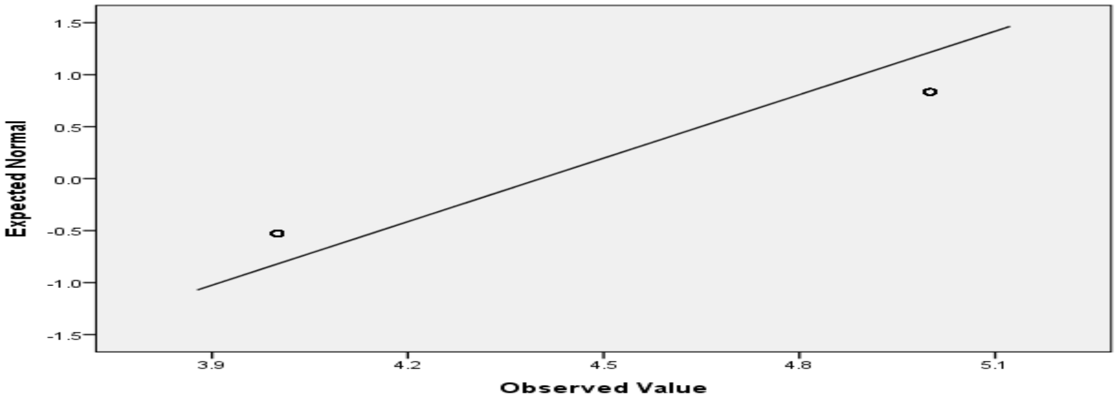
Normal Q-Q Plot of 7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.



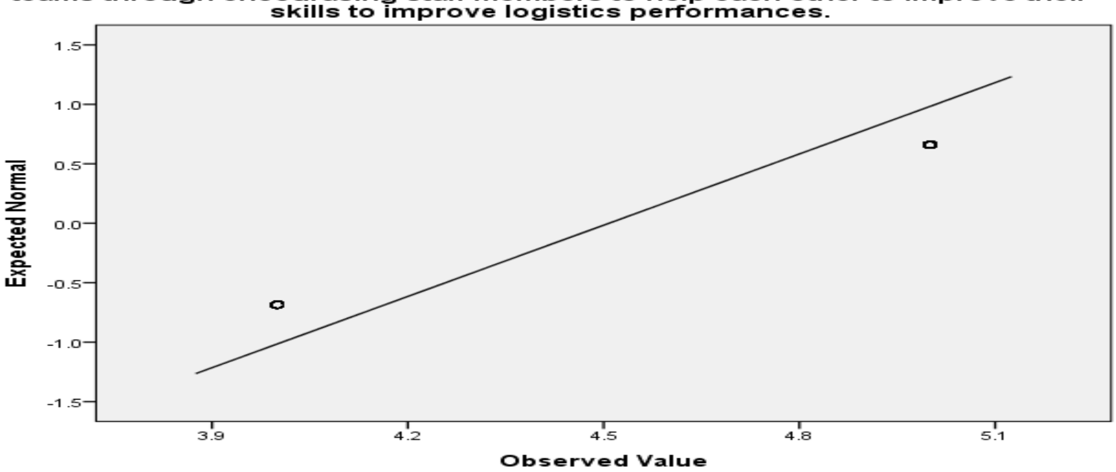
Normal Q-Q Plot of 7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.



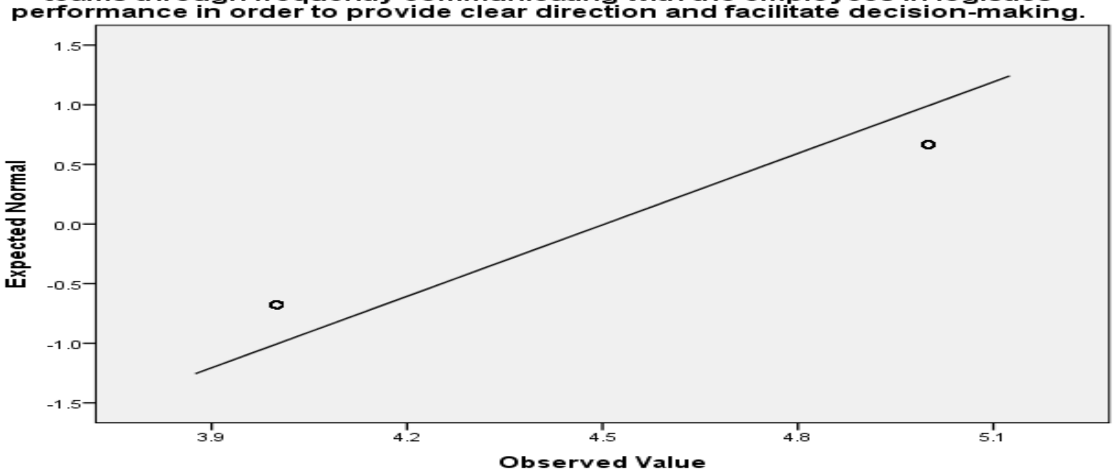
Normal Q-Q Plot of 7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.



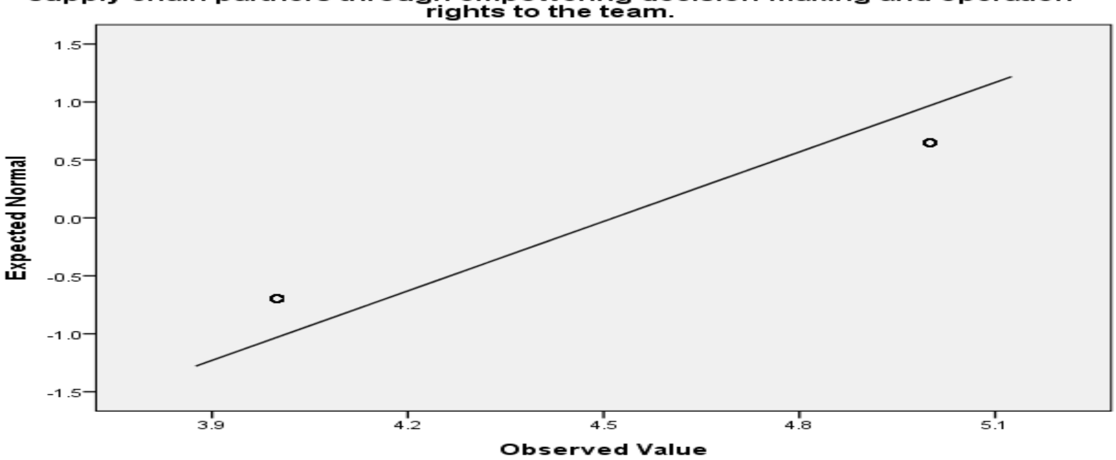
Normal Q-Q Plot of 7.1.5 Encouraging teamwork within internal cross-functional teams through encourasing staff members to help each other to improve their skills to improve logistics performances.

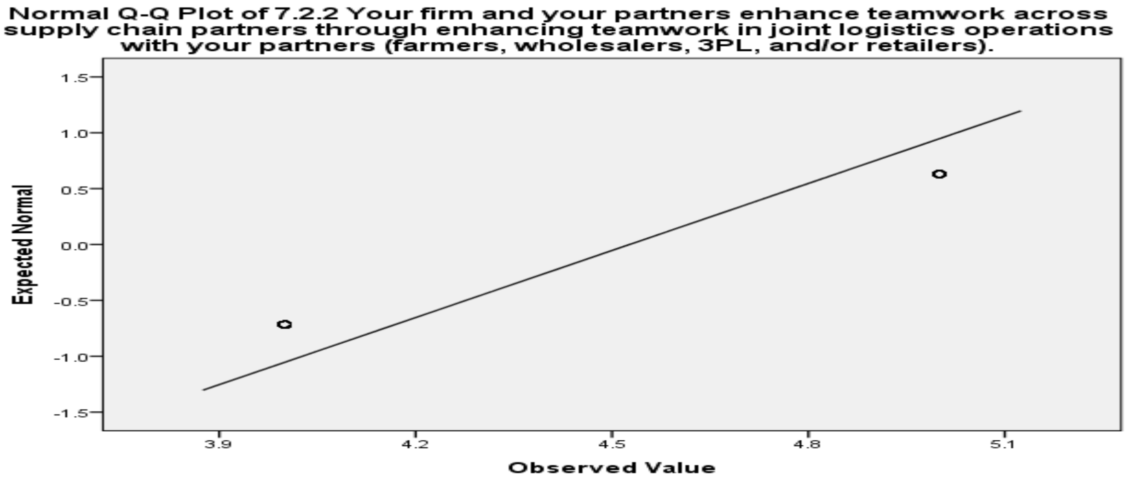


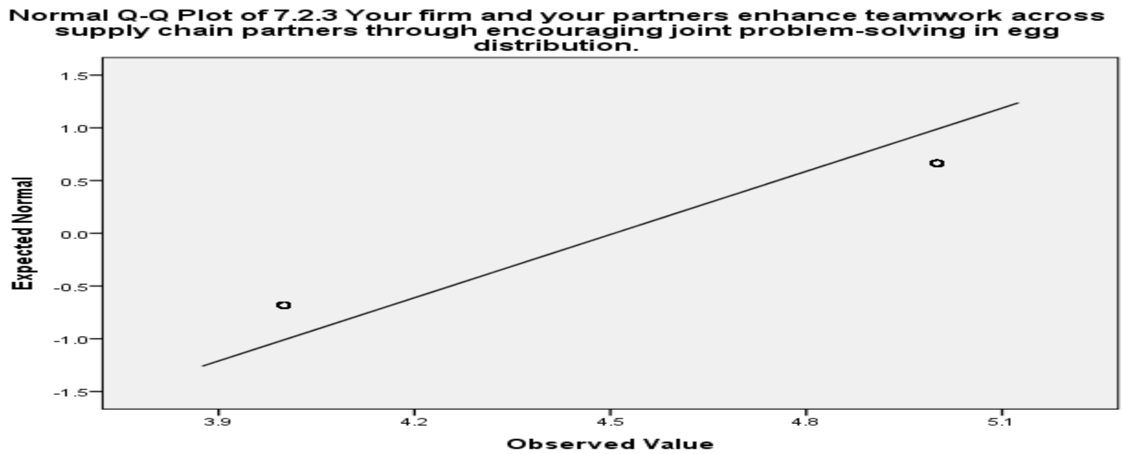
Normal Q-Q Plot of 7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.



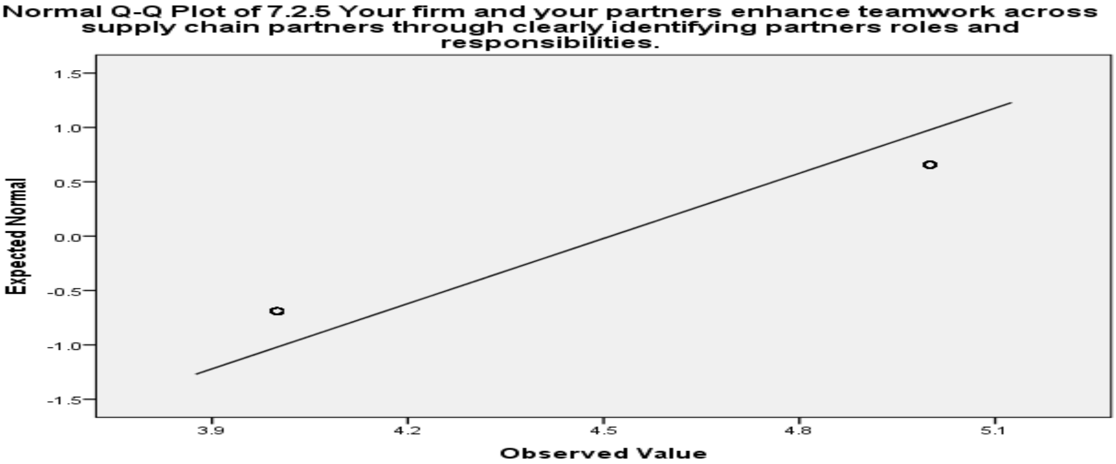
Normal Q-Q Plot of 7.2.1 Your firm and your partners enhance teamwork across supply chain partners through empowering decision-making and operation rights to the team.

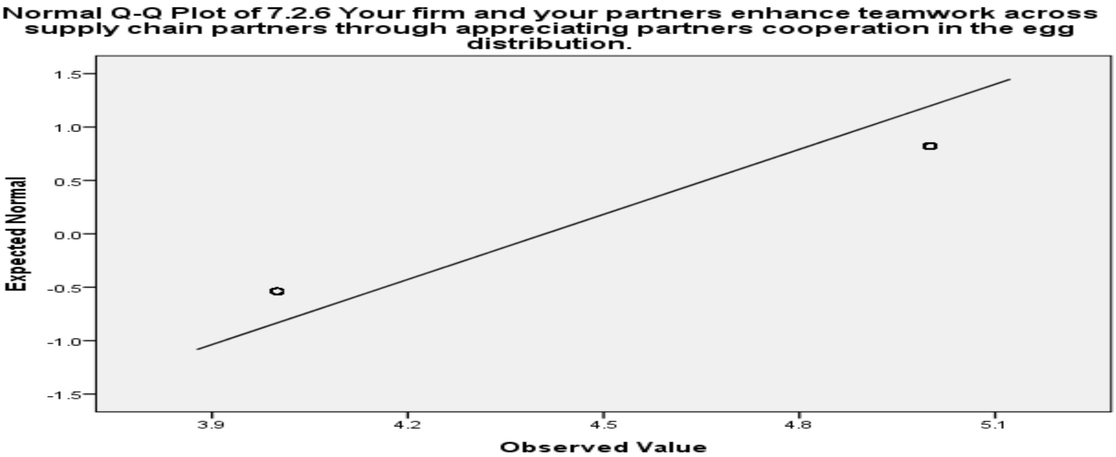


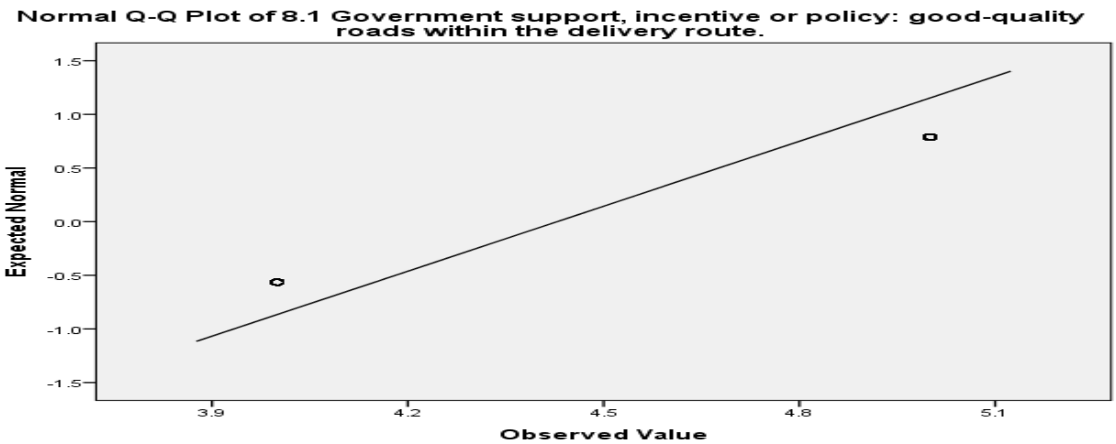

Normal Q-Q Plot of 7.2.2 Your firm and your partners enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

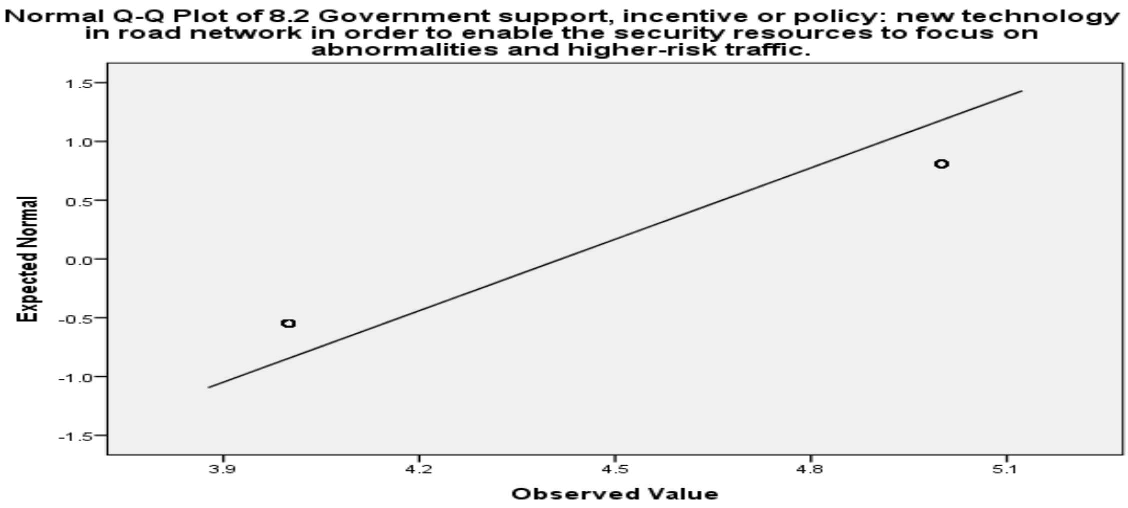

Normal Q-Q Plot of 7.2.3 Your firm and your partners enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

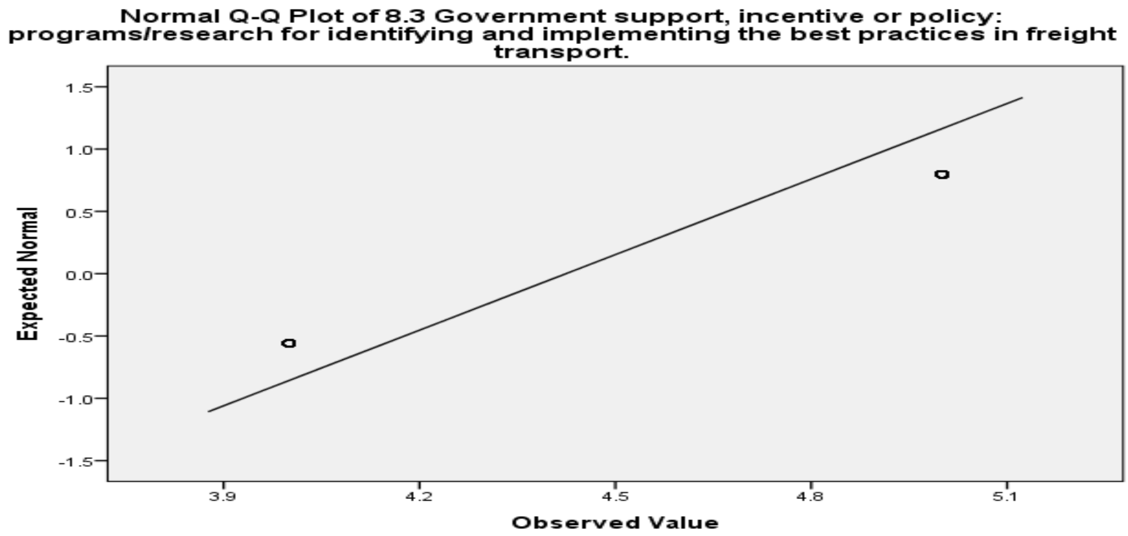

Normal Q-Q Plot of 7.2.4 Your firm and your partners enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

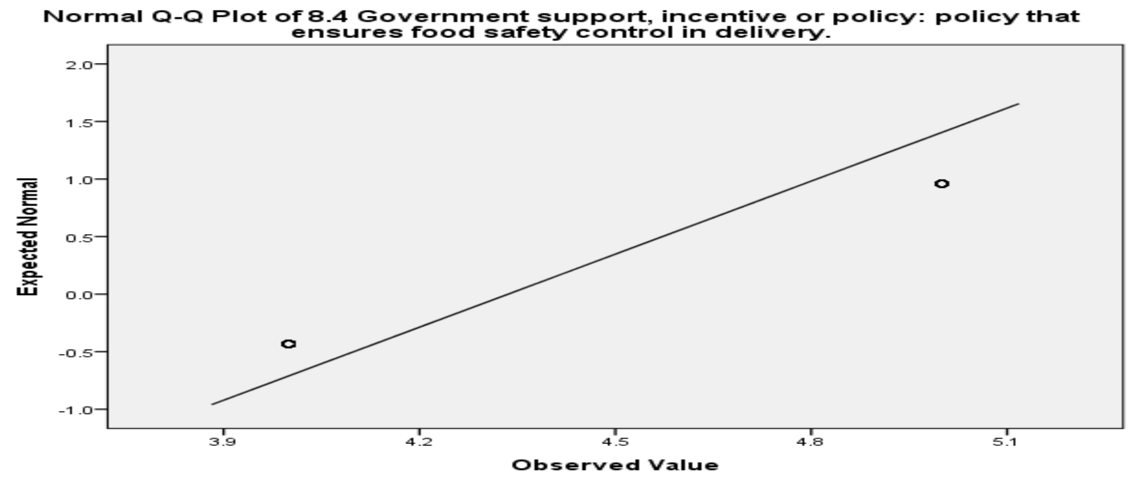

Normal Q-Q Plot of 7.2.5 Your firm and your partners enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 7.2.6 Your firm and your partners enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

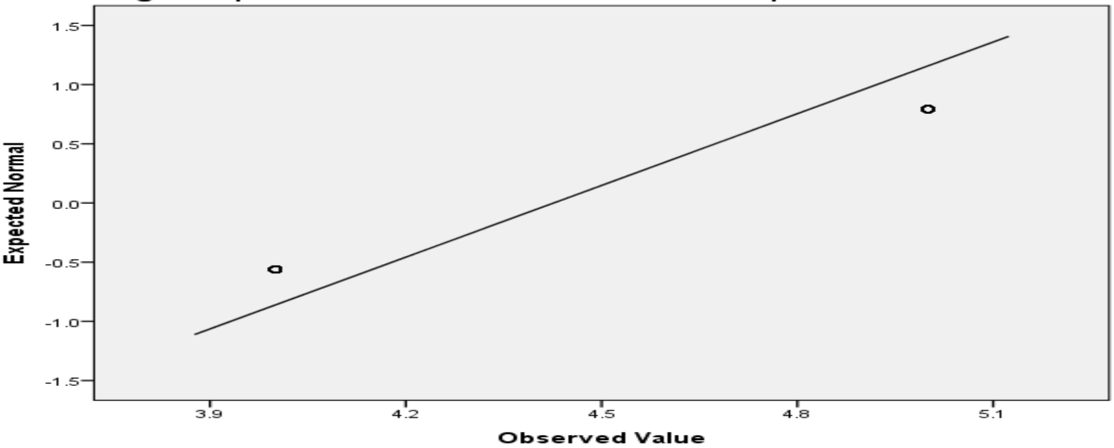

Normal Q-Q Plot of 8.1 Government support, incentive or policy: good-quality roads within the delivery route.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 8.2 Government support, incentive or policy: new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

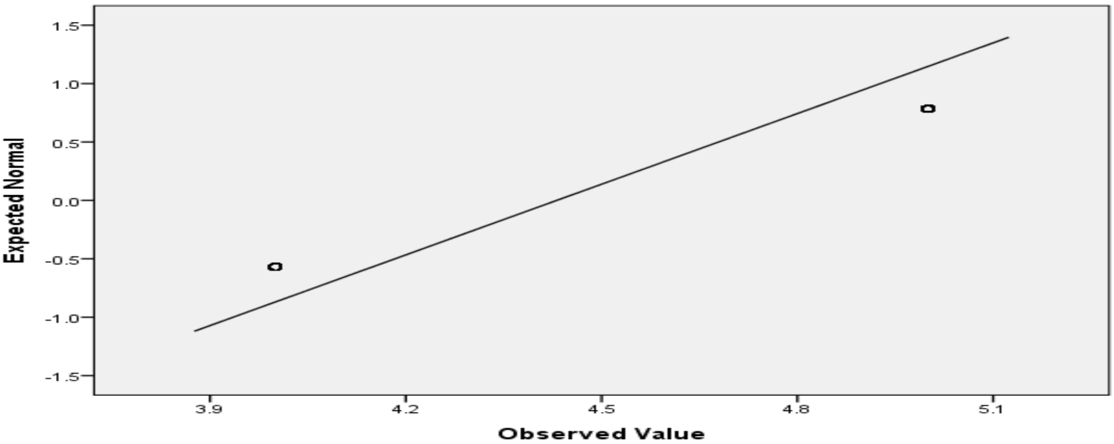

Normal Q-Q Plot of 8.3 Government support, incentive or policy: programs/research for identifying and implementing the best practices in freight transport.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 8.4 Government support, incentive or policy: policy that ensures food safety control in delivery.
Expected Normal
Observed Value
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
3.9
4.2
4.5
4.8
5.1

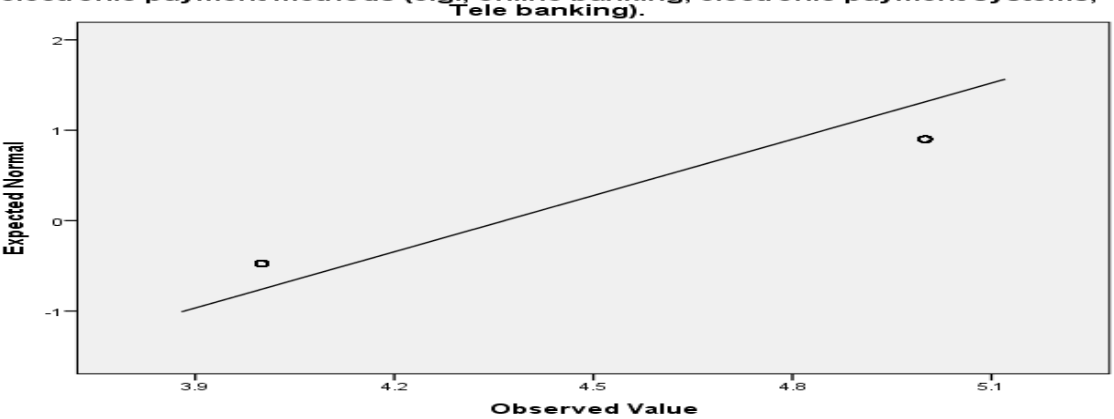
Normal Q-Q Plot of 8.5 Government support, incentive or policy: financial support for logistics providers to build new facilities and to purchase vehicles.

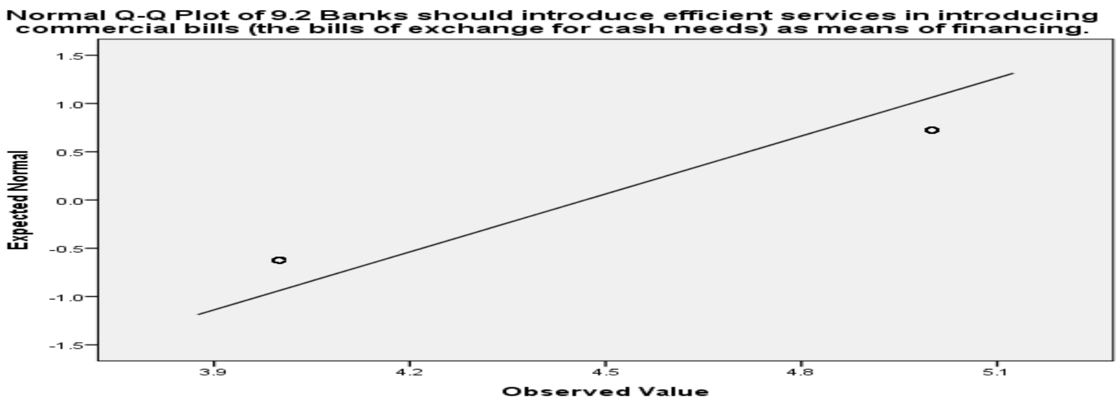


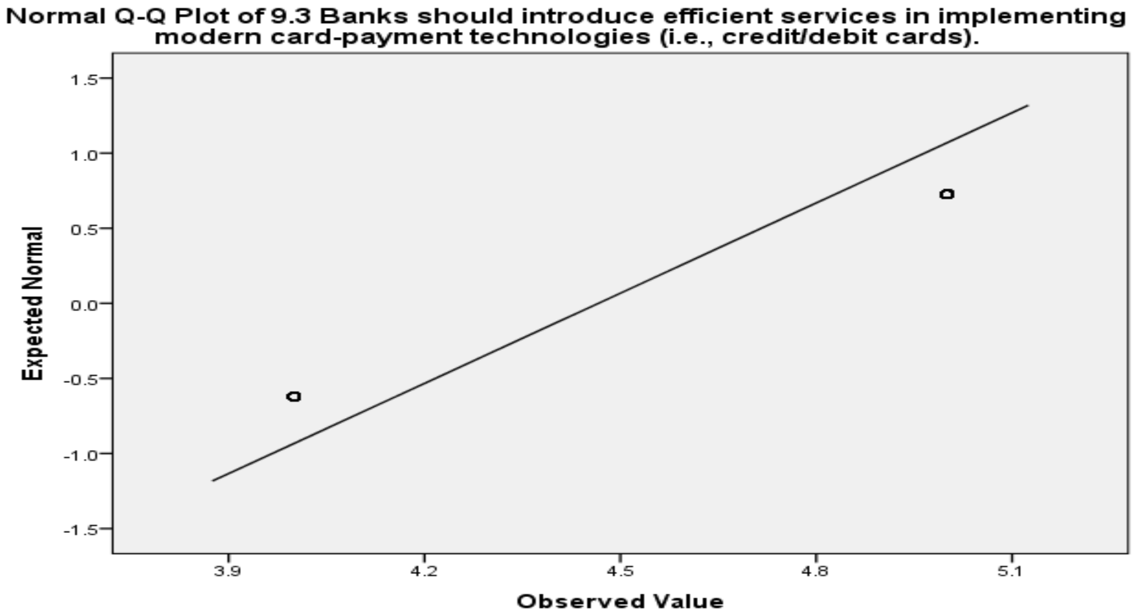
Normal Q-Q Plot of 8.6 Government support, incentive or policy: policy that supports education system in incorporating the logistics for egg industry in curricula.

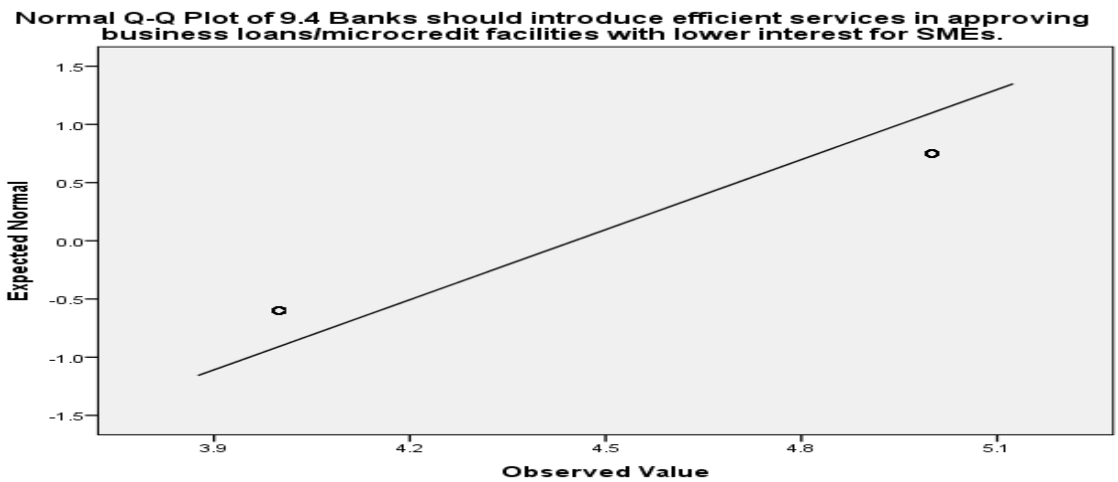


Normal Q-Q Plot of 9.1 Banks should introduce efficient services in converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).

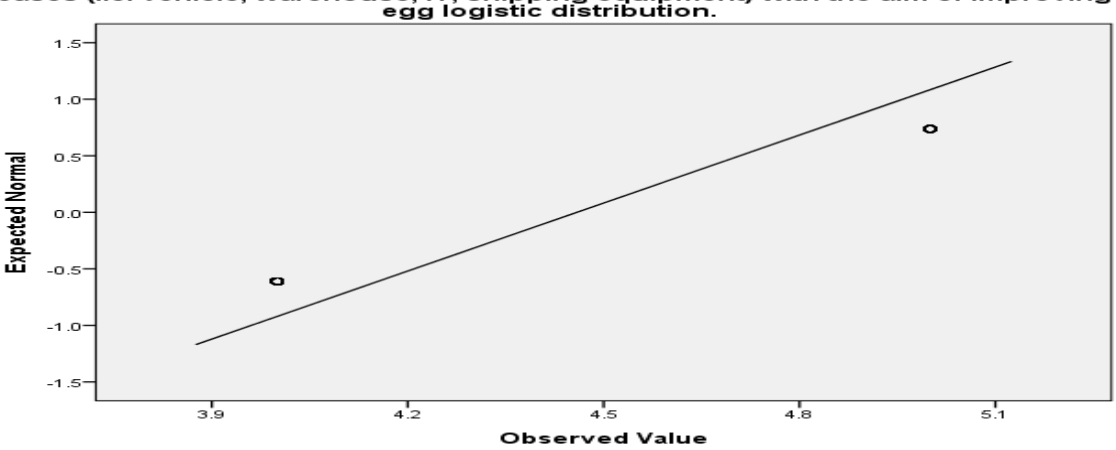



Normal Q-Q Plot of 9.2 Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

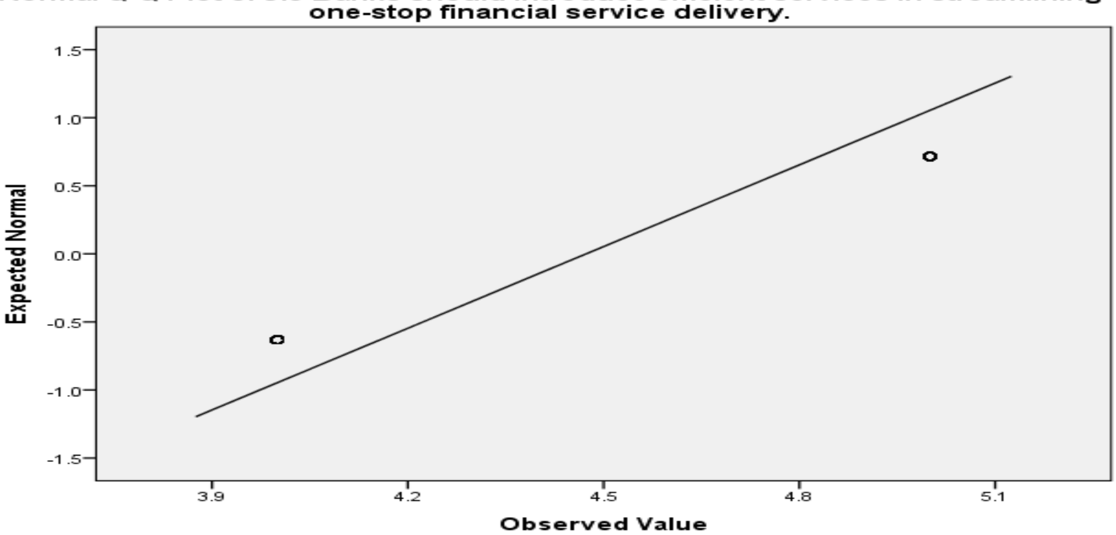

Normal Q-Q Plot of 9.3 Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 9.4 Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

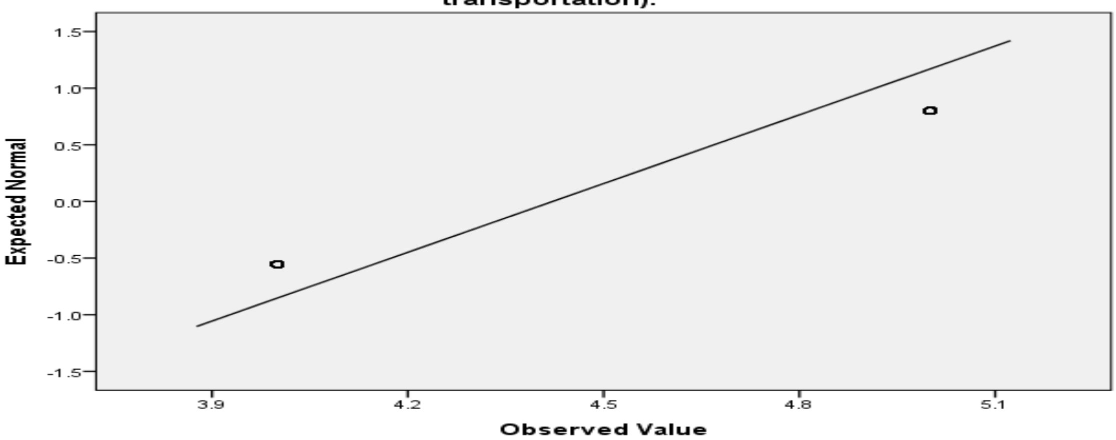
Normal Q-Q Plot of 9.5 Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.



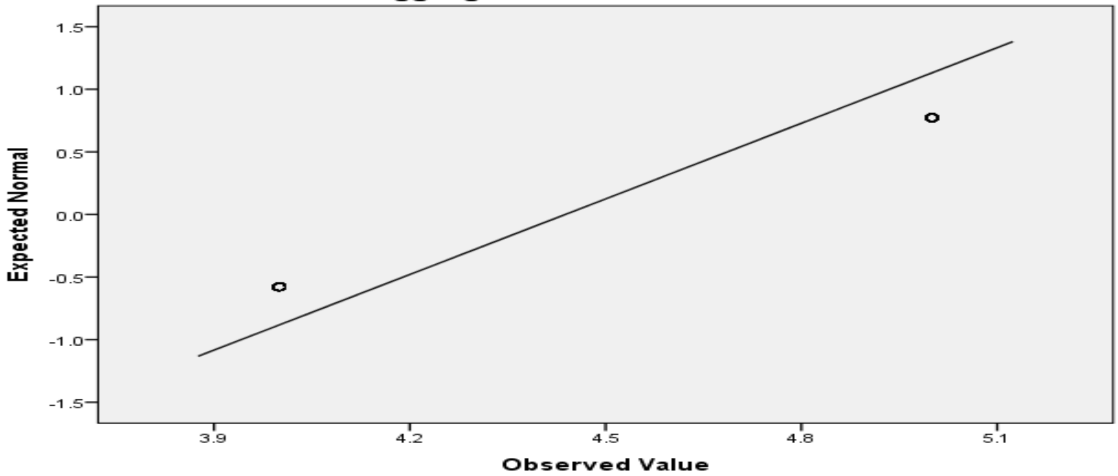
Normal Q-Q Plot of 9.6 Banks should introduce efficient services in streamlining one-stop financial service delivery.



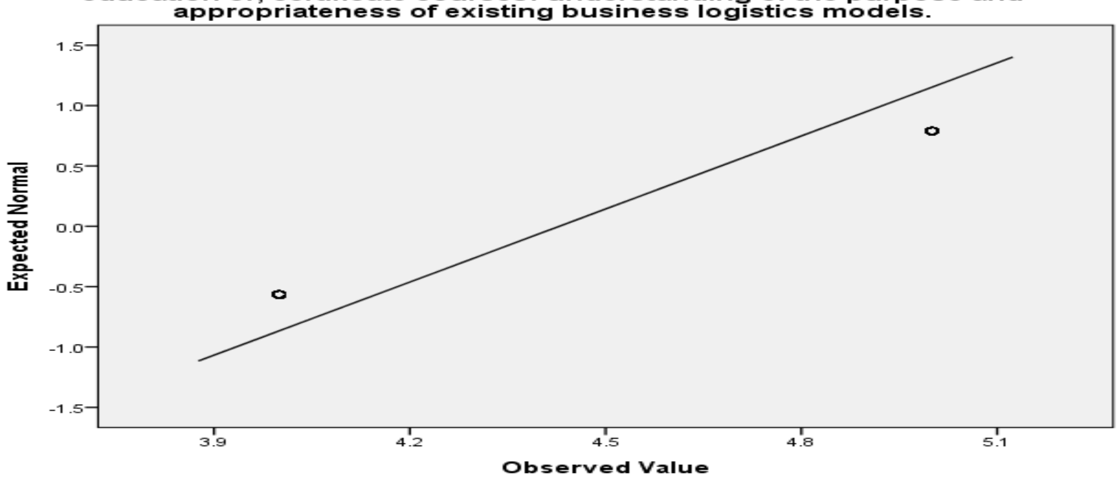
Normal Q-Q Plot of 10.1 Educational institutions should offer/ provide vocational education or, certificate courses: for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).



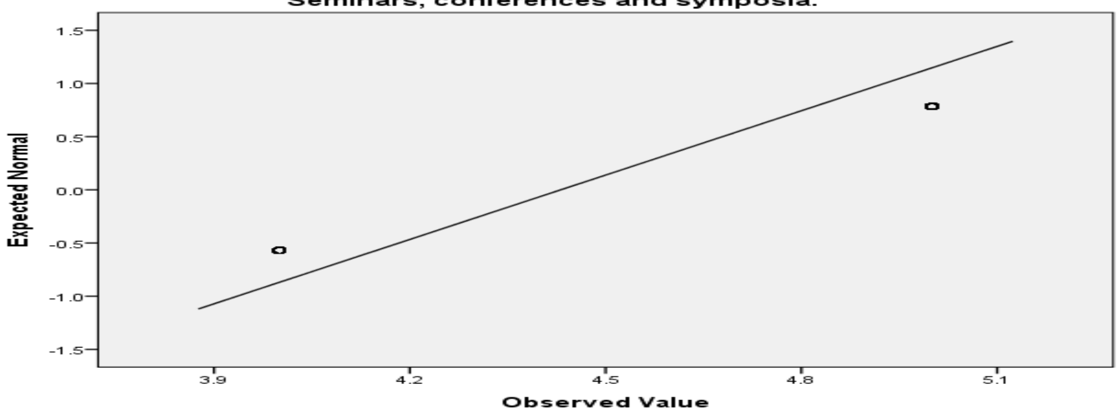
Normal Q-Q Plot of 10.2 Educational institutions should offer/ provide vocational education or, certificate courses: identifying and defining logistic strategies in egg logistics distribution.



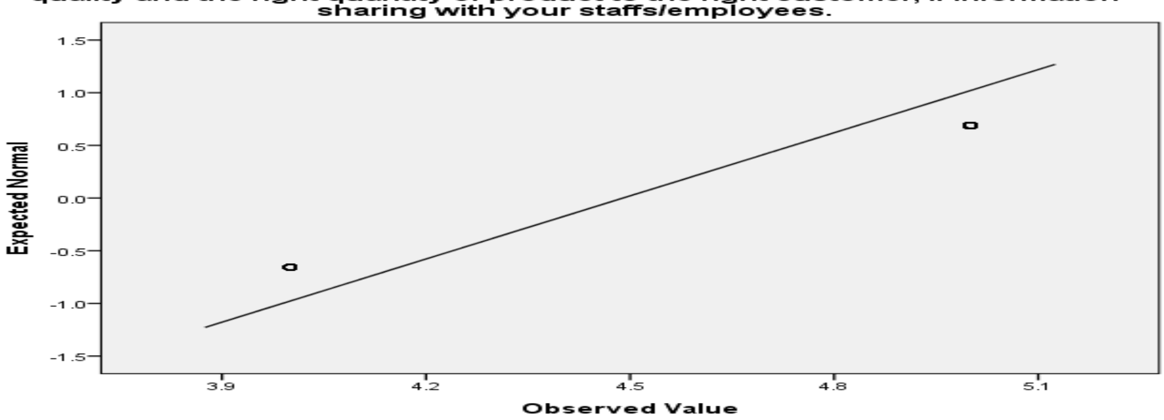
Normal Q-Q Plot of 10.3 Educational institutions should offer/ provide vocational education or, certificate courses: understanding of the purpose and appropriateness of existing business logistics models.



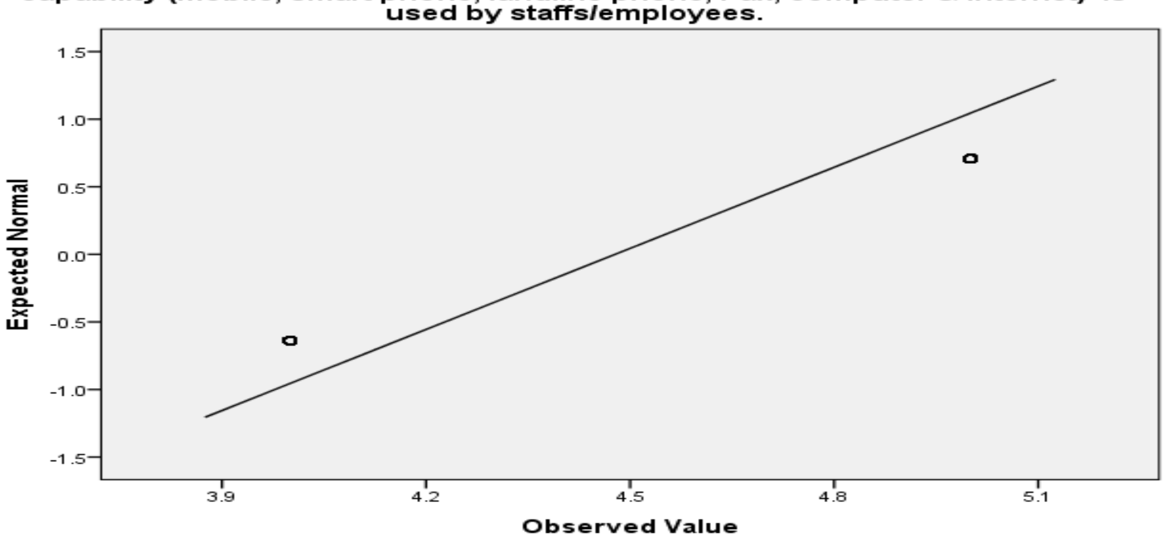
Normal Q-Q Plot of 10.4 Educational institutions should offer/ provide vocational education or, certificate courses: organise, invite and assist to participate in Seminars, conferences and symposia.



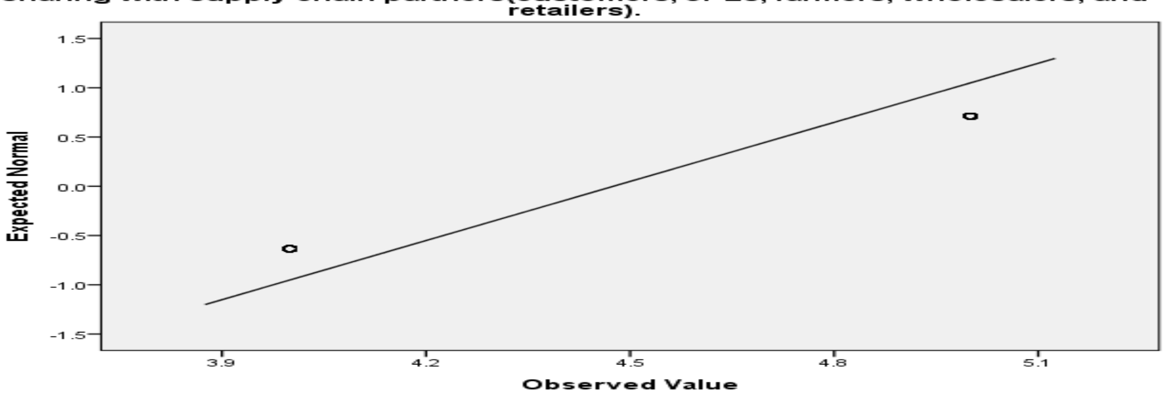
Normal Q-Q Plot of 11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.



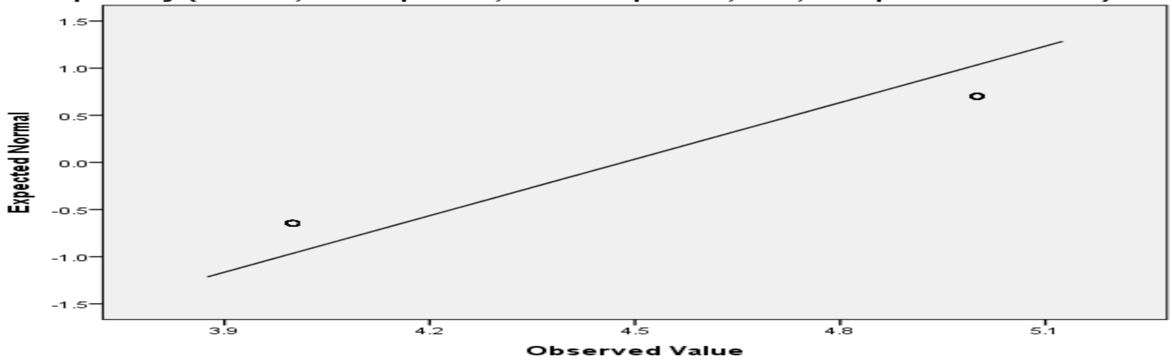
Normal Q-Q Plot of 11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.



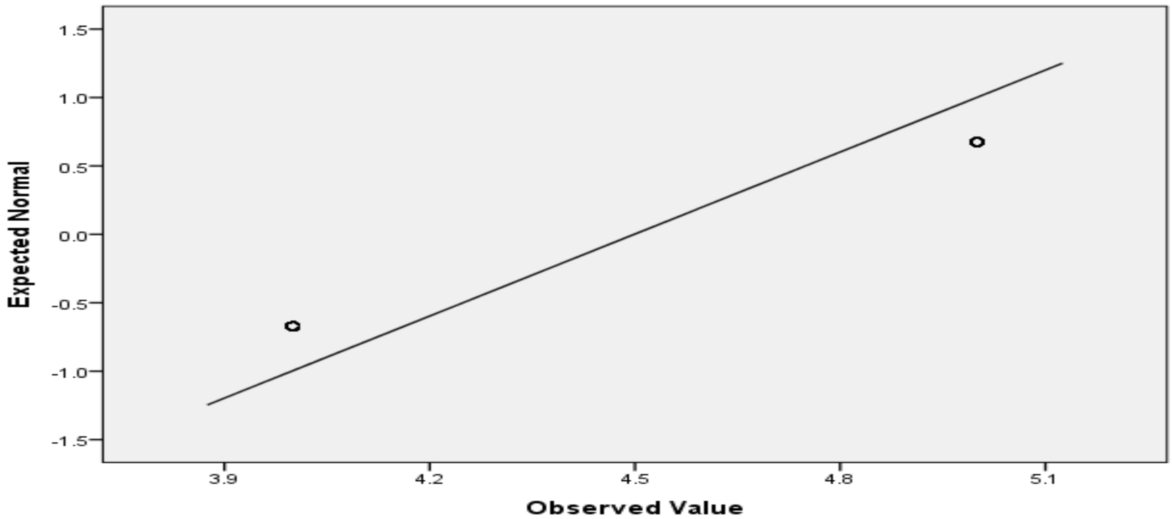
Normal Q-Q Plot of 11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners(customers, 3PLs, farmers, wholesalers, and retailers).



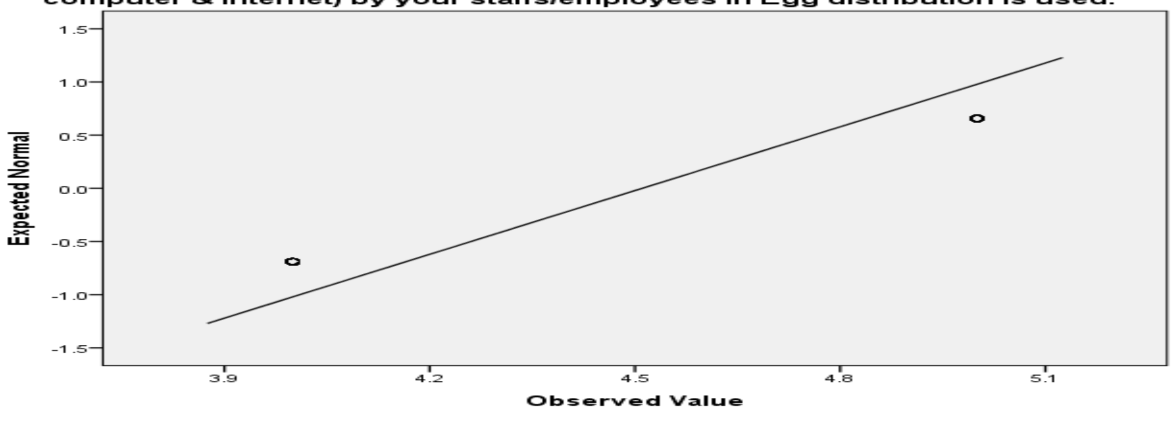
Normal Q-Q Plot of 11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet).

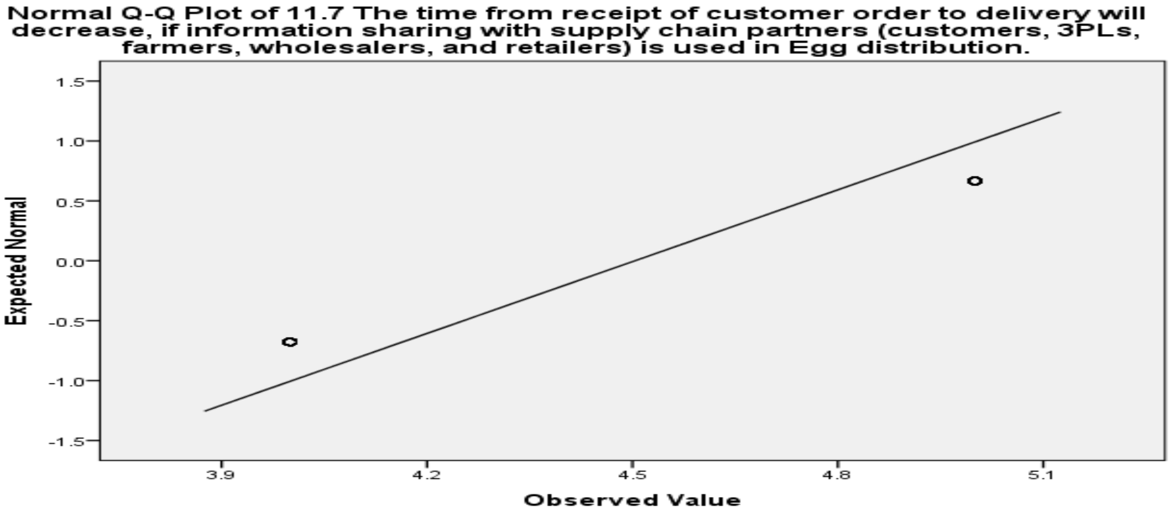


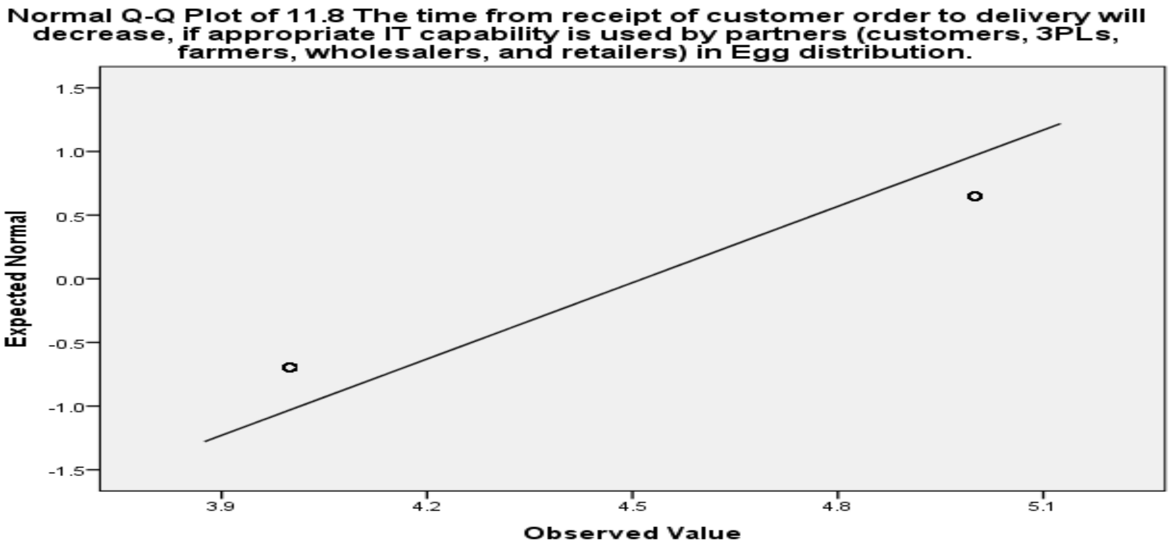
Normal Q-Q Plot of 11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.

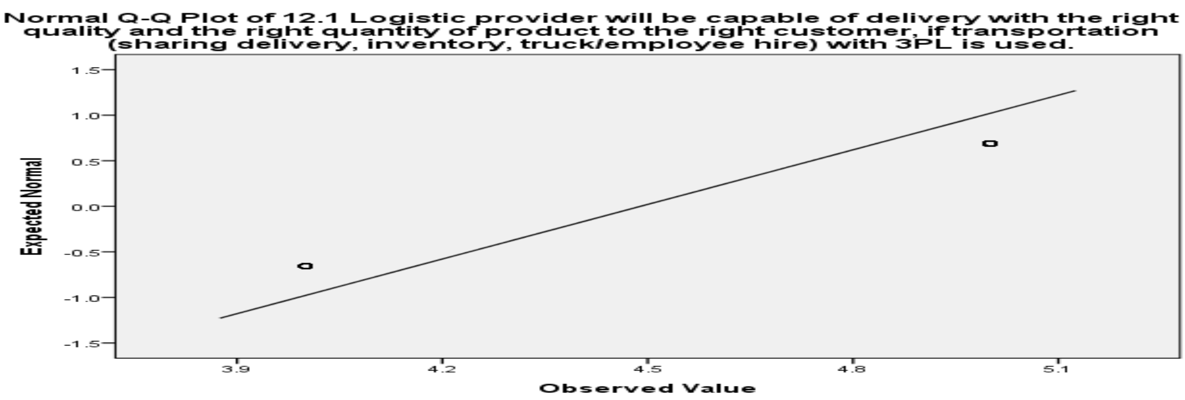


Normal Q-Q Plot of 11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.

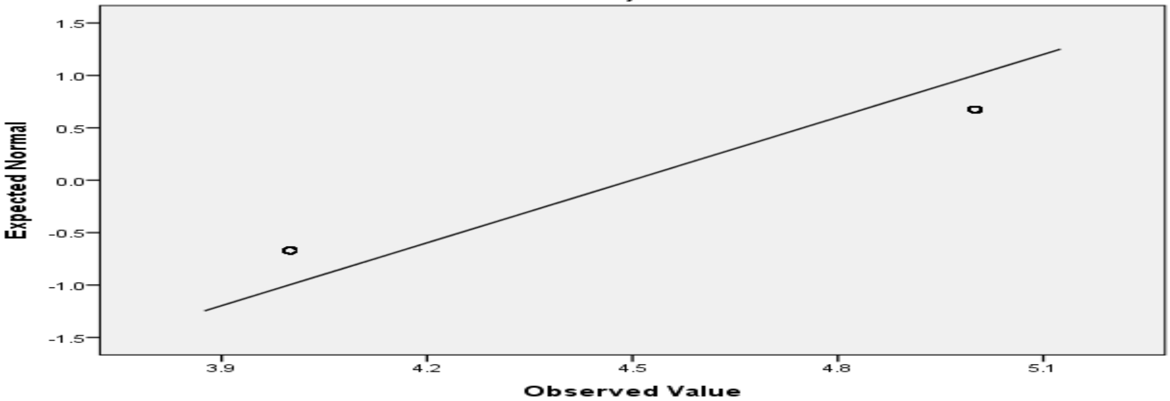



Normal Q-Q Plot of 11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

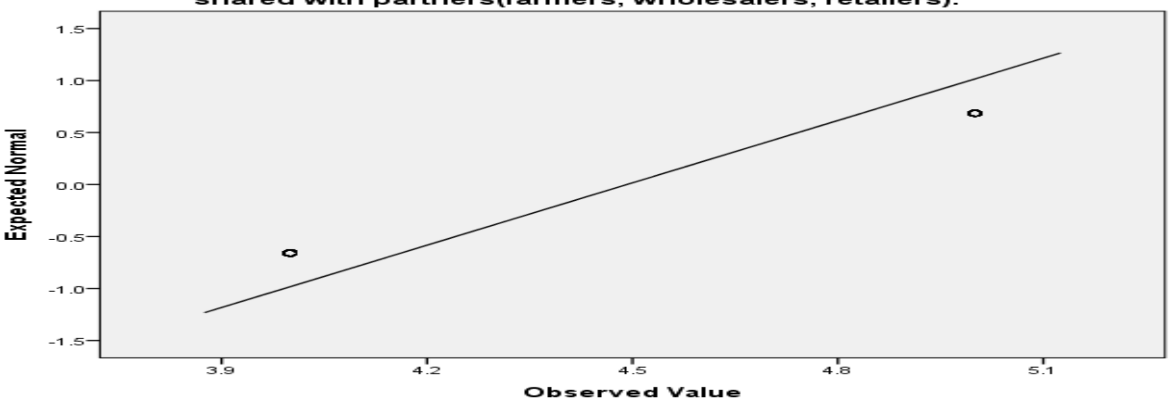

Normal Q-Q Plot of 11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1


Normal Q-Q Plot of 12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.
Expected Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1

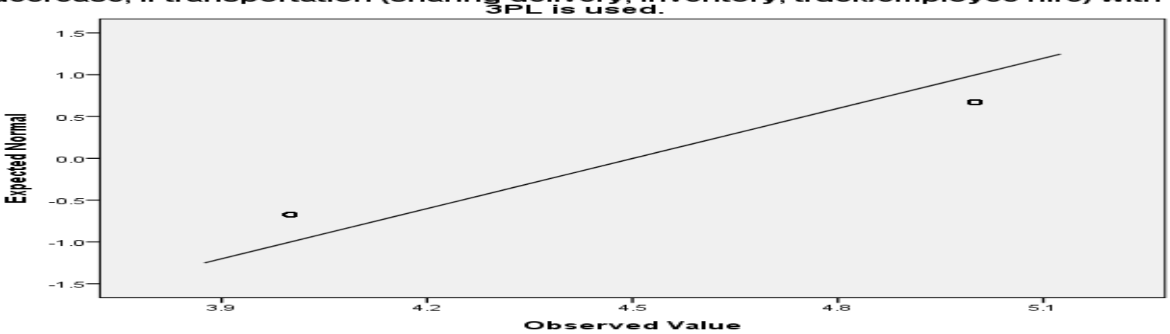
Normal Q-Q Plot of 12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners(farmers, wholesalers, retailers).

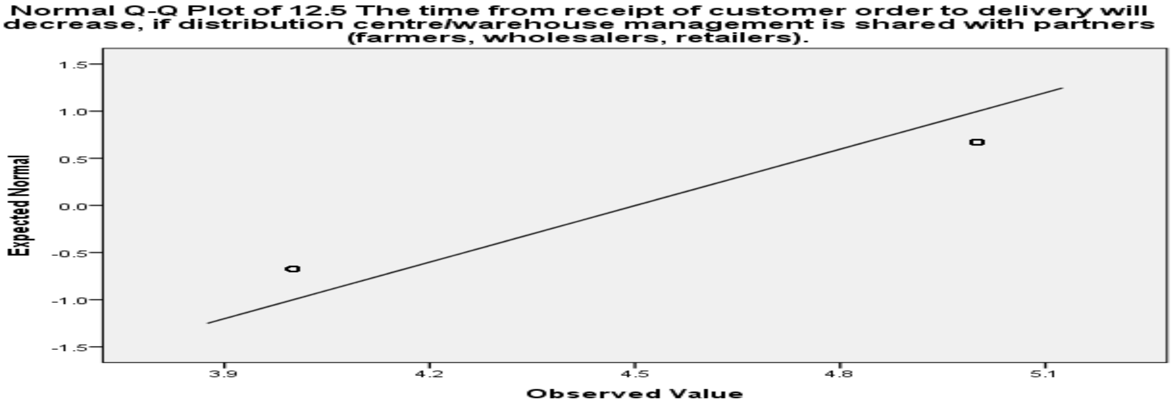


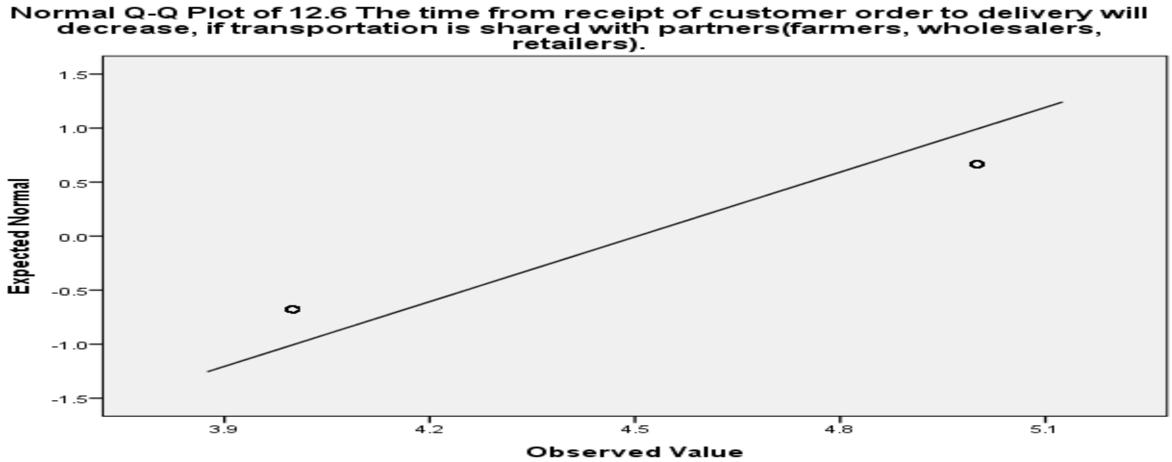
Normal Q-Q Plot of 12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners(farmers, wholesalers, retailers).

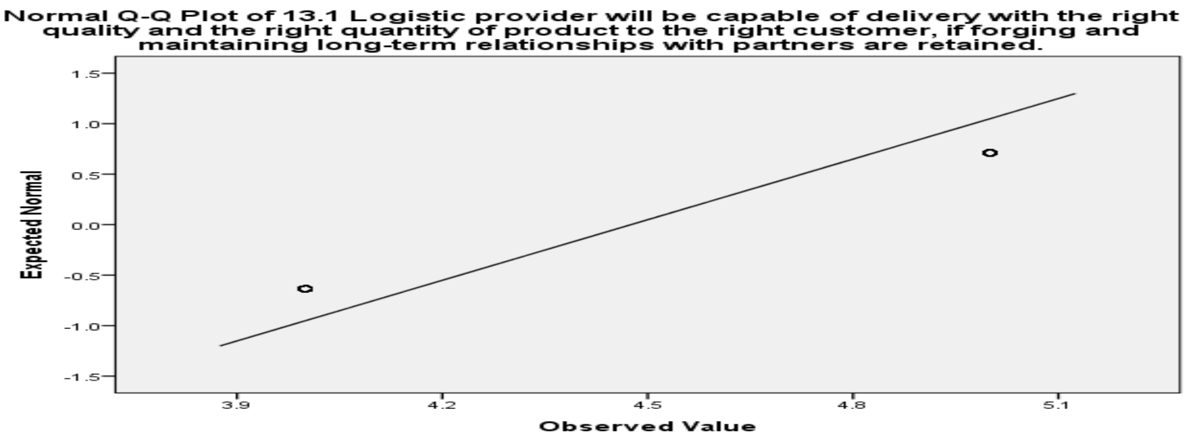


Normal Q-Q Plot of 12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.

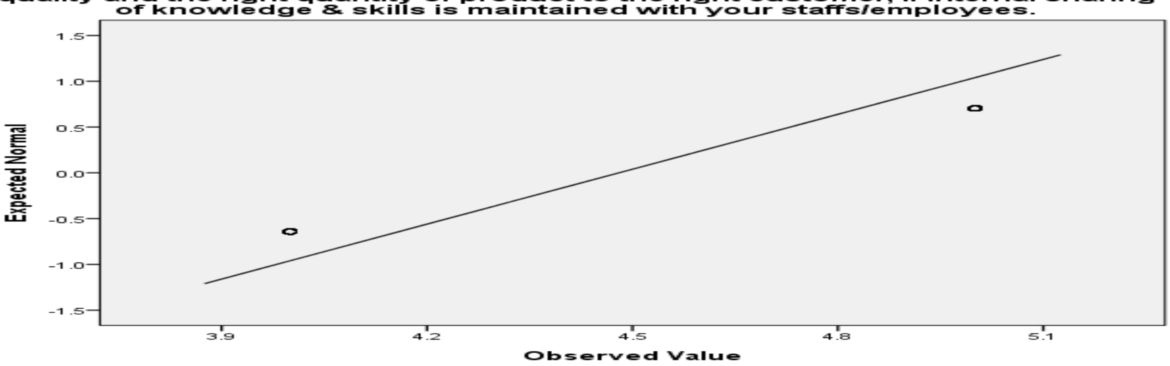



Normal Q-Q Plot of 12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners(farmers, wholesalers, retailers).
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

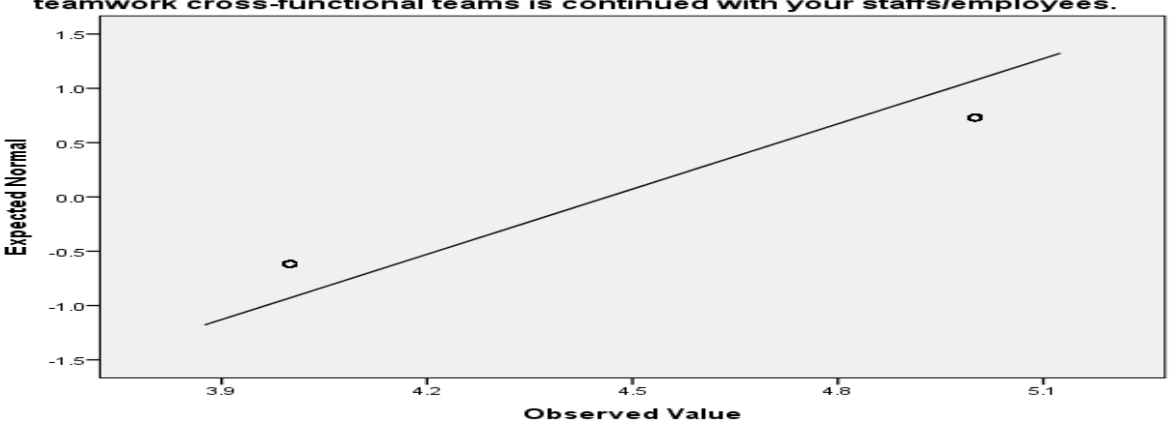

Normal Q-Q Plot of 13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners are retained.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

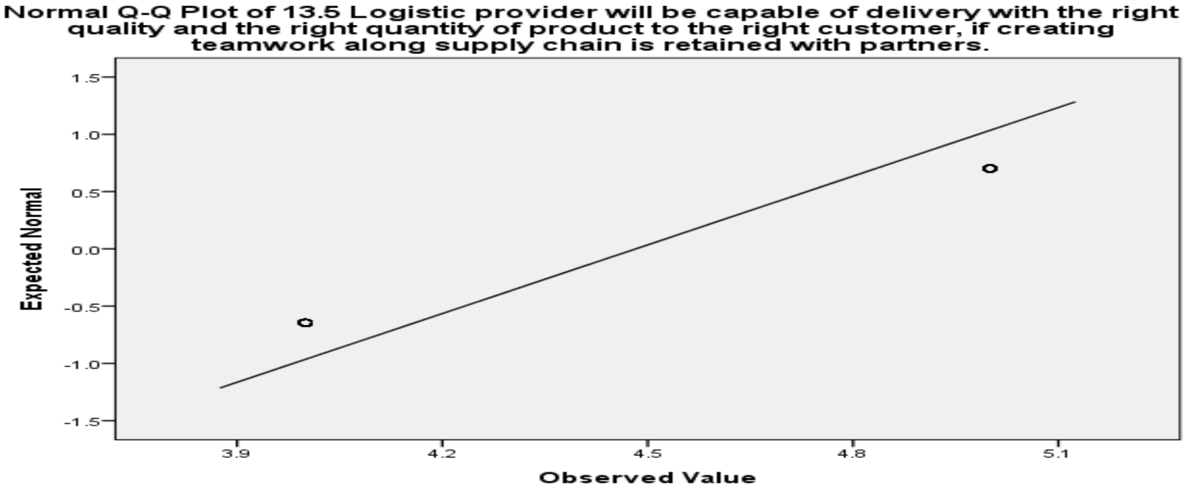
Normal Q-Q Plot of 13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.



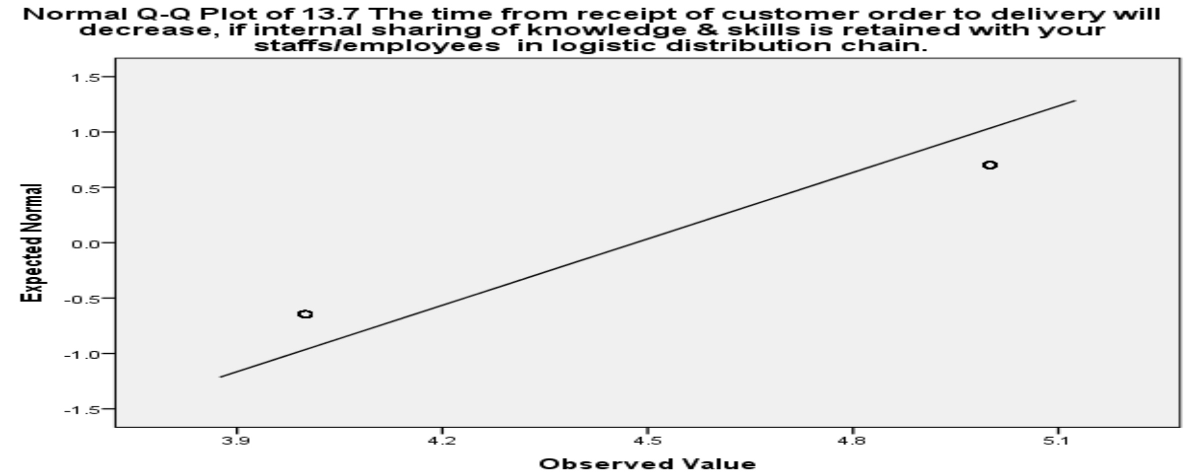
Normal Q-Q Plot of 13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if external sharing of knowledge & skills is maintained with partners.

Normal Q-Q Plot of 13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.

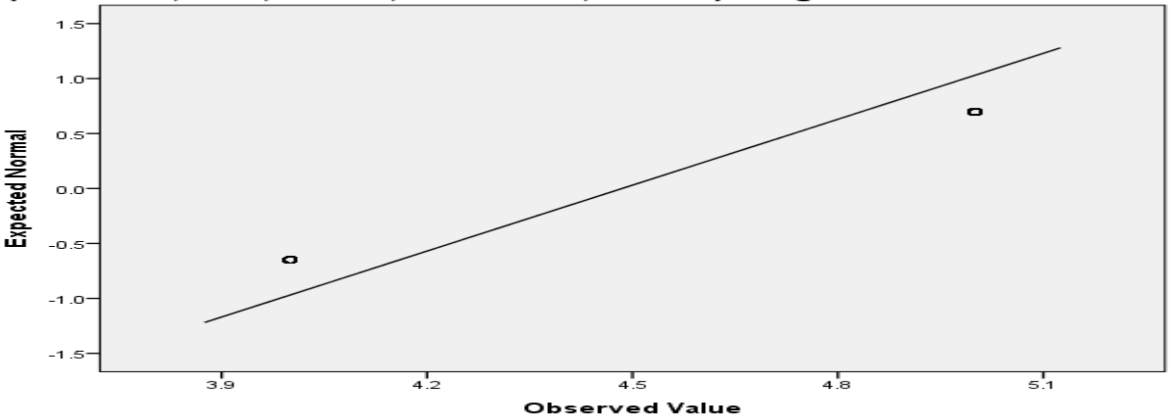



Normal Q-Q Plot of 13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

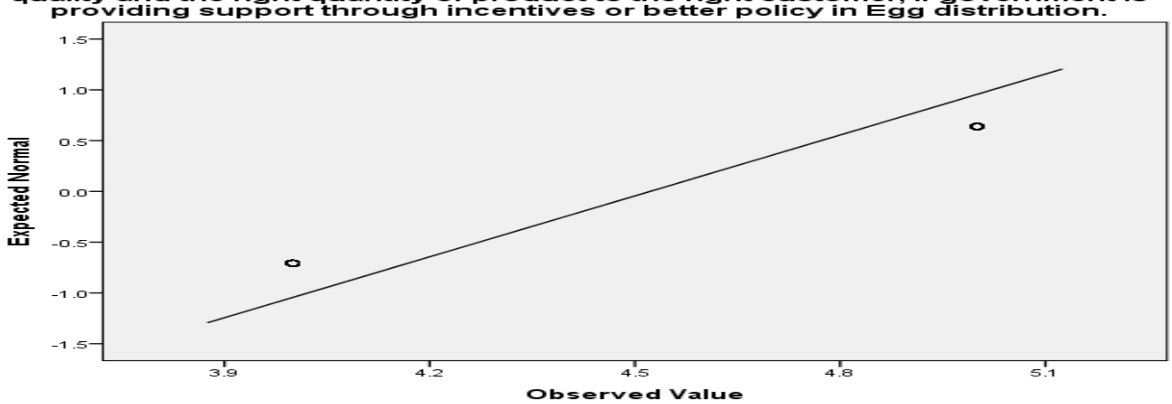
Normal Q-Q Plot of 13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.



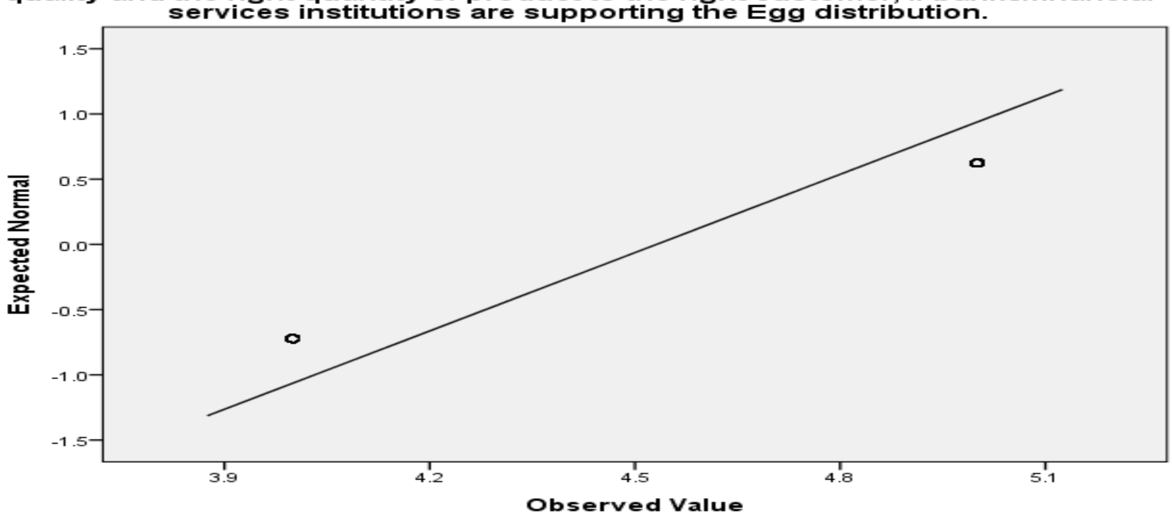
Normal Q-Q Plot of 13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.

Normal Q-Q Plot of 13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.

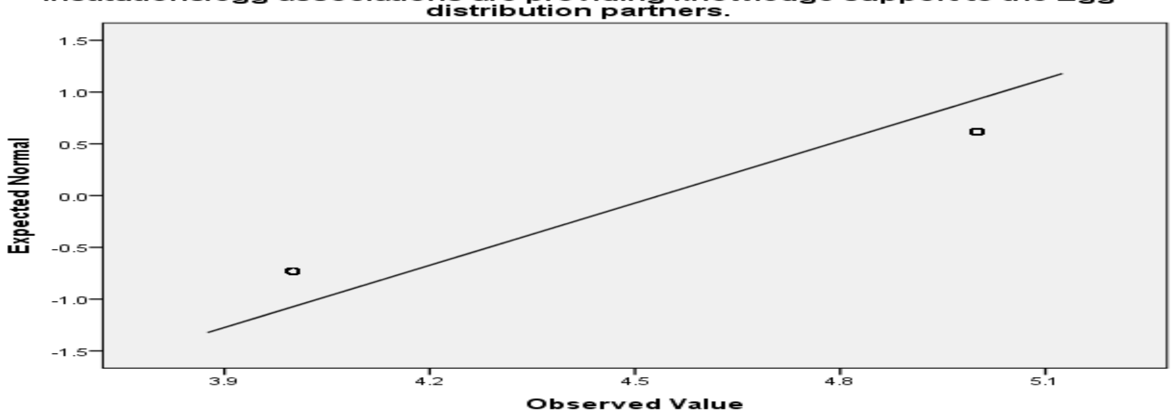
Normal Q-Q Plot of 14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.

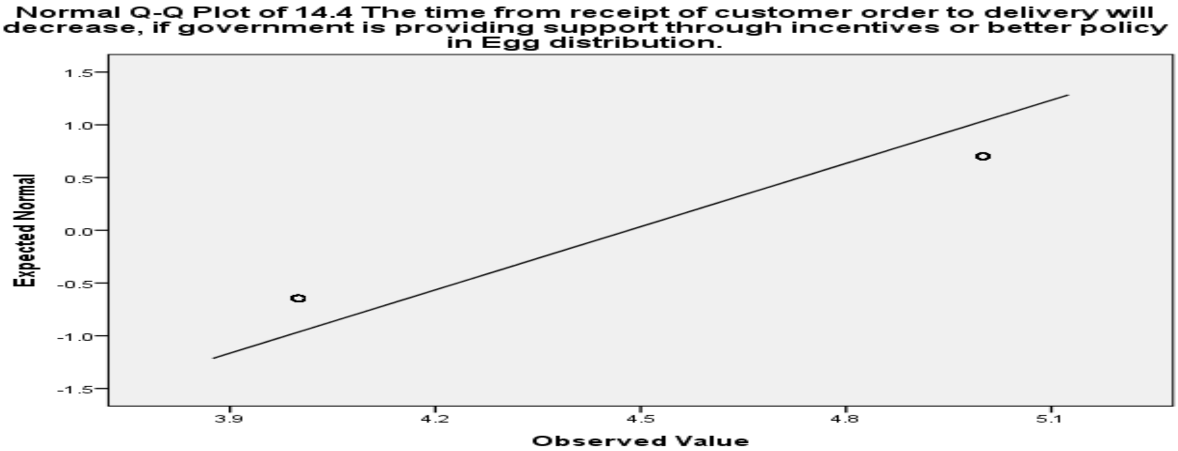


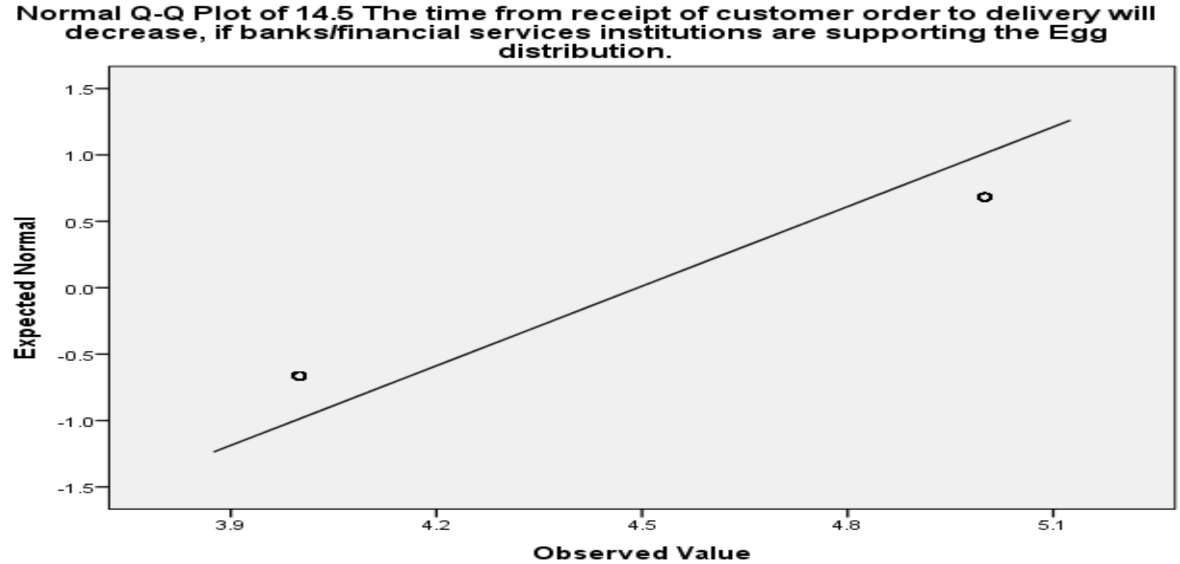
Normal Q-Q Plot of 14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.

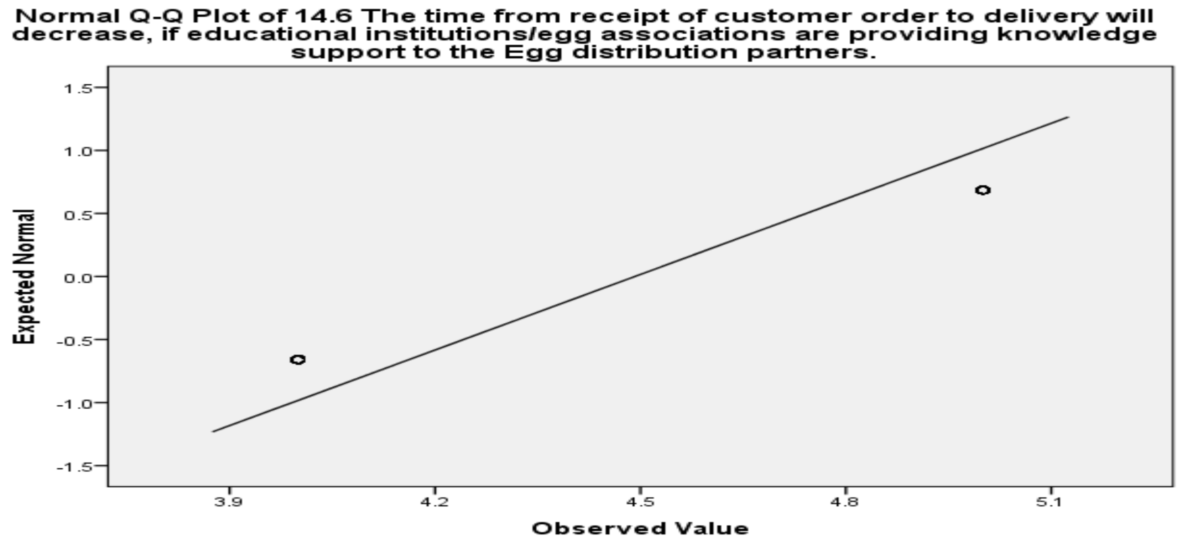


Normal Q-Q Plot of 14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.




Normal Q-Q Plot of 14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value


Normal Q-Q Plot of 14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.
Expected Normal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
3.9
4.2
4.5
4.8
5.1
Observed Value

Appendix 2.7 Correlation coefficient matrix for multicollinearity

2.7.1 The inter-item correlation values pertaining to factors for information integration

2.7.1.1 Correlation coefficient matrix for internal information sharing

	1.1.1	1.1.2	1.1.3	1.1.4
1.1.1	1.000			
1.1.2	.708	1.000		
1.1.3	.758	.697	1.000	
1.1.4	.778	.729	.768	1.000

2.7.1.2 Correlation coefficient matrix for external information sharing

	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6
1.2.1	1.000					
1.2.2	.786	1.000				
1.2.3	.767	.772	1.000			
1.2.4	.796	.791	.772	1.000		
1.2.5	.757	.753	.732	.753	1.000	
1.2.6	.757	.762	.742	.763	.732	1.000

2.7.1.3 Correlation coefficient matrix for internal IT capability

	2.1.1	2.1.2	2.1.3	2.1.4
2.1.1	1.000			
2.1.2	.753	1.000		
2.1.3	.781	.742	1.000	
2.1.4	.767	.727	.757	1.000

2.7.1.4 Correlation coefficient matrix for external IT capability

	2.2.1	2.2.2	2.2.3	2.2.4	2.2.5
2.2.1	1.000				
2.2.2	.790	1.000			
2.2.3	.784	.774	1.000		
2.2.4	.616	.811	.593	1.000	
2.2.5	.779	.758	.752	.580	1.000

2.7.2 The inter-item correlation values pertaining to factors for logistics operations coordination

2.7.2.1 Correlation coefficient matrix for transportation cooperation with 3PL

	3.1	3.2	3.4	3.5
3.1	1.000			
3.2	.784	1.000		
3.4	.770	.798	1.000	
3.5	.632	.655	.819	1.000

2.7.2.2 Correlation coefficient matrix for distribution centre/warehouse sharing

	4.1	4.3	4.4	4.5	4.6.
4.1	1.000				
4.3	.607	1.000			
4.4	.635	.730	1.000		
4.5	.814	.725	.770	1.000	
4.6	.643	.740	.784	.780	1.000

2.7.3 The inter-item correlation values pertaining to factors for organisation relationship

2.7.3.1 Correlation coefficient matrix for forging and maintaining long-term relationships

	5.1	5.2	5.3	5.4	5.5
5.1	1.000				
5.2	.762	1.000			
5.3	.781	.767	1.000		
5.4	.786	.772	.790	1.000	
5.5	.781	.767	.786	.790	1.000

2.7.3.2 Correlation coefficient matrix for internal sharing of knowledge & skills

	6.1.1	6.1.2	6.1.3	6.1.4	6.1.5	6.1.6
6.1.1	1.000					
6.1.2	.781	1.000				
6.1.3	.772	.776	1.000			
6.1.4	.753	.758	.749	1.000		
6.1.5	.640	.644	.644	.695	1.000	
6.1.6	.772	.767	.758	.739	.806	1.000

2.7.3.3 Correlation coefficient matrix for external sharing of knowledge & skills

	6.2.1	6.2.2	6.2.3	6.2.4	6.2.5
6.2.1	1.000				
6.2.2	.817	1.000			
6.2.3	.595	.739	1.000		
6.2.4	.607	.753	.772	1.000	
6.2.5	.611	.758	.776	.790	1.000

2.7.3.4 Correlation coefficient matrix for creating teamwork cross-functional team

	7.1.1	7.1.2	7.1.3	7.1.4	7.1.5	7.1.6
7.1.1	1.000					
7.1.2	.816	1.000				
7.1.3	.781	.635	1.000			
7.1.4	.632	.670	.813	1.000		
7.1.5	.777	.631	.753	.609	1.000	
7.1.6	.786	.638	.762	.617	.758	1.000

2.7.3.5 Correlation coefficient matrix for creating teamwork across supply chain

	7.2.1	7.2.2	7.2.3	7.2.4	7.2.5	7.2.6
7.2.1	1.000					
7.2.2	.743	1.000				
7.2.3	.786	.763	1.000			
7.2.4	.693	.674	.813	1.000		
7.2.5	.776	.753	.795	.700	1.000	
7.2.6	.676	.658	.692	.744	.817	1.000

2.7.4 <u>The inter-item correlation values pertaining to factors for institutional support</u>

2.7.4.1 Correlation coefficient matrix for government support, incent or policy

	8.1	8.2	8.3	8.4	8.5	8.6
8.1	1.000					
8.2	.785	1.000				
8.3	.771	.794	1.000			
8.4	.810	.650	.638	1.000		
8.5	.767	.790	.776	.635	1.000	
8.6	.767	.781	.767	.647	.762	1.000

2.7.4.2 Correlation coefficient matrix for the role of banks/financial services

	9.1	9.2	9.3	9.4	9.5	9.6
9.1	1.000					
9.2	.809	1.000				
9.3	.590	.714	1.000			
9.4	.613	.742	.747	1.000		
9.5	.601	.728	.733	.760	1.000	
9.6	.579	.710	.715	.734	.719	1.000

2.7.4.3 Correlation coefficient matrix for knowledge support from boards and associations, and educational institutions/educational support

	10.1	10.2	10.3	10.4
10.1	1.000			
10.2	.777	1.000		
10.3	.795	.763	1.000	
10.4	.791	.758	.777	1.000

2.7.5 <u>The inter-item correlation values pertaining to factors for distribution logistic integration through delivery reliability, and responsiveness (expedience)</u>

2.7.5.1 Correlation coefficient matrix for information integration through delivery reliability

	11.1	11.2	11.3	11.4
11.1	1.000			
11.2	.753	1.000		
11.3	.748	.771	1.000	
11.4	.734	.757	.762	1.000

2.7.5.2 Correlation coefficient matrix for information integration through responsiveness (expedience)

	11.5	11.6	11.7	11.8
11.5	1.000			
11.6	.762	1.000		
11.7	.776	.753	1.000	
11.8	.763	.739	.744	1.000

2.7.5.3 Correlation coefficient matrix for logistics operations coordination through delivery reliability

	12.1	12.2	12.3
12.1	1.000		
12.2	.767	1.000	
12.3	.781	.753	1.000

2.7.5.4 Correlation coefficient matrix for logistics operations coordination through responsiveness (expedience).

	12.4	12.5	12.6
12.4	1.000		
12.5	.776	1.000	
12.6	.772	.772	1.000

2.7.5.5 Correlation coefficient matrix for organisational relationship through delivery reliability

	13.1	13.2	13.3	13.4	13.5
13.1	1.000				
13.2	.757	1.000			
13.3	.762	.752	1.000		
13.4	.790	.781	.785	1.000	
13.5	.771	.753	.748	.776	1.000

2.7.5.6 Correlation coefficient matrix for organisational relationship through responsiveness (expedience)

	13.6	13.7	13.8	13.9	13.10
13.6	1.000				
13.7	.795	1.000			
13.8	.790	.762	1.000		
13.9	.786	.757	.753	1.000	
13.10	.755	.735	.721	.716	1.000

2.7.5.7 Correlation coefficient matrix for institutional support through delivery reliability

	14.1	14.2	14.3
14.1	1.000		
14.2	.766	1.000	
14.3	.757	.738	1.000

2.7.5.8 Correlation coefficient matrix for institutional support through responsiveness (expedience)

	14.4	14.5	14.6
14.4	1.000		
14.5	.772	1.000	
14.6	.776	.753	1.000

Appendix 2.8: ANOVA of comparing respondents' characteristics

Items	Farmer (N=370) Mean	Wholesaler (N=24) Mean	Retailer (N=35) Mean	F-value	Sig.
1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	4.59	4.67	4.60	.281	.755
1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	4.60	4.88	4.66	3.690	.026
1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	4.59	4.71	4.66	.962	.383
1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	4.58	4.71	4.60	.760	.468
1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	4.57	4.58	4.54	.060	.942
1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that take place frequently, informally, and in timely manner.	4.56	4.54	4.63	.317	.728
1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	4.58	4.54	4.54	.155	.856
1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	4.57	4.63	4.46	.996	.370
1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).	4.58	4.58	4.63	.148	.863

1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	4.59	4.67	4.46	1.486	.227
2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	4.58	4.58	4.46	.927	.397
2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.	4.57	4.63	4.63	.305	.737
2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	4.57	4.67	4.51	.676	.509
2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.	4.58	4.67	4.54	.477	.621
2.2.1 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication	4.62	4.67	4.69	.355	.701

technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.					
2.2.2 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.	4.63	4.71	4.66	.363	.696
2.2.3 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.	4.62	4.71	4.71	.841	.432
2.2.4 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation within the egg supply chain.	4.53	4.63	4.57	.493	.611
2.2.5 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.	4.64	4.71	4.69	.410	.664
3.1 You are intending to develop joint	4.46	4.54	4.43	.380	.684

transport planning, management and control processes for egg distribution with other logistics firms.					
3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	4.45	4.50	4.46	.136	.873
3.3 You are anticipating to collaborate with 3PL or freight truck firms on investment (buying/hiring vehicles).	3.94	3.88	4.09	1.152	.317
3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	4.45	4.50	4.49	.170	.843
3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	4.36	4.46	4.34	.491	.613
4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	4.36	4.46	4.51	1.906	.150
4.2 You are aiming to share shipping processes and resources (trucks, trolley, equipments and employees/staffs) in egg distribution.	3.78	3.79	3.66	1.176	.310
4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	4.49	4.50	4.49	.008	.992
4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	4.46	4.50	4.46	.068	.934
4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	4.45	4.54	4.57	1.216	.298
4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	4.45	4.54	4.46	.347	.707
5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).	4.51	4.42	4.46	.584	.558

5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	4.52	4.46	4.46	.381	.684
5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	4.51	4.42	4.43	.822	.440
5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	4.51	4.46	4.40	.866	.421
5.5 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.	4.51	4.38	4.51	.809	.446
6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	4.50	4.50	4.49	.013	.987
6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.	4.50	4.50	4.46	.117	.889
6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	4.49	4.50	4.51	.025	.975
6.1.4 To improve egg distribution with your employee/staff (internal firm), you	4.51	4.50	4.49	.055	.947

are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.					
6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	4.44	4.54	4.37	.834	.435
6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	4.51	4.54	4.46	.230	.795
6.2.1 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.	4.42	4.50	4.29	1.549	.214
6.2.2 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skill to handle the shipping processes in egg distribution shared with partners.	4.52	4.54	4.37	1.493	.226
6.2.3 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.	4.51	4.54	4.43	.459	.632
6.2.4 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.	4.50	4.54	4.43	.415	.661
6.2.5 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse	4.50	4.54	4.37	1.182	.308

management shared with partners.					
7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	4.49	4.46	4.51	.090	.914
7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	4.39	4.46	4.37	.247	.781
7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	4.50	4.46	4.57	.415	.661
7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	4.39	4.38	4.51	.992	.372
7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	4.50	4.42	4.63	1.439	.238
7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	4.49	4.54	4.57	.449	.638
7.2.1 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through Empowering decision-making and operation rights to the team.	4.52	4.58	4.43	.756	.470
7.2.2 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	4.53	4.58	4.46	.499	.608

7.2.3 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.	4.52	4.54	4.37	1.406	.246
7.2.4 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.	4.40	4.54	4.34	1.227	.294
7.2.5 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.	4.51	4.54	4.54	.138	.871
7.2.6 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.	4.39	4.54	4.51	1.901	.151
8.1 Government support, incentive or policy good-quality roads within the delivery route.	4.42	4.42	4.49	.252	.777
8.2 Government support, incentive or policy new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	4.42	4.33	4.43	.369	.691
8.3 Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.	4.42	4.42	4.51	.630	.533
8.4 Government support, incentive or policy that ensures food safety control in delivery.	4.33	4.42	4.37	.513	.599
8.5 Government support, incentive or policy financial support for logistics providers to build new facilities and to purchase vehicles.	4.42	4.38	4.49	.383	.682
8.6 Government support, incentive or policy that supports education system in incorporating the logistics for egg industry in curricula.	4.43	4.42	4.46	.060	.942
9.1 For Egg business, Banks should introduce efficient services in converting to electronic payment	4.36	4.46	4.31	.641	.527

methods (e.g., online banking, electronic payment systems, Tele banking).					
9.2 For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	4.47	4.50	4.46	.057	.944
9.3 For Egg business, Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).	4.46	4.46	4.49	.031	.970
9.4 For Egg business, Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.	4.45	4.42	4.46	.065	.937
9.5 For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	4.46	4.46	4.43	.072	.930
9.6 For Egg business, Banks should introduce efficient services in streamlining one-stop financial service delivery.	4.47	4.54	4.46	.249	.780
10.1 Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	4.42	4.38	4.49	.405	.667
10.2 Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.	4.44	4.42	4.49	.189	.828
10.3 Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics models.	4.42	4.38	4.54	1.108	.331
10.4 Educational institutions should offer/ provide vocational education or, certificate courses organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	4.43	4.42	4.46	.060	.942

11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	4.48	4.50	4.54	.228	.797
11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	4.48	4.46	4.46	.056	.946
11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.	4.47	4.46	4.54	.351	.704
11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	4.48	4.50	4.49	.017	.983
11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.	4.49	4.50	4.57	.403	.669
11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.	4.50	4.58	4.57	.594	.553
11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	4.50	4.54	4.51	.087	.917
11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg	4.52	4.54	4.49	.095	.910

distribution.					
12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	4.48	4.58	4.51	.516	.597
12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	4.50	4.58	4.46	.464	.629
12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	4.49	4.58	4.49	.424	.655
12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	4.50	4.54	4.49	.096	.909
12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	4.49	4.63	4.49	.782	.458
12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).	4.49	4.54	4.57	.449	.638
13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	4.49	4.42	4.40	.653	.521
13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.	4.48	4.54	4.43	.367	.693
13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right	4.49	4.42	4.43	.404	.668

customer, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).					
13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	4.47	4.46	4.40	.317	.728
13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	4.49	4.46	4.40	.568	.567
13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	4.48	4.46	4.34	1.230	.293
13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	4.48	4.58	4.40	.964	.382
13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	4.49	4.46	4.40	.606	.546
13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	4.50	4.46	4.40	.646	.525
13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	4.51	4.63	4.40	1.461	.233
14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right	4.51	4.50	4.63	.871	.419

customer, if government is providing support through incentives or better policy in Egg distribution.					
14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.	4.52	4.50	4.63	.746	.475
14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	4.54	4.46	4.60	.577	.562
14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.	4.48	4.54	4.51	.272	.762
14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	4.49	4.50	4.49	.007	.993
14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	4.50	4.54	4.40	.729	.483

Appendix 2.9: Non-response bias test

Items	First Wave (N=331) Mean	Second Wave (N=98) Mean	t-value	Sig. (2-tailed)
1.1.1 You are intending to provide your staffs/employees with any egg distribution information that might help them improve logistics performance.	4.57	4.66	-1.581	.115
1.1.2 You are aiming to have frequent face-to-face planning/communication meetings with your egg distribution staffs/employees.	4.61	4.67	-1.187	.236
1.1.3 You are planning to keep each other informed about events or changes that may affect the your egg distribution staffs/employees.	4.60	4.61	-.302	.763
1.1.4 You are intending to share product planning related information with the your egg distribution staffs/employees.	4.58	4.61	-.515	.607
1.2.1 You are intending to share sensitive information (financial, service, design, research, and/or competition) on egg distribution with your business partners (e.g. farmers, wholesalers, transporters, and/or retailers).	4.55	4.64	-1.688	.092
1.2.2 You are planning to ensure the egg distribution information exchange with your partners (farmers, wholesalers, transporters, and/or retailers) that take place frequently, informally, and in timely manner.	4.53	4.70	-3.159	.002
1.2.3 You are aiming to provide your partners (farmers, wholesalers, transporters, and/or retailers) with any egg distribution information that might help them improve logistics performance.	4.56	4.62	-1.064	.288
1.2.4 You are considering to have frequent face-to-face planning/communication meetings with your egg distribution partners (farmers, wholesalers, transporters, and/or retailers).	4.55	4.61	-1.146	.253
1.2.5 You are intending to keep each other informed about events or changes that may affect the other egg distribution party (farmers, wholesalers, transporters, and/or retailers).	4.57	4.62	-.853	.394
1.2.6 You are aiming to share egg demand forecasts and related information across the egg distribution chain partners (farmers, wholesalers, transporters, and/or retailers).	4.57	4.62	-.959	.338
2.1.1 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees that can help to fulfil customer demand more accurately to improve service level.	4.57	4.55	.350	.727
2.1.2 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of developing IT solutions that can significantly reduce the production or delivery lead time.	4.59	4.56	.437	.662
2.1.3 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of latest /appropriate ICT that allows integration of operational functions that support egg distribution.	4.58	4.55	.456	.648
2.1.4 You intend to use the modern information and communication technologies and devices (e.g., landline phone, Fax, mobile, smart phone, computer, software, etc.) to receive orders or to communicate with your staff/employees with the objective of use of ICT that can help the egg distribution more visible to know exact customer demand and hence making egg distribution more cost-effective.	4.58	4.57	.152	.880
2.2.1 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of further improving the business information sharing with chain partners.	4.63	4.62	.161	.872
2.2.2 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the	4.64	4.62	.270	.787

modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving customer service by sharing the information with all SCM parties.				
2.2.3 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of improving IT support that are suitable for egg distribution within chain partners.	4.64	4.63	.087	.931
2.2.4 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of develop IT capabilities that focus on optimizing the scheduling and routing of transportation within the egg supply chain.	4.54	4.53	.177	.860
2.2.5 To receive orders or to communicate with your business partners (e.g. farmers, wholesalers, and/or retailers), you intend to use the modern information and communication technologies and devices (e.g. landline phone, Fax, mobile, smart phone, computer, etc.) with the objective of allow integration of IT functions that support egg distribution within the egg supply chain.	4.64	4.64	.012	.991
3.1 You are intending to develop joint transport planning, management and control processes for egg distribution with other logistics firms.	4.47	4.44	.566	.572
3.2 You are aiming to share logistics information (pertaining to both pre- and post-contract transportation) with 3PL in transportation of eggs.	4.46	4.41	.944	.346
3.3 You are anticipating to collaborate with 3PL or freight truck firms on investment (buying/hiring vehicles).	3.96	3.92	.626	.532
3.4 You are expecting to make a contract with 3PL for a clear, specific and quality service level in egg delivery.	4.46	4.46	-.052	.958
3.5 You are intending to improve customer satisfaction by reducing the distribution costs through collaboration with 3PLs.	4.37	4.36	.206	.837
4.1 You are intending to share customer order information with others (as applicable to farmers, wholesalers, retailers) in egg distribution.	4.39	4.36	.529	.597
4.2 You are aiming to share shipping processes and resources (trucks, trolley, equipments and employees/staffs) in egg distribution.	3.77	3.77	.040	.968
4.3 You are anticipating to share storage facilities in egg distribution centre/warehouse management.	4.49	4.48	.171	.865
4.4 You are expecting to share order-picking resources (pallet, egg carton, employees/staffs) in egg distribution through centre/warehouse management.	4.46	4.49	-.585	.559
4.5 You are intending to share stock planning functions (e.g. calculation of quantities, stock capacity, etc.) in egg distribution through centre/warehouse management.	4.46	4.50	-.762	.446
4.6 You are aiming to share risks (i.e., transport cost, damages, environmental factors) in egg distribution through centre/warehouse management.	4.46	4.46	.001	1.000
5.1 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through sharing confidential information with your chain partners (your partner has often provided information that was later proven to be inaccurate).	4.50	4.50	.079	.937
5.2 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping promises and respecting agreements with partners (the partner usually keeps the promises made to your firm), such as delivery date, and quantity and quality of delivered eggs.	4.50	4.54	-.682	.495
5.3 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through being frank in your conduct (whenever the partner gives you advice on your business operations, you know that it is based on the best judgment).	4.50	4.51	-.203	.839
5.4 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through keeping interests on all stakeholders in mind (when making information sharing, the partner is concerned about your welfare).	4.50	4.51	-.256	.798

5.5 You are intending to build interpersonal trust to create/ maintain long-term relationships with other egg distribution partners through making frequent social/business contacts with your partner's (farmer, wholesaler, and retailer) facilities with the aim of establishing trust.	4.49	4.53	-.663	.508
6.1.1 To improve egg distribution with your employee/staff (internal firm), you are intending to share sufficient and up-to-date knowledge sharing with your employee/staff.	4.50	4.49	.203	.839
6.1.2 To improve egg distribution with your employee/staff (internal firm), you are intending to share skill to handle the shipping processes in egg distribution with your employee/staff.	4.49	4.53	-.768	.443
6.1.3 To improve egg distribution with your employee/staff (internal firm), you are intending to share expertise for order receiving services in egg distribution with your employee/staff.	4.49	4.53	-.768	.443
6.1.4 To improve egg distribution with your employee/staff (internal firm), you are intending to share experience to operate storage facilities in egg distribution centre/warehouse management with your employee/staff.	4.51	4.50	.236	.814
6.1.5 To improve egg distribution with your employee/staff (internal firm), you are intending to share skills related to order processing in egg distribution through centre/warehouse management with your employee/staff.	4.43	4.48	-.831	.406
6.1.6 To improve egg distribution with your employee/staff (internal firm), you are intending to share knowledge pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management with your employee/staff.	4.51	4.49	.361	.719
6.2.1 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share sufficient and up-to-date knowledge on egg distribution shared with partners.	4.39	4.47	-1.355	.176
6.2.2 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skill to handle the shipping processes in egg distribution shared with partners.	4.50	4.55	-.913	.362
6.2.3 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share necessary skill for order receiving services in egg distribution shared with partners.	4.51	4.48	.485	.628
6.2.4 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills related to order processing in egg distribution through centre/warehouse management shared with partners.	4.50	4.46	.787	.431
6.2.5 To improve Egg distribution with supply chain partners (farmers, wholesalers, 3PL, and/or retailers), you are intending to share skills pertaining to the stock planning functions (determining quantities) in egg distribution through centre/warehouse management shared with partners.	4.50	4.48	.276	.783
7.1.1 Encouraging teamwork within internal cross-functional teams through providing training your employees, so that they can work under diverse situation.	4.49	4.52	-.590	.555
7.1.2 Encouraging teamwork within internal cross-functional teams through creating opportunities for employees to share housing/live within the premises, which brings them closer and helps form positive inter-personal relationships.	4.38	4.45	-1.269	.205
7.1.3 Encouraging teamwork within internal cross-functional teams through enhancing team works in logistic distribution by placing a new employee into an existing team whose members are experienced.	4.50	4.54	-.787	.431
7.1.4 Encouraging teamwork within internal cross-functional teams through creating positive working environment by treating every member of staff fairly, as well as providing opportunities for old employees to work with their friends/cousins.	4.40	4.42	-.346	.729
7.1.5 Encouraging teamwork within internal cross-functional teams through encouraging staff members to help each other to improve their skills to improve logistics performances.	4.51	4.51	-.046	.963
7.1.6 Encouraging teamwork within internal cross-functional teams through frequently communicating with the employees in logistics performance in order to provide clear direction and facilitate decision-making.	4.49	4.54	-.840	.401
7.2.1 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through Empowering decision-making and operation rights to the team.	4.53	4.48	.801	.424

7.2.2 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through enhancing teamwork in joint logistics operations with your partners (farmers, wholesalers, 3PL, and/or retailers).	4.52	4.54	-.316	.753
7.2.3 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through encouraging joint problem-solving in egg distribution.	4.51	4.49	.361	.719
7.2.4 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through specifying acceptable team cooperation in the egg distribution.	4.39	4.45	-1.049	.295
7.2.5 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through clearly identifying partners roles and responsibilities.	4.52	4.49	.466	.642
7.2.6 Your firm and your partners (farmers, wholesalers, 3PL, and/or retailers) enhance teamwork across supply chain partners through appreciating partners cooperation in the egg distribution.	4.40	4.46	-1.120	.263
8.1 Government support, incentive or policy good-quality roads within the delivery route.	4.43	4.43	.008	.994
8.2 Government support, incentive or policy new technology in road network in order to enable the security resources to focus on abnormalities and higher-risk traffic.	4.42	4.41	.207	.836
8.3 Government support, incentive or policy programs/research for identifying and implementing the best practices in freight transport.	4.41	4.46	-.796	.427
8.4 Government support, incentive or policy that ensures food safety control in delivery.	4.33	4.36	-.512	.609
8.5 Government support, incentive or policy financial support for logistics providers to build new facilities and to purchase vehicles.	4.43	4.42	.187	.852
8.6 Government support, incentive or policy that supports education system in incorporating the logistics for egg industry in curricula.	4.44	4.42	.292	.770
9.1 For Egg business, Banks should introduce efficient services in converting to electronic payment methods (e.g., online banking, electronic payment systems, Tele banking).	4.38	4.31	1.400	.162
9.2 For Egg business, Banks should introduce efficient services in introducing commercial bills (the bills of exchange for cash needs) as means of financing.	4.47	4.45	.441	.660
9.3 For Egg business, Banks should introduce efficient services in implementing modern card-payment technologies (i.e., credit/debit cards).	4.47	4.47	-.072	.943
9.4 For Egg business, Banks should introduce efficient services in approving business loans/microcredit facilities with lower interest for SMEs.	4.44	4.48	-.619	.536
9.5 For Egg business, Banks should introduce efficient services in facilitating leases (i.e. vehicle, warehouse, IT, shipping equipment) with the aim of improving egg logistic distribution.	4.47	4.43	.692	.490
9.6 For Egg business, Banks should introduce efficient services in streamlining one-stop financial service delivery.	4.47	4.47	.086	.932
10.1 Educational institutions should offer/ provide vocational education or, certificate courses for understanding and assessing interrelationships among egg logistic functions (warehouse management, transportation).	4.42	4.44	-.384	.701
10.2 Educational institutions should offer/ provide vocational education or, certificate courses identifying and defining logistic strategies in egg logistics distribution.	4.42	4.49	-1.170	.242
10.3 Educational institutions should offer/ provide vocational education or, certificate courses understanding of the purpose and appropriateness of existing business logistics models.	4.42	4.46	-.688	.492
10.4 Educational institutions should offer/ provide vocational education or, certificate courses organise, invite and assist to participate in Seminars, conferences and symposia, where innovations in the development of egg distribution can be disseminated and discussed.	4.43	4.43	.060	.952
11.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with your staffs/employees.	4.49	4.48	.223	.824
11.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by staffs/employees.	4.48	4.48	-.039	.969

11.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution for reliability.	4.47	4.49	-.321	.748
11.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	4.49	4.45	.755	.451
11.5 The time from receipt of customer order to delivery will decrease, if information sharing with your staffs/employees is used in Egg distribution is used.	4.50	4.49	.203	.839
11.6 The time from receipt of customer order to delivery will decrease, if appropriate IT capability (mobile, smart phone, landline phone, Fax, computer & internet) by your staffs/employees in Egg distribution is used.	4.50	4.54	-.682	.495
11.7 The time from receipt of customer order to delivery will decrease, if information sharing with supply chain partners (customers, 3PLs, farmers, wholesalers, and retailers) is used in Egg distribution.	4.50	4.50	.079	.937
11.8 The time from receipt of customer order to delivery will decrease, if appropriate IT capability is used by partners (customers, 3PLs, farmers, wholesalers, and retailers) in Egg distribution.	4.52	4.50	.341	.733
12.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	4.47	4.54	-1.156	.248
12.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	4.50	4.50	-.026	.979
12.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if transportation is shared with partners (farmers, wholesalers, retailers).	4.48	4.52	-.643	.521
12.4 The time from receipt of customer order to delivery will decrease, if transportation (sharing delivery, inventory, truck/employee hire) with 3PL is used.	4.50	4.49	.256	.798
12.5 The time from receipt of customer order to delivery will decrease, if distribution centre/warehouse management is shared with partners (farmers, wholesalers, retailers).	4.51	4.47	.715	.475
12.6 The time from receipt of customer order to delivery will decrease, if transportation is shared with partners (farmers, wholesalers, retailers).	4.51	4.49	.308	.758
13.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are retained.	4.47	4.50	-.551	.582
13.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if internal sharing of knowledge & skills is maintained with your staffs/employees.	4.47	4.52	-.906	.365
13.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers).	4.47	4.52	-.959	.338
13.4 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork cross-functional teams is continued with your staffs/employees.	4.46	4.48	-.355	.723
13.5 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if creating teamwork along supply chain is retained with partners (customers, 3PLs, farmers, wholesalers, retailers).	4.48	4.50	-.393	.694
13.6 The time from receipt of customer order to delivery will decrease, if forging and maintaining long-term relationships with partners (customers, 3PLs, farmers, wholesalers, retailers) are maintained in logistic distribution chain.	4.47	4.47	-.019	.985
13.7 The time from receipt of customer order to delivery will decrease, if internal sharing of knowledge & skills is retained with your staffs/employees in logistic distribution chain.	4.48	4.48	.066	.948

13.8 The time from receipt of customer order to delivery will decrease, if external sharing of knowledge & skills is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	4.50	4.45	.808	.420
13.9 The time from receipt of customer order to delivery will decrease, if creating teamwork cross-functional teams is continued with your staffs/employees in logistic distribution chain.	4.48	4.51	-.518	.605
13.10 The time from receipt of customer order to delivery will decrease, if creating teamwork along supply chain is maintained with partners (customers, 3PLs, farmers, wholesalers, retailers) in logistic distribution chain.	4.50	4.51	-.151	.880
14.1 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if government is providing support through incentives or better policy in Egg distribution.	4.52	4.53	-.191	.849
14.2 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if banks/financial services institutions are supporting the Egg distribution.	4.53	4.53	.019	.985
14.3 Logistic provider will be capable of delivery with the right quality and the right quantity of product to the right customer, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	4.55	4.49	1.046	.296
14.4 The time from receipt of customer order to delivery will decrease, if government is providing support through incentives or better policy in Egg distribution.	4.49	4.46	.525	.600
14.5 The time from receipt of customer order to delivery will decrease, if banks/financial services institutions are supporting the Egg distribution.	4.51	4.44	1.248	.213
14.6 The time from receipt of customer order to delivery will decrease, if educational institutions/egg associations are providing knowledge support to the Egg distribution partners.	4.51	4.44	1.195	.233

Appendix 2.10 Total variance explained by Harman's factor EFA test

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	33.136	31.862	31.862	32.473	31.224	31.224
2	6.475	6.226	38.088			
3	5.803	5.580	43.668			
4	3.943	3.792	47.460			
5	3.197	3.074	50.534			
6	2.697	2.593	53.127			
7	2.579	2.480	55.607			
8	2.382	2.291	57.898			
9	2.314	2.225	60.123			
10	2.233	2.147	62.270			
11	2.155	2.072	64.342			
12	2.007	1.930	66.272			
13	1.852	1.781	68.053			
14	1.794	1.725	69.777			
15	1.696	1.630	71.408			
16	1.617	1.555	72.963			
17	1.560	1.500	74.463			
18	1.494	1.437	75.900			
19	1.312	1.261	77.161			
20	1.247	1.199	78.360			
21	1.149	1.105	79.465			
22	1.068	1.027	80.492			
23	.952	.916	81.407			
24	.806	.775	82.182			
25	.778	.748	82.930			
26	.676	.650	83.580			
27	.650	.625	84.205			
28	.633	.609	84.814			
29	.581	.559	85.373			
30	.562	.541	85.913			
31	.536	.515	86.429			
32	.498	.479	86.907			
33	.491	.472	87.379			
34	.452	.434	87.814			
35	.442	.425	88.238			

36	.414	.398	88.636			
37	.399	.384	89.020			
38	.379	.365	89.385			
39	.365	.351	89.736			
40	.361	.347	90.082			
41	.339	.326	90.408			
42	.336	.323	90.732			
43	.330	.317	91.049			
44	.322	.310	91.359			
45	.303	.292	91.651			
46	.301	.289	91.940			
47	.299	.288	92.228			
48	.281	.270	92.497			
49	.276	.266	92.763			
50	.271	.261	93.024			
51	.266	.256	93.280			
52	.256	.246	93.526			
53	.253	.243	93.769			
54	.244	.235	94.004			
55	.236	.226	94.231			
56	.229	.221	94.451			
57	.223	.215	94.666			
58	.217	.209	94.875			
59	.215	.207	95.082			
60	.206	.198	95.280			
61	.199	.191	95.471			
62	.195	.188	95.658			
63	.190	.183	95.841			
64	.186	.179	96.020			
65	.181	.174	96.194			
66	.176	.170	96.364			
67	.175	.168	96.532			
68	.166	.160	96.692			
69	.164	.158	96.849			
70	.162	.156	97.006			
71	.157	.151	97.156			
72	.150	.144	97.301			
73	.149	.143	97.444			
74	.146	.140	97.584			
75	.139	.134	97.718			
76	.139	.134	97.852			
77	.136	.130	97.982			
78	.132	.127	98.109			

79	.126	.121	98.231			
80	.123	.119	98.349			
81	.119	.115	98.464			
82	.116	.112	98.576			
83	.109	.105	98.681			
84	.101	.098	98.778			
85	.101	.097	98.875			
86	.097	.093	98.968			
87	.091	.087	99.055			
88	.088	.085	99.140			
89	.086	.083	99.223			
90	.085	.082	99.305			
91	.079	.076	99.380			
92	.077	.074	99.454			
93	.072	.069	99.523			
94	.072	.069	99.592			
95	.066	.063	99.656			
96	.058	.055	99.711			
97	.051	.049	99.760			
98	.045	.044	99.804			
99	.042	.040	99.844			
100	.039	.037	99.881			
101	.038	.036	99.918			
102	.033	.032	99.950			
103	.028	.027	99.977			
104	.024	.023	100.000			

Note: Extraction Method: Principal Axis Factoring.

Appendix 2.11 All-item CFA with common factor