PROCESSED EGG SUPPLY CHAIN INTEGRITY

A THESIS

SUBMITTED IN FULFILMENT

OF THE REQUIREMENT FOR THE DEGREE

OF

MASTER OF SUPPLY CHAIN MANAGEMENT

AT

MASSEY UNIVERSITY

BY

GIHAN KOHOBAN

MASSEY
UNIVERSITY

2017

Abstract

In modern industrialised society prepared meals and eating out of home is an increasing phenomenon. This develops new business opportunities for processed egg manufactures, since they need to create more convenience to the consumers through food that can be prepared in quantity and served quickly. However, the issue in distribution of temperature sensitive processed egg products is to store, handle and transport products to minimal supervision with keeping as much as possible of original quality and shelf life.

This study adopts a quantitative approach in order to analyse the mediating factors of supply chain integration and collaborative advantage on processed egg product integrity. Using a New Zealand sample from egg processors, logistic companies, and product manufactures, this study examines the direct relationship between processed egg supply chain integration and product integrity. In addition, the direct relationship between supply chain integration, collaborative advantage and processed egg product integrity are also examined.

Finally, study found that in New Zealand domestic market processed egg supply chain collaboration improve product integrity through supply chain integration. Moreover, study revealed that greater senior management support and favourable external dependencies offer the best setting for enhancing supply chain integration in practise. However, middle level managers and ground level workers showed least interest and understanding the benefits of greater supply chain integration on product integrity.

Acknowledgement

The completion of this study would not have been possible without the persistent support of several people. First of all, I would like to express my appreciation and sincere gratitude to Mr.Walter Glass, my supervisor of studies for his wisdom, invaluable guidance and professionalism from the beginning to the end in the course of this study. I am also grateful Professor Paul Childerhood course director for his insightful comments and support.

Next, my gratitude also goes to Mr.Giancarlo Hannan for his priceless support and advise. Your contribution, detailed comments and insight have been of great value to this study. Also “thank you” to Mrs.Denise Dignam, who supported on vetting and proofreading this study.Final acknowledgement go to Mr.Simon Richard, my office Manager for his generous support on time allocation, data collection, and other support.

CONTENTS

List of tables

List of figures

Appendix

1.0 INTRODUCTION

This chapter describes the background to Supply chain integration and the problems created when multiple agents are involved in the processed egg supply chain. The chapter also outlines and describes the survey design used in this study and includes the purpose and limitations of this master thesis work.

1.1 RESEARCH TOPIC

The aim in writing this paper is to determine **"Processed egg supply chain integrity"**.

1.2 PROBLEM DESCRIPTION AND RESEARCH OBJECTIVE

Supply chain integration (SCI) has an intense impact on processed egg product integrity, given that SCI encompass both information and material flows seamlessly across the supply chain (Childerhouse & Towill, 2003). Furthermore, food security increases greater expectations of safety, quality and traceability of food by consumer. Given these complexities companies are beginning to be more attentive to the supply chain integration and investing millions to ensure product integrity (Laosirihongthong & Dangayach, 2005). Processed egg products are highly perishable and are characterized by a short shelf life. It is well known that temperature is the most important influencing factor on processed egg quality and safety (Stern et al., 2003). Incorrect handling, improper storage and transport conditions are the key attributes as far as processed egg integrity is concerned (Smith & Sparks, 2004; Bogataj et al., 2005).

The chain that links the flow of processed egg product is complex. The processed eggs are passed through many different traders before reaching the retail store and eventually the consumer. With many intermediate steps involved, it would be rare to find the responsibility for the whole chain resting with one company alone (Beulens et al., 2005). To achieve a shared responsibility among the different traders in the supply chain is a problem. When processed

egg products are moved forward in the supply chain from producer to the consumer, product integrity is vital and the final food has to be of certain quality at the point of consumption (James, 1996).

Exchange of data throughout the supply chain plays an important role as the traders must be willing to exchange a range of information including temperature data, storage conditions and handling procedures. Temperature monitoring is primarily an internal processes, driven within each company. Frohlich and Westbrook (2001) revealed that supply chain integration in the light of information sharing and logistics movements has a positive association with product integrity as well as performance improvement.

The objective of the research is to uncover the nature and characteristics of processed egg supply chain integration and explore its impact on collaborative advantage towards product integrity by answering the following question.

Q1: How does the processed egg supply chains integration mediate the relationship between supply chain collaboration and processed egg integrity?

1.3 SCOPE AND BOUNDARIES OF THE RESEARCH

This research focuses on the phenomenon of supply chain integration (SCI) comprising of supplier network integration, customer integration and internal integration of core functional areas such as product development, sourcing, marketing, logistics and operations (Childerhouse & Towill, 2011). Furthermore, supply chain integration is related to three powerful dimensions as Lee and Whang, (2000) suggested, organizational relationship, information integration and coordination and resource sharing. This work examines aspect of the process to clarify effective communication, traceability and visibility factors concerning

supply chain integration in order to recognise and advance processed egg integrity along the supply chain.

New Zealand has very small export market within Pacific Islands. As per NZ statistics around 20,000Kg of processed eggs been exported over the last 10 years. Year 2016 exported no processed egg to any international market. Hence, the overall aim of this study is to uncover the nature and characteristics of processed egg supply chain integrity in New Zealand's domestic market. The first area considered in the scope of this work is the integrated processed egg supply chain and the supporting core dimensions. Also the manner that organizations effect such supply chain integration activities, are considered. That is, evidence that effective communication processes are linked, how strong those links are and if the process and link management within the integrated supply chain and its network encompass product visibility.

A research study inevitably has boundaries this work is constrained by several factors, such as time, finance, and the competency. There is a limit to the scope of this research. This research is valid mainly for organizations that produce, consume and deliver processed egg products within New Zealand domestic market. Moreover, in this context, the supply chain is described from poultry farm to end user via suppliers, including the logistic company and customer. Occasionally the supply chain is described from supplier to end user and this is made clear in the work as the end user may not be the customer who purchased the end product, and the end customer may not be the user. This thesis does not deal with the supply chain activities after the product's life cycle ends.

1.4 THE IMPORTANCE OF THE RESEARCH

Food safety and quality are major concerns of the consumer with eggs being of interest since they have been linked to many of foodborne illness outbreaks (Jol et al., 2006). Although egg processors are held liable for food safety incidences, ensuring the quality and safety of processed eggs is the responsibility of everyone in the processed egg distribution chain (Curtis et al., 1995). Previous researchers have demonstrated that time and temperature are important factors that need to be controlled to achieve safe and high quality processed egg products (Curtis et al., 1995).

Foodborne hazards may be of physical, chemical or microbiological origin, and there is currently widespread recognition that microbial foodborne hazards represent the greatest risk to consumers (Gospavic et al., 2008). The annual cost of processed egg associated diseases in humans has been estimated at up to 813 million US dollars (Bryan & Doyle, 1995). The incorporation of many components into the processed egg food chain highlights a development of the chain infrastructures from basic traceability to food chain e-platforms applying collaborative supply chain management principles, which is the eventual requirement for lasting food chain integrity (Hernandez, 2009).

Arguing along the same line, Kaufman et al., (2000) conclude from their work that there is an increased need for supply chain integration, in response to the business angst created by globalization. Childerhouse and Towill, (2011) expressed that integration as being synonymous with supply chain excellence an idea that many authors posited as a supply chain utopia. Empirical evidence also indicates that the level of chain uncertainty influences the level of chain integration (Childerhouse & Towill, 2002). For that reason, his study is significant as the findings offers a feasible conceptual framework in an area of processed egg supply

chain integrity. The work has importance to both the eggs production business and wider community.

1.5 RESEARCH METHOD OVERVIEW

The area of research interest for this study was identified from a critical analysis of the relevant literature in the field of supply chain integration, collaborative advantage and processed egg product integrity. This review helped to define the concepts under investigation. Based on the gap identified in the related literature this study developed a conceptual framework and hypotheses to address the inadequacy in contemporary research. This study and the questions that it seeks to answer utilises a quantitative approach whereby data is collected using a structured quantitative questionnaire, and survey design.

1.6 POTENTIAL CONTRIBUTION TO KNOWLEDGE

This research uses a quantitative approach to analyse the mediating role of supply chain key factors and drivers of SCI on the correlation between supply chain integration, collaborative advantage and processed egg integrity. Using a sample from the processed egg industry, research findings from this study will be significant for managers and operational decision makers, since they provide clarity for effective strategies in the process of implementing and evaluating supply chain integration.

First this study examines the direct relationship between the dimensions of SCI and processed egg product integrity as well as relationship between these two factors and collaborative advantage. Secondly, this research illustrates the core attributes and gravity that SCI has on

direct impact on chain integrity from the focal organization's perspective. Thirdly by classifying SCI into the structuring and structural aspects, this research will provide evidence on which factors has a stronger impact on processed egg product integrity.

1.7 FLOW AND CONTENTS OF REMAINING CHAPTERS

This research paper consists of five main chapters after chapter one and they are as follows;

Chapter One provides an overall introduction to the thesis, including the background of the study, the study aims and objectives, brief details of the study context of the supply chain integration and processed egg integrity and the process of investigation for the study

Chapter Two explains the academic approaches and key concepts use in the study. It presents literature on supply chain management, collaborative advantage and processed egg integrity. These key concepts and approaches help to establish and justify the study's theoretical basis and they assist in an understanding of the subsequent conceptual framework that was developed for the study. These keys areas of literature also provide insights into the character of, and influences on, processed egg integrity.

Chapter Three provides details of the research methodology and methods used in this study. It explains the theoretical position for researching the supply chain integration and product integrity. Based on a constructivism paradigm, the study uses a quantitative research approach which is explained in the chapter. There are details of each of the research methods used and of the processes of data collection employed in the fieldwork.

Chapter Four provides a detailed analysis of the performance measurement in order to understand the research question and hypothesis.

Chapter Five is a discussion chapter and provides a detailed explanation of the supply chain integration in relation to collaborative advantage and processed egg integrity. These performance measurement factors are identified in the study's conceptual framework.

Chapter Six presents the overall research conclusions and the final remarks. The chapter reviews the succinct answers to the research questions and the contribution of the conceptual framework

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter is to provide a foundation for the thesis based on the literature currently available. Emphasis is placed around the concepts of processed egg supply chain, processed egg integrity and supply chain integration.

There are three interconnected themes in this chapter, covering the themes of supply chain integration, collaborative advantages and processed egg integrity. The terms “supply chain integration” and “collaborative advantage” are clarified and precisely explored and defined by renowned experts in the field. This is followed by a historical overview of the processed egg integrity. Moreover, key published methodologies for evaluating supply chain integration practises will be reviewed.

However, the key contribution of this thesis is the close and in-depth exploration of how processed egg supply chain stakeholders enable product integrity and collaborative advantage through supply chain integration in practise. Finally, a conceptual model is developed that enables the researcher to evaluate processed egg supply chain integration practises and investigate pathways to processed egg integrity and collaborative advantage.

2.2 GLOBAL EGG INDUSTRY

In Early 19th century most of egg farms were confined into backyard systems. Many farmers supply their own egg requirements would sell only if any extra eggs at local markets. By the early 1960s, egg business been shifted from small flocks to greater commercial operations due to developments of sophisticated mechanical equipment and improved technology

(American Egg Board, 2017). After almost five decades, in 2011, global egg production reached a volume of 65 million as shown in the Figure 1 and 2.

World commercial egg production is setting record-breaking trends, and ten countries top the list for production. In 2011, five countries (China, USA, India, Japan, & Maxico) supplied about 55% and China alone supplied about 37% of the world's egg needs to the tune of a total of about 65 million metric tons as shown in Figure 2.

Figure 1 – Global egg production pattern in 2011. Source: FAO database

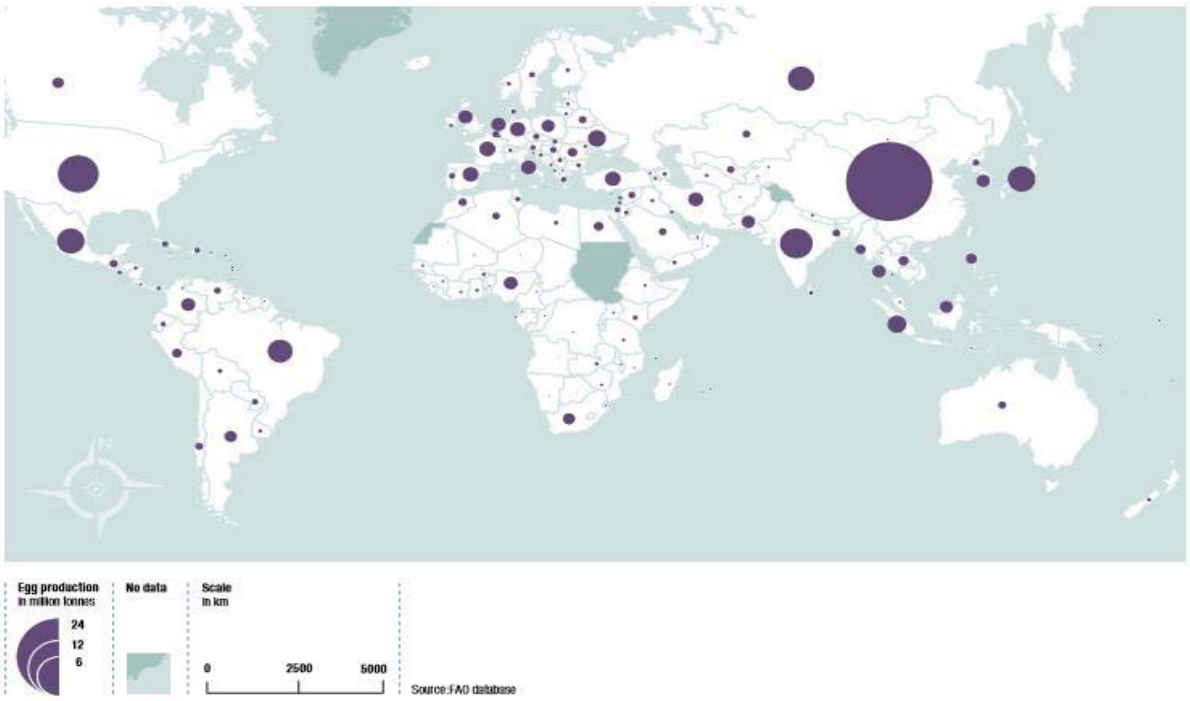
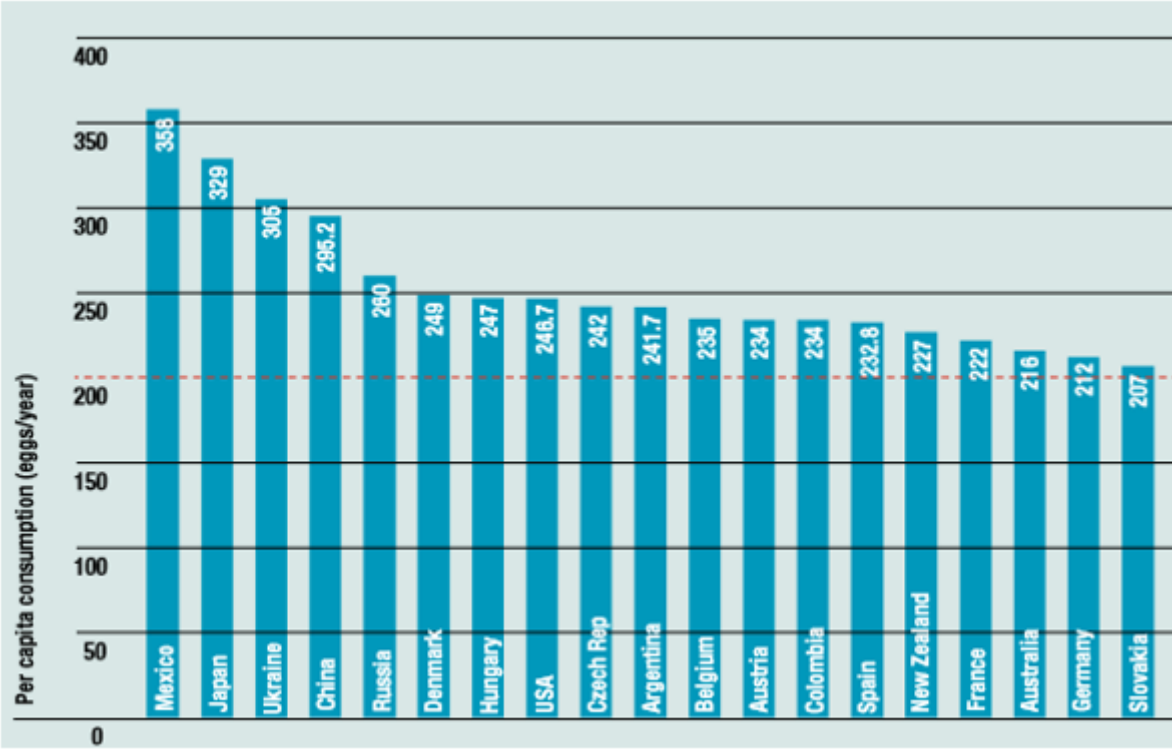


Figure 2 – Leading egg producing countries in 1971, 1991 and 2011. Source: FAO database

1971 COUNTRY	PRODUCTION (1,000 T)	SHARE (%)	1991 COUNTRY	PRODUCTION (1,000 T)	SHARE (%)	2011 COUNTRY	PRODUCTION (1,000 T)	SHARE (%)
USA	4,126	20.4	China	7,589	20.8	China	24,149	37.2
USSR	2,486	12.3	USSR	4,478	12.3	USA	5,419	8.3
Japan	1,800	8.9	USA	4,114	11.3	India	3,490	5.4
China	1,584	7.8	Japan	2,498	6.9	Japan	2,483	3.8
Germany	1,165	5.8	Brazil	1,315	3.6	Mexico	2,459	3.8
United Kingdom	879	4.3	India	1,210	3.3	Russia	2,284	3.5
France	647	3.2	Mexico	1,141	3.1	Brazil	2,037	3.1
Italy	588	2.9	Germany	922	2.5	Indonesia	1,166	1.8
Spain	494	2.4	France	918	2.5	Ukraine	1,064	1.6
Poland	396	2.0	Italy	715	2.0	France	840	1.3
Brazil	355	1.8	Netherlands	646	1.8	Spain	830	1.3
Mexico	350	1.7	Spain	641	1.8	Turkey	810	1.2
Canada	333	1.6	United Kingdom	634	1.7	Germany	777	1.2
India	308	1.5	Thailand	482	1.3	Iran	741	1.1
Netherlands	265	1.3	Republic of Korea	422	1.2	Italy	737	1.1
15 countries	**15,776**	***78.1**	**15 countries**	**27,724**	***76.0**	**15 countries**	**49,286**	**75.8**
World	20,206	100.0	**World**	36,453	100.0	**World**	65,003	100.0

As per the statistics, countries like New Zealand have demonstrated intense growth for egg consumption per person. At the beginning of the 20th century, New Zealanders ate only about 100 eggs each year, in 2009 it was recorded as 230, more than Australia, Canada, Brazil and the UK (Wintle & Lepper, 2017) as shown in Figure 3. As the demand for eggs has grown, New Zealand farming methods have had to evolve and expand in order to meet the nation's need for around one billion eggs per year (Egg producer's federation New Zealand, 2016).

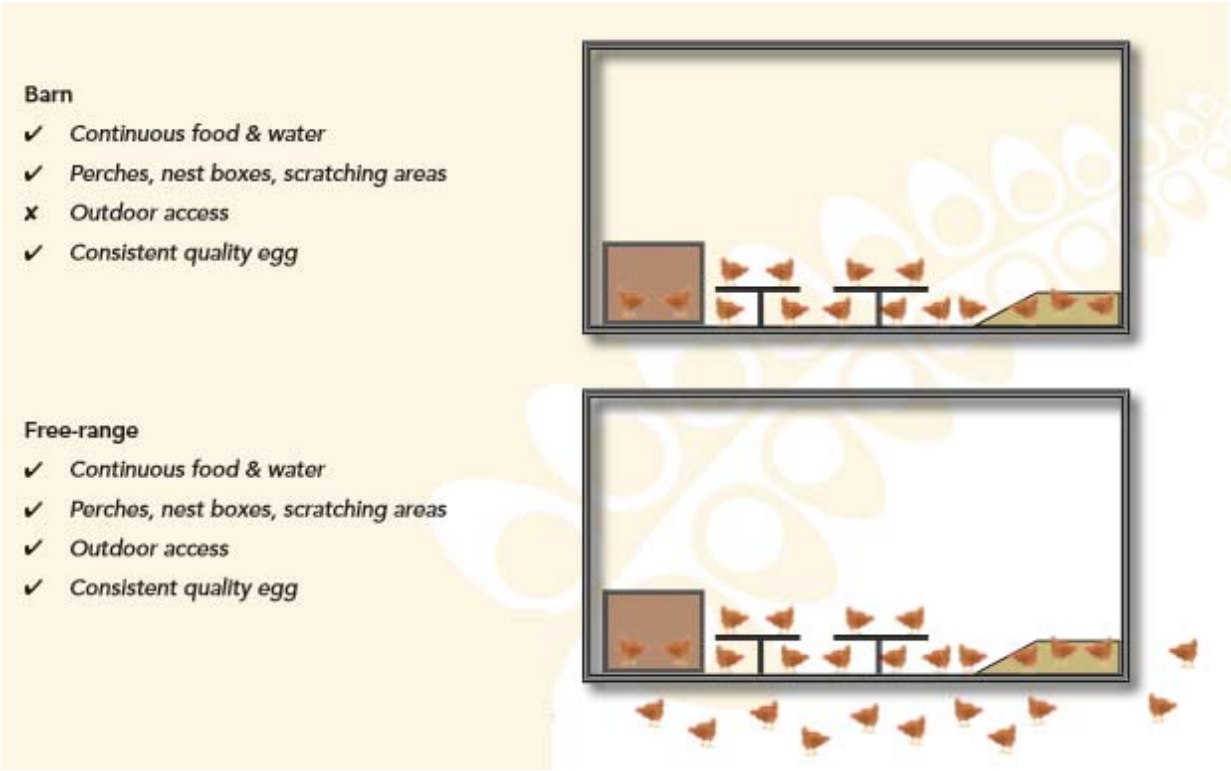
Figure 3 – Egg consumption by country in 2011. Source: ICE rapporteurs



Today, New Zealand backyard egg producers may see a local market for their surplus eggs. In contrast, new markets are continually being developed to supply specific niche market needs. As per NZ egg producer's federation, New Zealand has around 146 egg farms which produce 75% of conventional caged eggs, 19% of free-range, 5% of barns, and the organic eggs make up around 1%. The majority of New Zealand's eggs are currently farmed in conventional cages; these are due to be phased out of use by 2022 under the new code of welfare for layer hens (Animal welfare act 1999). Retail sales of eggs are worth upwards of $286 million and up to 85% of commercially farmed eggs are sold as "table eggs", with the remainder used in the backing catering industries as processed eggs. New Zealand also has a small but increasing export base to the Pacific Islands and Oceania regions (Egg producer's federation New Zealand, 2016)

On the other hand, consumers demand to know that eggs been produced in a safe, welfare-friendly and sustainable manner at affordable price. Therefore, the new code of welfare (Layer Hens 2012) drives a significant advance for hen welfare while helping retain affordability. Latest research and development has led to the introduction of colony farming which, alongside barn and free range, this approach significantly improves hen wellbeing and production of affordable eggs as shown in Figure 4 (Egg Producers Federation New Zealand, 2016).

Figure 4 – Types of egg farming in New Zealand. Source: Egg producer's federation NZ



2.3 EGG PROCESSING

Egg processing includes multiple steps as shown in Figure 5. Processed egg products include whole egg, yolks, whites, and various processed and pasteurized blends which comes in liquid, frozen, and dried forms.

Figure 5 – Egg processing cycle. Source: Eggway, 2011

Receiving Eggs

Eggs are transported to the processing plants directly from either laying hens or contract flocks, or both. Usually eggs will be kept refrigerated at 13C until used and allowed to warm to room temperature (20C) for 12-24 hours.

Figure 6 –Receiving Eggs for processing. Source: International egg commission, 2013

Loading eggs

In egg processing plants, the production starts with the loading of eggs either in-line operations or off-line systems. In off-line systems, once the egg filter-flats or nest -run eggs arrive in the transfer room, flats of eggs are loaded to the off-line conveyors and moved to conveyor spools going through the egg washers.

Figure 7 – Eggs loading matching in an egg processing plant. Source: International egg commission, 2013

Washing eggs

Shell eggs, when presented for breaking, must be clean. Modern egg washers use pressure sprays, rotating brushes, and an egg-spinning device that increases contact between the egg and the brush and minimizes damage to the eggs. Plant personnel segregate shell eggs ineligible for breaking during the candling operation. Shell eggs continue on the conveyor to the braking room.

Figure 8 – Egg washing matching in an egg processing plant. Source: International egg commission, 2013

Candling eggs

In the candling process, eggs are mechanically rotated several times over a bright light to examine the internal quality of the egg. The primary function of the candling procedure is to remove the dirty or cracked, and ineligible eggs before the breaking step.

Figure 9– Egg candling process in an egg processing plant. Source: International egg commission, 2013

Breaking Eggs

In breaking step facilities and operations, shell eggs are broken and the liquid is separated from the shells. After the eggs is broken, the breaking machine can separate the yolk from the white.

Figure 10 – Egg breaking matching in an egg processing plant. Source: International egg commission, 2013

Liquid egg product handling

After breaking, the liquid egg flows into collection vats (balance tanks) by gravity. A perforated plate contained within the vat serves as a filter to remove eggshells. The liquid eggs pumped through a filter and then is pumped to the cooling system. After cooling, the liquid egg is pumped to a storage silo for further processing.

Figure 11 – Liquid egg product handing. Source: International egg commission, 2013

The egg processing industry produces number of products these include: egg white, whole egg with yolk added (fortified), plain yolk, whole egg with corn syrup added, sugared egg yolk, salted egg yolk, and salted whole egg (Forsythe, 1970). The baking industry commonly uses frozen whole egg products, frozen albumen, and frozen plain or sugared yolks. Some frozen whole egg also is prepared for institutional use whereas some frozen albumen is used by confectioners. Procedures of dairy products and noodles also utilize frozen yolk, either sugared or plain (Forsythe, 1970). Processed egg products are frozen primarily to extend their shelf life, quality, and safety. Commercial egg products are frozen in two forms: pasteurized liquid egg and cooked egg (Dawson, 1995). The uses and specifications of some liquid frozen egg products are showed in Table 1 & 2.

Table 1 - Specifications and users of processed egg products.

Product	Specifications	Uses
Whole egg	Whole egg in natural proportions; no additives with a minimum of 25.5% egg solids	In baked goods (cakes, cookies, sweet doughs, and pastries)
Fortified whole egg	Whole eggs with extra yolk and sugar	Same as whole egg
Standard albumen	Albumen with a minimum of 11.5% egg solid a minimum fat content of 0.03%	In baked goods (angel food and white cakes, meringues, icings, and candy)
Quick-whipping albumen	Specially processed albumen to promote quicker whipping	In angel food cakes
Plain yolk	Yolks with a minimum of 45% solids with no additives	In egg noodles and baby foods
Sugared yolk	Yolk with a minimum of 43% solids with 10% sugar added	In baked goods (cakes, pastries, ice cream, and baby food)
Salted yolk	Yolks with a minimum of 43% solids with 10% salt added	In mayonnaise, salad dressings, and condiments

Source (Hsu et. Al., 1979)

Albumen, yolk, and mixed whole eggs are frozen commercially. When subject to federal regulations, these products must be pasteurized prior to freezing to inactivate any Salmonellae organisms that might be present (Craig, 2010). From a public health point of view, the presence of salmonellae is probably of greatest risk in the processed egg industry (Kraft, 1971). Presence of salmonellae in processed egg is not an uncommon event. Mullner et al (2009), revealed that >50% of salmonellae cases in New Zealand were attributable to poultry.

Table 2 – Uses & examples of whole/ separated egg products.

Whole/separated egg products		Uses	Example
	Whole egg	Baking	Biscuits, cakes, pies, quiches, pasta, omelettes or any product requiring whole egg
	Albumen (Egg White)	Foaming (Aeration)	Fluffy omelettes, Soufflés, Meringues, Pavlova
		Clarifying	Dropped into consommés to draw out impurities
		Binding	Meat & fish products
		Protein Source	Add to fruit drinks, milkshakes, yoghurt smoothies, Scramble up in an omelette
	Salted Egg Yolk	Emulsifying	Mayonnaise, Hollandaise, Béarnaise sauces
	Sugared Egg Yolk	Thickening	Custard, Pastries, ice cream, baking

In addition, further bacterial risk is demonstrated by temperature abuse, this increases the growth and survival rates of pathogenic bacteria and enhances the potential for subsequent toxin production (Lambert et al., 1991; Jol et al., 2007). Other critical temperature risks within the production of egg products include product cooling prior to palletizing or loading at the producer, waiting times at dispatch and loading points, temperature abuse during transport caused by excessive door opening times and inappropriate handling and storage of the goods at the retailers (Montanari, 2008; Raab et al., 2008). To meet legal requirements and to eliminate or minimise weaknesses in the processed egg chain, efficient temperature monitoring is of great relevance to all involved in the supply chain, from primary producers, to processors, distributors, retailers and finally to the consumer (Nychas et al., 2008). These

authors have identified a number of imperative factors influencing safe quality egg production this work identifies five key influences on processed egg quality and uses these as guidelines when considering the effects shown in Table 3 and Table 4. The five identified are freezing rate, storage time, storage temperature, thawing rate, and additives.

Measured temperature data and analysis are often insufficient and may lead to incorrect decisions for further handling of the products. One aspect is that during storage and transport the environmental temperature is controlled which often differs from the product temperature (Gill et al., 1996; Moureh and Derens, 2000).

Tracing (backward) and tracking (forward) biological contamination in processed egg supply chain, advances in detection technologies, improvements in molecular marker identification, clearer understanding of pathogenicity markers, improved modelling methodologies and, more importantly, the integration of these disciplines will lead to better capability in full chain tracing and tracking of biological contaminations (Barker et al. 2009). Furthermore, such integration will result in an integrated understanding of the growth and spread of pathogenic microorganisms and their toxins in the chain structures. Therefore, Gill et al., (1996), calls for a comprehensive and integrated processed egg supply chain approach to ensure a high level of human health and consumer protection.

Table 3 – General effects of freezing rate, storage time, storage temperature, thawing rate, and additive on liquid egg product quality

Influencing Factor	Effect on quality		
	Egg albumen[a]	Egg yolk[b]	Whole egg[c]
Freezing rate	Slower rate causes reduced viscosity and increased foam stability	Slower rate causes increased viscosity and gelation	Same as liquid EY but less severe
Storage time	Longer time causes reduced viscosity and increased foam stability	Longer time causes increased viscosity and gelation	Same as liquid EY but less severe
Storage Temperature	Lower temperature causes reduced viscosity and increased foam stability	-18° C results in maximum increase in viscosity and gelation	Same as liquid EY but less severe
Thawing rate	Faster rate causes some protein denaturation	Slower rate causes increased viscosity and gelation	Same as liquid EY but less severe
Additives	None normally needed	2% NaCl and 8% sucrose inhibits gelation; 10% used commercially	None normally needed

Source (Hsu et. Al., 1979)

Table 4 - General effects of freezing rate, storage time, storage temperature, thawing rate, and additive on cooked egg product quality

Influencing Factor	Effect on quality		
	Egg albumen	Egg yolk	Whole egg
Freezing rate	Slower rate causes greater syneresis	Little effect on functionality	Same as albumen but less severe
Storage time	Longer time causes greater syneresis	Little effect on functionality	Same as albumen but less severe
Storage Temperature	Lower temperature slightly increases syneresis	Little effect on functionality	Same as albumen but less severe
Thawing rate	Faster rate increases syneresis	Little effect on functionality	Same as albumen but less severe
Additives	Starches, algin carrageenan, agar inhibit syneresis	None normally needed	Sodium caseinate, gums, and starches at 2-5% inhibit syneresis

Source (Hsu et. Al., 1979)

2.4 PROCESSED EGG SUPPLY CHAIN INTEGRATION (SCI)

The term SCI construct is relatively new as an area of research, though there is an extensive body of research on multi-dimensional supply chain relationships, exploring collaborative relationships between a manufacturer and either its customer or suppliers (Mabert & Venkataramanan, 1998; Spekman et al., 1998; Paulraj et al., 2008). The term “integration” is defined as “the unified control of a number of successive or similar economic or especially industrial processes formerly carried on independently” (Gove, 1966).

One main aspect in the processed egg supply chain, besides the integration of temperature monitoring systems, is the linkage of product characteristic and temperature data (Gospavic et al., 2008). Researchers have shown that predictive food models can be possible solutions to link product quality with the temperature history of the product (Giannakourou, 2001). Such models permit the prediction of food quality and remaining shelf life, based on microbiological growth depending on defined environmental factors (Dalgaard et al., 2002). However, a key element of the integration of such models and the calculation of the remaining shelf life is the continuous control of product temperature during the different stages of the processed egg supply chain, whereby aspects such as the reading and recording of the temperature should be considered (Kreyenschmidt et al., 2010).

Furthermore, the organization's structure and technical conditions of the processed egg supply chain need to be considered (Dalgaard et al., 2002). In general, temperature conditions and variations, data on temperature history, system construction regarding management of temperature, and quality data and microbiological data are needed for prediction of remaining shelf life in each step of the processed egg supply chain (Kreyenschmidt et al., 2010). A key element for processed egg supply chain and integrated disciplines such as cold

chain management is a good data basis for operational and managerial decisions at important inspection and decision points within the chain (van der Vorst et al., 2007).

The recent push for traceability in food supply chains and subsequent legislation have made several software suppliers take a holistic approach to the entire supply chain (Thompson et al., 2005). Bollen et al. (2006) suggested that a very detailed traceability system would be able to track and locate a product at all points from harvest or slaughter to market and, by including temperature data, this could be used to predict quality at all times.

2.5 COLLABORATIVE ADVANTAGE

Supply chain collaborative advantage is called combined competitive advantage (Jap, 2001). The term collaborative advantage has immediate attraction as it refers to strategic benefits gained over opponents in the marketplace through supply chain integration. Collaborative advantage relates to the anticipated result of collaborative action that no one organization could have produced on its own (Vangen & Huxham, 2003). Jap (1999) explains that collaboration can widen the size of the combined benefits and give each stakeholder a share of better gain that could not be generated by each member on its own.

Min et al., (2005) revealed that collaborative advantage benefits may not be instantly evident; but, progressive strategic rewards are enticing along the supply chain. The concept of collaborative advantage originates from this work as a concept which may drive the collaborative process and make it more effectively (Duffy & Fearne, 2004). Along similar lines, this work conceptualizes collaborative advantage as the following five key components: process efficiency, offering flexibility, business synergy, quality, and innovation. It seems most

logical that collaborative advantage and food integrity be considered from the supply chain stakeholder's perspective (Duffy & Fearne, 2004).

Process efficiency drives performance towards critical strategic objectives and improves the efficiency throughout supply chain integration (Bagchi & Larsen, 2005). Efficiency can be seen as a set of practices aimed at managing and coordinating the whole supply chain (Slack et al., 2001), to develop greater synergy through collaboration along the whole supply chain (New & Ramsay, 1997). This approach can also offer flexibility based on the degree to which the facility can respond to a changing environment and extraordinary demand requests (Beamon, 1998).

Ansoff (1988), argues that greater synergy leads to gains and an impressive economy of scale for their product, noting that the collaborative effect creates better process efficiency making greater use of resources in the supply chain process (Itami & Roehl, 1987). Gavin (1988) discusses a research study that found organizations with greater synergy respond faster to customer requirements, show greater product quality and innovative design, and exceptional aftersales service that supposedly builds customer loyalty. These aspects in turn expand market shares and eventually a gain in higher profits (Garvin, 1988).

As often new products have shorter product life cycles, organizations need to innovate regularly and in small increments (Handfield & Pannesi, 1995; Kessler & Chakrabarti, 1996). Tan et al., (2002) note that in the 1990's as product life cycles shrank and global competition intensified , many manufacturers collaborated with their suppliers to improve product quality and the ability to engage in process and product innovation (Kaufman et al., 2000). Stewart (1995) discussed an increase in product quality through constant innovation, combined organizational learning, knowledge sharing, joint problem solving between supply chain

partners. Without such a collaborative approach at the outset, there is littlet point in trying to pursue an integrated approach to chain improvement, as David (2015) notes this is likely to be undermined by a lack of integrity and an anxiety regarding sharing benefits.

2.6 PROCESSED EGG INTEGRITY

Food integrity refers to how well a firm fulfils a contract with high-quality product and integrity associated information (Beulens et al., 2005). Processed egg product integrity is measured by process transparency, product safety, quality, product traceability and tracking. These measures have been widely used in previous researchers because they are primary yardsticks for most stakeholders (Narasimhan & Kim, 2002; Petersen et al., 2005).

Traceability is gaining importance a method of providing safer food supplies and of connecting producers and consumers (Regattieri et al., 2007). Traceabile systems can be seen as a tool to manage the flow of inputs and products to improve efficiency, product differentiation, food safety and product quality (Golan et al., 2004). According to Schwagele (2005) traceability can be divided into two key functions, tracking and tracing. Schwagele (2005) defines 'tracking' as the ability to follow the path of an item as it moves downstream through the supply chain from the beginning to the end, while 'tracing' is the ability to identify the origin of an item or group of items through records upstream in the supply chain. Regattieri et al., (2007) argue "It is crucial that information flows readily in both directions, especially in the event of a customer complaint or concern over a food product's safety or integrity".

To establish a processed egg transparency system, it has to be clarified 'how much and which data' can be made accessible to the different user groups without violating the confidentiality

needs of the producers yet still ensuring adequate and timely information (Fritz & Schiefer, 2008). Other factors that contribute to processed egg integrity includes cross contaminations during processing process and storage of the raw egg at the temperature that would permit growth of Salmonella (Mann, 2008). Once the integrity has been compromised, Salmonella can gain access to the yolk, where it can grow if temperatures are greater than 7^0 C (Mann, 2008). On the other hand, transparency and the availability of this information can be a prerequisite for gaining trust within the processed egg supply chain (Li et al., 2006).

Supply chain integration offers joint competitive advantage and comes from an interactive collaboration, a common benefit that increases product integrity throughout the chain (Dyer & Singh, 1998). It is evident that the principal transparency interest of consumers is on the product they consume, their safety, quality, traceability and visibility (Fritz & Schiefer, 2008). Therefore, information regarding the integrity performance must follow the relevant quantity, which again must be traceable along the chain, carrying information from the farm to processing to retail (Li et al., 2006).

2.7 CONCEPTUAL MODEL

Through greater integration, supply chain stakeholders can work as if they were a part of a sole organization (Lambert & Christopher, 2000). Furthermore, it enhances accessibility and collaborative resources and so all parties benefit. Equally the improvement in the processed egg supply chain integration can surpass collaborative advantage and excel egg product integrity along the supply chain as shown in Figure 12.

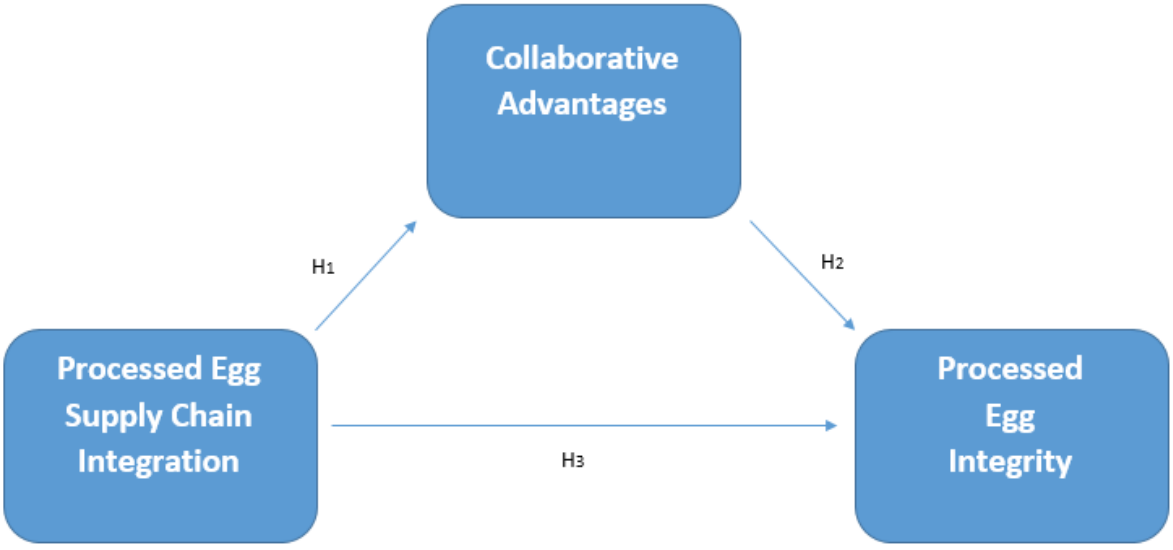
The mutuality of supply chain integration can be defined in various ways, and mostly these divided into two main dimensions of conceptualization: complementary of processes and relationship focus. Supply chain integration seeks to align supply chain strategy with business strategy in order to deliver highest customer satisfaction, streamline processes and achieve operational excellence (Manthou et al., 2004; Sheu et al., 2006).

Coalescing both process and relationship focus, SCI can be described as an allied process where two or more independent organizations work closely to plan and accomplish supply chain processes toward common goals and mutual benefits (Bagchi & Larsen, 2005). The process consists of information sharing (Manthou et al., 2004), goal congruence (Angeles & Nath, 2001), decision synchronization (Stank et al., 2001), resource sharing (Sheu et al., 2006), collaborative communication (Mohr & Nevin, 1990), and joint knowledge creation (Malhotra et al., 2005) among independent supply chain partners.

Collaborative advantage is synergised with the creation of synergy between collaborating partners (Jap, 2001). The engagement of a collaborative relationship can also expose relational risks which according to Jap (2001) can lead to collaborative failures.. Therefore, collaborative advantage relates to the anticipated synergistic outcome of collective activity that could not have been gained by any organization acting alone (Vangen & Huxham, 2003). As discussed above in the chapter two, this research conceptualizes collaborative advantage into five subcomponents: process efficiency, offering flexibility, business synergy, quality, and innovation. These collaborative advantage and performance are viewed from the focal firm's and end user perspective (Duffy & Fearne, 2004).

Product integrity refers to how well a product security intelligence allows companies to detect something amiss, respond and communicate with key stakeholders (Petersen et al., 2005). Ensuring the legitimate supply chain's integrity also requires a strategy to provide product security 'intelligence,' meaning here, 'information gathering, assessment and evaluation processes to make tactical and strategic decisions' (Schwagele, 2005). Jaafar et al., (2011) offers a similar opinion on this matter. Their study agrees that the product in various nodes can be tracking slightly different information. An implication is that the same attribute is not tracked throughout the entire life of the product. A consideration for data integration is to determine which attributes will need to be tracked over different stages, and the level of traceability of the products with real time data to be tracked throughout the chain (Duffy & Fearne, 2004).

Figure 12 - Conceptual model "Impact of processed egg supply chain integration on collaborative advantage and processed egg integrity"



Source: author

3.0 RESEARCH METHODOLOGY

3.1 DETAILED DESCRIPTION OF RESEARCH QUESTION/HYPOTHESES

The concept of supply chain collaboration and collective advantage has been mentioned in the literature (Vangen & Huxham, 2003). However, when considering the performance implication of supply chain integration, a distinction should be made between supply chain integration, collaborative advantage and the impact of integrations on food integrity. There are many empirical studies that tested the relationship between SCI and organization performance (Deveraj et al., 2007; van der Vaart & Van Donk, 2008). There are some studies that provided empirical evidence of the impact of SCI practices on competitive advantage and organisation performance (Li et al., 2006; Flynn et al., 2010); however, there is little evidence is published on the impact of SCI on collaborative advantage and food integrity.

The main objective of the study is to discover the nature and key characteristics of processed egg supply chain integration and identify the impact on collaborative advantage and processed egg integrity by answering following research question.

"How does the processed egg supply chains integration mediate the relationship between collaborative advantage and processed egg integrity?"

Previous studies suggested that supply chain integration benefits include cost reduction, risk sharing, access to financial capital, complementary assets and knowledge transfer (Park et al., 2004). Shared resources between supply chain partners encompass reduce process cost, complementary resources, which bring super-additive value (Tanriverdi, 2006). Hence, this

study develops the following hypothesis:

Hypothesis 1. Processed egg supply chain integration has a significant positive impact on collaborative advantage

The necessary condition for supply chain collaboration is that the supply chain stakeholders are able to expand the total gain due to synergy (Simatupang & Sridharan, 2005). Fisher (1997) discussed that greater supply chain collaborations excel the financial benefits by increasing responsiveness, especially for innovative products and process integrity. In particular, cooperation among competitors can foster greater knowledge seeking and result in synergetic process for greater product integrity (Stuart & McCutcheon, 1996). Therefore, this study hypothesis two is:

Hypothesis 2. Collaborative advantage has a significant positive impact on processed egg integrity

Many scholars argue that both customer and supplier firms seek collaborative relationship with each other as a way of improving performance (Sheu at al., 2006). Simatupang and Sridharan (2005) described how supply chain integration enables the chain members to respond and to react to demand changes. Efficient integration enables the supply chain partners to improve their ability to fulfil customer needs by flexible offerings. Lee and Whang (2001) reported that food product industry reported higher than average profit were the ones who were engaged in higher level of information sharing within supply chain stakeholders and end users. Thus, this study hypothesis number three is:

Hypothesis 3. Processed egg supply chain integration has a significant positive impact on processed egg integrity

3.2 THE ONTOLOGICAL AND EPISTEMOLOGICAL PERSPECTIVE

It has been debated that researchers must first decide on an appropriate research paradigm, prior to selecting the methodological approach (Guba & Lincoln, 1994). The concept of 'Research paradigm' has been defined as the principle, system or views, which enable a researcher to make an informed choice on the appropriate method, epistemology and ontology for a given study (Goles & Hirschheim, 2000). Thus, research paradigms development analysis might assist researchers to better explain why a selected methodology is more appropriate than others in a study (Meredith et al., 1989).

3.2.1 ONTOLOGY

Ontology concerns the nature and form of reality in the physical world, is important to describe reality as it is under investigation (Guba & Lincoln, 1994). There are two main features of ontology that have been argued to produce valid and reliable knowledge, objectivism and subjectivism. Objectivism holds the view that in reality, social structures exist regardless of the social actors and their concern with its existence; in contrast the subjective view that, the social entities exist in accordance to the social actor's view and relevant actions (Collis & Hussey, 2009). Typically, quantitative methods such as surveys and mathematical/statistical analysis are used in this paradigm. A quantitative approach also assumes general laws can be evidenced and tends to emphasize the measurement and the

analysis of causal relationship between variables (Naslund, 2002).

3.2.2 EPISTEMOLOGY

Epistemology concerns the nature of knowledge, or the way of knowing, is needed to understand how the knowledge about reality is sought (Guba & Lincoln, 1994). It also questions whether the same approach adopted by natural scientist could be used in the social sciences (Sekaran, 2006). On the other hand, for studies related to feelings and attitudes of organizational members, researchers take a philosophical approach, commonly referred to as "interpretivist" (Goles & Hirschheim, 2000). In general, qualitative researchers are more interpretive and subjective in their approach (Denzin & Lincoln, 1994). There are a number of inter-paradigms that give the inquirer into social science options to choose from. The paradigms that will be used in this research are based on Lincoln et al., (2011)'s classification as shown in Table 5.

Traditional supply chain management researchers tend to belong to the positivist paradigm (Eisenhardt, 1989). This approach is still very predominant in today's management research. Mentzer and Kahn (1995), have been identified that 50% of supply chain publications were survey based and case study research accounted only for 3.2%. Arguing along the same line Carter and Ellram (2003) who reviewed 35 years of publication in *The Journal of Supply Chain Management*, and identified that the dominant type of primary research design employed is mail survey (approximately 60%); case study research only accounted for approximately 18%. The dominance of surveys indicates that a positivist paradigm and, thus, mainly quantitative methods, are preferred by supply chain management researchers. Mostly due to the fact that

SC research lends to numerical data and time specifics which can easily be quantified and measured.

Table 5 - Comparison of Ontology and Epistemology approaches

	Positivist	Post-positivist	Social Constructivist	Critical Theory/ post-modernist	Participative
Ontology	Naive realism - "real" but apprehensible	Critical realism- "real" reality but only imperfectly and probabilistically apprehensible	Relativism –local and specific co-constructed realities	Historical realism- virtual reality shaped by social, political, cultural, economic, ethnic, and gender values; crystallised over time	Participative reality – subjective-objective reality, co-created by minds and given cosmos
Epistemology	Dualist/objectivist; findings true	Modified dualist/ objectivist; critical tradition/community, findings probably true	Transactional/subjectivist; co-created findings	Transactional/subjectivist; value-mediated findings	Critical subjectivity in participatory transaction with cosmos; extended epistemology of experiential, propositional, and practical knowing; co-created findings
Methodology	Experimental/manipulative; verification of hypotheses; chiefly quantitative methods	Modified experimental /manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods	Hermeneutical/ Dialectical	Dialogic/dialectical	Political participation in collaborative action inquiry; primacy of the practical; use of language grounded in shared experiential context

Source: (Bryman & Bell, 2011)

3.3 APPRAISAL OF ALTERNATIVE RESEARCH METHODOLGY

The most common research methodologies fall into either qualitative or quantitative approaches. Qualitative method usually has emphasis on subjective data like words rather than quantification in the collection and analysis of data. The qualitative approach is mainly popular to social research and includes with a number of steps; delineating the sequence of stages is the most critical and important aspect (Neuman, 2006). Qualitative data is often not represented as numerical, though nominal codes may be given to concepts and constructs. Therefore qualitative methods usually have less codification of the research process; and

express a difference of the concepts of reliability and validity from those of quantitative research.

Quantitative research approach mainly deals with quantifiable aspects of a phenomena consist of a number of steps including; linear succession of stages; the importance of measuring concepts and the way in which measures may be devised for concepts. Measuring concepts or elements in a process; includes of important idea of an indicator, which is devised as a way of measuring a concept for which there is no direct measure. Also procedures for checking the reliability and validity of the measurement process are the main preoccupations of quantitative research (Neuman, 2006). Quantitate research is concerned with four features: measurements; causality; generalization; and replication.

Each approach and methodology has its own strengths as well as weakness. For instance, quantitative thinking may fail to distinguish between people and social institutions from the world of nature, and rely on instruments and procedures, while qualitative methods may be too subjective and may not evidence-transparency. This research uses a quantitative method and analysis is based on quantifiable aspects to test hypothesis as discussed above.

3.4 SELECTION OF RESEARCH METHODOLOGY

The purpose of this study is to understand and explain the nature of the relationship that exist among the SCI in the egg industry and food integrity related variables are considered. The variables considered have been identified through related literature as being those variables most needed in order to answer the research questions posted in section 3.1 above.

Using a quantitative study method to examine the research the key questions identify causal relationships and research outcome variables. This correlational field study, utilizes a minimal interference industry survey, and selects the identification of specific cause for the questions identified above.

3.5 DETAILED DESCRIPTION OF RESEARCH APPROACH

Drawing on a critical literature review and establishing the conceptual framework enable the generation of three hypotheses. . In order to examine the hypotheses, this research takes a quantitative (deductive) approach in collecting and analysing the information. The research design (strategies) include a number of essential logical decisions such as, the aim and objectives, the type, target respondents and the reliability limitations of the study (Cavana et al., 2001). Research elements include analysis and considerations on how the variables are measured, and how the data are collected. This will enable the research to choose the most applicable method for collecting and analysing the data (Collis et al., 2003).

The main intention behind this study is to find out the correlation between processed egg supply chain integration, collaborative advantage and food integrity along the processed egg supply chain. Therefore, a structured quantitative questionnaire has been used as main technique for the study and data included the interview of selected stakeholders within processed egg supply chain networks. The variables used in the research questionnaire from the selected key question topics related to independent variables as shown in Appendix C;

The main purpose of an interview is to understand the research question from the interviewee's perspective and to understand how and why the interviewee has this perspective (King et al., 1994). Therefore, structured questionnaire permit rich data to be collected in terms of respond to answers and verify responses. The interviewees groups and the key actors who will be interviewed will be as follows;

Interviewees groups

- Top management
- Processing department
- Logistics department

Key factors

- Managing director/ General manager
- Department manager
- Officers
- End Users

Bryman (2004) explained how process observation as a data collection approach can be used and how that the approach allows observed processes and subject behaviour to be collected. Thus, as discussed earlier, process observations and review of archival data will also be used as data in this research. This approach entails an investigation in to the gap between the stated and actual behaviour. Target interviewees of this research will be will be divided into

three categories to represent the entire supply chain with respect to upstream suppliers and downstream customers along with operational supply chain process;

- Farm - Processing
- Processing - Warehouse
- Warehouse – End User

3.6 PLANNED MEASUREMENT TECHNIQUE AND ASSOCIATED ANALYSIS

The development of measurement technique for this study will be generated from instruments for supply chain integration and collaborative advantage (Lavie, 2006). The process includes item generation, structured interviews and analysis.

Firstly to ensure the content validity of the constructs, an extensive literature review was conducted to define each construct and generate the initial items for measuring the constructs. The purpose of item generation is to reach the content validity of constructs by reviewing literature and interviewing industrial experts. The measurement items for a scale should cover the content domain of a construct (Churchill, 1979; Segars & Grover, 1998). Upon examine of extensive literature, 30 items were created for six components of processed egg supply chain integration and 20 items were developed for five components of collaborative advantage, then a final 10 items were created for two components of processed egg food product integrity (refer Appendix C).

A 7-point Likert scale was used to indicate the extent to which Supply chain stakeholders agree or disagree with each statement where 1 = strongly disagree, 2 = disagree, 3 =

moderately disagree, 4 = undecided, 5 = moderately agree, 6 = agree, and 7 = strongly agree. After the measurement items were created, the common pool of items were reviewed and evaluated by practitioners from four different manufacturing firms to pre assess the reliability and validity of the scales. This process included firstly, structured interviews, these were conducted to check the relevance and clarity of each sub construct's definition and to clarify the wording of question items.

The supply chain integration is described as the independent variable and the dependent variable is enabling food integrity along value chain. Pearson correlation has been performed according to the vicariate application in this research. Validate the respondent's answers, Cronbach's alpha test descriptive statistics have been used to test data validity prior to answer research question. All the hypothesis will also be tested by using SPSS software.

3.7 ETHICAL CONSIDERATION

Ethical considerations in this research are recognised and made explicit throughout the stud. Ethical consideration has been made during the preparation prior to the fieldwork, during the fieldwork and also when undertaking analysis and presentation. It is very important that the data gathered through the food companies remain fully confidential. The anonymity of the respondents is a top priority and is adhered to without conceding the right of the respondent, researcher and the university. The questionnaire does not gather any identifying information in order to maintain anonymity and prevent any exposure of the participant. The research institution hosting this study is the Massey University, which has an ethical code of research that aligns with New Zealand's research policies.

3.8 CRITICAL REVIEW OF THE CHOSEN RESEARCH MEHODOLOGY

This research explores the impact of processed egg supply chain integration on collaborative advantage and food integrity. A description of the main study dimensions of this work are presented in Table 6. The justification for the choice of the work descriptors are shown in the table and this is taken from the respective research methodology literature. Sekaran (1992) explains with the use of examples the approach to be used with a study and set of research questions. Similarly, Baker (1995) explains a similar exposure of the research methodology parameters that must be considered in undertaking an analysis. The core research processes use in this study therefore are consistent with a correlation, cross-sectional hypothesis testing type study as recommended by the literature for the quantitative approach use in this research (Sakaran, 1992).

Table 6 - Description of the research's main characteristics

Study Dimensions	Description
Purpose of the study	Hypothesis testing
Paradigm	Positivist
Type of investigation	Causal, correlational
Extent of research interference	Minimal
Study setting	Non-contrived, field study
Unit of analysis	Organizational level
Sampling design	Selected 100 supply chain professionals targeted
Time horizon	Cross-sectional study
Data collection method	Survey questionnaire
Measurement of variables	Element definition 7 point Likert scales

The research approach takes an epistemological and ontological position consistent with quantitative methodology. Thus, this study provides data that can be expressed in numerical

form. Consequently, the data is subject to applied statistical tests to make statements about the findings and in order to obtain inferential statistics through a Person correlation.

Great strength of this approach is providing data that is descriptive and allows the researcher to capture a snapshot of a user population using a tool that can be administrated and evaluated quickly. There was no need to spend additional time at the organization prior to administrating the survey, and the responses can be tabulated within a short timeframe. Moreover, numerical data obtained through this approach facilitates additional evaluation of co relation between supply chain integration and food integrity, as well as allowing determination of the extent of agreement or disagreement between respondents (Yauch & Steudel, 2003). The other advantage of legitimate quantitative data that is data which is will be collected rigorously, using the appropriate methods and analysis thus improving reliability.

It is worth noting that a limitation to the analysis is the lack of support information to supplement data, which would be necessary to interpret outcomes of the research findings. The quantitative approach selected in this study does not gather information on identities, perceptions, and beliefs these cannot be meaningfully reduce to numbers without reference to the local context in which people exist (Dudwick et. al., 2006). Also research robustness in the quantitative approach depends on sample size, a small sample size in this study is another limitation of this research.

4.0 DATA ANALYSIS

4.1 OVERVIEW OF DATA COLLECTED

This chapter presents the statistical analysis of the data. Upon completion of a developed questioner survey, close-ended questionnaires were administered to a sample of 95 supply chain stakeholders within the processed egg supply chain. Even though the response rate was quite low, the question of non-response bias was a still a potential issue. Out of the 95 invitations, only 30 surveys were considered.

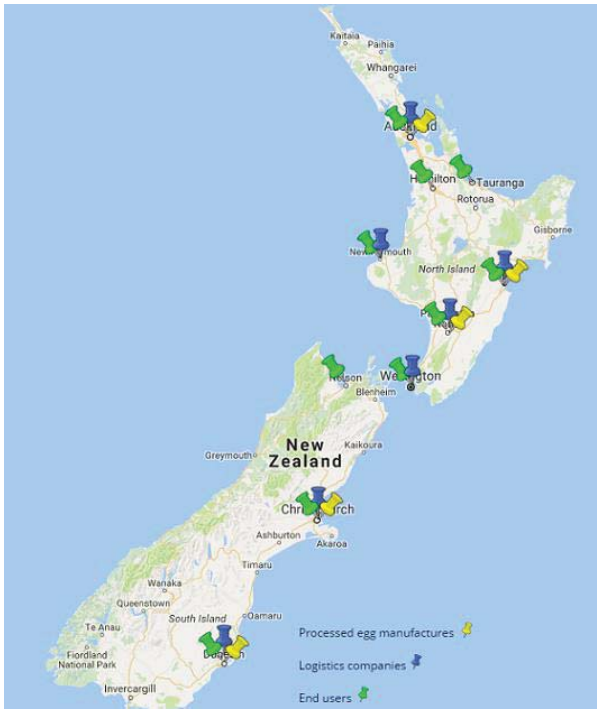
The survey utilized in this research was open to all respondents from November 2016 thru January 2017. The invitation consisted of a cover letter as attached in Appendix B. Participant in this survey was strictly voluntary and bound to protect anonymity of all respondents. Respondent's job titles and number of responds as shown in Table 7. The researcher chose the interviewees so that they represent different groups according to their business model, responsibilities, position and physical location (see Figure 13).

Table 7 – Questioner respondents and job titles

Job Title	Respondents	Non-Respondents
General Manager	2	3
Group Operations Manager	1	4
Procurement Manager	5	10
Planning Manager	3	12
Processing Manager	2	13
Bakery Manager	10	15
Logistics/Transport staff	7	8

The survey questionnaire was pre-tested with four independent respondents who did not form part of the targeted population. This was is to ensure that the questions in the instrument are stated clearly and have the same meaning to all the respondents. Respondents on which the questionnaire was pretested are not be part of the target population of the study (Mugenda, 2003).

Figure 13 – Questionnaire interviewees locations in NZ



Source – Author

4.2 DATA ANALYSIS AND INTERPRETATION

The quality of the quantitative research approach rests with the reliability and validity of any tools prior to investigation this effects the empirical robustness of Pearson correlation between factors. Winter (2000) explained “Reliability and validity are tools of an essentially positivist epistemology.” Reliability shows the consistency of research results and its aim is to minimise errors during a study (Garson, 2002). Moreover, statistical errors are common in research analysis, and about 50% of the published articles have at least one error (Garson,

2002). Thus the assumption of normality is especially vital when constructing survey analysis (Garson, 2002). Normality test is used in this study to determine if the data set is well-modelled by a normal distribution and to compute how likely it is for a random variable underline the data set to be normally distributed. Upon reliability and normality test, collected data was sorted and coded, then entered into the Statistical Package for Social Sciences (SPSS). With the aid of SPSS 22.0 software package, the researcher performed a Pearson correlation analysis on the primary data to establish the relationship between the variables. The results of analysed data are presented using tables and charts with a brief description thereafter.

4.2.1 RELIABILITY TEST

The Cronbach's Alpha is designed as a measure of internal consistency of items in the questionnaire. Cronbach's alpha reliability coefficients normally range between 0 and 1. However, there is no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale. The total number of questions or items in the questionnaire is 60 including; 30 testing variables of processed egg supply chain integration, 20 testing variables of collaborative advantage and 10 testing variables of processed egg integrity. The Cronbach's alpha reliability coefficient for the constructs supply chain integration, collaborative advantage and product integrity were 0.896, 0.813, and 0.802 respectively as shown in Table 8, 9, and 10. These coefficients exceeded the minimum threshold level of 0.7 for acceptable reliability (Hair et al., 2006). Therefore, the selected items demonstrated reliability and represented the estimated constructs giving confidence in the internal consistency of the items.

Table 8 - Cronbach's alpha analysis results for processed egg supply chain integration

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.896	.890	30

Table 9 - Cronbach's alpha analysis results for collaborative advantage

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.813	.821	20

Table 10 - Cronbach's alpha analysis results for processed egg product integrity

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.802	.809	10

4.2.2 NORMALITY TEST

Most of the statistical procedures including correlation, regression, t test is based on the assumptions that the data follows a normal distribution or a Gaussian distribution, which is assumed that the population from which the sample are taken are normally distributed (Altman & Bland, 1995). Although true normality is considered to be a myth (Elliott & Woodward, 2007), we can look for normality visually by using normal plots or by significance tests, that is comparing the sample distribution to a normal one. Therefore, it is important to check whether data show a serious deviation from normality (Elliott & Woodward, 2007).

The assumption of normality for the concepts of processed egg supply chain integration, collaborative advantage, and processed egg integrity was tested via standard error for both the skewness and kurtosis scores and graphically illustrated through SPSS histogram. This allows a simple rule of thumb to determine the normality of data, by dividing either score (skewness, kurtosis) by its standard error to determine the result whether it's less than ±1.96, which suggests that data is normal with respect to that statistic. Because more than ±1.96 standard deviations away are outlier at the 0.95 confident level.

SPSS output for skewness and kurtosis tests from a sample of test scores is given in Appendix A. Applying the rule of thumb of dividing each value by its standard error (Std. Error), in order to calculate the Z value for both skewness and kurtosis. The calculated Z value for processed egg supply chain integration (Ske = 1.28 & kur = 0.45), collaborative advantage (Ske = -0.51 & kur = -0.10), and processed egg integrity (Ske = -0.67 & kur = -0.79), both skewness and kurtosis well within ±1.96 limits, suggesting that the departure from normality is not too extreme.

4.2.3 Hypotheses testing and Correlation Analysis

In order to measure relationships between processed egg SCI, collaborative advantage and processed egg product integrity, a Pearson's correlation was calculated. Pearson's correlation is the test statistic that measures the statistical relationship, or association, between two continuous variables (Neuman, 2006). Pearson correlation is a measure of the correlation (linear dependence) between two variables X and Y, giving a value between +1 and −1 inclusive (Nunnally, 1978). If inter-item correlations are greater, the stronger the relationship.

Hypothesis 1. Processed egg supply chain integration (SCI) has a significant positive impact on collaborative advantage (CA)

Pearson's correlation was carried out to test if a relationship exists between the variables processed egg supply chain integration and collaborative advantage. The results are shown in Table 11 supports Hypothesis 1 showing the evidence of a strong correlation relationship between processed egg supply chain integration and collaborative advantage (r = 0.400, p= 0.028). Since the p value 0.028 is significant as it is less than 0.05, there is enough evidence to reject the null hypothesis and support hypothesis 1, that is to support the claim that processed egg supply chain integration has significant, positive, and direct impact on collaborative advantage.

Table 11 : Pearson correlation analysis – processed egg supply chain integration and collaborative advantage

Correlations

		SCI	CA
SCI	Pearson Correlation	1	.400*
	Sig. (2-tailed)		.028
	N	30	30
CA	Pearson Correlation	.400*	1
	Sig. (2-tailed)	.028	
	N	30	30

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

Hypothesis 2. Collaborative advantage has a significant positive impact on processed egg product integrity

The Processed egg product integrity measure was comprised of 10 items and utilized a 7-point Likert scale. The resulting Pearson's correlation for the response data sample (n=30) was .469

(p>.05), which failed to support hypothesis 2 as shown in Table 12. This result indicates that there is not enough evidence to reject null hypothesis in order to support hypothesis 2. The findings do not confirm that collaborative advantage has strong, positive, and direct impact on processed egg product integrity.

Table 12 : Pearson correlation analysis – Collaborative advantage and processed egg integrity

Correlations

		CA	Product Integrity
CA	Pearson Correlation	1	.137
	Sig. (2-tailed)		.469
	N	30	30
Product Integrity	Pearson Correlation	.137	1
	Sig. (2-tailed)	.469	
	N	30	30

Hypothesis 3. Processed egg supply chain integration has a significant positive impact on processed egg product integrity

The Pearson's correlation for the response data in the sample (n=30) was .188 (p>.05), which failed to support hypothesis 3 as shown in Table 13. This result indicates there is not enough evidence to reject the null hypothesis and support hypothesis 3. The findings do not to confirm that processed egg supply chain integration has strong, positive, and direct impact on processed egg product integrity.

Table 13 : Pearson correlation analysis – Processed egg supply chain integration and processed egg integrity

Correlations

		SCI	Product Integrity
SCI	Pearson Correlation	1	.247
	Sig. (2-tailed)		.188
	N	30	30
Product Integrity	Pearson Correlation	.247	1
	Sig. (2-tailed)	.188	
	N	30	30

4.4 MAJOR FINDINGS

The primary findings of this study based on the data generated and the analysis suggest that New Zealand processed egg supply chains are only weakly integrated with their suppliers (see Table 16). Every company in this research sample preferred to operate in isolation, which considerably reduces the chances of supply chain integration. The research continues that the goal of congruence is the key dominant variable of processed egg supply chain integration regarding processed egg integrity at 0.05 significant level ($r = .376$, $p = .040$) as shown in Table 16.

As shown in Table 16, the majority of companies (n=30) in this sample illustrated strong negativity on sharing confidential information among supply chain partners. Many instances of lack of and misaligned supplier integration practises have been shown among all supply chain partners leading one to conclude there is a lack of evidence to support correlation between processed egg supply chain integration and processed egg integrity. If this is any way representative of all processed egg supply chains in New Zealand organizations, it is evident

there exists a significant gap between supply chain integration and its application by New Zealand practitioners (Bohme et al., 2008).

Furthermore, by testing for the direct relationship between processed egg supply chain integration actors and collaborative advantage, in this study it was found that processed egg SCI was significantly related to offering flexibility at 0.05 significant level (r = .378, p = .039), and found that business synergy was showing the least related CA actor response (r = .181, p = .339), in the processed egg supply chain integration (see Table 14). The study also found the least negative relationship between Process efficiency and quality (r = -.075, p = .692),and innovation (r = -.068, p = .719) which needs to be address in future research.

Similarly, the study also identified the relationship between collaborative advantage actors and processed egg integrity. However, it is expected that only innovation showed strong correlation on processed egg integrity at 0.05 significant level (r = .379, p = 039), and found that process efficiency and business synergy was showing negativity toward processed egg integrity (r = -.026, p = 893), (r = -.127, p = .504) as shown in Table 15.

Table 14 – Pearson's correlation analysis – Processed egg SCI and collaborative advantage actors

Correlations

		Process Efficiency	Offering Flexibility	Business Synergy	Quality	Innovation	SCI
Process Efficiency	Pearson Correlation	1	.201	.126	-.075	-.068	.246
	Sig. (2-tailed)		.288	.506	.692	.719	.190
	N	30	30	30	30	30	30
Offering Flexibility	Pearson Correlation	.201	1	.205	.353	.117	.378*
	Sig. (2-tailed)	.288		.277	.056	.537	.039
	N	30	30	30	30	30	30
Business Synergy	Pearson Correlation	.126	.205	1	.048	.069	.181
	Sig. (2-tailed)	.506	.277		.800	.718	.339
	N	30	30	30	30	30	30
Quality	Pearson Correlation	-.075	.353	.048	1	.225	.250
	Sig. (2-tailed)	.692	.056	.800		.231	.183
	N	30	30	30	30	30	30
Innovation	Pearson Correlation	-.068	.117	.069	.225	1	.259
	Sig. (2-tailed)	.719	.537	.718	.231		.166
	N	30	30	30	30	30	30
SCI	Pearson Correlation	.246	.378*	.181	.250	.259	1
	Sig. (2-tailed)	.190	.039	.339	.183	.166	
	N	30	30	30	30	30	30

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

Finally, simulation been performed to find relationships between supply chain integration actors and processed egg integrity and found that goal congruence was showing strong correlation (r = .376, p = .040) on processed egg integrity. On the other hand, joint knowledge creation was strongly related on collaborative communication (r = .501, p = .005) at 0.05 significant level and risk sharing was showing negativity on processed egg integrity (r = -.110, p = .562).

Table 15 – Pearson's correlation analysis – Processed egg integrity and collaborative advantage actors

Correlations

		Process Efficiency	Offering Flexibility	Business Synergy	Quality	Innovation	Product Integrity
Process Efficiency	Pearson Correlation	1	.201	.126	-.075	-.068	-.026
	Sig. (2-tailed)		.288	.506	.692	.719	.893
	N	30	30	30	30	30	30
Offering Flexibility	Pearson Correlation	.201	1	.205	.353	.117	.198
	Sig. (2-tailed)	.288		.277	.056	.537	.295
	N	30	30	30	30	30	30
Business Synergy	Pearson Correlation	.126	.205	1	.048	.069	-.127
	Sig. (2-tailed)	.506	.277		.800	.718	.504
	N	30	30	30	30	30	30
Quality	Pearson Correlation	-.075	.353	.048	1	.225	.230
	Sig. (2-tailed)	.692	.056	.800		.231	.222
	N	30	30	30	30	30	30
Innovation	Pearson Correlation	-.068	.117	.069	.225	1	.379*
	Sig. (2-tailed)	.719	.537	.718	.231		.039
	N	30	30	30	30	30	30
Product Integrity	Pearson Correlation	-.026	.198	-.127	.230	.379*	1
	Sig. (2-tailed)	.893	.295	.504	.222	.039	
	N	30	30	30	30	30	30

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

Upon secondary analysis it has found the respondents include both senior executive (GM) and mid-level managers these respondents had significant differences in relationship perceptions. (see Figure 14, 15 & 16). Therefore, this differentiation could have had a negative impact on the research findings and it would be useful to examine the impact on processed egg integrity within integrated processed egg supply chain integration.

Table 16 – Pearson's correlation analysis – Processed egg integrity and supply chain

Correlations

		Information Sharing	Goal Congruence	Decision Synchronization	Risk Sharing	Collaborative Communication	Joint Knowledge Creation	Product Integrity
Information Sharing	Pearson Correlation	1	-.131	-.272	-.116	-.276	.204	.115
	Sig. (2-tailed)		.489	.146	.441	.141	.278	.545
	N	30	30	30	30	30	30	30
Goal Congruence	Pearson Correlation	-.131	1	.245	.222	.125	.193	.376*
	Sig. (2-tailed)	.489		.192	.275	.512	.306	.040
	N	30	30	30	30	30	30	30
Decision Synchronization	Pearson Correlation	-.272	.245	1	.167	.255	.308	.224
	Sig. (2-tailed)	.146	.192		.298	.173	.098	.235
	N	30	30	30	30	30	30	30
Risk Sharing	Pearson Correlation	-.116	.222	.167	1	.143	.301	-.110
	Sig. (2-tailed)	.441	.275	.298		.265	.087	.562
	N	30	30	30		30	30	30
Collaborative Communication	Pearson Correlation	-.276	.125	.255	.143	1	.501**	.131
	Sig. (2-tailed)	.141	.512	.173	.265		.005	.490
	N	30	30	30	30	30	30	30
Joint Knowledge Creation	Pearson Correlation	.204	.193	.308	.301	.501**	1	.157
	Sig. (2-tailed)	.278	.306	.098	.087	.005		.406
	N	30	30	30	30	30	30	30
Product Integrity	Pearson Correlation	.115	.376*	.224	-.110	.131	.157	1
	Sig. (2-tailed)	.545	.040	.235	.562	.490	.406	
	N	30	30	30	30	30	30	30

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

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

Figure 14 - : Histogram of top management questioner response on SCI

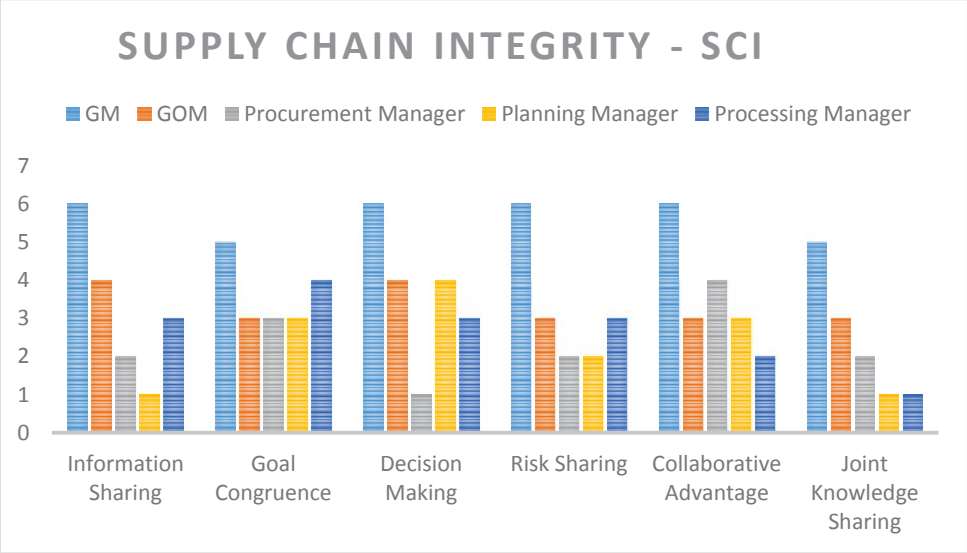


Figure 15 - : Histogram of top management questioner response on CA

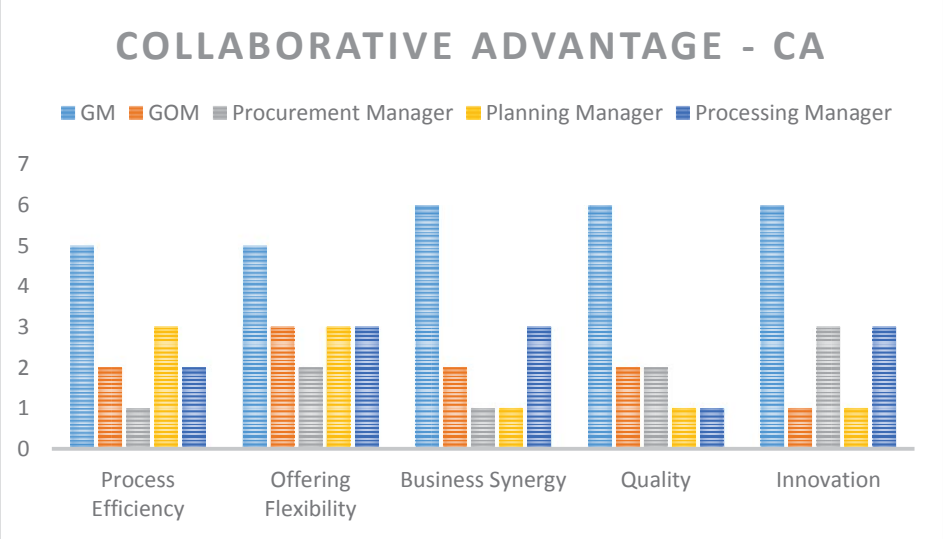
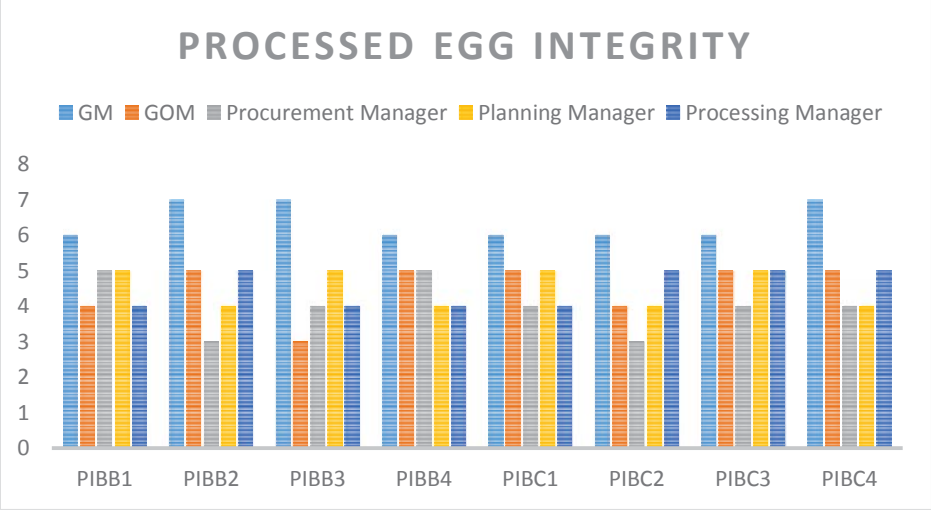


Figure 16 - : Histogram of top management questioner response on PI



5.0 DISCUSSION

5.1 REVIEW OF CONCEPTUAL MODEL IN THE LIGHT OF THE DATA

The findings of this study indicate that processed egg supply chain integration with trading partners is an important driver of improved collaborative advantages and that neither collaborative advantage or supply chain integration are key in the light of ensuring processed egg food integrity. The model tested in this study indicates that egg processing organizations need to be thinking beyond twofold (supplier-buyer) relationships. Organisations may be best served by focusing on their combined relationship with customers as well as on strategies to ensure a high level of involvement with supply chain stakeholders.

5.2 CORRELATION OF FINDINGS WITH PREVIOUS LITERATURE

The evidence from this study suggests that firms that pursue greater product integrity should look at developing close working relationships with all supply chain stakeholders to develop well integrated supply chain. Should these integrated systems succeed, then it is a reasonable expectation that performance may improve but greater product integrity would not necessarily result.

The findings of this research are consistent with a similar study conducted by Thatte (2007) r at the University of Toledo, where the author reports that supply chain integration dimension appeared to have a positive effect on collaborative advantage. Subsequent research heightened the emphasis on positive correlation between supply chain integration and collaborative advantage, including process efficiency (Saeed et al., 2005) and logistics service

performance (Germain & Iyer, 2006). Further supporting the, evidence for the relationship between supply chain integration and collaborative advantage (Frohlich & Westbrook, 2001; Narasimhan & Kim, 2002; Das et al., 2006; Devaraj et al., 2007; Flynn et al., 2010). These studies provide empirical evidence of the performance inferences for collaborative advantage, based on a comprehensive conceptualization of five interrelating dimensions. This research has in part addressed the call of scholars who have stressed the need for empirical research that examines the outcome of supply chain integration (Jap, 1999), supply chain integration and collaborative advantage.

Previous studies have suggested that business synergy is crucial for the supply chain integration in the light of collaborative advantage (Daugherty et al., 1996). Similarly, collaborative communications are also commonly accepted as a tool to achieve collaborative advantage within integrated supply chain (Davenport, 2000; Gattiker, 2007). Moreover, Kuznesof and Brennan (2004), found that communication within food chain has to be conducted in an integrated manner with food industry, government and consumers in order to accomplish food integrity. However, this study did not find any significant outcome of business synergy or collaborative communications on collaborative advantage within integrated supply chain and product integrity.

Alone the same line, Taoukis et al., (1999) and Vaikousi et al., (2009), proved that sharing information along the integrated food supply chain is the key to gain consumer trust. However, this study revealed that information sharing is the least important factor out of six factors tested between supply chain integration and processed egg integrity ($r = .115$, $p = .562$).

5.3 MANAGERIAL/ POLICY IMPLICATION

Many organizations implement supply chain integration based on intuition, executive judgment taking into account competitive and customer pressure. In doing so, it could well be that organizations are focusing on aspects that may not be so important Instead of implementing unproven frameworks, the conceptual model presented in this paper provides a validated model that can guide the actions of practitioners in terms of processed egg SCI elements to emphasize vice versa those that do not need the same level of attention.

In particular, the constructs, especially goal congruence, risk sharing, and offering flexibility, have been developed using a rigorous confirmatory methodology to ascertain their psychometric properties. The results are positive. The items that estimate the constructs should provide confidence to practitioners as to how they can implement collaborative relationships with customers and suppliers, since these have been shown to be valid measures of the constructs.

As a result of this study and a cause and effect analysis, it is possible for egg processing practitioners to gain a holistic view of the various supply chain integration strongholds; hereby focusing on communication, knowledge sharing, innovation and value stream aspects. This categorisation is very useful as it provides supply chain managers with a barrier assessment so they might align resources accordingly. However, barriers should not be viewed in isolation; they are often uniquely interlinked and managers also need to understand the resulting effects of their actions internally as well as externally provided, requires staff with systems thinking capabilities.

The application of this study identified that processed egg supply chain integration is not operating at best practices and fall short of industry standards. Because most of processed egg chains are working in isolation and poorly integrated. These findings should comfort supply chain practitioners because practical integration seems to be very difficult to achieve. However, much good practise is present in some value streams and practitioners need to understand that advanced practises are attainable.

The level of processed egg supply chain integration development in practise is slow in New Zealand. In all cases managers and policy makers invested in people and the necessary fundamental changes to processed egg supply chain management philosophy first. On the other hand, processed egg supply chain logistics members need to understand the wider trade-offs of their actions, before effective process and relationship changes can take place. Technological inhibitors to processed egg supply chain integration are best left, until the end when seeking to enhance practise in the light of real time information sharing and traceability are concern.

5.4 CRITIQUE OF THE RESEARCH

There is little currently known about the direct application of processed egg chain integration and collaborative advantage on processed egg food integrity. However, this studies outcomes offer some contribution to the area of inquiry, the findings must be considered in light of some bias due to the retrospective nature of the data collection and the possibility of recall bias, further the small sample size for prospective studies is a limitation.

However, results of this research could be quickly incorporated into effective policies. Among the relatively minor weakness of the findings is the fact that a research assistant may not be experienced enough to be responsible for the day-to-day operation of the processed egg supply chain integration, including data mining, onsite inspections aspects such as conducting stakeholder interviews. Also, the application does not describe how to validate product integrity considering customer satisfaction and trust.

5.5 FURTHER RESEARCH

Outcome of this research appears to support the prevailing belief in literature that processed egg SCI is positively related to collaborative advantage and findings did not support collaborative advantage and processed egg SCI are related to processed egg integrity. As mentioned this study was limited by the small data sample utilized. Future research should attempt to sample from a larger population size sample. Perhaps future research also could work on global trend with better survey response rate. A larger sample size would allow for the use of more specific statistical analysis in order to produce greater significant findings.

Future research should also consider extending an analysis of supply chain integration to other industries. BY examining how other industries are use supply chain integration and what the common attributes in each industry yare would help identify any industry- specific bias towards or against product integrity within supply chain process. Also the studies who have respondents that include both senior executive (CEO's, presidents, GM) and mid-level managers (directors and managers), as in this study, found significant differences in relationship perceptions between senior executives and mid-level management.

It would also be useful to examine the interaction effects between the CA dimensions, process efficiency, quality, and innovations, and its impact on product integrity as to understand why process efficiency had least negative correlation on quality and innovation.

Finally, the adaptation of the quick scan studies can be further refined; for example, the follow up data collection process could be improved by introducing a second researcher to increase validity and extend the triangulation practise from that of data triangulation to researcher triangulation.

6.0 CONCLUSION

6.1 SUCCINCT ANSWERS TO THE RESEARCH QUESTIONS

The stated research question from Chapter 1 is:

"How does the processed egg supply chains integration mediate the relationship between supply chain collaborative advantage and processed egg integrity?"

Using the results of the hypothesis testing as discussed in the data analysis section above, it is concluded that the integration of processed egg supply chain processes does significantly and positively impact collaborative advantage. The study did not find any correlation on processed egg integrity as defined and used in this work. It is further concluded in individual hypothesis analysis outcomes, stated at section 4.5 above, that the application of processed egg supply chain integration impact higher levels of collaborative advantage.

6.2 ORIGINAL CONTRIBUTION

The original contribution to knowledge is best explained in relation to the stepwise detail description presented in chapter 5.0. Which illustrates the research question topics, hypothesis testing and outcomes demonstrated in the findings chapter. A detailed summary of the research conducted at each step and the process offers an original contribution to knowledge.

The investigation into current processed egg supply chain integration practise's in the processed egg food industry supports the current literature and the assessment that a gap exists between processed egg supply chain integration theory and actual uptake in practise. The investigation further revealed that processed egg supply chain value streams are weak and poorly integrated.

The data collected was also used to validate currently available processed egg supply chain integration models. Here, the research findings supported existing models and a new supply chain integration model has been proposed, which was subsequently validated in Chapter 5.2.

The major contribution regarding internal and external barriers to processed egg supply chain integration lies in the clear categorisation and close examination of the topic. Barriers to supply chain integration were identified and categorised using a three-layer conceptual model. The categories are termed: (a) communication barriers; (b) information sharing specific barriers; and, (c) innovation and product development stream barriers. The research further provided support for the literature that the identified barriers are also common to processed egg industry, and that a multitude of barriers obstruct processed egg supply chain integration in practise. Finally, the research revealed that many barriers to internal integration relate to people and the structures and working arrangements imposed on those people by the focal organisation.

This thesis offers opportunities and guidelines for practitioners to enhance their performance through understanding the role of power in processed egg supply chain integration and better management of collaborative relationships. Here, key variables and their overall importance of collaborative advantages have been identified. This provides better understanding of how

strategic decision making can be conceptually supported via a focus on greater collaborative relationships.

The thesis also highlights the importance of people, communication and relationships regarding supply chain integration. Companies that initiate an integration process should overcome some internal barriers, such as resistance to change, the existing supply chain structure.

References

Altman, D. G., & Bland, J. M. (1995). Statistics notes: the normal distribution. Bmj, 310(6975), 298.

Angeles, R., Nath, R., 2001. Partner congruence in electronic data interchange (EDI) enabled relationships. Journal of Business Logistics 22 (2), 109–127.

Ansoff, H.I., 1988. The New Corporate Strategy. Wiley, New York, NY.

Bagchi, P.K., Skjoett-Larsen, T., 2005. Supply chain integration: a survey. The International Journal of Logistics Management 16 (2), 275–294.

Barker, R., Hong-Minh, S., & Naim, M. M. (2000). The terrain scanning methodology, Assessing and improving construction supply chains. European Journal of Purchasing & Supply Management, 6(3), 179-193.

Baruch, Y. (1999). Response rate in academic studies-A comparative analysis. Human relations, 52(4), 421-438.c

Beulens, A. J., Broens, D. F., Folstar, P., & Hofstede, G. J. (2005). Food safety and transparency in food chains and networks Relationships and challenges. Food control, 16(6), 481-486.

Bowersox, D.J., 1990. The strategic benefits of logistics alliances. Harvard Business Review 68 (4), 36–43.

Bowersox, D.J., Closs, D.J., Stank, T.P., 2003. How to master cross-enterprise collaboration. Supply Chain Management Review 7 (4), 18–27.

Bryan, F. L., & Doyle, M. P. (1995). Health risks and consequences of Salmonella and Campylobacter jejuni in raw poultry. Journal of Food Protection, 58(3), 326-344.

Bogataj, M., Bogataj, L., & Vodopivec, R. (2005). Stability of perishable goods in cold logistic chains. International Journal of Production Economics, 93, 345-356.

Bollen, A. F., Riden, C. P., & Cox, N. R. (2007). Agricultural supply system traceability, Part I: Role of packing procedures and effects of fruit mixing. Biosystems Engineering, 98, 391–400.

Baker, M. (1995). Corpora in translation studies: An overview and some suggestions for future research. Target. International Journal of Translation Studies, 7(2), 223-243.

Beamon, B. M. (1998). Supply chain design and analysis:: Models and methods. International journal of production economics, 55(3), 281-294.

Branscheid, W., K.O. Honikel, G. Von Lengerken and K. Troeger, 2007. Qualität von Fleisch und Fleischwaren. Band 2. Deutscher Fachverlag GmbH, Frankfurt am Main.

Bryman, A. (2004). Qualitative research on leadership: A critical but appreciative review. The leadership quarterly, 15(6), 729-769.

Carter, C. R., & Ellram, L. M. (2003). Thirty-Rve Years of The Journal of Supply Chain Management: Where Have We Been and Where are We Going?. Journal of Supply Chain Management, 39(1), 27-39.

Cavana, R. Y., Delahaye, B. L., & Sekaran, U. (2001). Applied business research: Qualitative and quantitative methods. John Wiley & Sons Australia.

Centres for Disease Control and Orevention, 2005. October National centre for Immunization and Respiratory Diseases: Division of Bacterial Diseases, Salmonella enteritis.

Cetindamar, D., Çatay, B., & Serdar Basmaci, O. (2005). Competition through collaboration: insights from an initiative in the Turkish textile supply chain. Supply Chain Management: an international journal, 10(4), 238-240.

Childerhouse, P., & Towill, D. R. (2002). Enabling seamless market-orientated supply chains.

Childerhouse, P., & Towill, D. R. (2003). Simplified material flow holds the key to supply chain integration. Omega, 31(1), 17-27.

Childerhouse, P., & Towill, D. R. (2011). Arcs of supply chain integration.International journal of production research, 49(24), 7441-7468.

Churchill Jr, G. A. (1979). A paradigm for developing better measures of marketing constructs. Journal of marketing research, 64-73.

Collins, J., & Hussey, R. (2003). Business research methods.

Collins, D. (2003). Pretesting survey instruments: an overview of cognitive methods. Quality of life research, 12(3), 229-238.

Craig, C. L. (2010). Frozen storage and protection of eggs from chum salmon (Oncorhynchus keta) (Doctoral dissertation, University of British Columbia).

Cunningham, D. C. (2001). The distribution and extent of agri-food chain management research in the public domain. Supply Chain Management: An International Journal, 6(5), 212-215.

Curtis, P. A., K. E. Anderson, and F. T. Jones. 1995. Cryogenic gas for rapid cooling of commercially processed shell eggs before packaging. J. Food Prot. 58:389–394.

Das, A., Narasimhan, R., & Talluri, S. (2006). Supplier integration—finding an optimal configuration. Journal of Operations Management, 24(5), 563-582.

Daugherty, Patricia J., Alexander E. Ellinger, and Craig M. Gustin. "Integrated logistics: achieving logistics performance improvements." Supply Chain Management: An International Journal 1, no. 3 (1996): 25-33.

Davenport, T. H. (2000). The future of enterprise system-enabled organizations. Information Systems Frontiers, 2(2), 163-180.

David H. Taylor, (2005),"Value chain analysis: an approach to supply chain improvement in agri-food chains", International Journal of Physical Distribution & Logistics Management, Vol. 35 Iss 10 pp. 744 - 761 Permanent link to this document:

Dawson, P.L., (1995) Effects of Freezing, Frozen Storage, and Thawing on Eggs and Egg Products, “Freezing Effects on Food Quality”; pp. 337-363

Dalgaard, P., Buch, P., & Silberg, S. (2002). Seafood Spoilage Predictor development and distribution of a product specific application software. International journal of food microbiology, 73(2), 343-349.

Denzin, N. K., & Lincoln, Y. S. (1994). Handbook of qualitative research. Sage publications, inc.

Devaraj, S., Krajewski, L., & Wei, J. C. (2007). Impact of eBusiness technologies on operational performance: the role of production information integration in the supply chain. Journal of Operations Management, 25(6), 1199-1216.

Droge, C., Jayaram, J., & Vickery, S. K. (2004). The effects of internal versus external integration practices on time-based performance and overall firm performance. Journal of operations management, 22(6), 557-573.

Dudwick, N., Kuehnast, K., Jones, V. N., and Woolcock, M. (2006) Analyzing Social Capital in Context: A Guide to Using Qualitative Methods and Data, World Bank Institute, Washington

Duffy, R., Fearne, A., 2004. The impact of supply chain partnerships on supplier performance. International Journal of Logistics Management 15 (1), 57–71.

Dyer, J.H., Singh, H., 1998. The relational view: cooperative strategy and sources of inter-organizational competitive advantage. Academy of Management Review 23 (4), 660–679.

Egg Producers Federation New Zealand, 2013. http://eggfarmers.org.nz/egg-farming-in-nz

Eiser, J. R., Miles, S., & Frewer, L. J. (2002). Trust, perceived risk, and attitudes toward food technologies1. Journal of Applied Social Psychology, 32(11), 2423-2433.

Elliott, A. C., & Woodward, W. A. (2007). Statistical analysis quick reference guidebook: With SPSS examples. Sage.

Ellram, L. M. (1990). The supplier selection decision in strategic partnerships. Journal of Supply Chain Management, 26(4), 8.

Fritz, M., & Schiefer, G. (2008). Food chain management for sustainable food system development: a European research agenda. Agribusiness, 24(4), 440-452.

Fisher, M.L., 1997. What is the right supply chain for your product? Harvard Business Review 75 (2), 105–116.

Flynn, B.B., Huo, B., Zhao, X., 2010. The impact of supply chain integration on performance: a contingency and configuration approach. Journal of Operations Management 28 (1), 58–71.

Forsythe, R. H. (1970). EGG PROCESSING TECHNOLOGY–PROGRESS AND SANITATION PROGRAMS 1. Journal of Milk and Food Technology, 33(2), 64-73.

Fritz, M., & Schiefer, G. (2008). Food Chain Management for Sustainable Food System Development: A European Research Agenda. Agribusiness, Vol. 24 (4), 440–452 (2008). Garvin, D., 1988. Managing quality. McKinsey Quarterly 3, 61–70.

Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. Journal of operations management, 19(2), 185-200.

Garson, G. D. Guide to writing empirical papers, theses and dissertations. 2002. NY Marcel Dekker.

Gattiker, T. F. (2007). Enterprise resource planning (ERP) systems and the manufacturing–marketing interface: an information-processing theory view. International Journal of Production Research, 45(13), 2895-2917.

Germain, R., & Iyer, K. N. (2006). The interaction of internal and downstream integration and its association with performance. Journal of Business Logistics, 27(2), 29-52.

Giannakourou, M. C., Koutsoumanis, K., Nychas, G. J. E., & Taoukis, P. S. (2001). Development and assessment of an intelligent shelf life decision system for quality optimization of the food chill chain. Journal of Food Protection, 64(7), 1051-1057.

Gill, C. O. (1996). Extending the storage life of raw chilled meats. Meat science, 43, 99-109. Golan, E., Krissoff, B., Kuchler, F., Calvin, L., Nelson, K., & Price, G. (2004). Traceability in the US food supply: economic theory and industry studies. Agricultural economic report, 830(3), 183-185.

Golicic, S.L., Foggin, J.H., Mentzer, J.T., 2003. Relationship magnitude and its role in inter organizational relationship structure. Journal of Business Logistics 24 (1), 57–75.

Gosain, S., Malhotra, A., El Sawy, O.A., 2004. Coordinating for flexibility in e-business supply chains. Journal of Management Information Systems 21 (3), 7–45.

Gospavic, R., Kreyenschmidt, J., Bruckner, S., Popov, V., & Haque, N. (2008). Mathematical modelling for predicting the growth of Pseudomonas spp. in poultry under variable temperature conditions. International journal of food microbiology, 127(3), 290-297.

Goles T and Hirschheim R (2000) The paradigm is dead, the paradigm is dead long live the paradigm: the legacy of Burell and Morgan. Omega 28, 249–268.

Gove, P. B. (1966). Webster's Third New International Dictionary (1966). G & C. Merriam Co., Springfield, Massachusetts, USA.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. Handbook of qualitative research, 2(163-194), 105.

Handfield, R.B., Pannesi, R.T., 1995. Antecedents of lead time competitiveness in make-to-order manufacturing firms. International Journal of Production Research 33 (2), 511–537.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L., 2006. Multivariate Data Analysis, 6th ed. Prentice-Hall, Inc., New Jersey

Holleran, E., Bredahl, M. E., & Zaibet, L. (1999). Private incentives for adopting food safety and quality assurance. Food policy, 24(6), 669-683.

Hsu, K. H., Hoseney, R. C., & Seib, P. A. (1979). Frozen dough. I. Factors affecting stability of yeasted doughs [quality, fermentation, freeze damage]. Cereal Chemistry (USA).

Humphrey, J. (2006). Policy implication of trade in agribusiness value chain. European journal of development research. 18 572-592.

Itami, H., Roehl, T., 1987. Mobilizing Invisible Assets. Harvard University Press, Cam-bridge, MA.

James, S. (1996), The Chill Chain "from Carcass to Consumer". Meat Science, vol. 43, no. S, pp. 203-216.

Jap, S.D., 1999. Pie-expansion efforts: collaboration processes in buyer-supplier relationships. Journal of Marketing Research 36 (4), 461–476.

Jap, S.D., 2001. Perspectives on joint competitive advantages in buyer-supplier relationships. International Journal of Research in Marketing 18 (1–2), 19–35.

Jervell, A. M., & Borgen*, S. O. (2004). New marketing channels for food quality products in Norway. Food Economics-Acta Agriculture Scandinavia, Section C, 1(2), 108-118.

Jol, S., Kassianenko, A., Wszol, K., & Oggel, J. (2006). Issues in time and temperature abuse of refrigerated foods. Food Safety, 11(6), 30-32.

Jol, S., Kassianenko, A., Wszol, K., & Oggel, J. (2007). The Cold Chain, one link in Canada's food safety initiatives. Food Control, 18(6), 713-715.

Kaufman, A., Wood, C.H. and Theyel, G. (2000), "Collaboration and technology linkages: a strategic supplier typology", Strategic Management Journal, Vol. 21 No. 6, pp. 649-63.

Kessler, E., Chakrabarti, A., 1996. Innovation speed: a conceptual model of con-text, antecedents, and outcomes. The Academy of Management Review 21 (4), 1143–1191.

Kierstan, M. (1995). Food hygiene, quality and safety: towards the year 2000. British Food Journal, 97(10), 8-10.

King, G., Keohane, R. O., & Verba, S. (1994). Designing social inquiry: Scientific inference in qualitative research. Princeton university press.

Kraft, A. A. (1971). MICROBIOLOGY OF POULTRY PRODUCTS 1, 2. Journal of Milk and Food Technology, 34(1), 23-29.

Kreyenschmidt, J., Christiansen, H., Hübner, A., Raab, V., & Petersen, B. (2010). A novel photochromic time temperature indicator to support cold chain management. International journal of food science & technology, 45(2), 208-215.

Kreyenschmidt, J., Aabo, S., Bruckner, S., Christensen, B. B., Gkisakis, V., Hansen, T. B., ... & Petersen, B. (2007). Development of a "Decision Support Tool"(DST) for the pork supply chain.

Kuo, J. C., & Chen, M. C. (2010). Developing an advanced multi-temperature joint distribution system for the food cold chain. Food control, 21(4), 559-566.

Kuznesof, S., & Brennan, M. (2004). Perceived risk and product safety in the food supply chain. Food supply chain management, 32-48.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. Academy of management review, 31(3), 638-658.

Lambert, D.M., Christopher, M.G., 2000. From the editors. International Journal of Logistics Management 11 (2), pii-ii.

Langton, D. (2008, January). Avian Flu Pandemic: Potential Impact of Trade Disruptions. LIBRARY OF CONGRESS WASHINGTON DC CONGRESSIONAL RESEARCH SERVICE.

Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. The Sage handbook of qualitative research, 4, 97-128.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S., Rao, S.S., 2006. The impact of supply chain management practices on competitive advantage and organizational performance. Omega 34, 107–124.

Lindgreen, A. (2003). Trust as a valuable strategic variable in the food industry: Different types of trust and their implementation. British Food Journal, 105(6), 310-327.

Lambert, A. D., Smith, J. P., & Dodds, K. L. (1991). Shelf life extension and microbiological safety of fresh meat—a review. Food Microbiology, 8(4), 267-297.

LEE, H.L., S. WHANG (2000) Information sharing in a supply chain. International Journal of Technology Management 20(3/4): 373.

Lee, H.L., Whang, S., 2001. E-business and supply chain integration. Stanford Global Supply Chain Management Forum, SGSCMF-W2-2001.

Lobb, A.E., and Mazzocchi, M., (2007), Domestically produced food; consumer perception of origin, safe and the issue of trust, Agriculture Scandinavia section C, Vol. 3, 3-12

Laosirihongthong, T., & Dangayach, G. S. (2005). A comparative study of implementation of manufacturing strategies in Thai and Indian automotive manufacturing companies. Journal of Manufacturing Systems, 24(2), 131-143.

Mabert, V. A., & Venkataramanan, M. A. (1998). Special research focus on supply chain linkages: challenges for design and management in the 21st century. Decision Sciences, 29(3), 537-552.

Mann, K. (2008). Proteomic analysis of the chiken egg vitelline membrane. Proteomic 2008, 8: 2322 – 2332.

Manthou, V., Vlachopoulou, M., Folinas, D., 2004. Virtual e-Chain (VeC) model for supply chain collaboration. International Journal of Production Economics 87 (3), 241–250.

Matopoulos, A., Vlachopoulou, M., Manthou, V., & Manos, B. (2007). A conceptual framework for supply chain collaboration: empirical evidence from the agri-food industry. Supply Chain Management: an international journal, 12(3), 177-186.

Maye, D. (2005). Food Supply Chains and Sustainability: Evidence from Specialist Food Producers in the Scottish/English Borders. Land Use Policy Vol. 22. 331–344 (2005).

Mentzer, J. T., & Kahn, K. B. (1995). A framework of logistics research. Journal of Business Logistics, 16(1), 231.

Min, S., Roath, A., Daugherty, P.J., Genchev, S.E., Chen, H., Arndt, A.D., 2005. Sup-ply chain collaboration: what's happening? International Journal of Logistics Management 16 (2), 237–256.

Moe, T., (1998), Perspective on traceability in food manufacturer, trend in food science and technology, Vol 9, 2111-2114.

Mohr, J., Nevin, J.R., 1990. Communication strategies in marketing channels: a theoretical perspective. Journal of Marketing 54 (4), 36–51.

Montanari, R. (2008). Cold chain tracking: a managerial perspective. Trends in Food Science & Technology, 19(8), 425-431.

Moureh, J., & Derens, E. (2000). Numerical modelling of the temperature increase in frozen food packaged in pallets in the distribution chain. International Journal of Refrigeration, 23(7), 540-552.

Mugenda, O. & Mugenda A. (2003). Research methods: quantitative and qualitative approaches.

Mullner, P., Spencer, S. E., Wilson, D. J., Jones, G., Noble, A. D., Midwinter, A. C., ... & French, N. P. (2009). Assigning the source of human campylobacteriosis in New Zealand: a comparative genetic and epidemiological approach. Infection, Genetics and Evolution, 9(6), 1311-1319.

Murray, I. (1999). Cases of human 'mad cow disease rise to 40. The Times, 16, 16.

Narasimhan, R., Kim, S.W., 2002. Effect of supply chain integration on the relationship between diversification and performance: evidence from Japanese and Korean firms. Journal of Operations Management 20 (3), 303–323.

Näslund, D. (2002). Logistics needs qualitative research especially action research. International Journal of Physical Distribution & Logistics Management, 32(5), 321-338.

Neuman, W. L. (2006). Social research methods: Qualitative and quantitative approaches. US: Pearson Education. Inc. 連結.
New, S., & Ramsay, J. (1997). A critical appraisal of aspects of the lean chain approach. European Journal of Purchasing & Supply Management, 3(2), 93-102.

Nychas, G. J. E., Skandamis, P. N., Tassou, C. C., & Koutsoumanis, K. P. (2008). Meat spoilage during distribution. Meat Science, 78(1), 77-89.

Nunnally, J. (1978). Psychometric methods.

Olsson, A. (2004). Temperature controlled supply chains call for improved knowledge and shared responsibility. In H. Aronsson (Ed.), Proceedings of the 16th Annual Conference Nofoma. (pp. 569-582). Logistics Management, Linköpings Universitet.

Park, N.K., Mezias, J.M., Song, J., 2004. A resource-based view of strategic alliances and firm value in the electronic marketplace. Journal of Management 30 (1), 7–27.

Petersen, K. J., Ragatz, G. L., & Monczka, R. M. (2005). An examination of collaborative planning effectiveness and supply chain performance. Journal of Supply Chain Management, 41(2), 14-25.

Raab, V., Bruckner, S., Beierle, E., Kampmann, Y., Petersen, B., & Kreyenschmidt, J. (2008). Generic model for the prediction of remaining shelf life in support of cold chain management in pork and poultry supply chains. Journal on Chain and Network Science, 8(1), 59-73.

Regattieri, R., Gamberi, M., & Manzini, R. (2007). Traceability of food products: General framework and experimental evidence: Journal of Food Engineering Vol. 81, 347–356 (2007).

Ross, T., & Dalgaard, P. (2004). Modeling microbial responses in food. Chap. Secondary models, pp. 63–150). CRC Press LLC.

Saeed, K. A., Malhotra, M. K., & Grover, V. (2005). Examining the impact of interorganizational systems on process efficiency and sourcing leverage in buyer–supplier dyads. Decision Sciences, 36(3), 365-396.

Scheer, F.P., 2006. Optimising supply chains using traceability systems. In: Improving traceability in food processing and distribution W.p. limited., Cambridge, England.

Schwagele, f. (2005), review; traceability from a European perspective, Meat science, Vol 71, 164-173

Segars, A. H., & Grover, V. (1998). Strategic information systems planning success: an investigation of the construct and its measurement. MIS quarterly, 139-163.

Sekaran, U. (1992). Research Methods for Business, Canada.

Sekaran, U. (2006). Research methods for business: A skill building approach. John Wiley & Sons.

Seuring, S., & Muller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management, Journal of Cleaner Production, Vol. 16. 1699–1710 (2008)

Sheu, C., Yen, H.R., Chae, D., 2006. Determinants of supplier-retailer collaboration: evidence from an international study. International Journal of Operations and Production Management 26 (1), 24–49.

Simatupang, T.M., Sridharan, R., 2005. An Integrative framework for supply chain collaboration. International Journal of Logistics Management 16 (2), 257–274.

Slack, J. K., Adams, R. B., Rovin, J. D., Bissonette, E. A., Stoker, C. E., & Parsons, J. T. (2001). Alterations in the focal adhesion kinase/Src signal transduction pathway correlate with increased migratory capacity of prostate carcinoma cells. Oncogene, 20(10), 1152.

Smith, D., & Sparks, L. (2004). Logistics in Tesco: past, present and future. Logistics and Retail Management, 2, 101-120.

Spekman, R. E., Kamauff Jr, J. W., & Myhr, N. (1998). An empirical investigation into supply chain management: a perspective on partnerships. Supply Chain Management: An International Journal, 3(2), 53-67.

Stanciu, S., Stanciuc, N., Dumitrascu, L., Ion, R., & Nistor, C. (2013). The effects of horse meat scandal on Romanian meat market. SEA-Practical Application of Science, 1(1), 174-181.

Stank, T.P., Keller, S.B., Daugherty, P.J., 2001. Supply chain collaboration and logistical service performance. Journal of Business Logistics 22 (1), 29–48.

Stern, N. J., Hiett, K. L., Alfredsson, G. A., Kristinsson, K. G., Reiersen, J., Hardardottir, H., ... & Berndtson, E. (2003). Campylobacter spp. in Icelandic poultry operations and human disease. Epidemiology and infection, 130(01), 23-32.

Stewart, G. (1995). Supply chain performance benchmarking study reveals keys to supply chain excellence. Logistics Information Management, 8(2), 38-44.

Stuart, F.I., McCutcheon, D., 1996. Sustaining strategic supplier alliances. International Journal of Operation and Production Management 16 (10), 5–22.

Surkiewicz, B. F., Johnston, R. W., Moran, A. B., & Krumm, G. W. (1969). Bacteriological survey of chicken eviscerating plants. Food technology.

Tan, K. C. (2002). Supply chain management: practices, concerns, and performance issues. Journal of Supply Chain Management, 38(4), 42-53.

Tanriverdi, H., 2006. Performance effects of information technology synergies in multi-business firms. MIS Quarterly 30 (1), 57–77.

Taoukis, P. S., Koutsoumanis, K., & Nychas, G. J. E. (1999). Use of time–temperature integrators and predictive modelling for shelf life control of chilled fish under dynamic storage conditions. International Journal of Food Microbiology, 53(1), 21-31.

Taylor, T. A. (2006). Sale timing in a supply chain: When to sell to the retailer. Manufacturing & Service Operations Management, 8(1), 23-42.

Thatte, A. A. (2007). Competitive advantage of a firm through supply chain responsiveness and SCM practices (Doctoral dissertation, The University of Toledo).

Thompson, M., Sylvia, G., & Morrissy, M. T. (2005). Seafood traceability in the united states: Current trends, system design, and potential applications. Comprehensive Reviews in Food Science and Food Safety, 1, 1–7.

Vaikousi, H., Biliaderis, C. G., & Koutsoumanis, K. P. (2009). Applicability of a microbial Time Temperature Indicator (TTI) for monitoring spoilage of modified atmosphere packed minced meat. International Journal of Food Microbiology, 133(3), 272-278.

Van Der Vorst, J. G. A. J., Tromp, S., & Van Der Zee, D. J. (2010). Simulation modelling for food supply chain redesign; Integrated decision making on product quality, sustainability and logistics, International Journal of Production Research, Vol. 47(23). 6611-6631.

Van der Vorst, J. G., Da Silva, C. A., & Trienekens, J. H. (2007). Agro-industrial supply chain management: concepts and applications. FAO.

Van der Vaart, T., Van Donk, D., 2008. A critical review of survey-based research in supply chain integration. International Journal of Production Economics 111, 42–55.

Vangen, S., Huxham, C., 2003. Enacting leadership for collaborative advantage: dilemmas of ideology and pragmatism in the activities of partnership managers. British Journal of Management 14 (Suppl. 1), S61–S76.

Wintle, V., and Lepper, S. (2017). 'Poultry industry - Growth of the egg industry', Te Ara - the Encyclopaedia of New Zealand, http://www.TeAra.govt.nz/en/poultry-industry/page-3 (accessed 10 March 2017)

Yauch, C. A. and Steudel, H. J. (2003) Complementary Use of Qualitative and Quantitative Cultural Assessment Methods, Organizational Research Methods, Vol. 6, No. 4, pp. 465-481.

Yeung, A., 2008. Strategic supply management, quality initiatives, and organizational performance. Journal of Operations Management 26, 490–502

Appendix A – Descriptive statistics for processed egg SCI, CA and PI

Descriptive

		Statistic	Std. Error
SCI	Mean	3.3667	.11227
	5% Trimmed Mean	3.3519	
	Median	3.0000	
	Variance	.378	
	Std. Deviation	.61495	
	Minimum	2.00	
	Maximum	5.00	
	Range	3.00	
	Interquartile Range	1.00	
	Skewness	.549	.427
	Kurtosis	.382	.833
CA	Mean	3.4667	.12441
	5% Trimmed Mean	3.4815	
	Median	3.5000	
	Variance	.464	
	Std. Deviation	.68145	
	Minimum	2.00	
	Maximum	5.00	
	Range	3.00	
	Interquartile Range	1.00	
	Skewness	-.222	.427
	Kurtosis	-.085	.833
Product Integrity	Mean	4.2333	.18372
	5% Trimmed Mean	4.2407	
	Median	4.0000	
	Variance	1.013	
	Std. Deviation	1.00630	
	Minimum	2.00	
	Maximum	6.00	
	Range	4.00	
	Interquartile Range	2.00	
	Skewness	-.288	.427
	Kurtosis	-.660	.833

Appendix B;

Dear Participant,

I invite you to participate in a research study entitled ***"Processed egg supply chain integrity"***. I am currently enrolled in the ***Master of Logistics & Supply Chain*** at Massey University in Palmerston North, New Zealand, and am in the process of writing my Master Thesis. The purpose of the research is to determine: ***"How does the processed egg supply chains integration mediate the relationship between supply chain collaboration and processed egg integrity?"***

Your participation in this research project is completely voluntary. You may decline altogether, or leave blank any questions you don't wish to answer. There are no known risks to participation beyond those encountered in everyday life. Your responses will remain confidential and anonymous. Data from this research will be kept under lock and key and reported only as a collective combined total. No one other than the researchers will know your individual answers to this questionnaire.

If you have any questions about this project, feel free to contact Gihan Kohoban at 021520809 / gihan.indika.kohoban.arachchi.1@uni.massey.ac.nz or research supervisor Mr.Walter Glass at wmglass@corplogistics.co.nz If you have any questions concerning your rights as a research participant, please contact the IRB of Massey University at contact@massey.ac.nz or 06 350 5701.

Thank you for your assistance in this important endeavor.

Yours faithfully,

Gihan Indika Kohoban Arachchi

Appendix C;

	The Business :_____							
	Throughout this survey, will you be answering on behalf of your whole company, the							
	deivion you work in, or the business unit you work in? _____							
	Your position in your organizition : _____							
		Strongly Disagree			Neutral			Strongly Agree
		1	2	3	4	5	6	7
	Supply chain process Integration							
	Information sharing							
SIIS1	Our company and supply chain partners exchange relevet information							
SIIS2	Our company and supply chain partners exchange accurate information							
SIIS3	Our company and supply chain partners exchange timely information							
SIIS4	Our company and supply chain partners exchange complete information							
SIIS5	Our company and supply chain partners exchange confidential information							
	Goal congruence							
SIGC1	Our company and supply chain partners have agreement on the goals of the supply chain							
SIGC2	Our company and supply chain partners have agreement on the importance of integration across the supply chain							
SIGC3	Our company and supply chain partners have agreement on the importance of improvements that benefits the supply chain as a whole							
SIGC4	Our company and supply chain partners agree that our own goals can be achieved through working towards the goals of the supply chain							
SIGC5	Our company and supply chain partners jointly layout integration implemantation plans to achieve the goals of the supply chain							
	Decision synchronization							
SIDS1	Our company and supply chain partners jointly plan on promotional events							
SIDS2	Our company and supply chain partners jointly develop demand forecasts							
SIDS3	Our company and supply chain partners jointly manage inventory							
SIDS4	Our company and supply chain partners jointly plan on product assortment							
SIDS5	Our company and supply chain partners jointly work out solutions							
	Risk sharing							
SIRS1	Our company and supply chain partners use cross organizational tem frequently for process design and improvements							
SIRS2	Our company and supply chain partners dedicate personnel to manage the collaborative processes							
SIRS3	Our company and supply chain partners share technical supports							
SIRS4	Our company and supply chain partners share equipments							
SIRS5	Our company and supply chain partners pool financial and non-financial resources							
	Collaborative communication							
SICC1	Our company and supply chain partners have frequent contacts on a regular basis							
SICC2	Our company and supply chain partners have open and two-way communication							
SICC3	Our company and supply chain partners have informal communication							
SICC4	Our company and supply chain partners have many different channels to communicate							
SICC5	Our company and supply chain partners influence each other's decisions through discussion rather than request							

		Strongly Disagree		Neutral			Strongly Agree	
		1	2	3	4	5	6	7
	Joint knowledge creation							
SIJK1	Our company and spply chain partners jointly serch and acquire new and relevant knowledge							
SIJK2	Our company and spply chain partners jointly assimilate and apply relevant knowledge							
SIJK3	Our company and spply chain partners jointly identify customer needs							
SIJK4	Our company and spply chain partners jointly discover new or emerging markets							
SIJK5	Our company and spply chain partners jointly learn the intentions and capabilities of our competitors							
	Collaborative advantage							
	Process efficiency							
CAPE1	Our company with supply chain partners meets agreed upon unit costs in comparison with industry norms							
CAPE2	Our company with supply chain partners meets productivity standards in comparison with industry norms							
CAPE3	Our company with supply chain partners meets on-time delivery requirement in comparison with industry norms							
CAPE4	Our company with supply chain partners meets inventory requirments in comparison with industry norms							
	Offering flexibility							
CAOF1	Our company with supply chain partners offers a variety of products and services effciently in comparison with industry norms							
CAOF2	Our company with supply chain partners offers customized products and services with different features quickly in comparison with industry norms							
CAOF3	Our company with supply chain partners meets different customer volume requirments efficiently in comparison with industry norms							
CAOF4	Our company with supply chain partners has good customer responsivness in comparison with industry norms							
	Business synergy							
CABS1	Our company and supply chain partners have integrated IT infrastructure and IT resources							
CABS2	Our company and supply chain partners have integrated knowledge and know-how							
CABS3	Our company and supply chain partners have integrated marketing efforts							
CABS4	Our company and supply chain partners have integrated production systems							
	Quality							
CAQ1	Our company with supply chain partners offrs products that are highly reliable							
CAQ2	Our company with supply chain partners offrs products that are highly durable							
CAQ3	Our company with supply chain partners offrs high qualty products to our customers							
CAQ4	Our company with supply chain partners have helped each other to improve product qualty							
	Innovation							
CAI1	Our company with supply chain partners introduces new products and services to market quickly							
CAI2	Our company with supply chain partners has rapid new product development							
CAI3	Our company with supply chain partners has time-to-market lower than industry average							
CAI4	Our company with supply chain partners innovates frequently							

		Strongly Disagree		Neutral			Strongly Agree	
		1	2	3	4	5	6	7
	Product integrity							
	B2B							
PIBB1	Our company's planning and scheduling process are integrated with trading partnes							
PIBB2	Our company frequently evaluates the formal and informal complaints of its trading partnes							
PIBB3	Our company periodically evaluates the importance of its relationship with its trading partnes							
PIBB4	Our company keep trading partners fully informed about issues that affect its business							
PIBB5	Our company informs its trading partners in advance of changing needs							
	B2C							
PIBC1	Our company shares a sense of fair play with its customers							
PIBC2	Our company keep customers fully informed about issues that affect products							
PIBC3	Our company facilitates customers' ability to seek assistance from it							
PIBC4	Our company keep realtime product tracebility information open to its customers							
PIBC5	Our company holds full ownership of product trakcing information reliability throughout the supply chain							