An Investigation of the Collaboration - Postharvest Food Loss Relationship and the Effect of the Environmental Turbulence Factors

By

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(Doctoral Thesis)

Submitted in partial fulfillment of the requirements for the award of
Doctor of Philosophy of Loughborough University
(30.01.2016)

Αφιερωμένο στους γονείς μου,

Μαριλέλα και Ηλίας

I dedicate this thesis to my parents,

Marilela and Elias

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Abstract

The increasing need for food supply chain sustainability and food security has considerably strengthened the importance of reducing Postharvest Food Losses (PHFL). Recent studies suggested that collaboration among upstream Agricultural Supply Chain (ASC) partners will impact and possibly reduce PHFL levels; a possible direct relationship between collaboration and PHFL was indicated. Hence, collaboration could be a possible solution to PHFL. Research done in the area of PHFL reduction has not considered the producers' unit of analysis. Moreover, there have been many changes in the EU ASC's environment and those changes cause turbulence in the latter environment and impact both collaboration among upstream partners and PHFL. Thus, this research investigates the relationship between collaboration and PHFL as well as the possible moderating effects of the different environmental turbulence factors in the aforementioned relationship in the EU ASCs from the producers' perspective.

Drawing on Contingency Theory and Resource Based View of the Firm theories, considering the specific ASC context the conceptual framework of this research was established with its respective hypotheses. Therefore, a conceptual framework involving collaboration, PHFL and the different environmental turbulence factors in the Greek ASC context was developed and was empirically tested using data from 220 producers.

The findings of this research suggest that collaboration is negatively related to PHFL and this confirmed the main hypothesis of this study. This is a unique finding that opens numerous future research avenues, given that this is the first academic study to consider collaboration as an important way of reducing PHFL. The relevant environmental turbulence factors in the collaboration - PHFL relationship have been also identified in this research. Those environmental turbulence factors that act as moderators in the collaboration - PHFL relationship are as follows: food safety regulations, food quality regulations, food traceability regulations, weather conditions, and competitive intensity.

The theoretical and the practical implications of this study's findings are subsequently presented along with an acknowledgment of the study's limitations and proposed future research to further explore this important area.

List of Publications

- Despoudi S., Papaioannou G., & Dani S., 2015, The Promise of Supply Chain Collaboration: A Myth or Reality? An empirical analysis of fruit producers' perceptions, In Proceedings of the 20th International Symposium on Logistics (ISL 2015), Bologna, Italy.

- Despoudi S., Papaioannou G., & Dani S., 2015, An Investigation of the Environmental Turbulence Factors and their Sources in the Collaboration - Postharvest Food Loss Relationship, Fork to Farm: International Journal of Innovative Research and Practice, Vol. 2, Issue 1, pp.1-6.

- Despoudi S., Papaioannou G., & Dani S., 2013, An exploration of the Environmental Turbulence Factors in the Collaboration Postharvest food loss relationship. In 18th Logistics Research Network Annual Conference, Birmingham, UK, pp. 10-18.

- Despoudi S., Papaioannou G., & Dani S., 2013, Managing Environmental Turbulence in the EU Agricultural Supply Chains: the case of Greece. In Proceedings of the 18th International Symposium on Logistics (ISL 2013), Vienna, Austria, pp. 927-935, ISBN: 978 085358 292 2.

- Despoudi S., Papaioannou G., & Dani S., 2012, Supply Chain Collaboration (SCC) to reduce Postharvest food losses (PHFL). In 17th Logistics Research Network Annual Conference, Cranfield University, UK, pp. 1-8.

- Despoudi S., Papaioannou G., & Dani S., 2012, Food Security and Food Losses: A Producer to Processor perspective. In Proceedings of the 17th International Symposium on Logistics (ISL 2012), New horizons in Logistics and Supply Chain Management, Cape Town, South Africa, pp. 343-351, ISBN: 978-085358-284-7.

List of Abbreviations

- Agricultural Supply Chain (ASC)
- Collaboration (CO)
- Collaborative Communication (CM)
- Collaborative Planning Forecasting Replenishment (CPFR)
- Competitive Intensity (CI)
- Contingency Theory (CT)
- Decision Synchronisation (DS)
- Economic Conditions (E)
- Food Supply Chain (FSC)
- Food Supply Chain Management (FSCM)
- Food Safety Regulations (FSR)
- Food Traceability Regulations (FTR)
- Food Transport and Handling Regulations (FHR)
- Food Quality Regulations (FQR)
- Goal Congruence (GC)
- Incentive Alignment (AS)
- Information Sharing (IS)
- Joint Knowledge Creation (KC)
- Organic Food Regulations (OFR)
- Political Conditions (P)
- Postharvest Food Loss (PHFL)
- Radio Frequency Identification (RFID)
- Resource-Based View (RBV)
- Supply Chain (SC)
- Supply Chain Management (SCM)
- Vendor Management Inventory (VMI)
- Weather Conditions (W)

Acknowledgements

First and foremost, I would like to express my profound gratitude to my supervisors Dr Grammatoula Papaioannou and Professor Samir Dani. I deeply appreciate their constructive comments, support, patience, and encouragement at all levels of my study. I would like to thank them for helping me to become a better thinker and an independent academic.

I would like to thank Professor John W. Cadogan. His valuable comments and support were crucial for the successful completion of my thesis.

I would also like to thank my panel committee members, Professor Jiyin Liu and Professor Baibing Li for their help and useful comments in the panel meetings.

I give a special thank to the School of Business and Economics for funding my PhD and making it possible in the first place.

I am equally thankful to my fellow doctoral students at the School of Business and Economics for their advice and moral support. I would like to express my gratitude to my friends and colleagues Abhijeet Ghadge, Rubini Tsakona, Milena Micevski, Soeren Winkelmann, and João Oliveira for being very supportive and for making this journey more enjoyable.

I am grateful to my friend Lia Nedelkou for her belief in me and her continuous encouragement and support.

Finally, I am very grateful to my mother Marilela, my father Elias, my sister Elena, and my brothers Konstantinos and Giannis. Despite being so far from me, their patience, support, encouragement and love were fundamental in completing this thesis.

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Chapter 1

Introduction

1.1 Introduction

The aim of this chapter is to introduce the reader to the study undertaken in this thesis. The chapter begins with a description of the context of this research (i.e. current challenges of the food supply chain). Then, it precedes with a discussion of the research gaps. Three research gaps are identified for this study as follows: (a) the relationship between collaboration and Postharvest Food Loss (PHFL) from the producers' perspective, (b) the consideration of the environmental turbulence factors in the collaboration - PHFL relationship, and (c) the Greek Agricultural Supply Chain (ASC) context. Based on the aforementioned identified research gaps the research objectives and the overall aim of this research are presented. The envisaged theoretical, practical and policy contributions of this work are then outlined. The chapter concludes with an outline of the thesis chapters and an overview of the contents of each chapter.

1.2 The Research Context

Today's Food Supply Chain (FSC) is facing many pressures due to issues related to fewer natural resources available, limited agricultural land available, population growth, world's food insecurity, climate change, dietary changes, governance of the FSC system, and food waste or else PHFL (FAO, 2002; 2011, Defra, 2006; FAO, 2011). The major natural resources i.e. food, energy and water are becoming scarce (FAO, 2011). The future scarcity of the natural resources indicates that they need to be preserved and should not intentionally be wasted. The agricultural land is also limited; new ways to grow crops need to be found in places that until now was not possible to farm (Vidal, 2012). The world population has been predicted to reach 9 billion by 2050 and this will require a 70% increase

in food production (FAO, 2009). Producing enough food, appropriately distributing it, and minimizing its wastage are some of the challenges that the food industry is facing related to the rising population (Foresight, 2011a). According to FAO (2011) food insecurity can be defined as a situation that exists when people do not have consistent and everyday physical, social and economic access to sufficient, safe and nutritious food based on their dietary preferences and needs. Thus, the world's food insecurity issue is becoming a major concern. The rising population, the fewer natural resources available, the possible future insufficient acceleration of technology, and the high levels of food waste rise major concerns about world's food insecurity.

However, the issue of food insecurity and the limited natural resources is not a new one. Malthus (1798) in his 'Essay on the Principle of World Population' talked about the restriction of population growth due to the limited available resources for food production. According to Malthus the amount of food produced is determined by the availability of natural resources and technology used to reclaim them. From time to time there is significant increase in food availability, but this increase cannot be followed by the increase in population's growth. Meadows et al. (1972) produced different scenarios to examine world's population increase, industrialization, pollution, food production and resource depletion; the authors stated that if the latter trends continue to grow the nature's limits will soon be reached and the whole earth system will collapse.

Both Malthus (1798) and Meadows et al. (1972) highlighted that in a world with finite natural resources food production is not possible to meet an increasing populations' future needs for food. Criticisms of Malthus' 'limits to growth model' stated that this model failed to capture effectively the acceleration of technology until now (Engels, 1843). Acceleration of technology managed to increase crop yield and create new types of crops (e.g. genetic modified crops). However, the pace of population growth, climate change, income distribution imbalances and the change of consumption patterns are moving faster than technological advancements (Foresight, 2011b). This means that in the future technological advances may not be able to keep up with the population growth and the deterioration of the natural environment. Therefore, the issue of future scarcity of natural resources relatively to population increase has been predicted and discussed many years ago. Technology seems to act as a balancing factor of the

two aforementioned issues; however it is not certain for how long technology will keep the balance between the two.

Climate change and future scarcity of natural resources put limits to growth in agriculture and food production, which means that a 70% increase in food production to feed nine billion people is impossible to be achieved (Hodges et al., 2010). Climate change also has and will continue to have in the future severe negative consequences to the FSC (Bereuter et al., 2014). Weather changes in the form of extreme weather events, the rise of global temperature and the increase of green house gas emissions are the main causes of climate change that will impact significantly the FSC. According to Bennett's Law increasing wealth pushes people in consumption of higher calories food such as fats, protein, and sugar (Godfray et al., 2010). Those dietary changes affect significantly the FSC as high caloric diets require more natural resources to be spent. The governance of the global FSC at both national and international levels is another challenge that the FSC is facing (FAO, 2002). The globalisation of the markets led to changes in power imbalance in the FSC and this creates governance issues in the sector. More precisely, producers are the less powerful in the FSC, while big retailers have dominated the sector (Delloite, 2013).

Another major challenge that the FSC is facing is food losses or else called Postharvest Food Losses (PHFL). It has been estimated that between 25% and 50% of food produced is lost or wasted along the supply chain and does not reach consumers, depending on its position in the supply chain (Lundqvist et al., 2008; FAO, 2010). Reducing PHFL can increase grain supply, food availability and food security without wasting other resources such as land, labour, water and inputs (APO, 2006; The World Bank, 2011). According to a recent study conducted by the FAO titled 'Global Food Losses and Food Waste' (Gustavsson et al., 2010, p. 4), "food is lost or wasted throughout the supply chain, from the initial agricultural production down to the final household consumption". This means that there are significant amounts of lost food throughout the FSC. The majority of food is lost from the producers to retailers point in the supply chain (Gustavsson et al., 2010). There is a need for development of a sustainable and fair FSC (Driscoll, 2012; Gidney, 2015). Smallholder farmers despite producing more than 70% world's food, they represent more than half of the world's hungriest people (Gidney, 2015). Hence, producers need to be supported in

order to enable sustainable food production for now and for the future. Considering the scarcity of the natural resources, the increase of population with diverse consumption needs and income, the limited agricultural land for production, the climate change, and the increasing world's food insecurity, the existence of high percentage of PHFL throughout the FSC is deteriorating the challenges of the FSC.

Food provisioning in a resource constrained world must be done in a sustainable way in order to achieve food security for all the people in the world (Krejci and Beamon, 2010; Premanandh, 2011). Further research in the area of food security is needed (FAO, 2011). Preserving inputs in the FSC (e.g. raw materials) and using them as efficiently as possible can increase food security for now and for the future (FAO, 2008). PHFL found to inhibit both food security and FSC sustainability (Foresight, 2011a). Hence, reducing PHFL would improve the FSCs sustainability, increase food availability, and would possibly increase word's food security.

1.3 Research Gaps in the Literature

The purpose of this study is to address the current and emerging topic of food losses or else PHFL in FSCs. In the sections that follow, the study provides a detailed discussion of the research gaps that lead to the main focus of this research.

1.3.1 The Relationship between Collaboration & Postharvest Food Loss

Food is lost or wasted throughout the supply chain from initial agricultural production down to final household consumption (Gustavsson et al., 2010). "Producing and appropriately distributing enough food to feed a rising population presents many challenges for the industry, reducing PHFL across the supply chain is a primary target to ensure global food security" (Mena et al., 2011, p.649). PHFL is defined as the decrease of edible food mass that occurs from producers until reaching consumers and includes all the edible food that was lost unintentionally (see also Section 2.4.1).

Interventions to reduce PHFL are seen as important efforts to reduce food insecurity and to realize agriculture's potential to meet the world's need for food (World Bank, 2011). Environmental and human priorities lie in addressing PHFL reduction rather than finding better ways to treat food that might be lost in the supply chain such as value adding activities (Foresight, 2011b). PHFL needs to be significantly reduced or even achieve zero PHFL in the face of a sustainable future (World Economic Forum, 2011). Reducing PHFL can increase grain supply and food security without wasting other resources such as land, labour, water and inputs (Kader, 2005; FAO, 2006; Hodges et al., 2010; The World Bank, 2011; Foresight, 2011b). By reducing PHFL both the profitability and the operational performance of all supply chain partners will be increased (Chapman, 2010). PHFL does not only have environmental and economic impacts, but also social impacts; it is a cause of poor nutrition and has significant effects on health and life expectancy (FAO, 2006). It could be said that many authors and food organisations have indicated the need to reduce PHFL and the expected benefits that could be achieved through its reduction.

Although there is much discussed on PHFL within the supply chain management literature, there is limited information on how to reduce and prevent it from happening in the upstream FSC (Parfitt et al., 2010). Researchers proposed different ways to reduce PHFL, however empirical research is missing (Mena et al., 2011). Most of the research about PHFL is focused either at retailers' or at consumers' point in the FSC (Mena et al, 2011; WRAP, 2011). There is limited research about PHFL from the producers' perspective (FAO, 2011; FAO, 2012). Since the majority of the PHFL is happening from the producers to their buyer stage in the supply chain, research regarding PHFL from the producers' perspective will provide significant insights about PHFL reduction at that specific stage of the FSC. Different ways have been suggested to address the PHFL problem such as improving technology, developing better storage and cooling facilities etc (Hodges et al., 2010). There is a focus on technological and infrastructural interventions for PHFL reduction (IGD, 2008). In FAO's (2011) report is stated that the key factors contributing to PHFL are related to the lack of coordination among different actors in the upstream supply chain. Chapman (2010) referred to PHFL as a shrinkage problem characterised it as a 'complex' problem that needs to be addressed in a collaborative manner and involve wide

range of stakeholders to get different perspectives of the problem to deliver holistic solutions. In the World Economic Forum report (2011) is stated that improved coordination among chain members could impact PHFL levels. Recent research suggested that better and closer collaboration between suppliers and retailers can be a starting point to reduce PHFL levels; a possible direct relationship between collaboration and PHFL was indicated (Mena et al., 2011; WRAP, 2011). However, to the author's best knowledge there is no research examining the collaboration - PHFL relationship from the producers' perspective although its relevance and importance has been speculated. Identifying the best collaborative practices that impact PHFL from the producers' perspective, will provide guidance on how to practically address the PHFL issue at that part of the FSC. The role of collaboration in PHFL reduction in the upstream (i.e. producers) FSC needs to be further explored.

Different studies examined the impact of collaboration on business performance Hyvonen and Tuominen, 2007; Vachon and Klassen, 2008). The positive effect of collaboration within the supply chain on business performance outcomes has been confirmed by many research studies (Hyvonen et al., 2007; Zacharia et al., 2009; Rosenzweig, 2009). Hyvonen et al. (2007) examined the collaboration - business performance relationship from the manufacturers, wholesalers and retailers perspective; the positive relationship between collaboration and business performance was confirmed. Singh and Power (2009) proved the existence of bidirectional relationships between inter-firm collaboration and business sales. However, William et al. (2009) examined the effect of internal and external collaboration practices of firms on their performance and proved that there is no significant association between collaboration and performance. Also, Stank et al. (2001) concluded that the relationship between collaboration with business partners and logistical service performance is not significant. Weak empirical support was found by Vereecke and Muylle (2006) for the hypothesized positive relationships between supplier or customer collaboration and business performance improvement. Thus, it is not clear from the literature whether collaboration has a positive or negative or no influence on business performance. All aforementioned studies examined the collaboration - business performance relationship from the firms, manufacturers and retailers perspective. The PHFL levels from the point of producers could be regarded as a measure of business

performance, as it is lost sales (i.e. wasted food products that could have been sold). There is a lack of research from the producers' point of view and the specific context (i.e. FSC). Also, there is no research indicating the positive or negative effect of collaboration on FSC's producers' business performance (i.e. PHFL levels).

Overall, from the literature review conducted PHFL found to be an emerging issue in FSCs. Most of the research is focused on PHFL occurring from retailers to consumers (i.e. downstream supply chain); research on upstream supply chain PHFL is limited (Parfitt et al., 2010). Moreover, there is a focus on technological solutions for PHFL reduction. The human element and to be more precise the interactions among upstream FSC members have not been considered in the academic literature of supply chain management. It seems that there is a research gap in the literature between upstream FSC actors (i.e. producers) interactions and their buyer's collaborative practices towards PHFL reduction. Thus, the **first research gap** identified relates to the lack of research about the nature of relationship between collaboration and PHFL from the producers' perspective in FSCs.

1.3.2 Consideration of the Environmental Turbulence Factors

Uncertainty has been extensively examined in organisational studies aiming to explain the relationship between organisations and their operating environments (Duncan, 1972; Milliken, 1987). According to Miliken (1987, p. 133) "uncertainty can be defined as an individual's perceived inability to predict something accurately because of the lack of information or inability to discriminate between relevant and irrelevant data". Environmental uncertainty means that one does not understand how components of the environment might be changing or one has an incomplete understanding of the interrelationship between different environmental elements (Milliken, 1987). Van der Vorst (2000) defines supply chain uncertainty from a decision making perspective as "situations where the decision-maker lacks effective control actions or is unable to accurately predict the possible impact of control actions on system behaviour because of lack of information or understanding of the environment or current supply chain state" (Van der Vorst, 2000, p.73). The role of supply chain management should be to

reduce and eliminate those uncertainties to improve the performance of the supply chain (Van der Vorst, 1998).

Environmental turbulence is defined as the degree to which technological, competitive, regulatory and customer levels within an industry change and affect managerial decisions of an organisation (Calantone et al., 2003; Kuivalainen et al., 2004). Turbulent environments are environments characterised by the following characteristics: high levels of inter-period change that creates uncertainty and unpredictability, heterogeneity (i.e. diversity of market segments), dynamism (i.e. rate and predictability of change) and hostility (i.e. unfavourable climate, high level of competitive intensity and uncertainty) (Glazer and Weiss, 1993; Calantone et al., 2003; Kuivalainen et al., 2004). Increasing environmental turbulence requires firms to continuously adapt to changes in their business environments and questions the ability of traditional supply chain management models to manage it (Christopher and Holweg, 2011). Therefore, environmental turbulence is a factor that needs to be considered in managing supply chains.

Environmental turbulence has been described as an important contingency factor of an organisation's external environment (Glazer and Weiss, 1993; Robertson and Chetty, 2000). Environmental turbulence in the Supply Chain (SC) can be classified in terms of its origin, as endogenous (within a supply chain) and exogenous (from the outside environment) uncertainties (Van der Vorst, 2000; Trkman and McCormack, 2009). The main difference in managing endogenous and exogenous uncertainties is that the former could be controlled by SC entities, while the latter cannot be directly controlled (Vlajic et al., 2012). Endogenous turbulence can be measured by studying the different environments in which an organisation operates in terms of competitors, market, technological and regulatory turbulence (Cadogan and Paul, 1999). While, exogenous turbulence involves discrete events (e.g. terrorist attacks, workers strikes, contagious diseases) and continuous uncertainties (e.g. price changes, weather changes, political changes) (Trkman and McCormack, 2009).

In the EU's Agricultural Supply Chain (ASC) environment there are high levels of inter-period change and the future environmental conditions cannot be accurately predicted due to the high levels of uncertainty (Galanopoulos et al., 2011). The main changes in the EU's ASC environment are related to globalisation, changing

consumer attitudes and concerns, changing markets, increased competition, new technologies, demand for environmental sustainability and changing food regulations (Ziggers and Trienekens, 1999; Bourlakis and Weightman, 2004; Spence and Bourlakis, 2009; Reynolds et al., 2009; Van der Vorst et al., 2009; Foresight, 2011a; Foresight, 2011b). Thus, all the aforementioned changes are the causes of a highly uncertain operating environment. Moreover, climate change will continue to have severe effects to FSCs and ASCs worldwide. According to Carrington (2013) the global food crisis will worsen by up to 30% by 2050 due to extreme weather events. High economic and political instability are also existent in the EU's environment (Warner 2014; Winchester, 2015). Hence, it could be said that EU's ASC's environment is characterized by both endogenous and exogenous turbulence factors. Further exploration is needed to ascertain the relevant environmental turbulence factors in the EU ASC context.

Collaboration among upstream ASC chain members is said to be influenced by several factors such as environmental uncertainty, partners' knowledge and resources, commitment and trust among partners (Ziggers and Trienekens, 1999; Fischer et al., 2010). Many studies investigated the impact of environmental turbulence factors on SC partners' relationships (e.g. Fynes et al., 2004; Saccani and Perona, 2007; Trkman and McCormack, 2009; Srinivasan et al., 2011; Sambasivan et al., 2013). Partners' relationships in ASC are impacted by the specific industry's environmental characteristics. Different authors indicated that in environments with high environmental turbulence business partners will collaborate closer in order to reduce and / or manage this turbulence (Kumar and Muglia, 2010; Danese, 2011; Arora and Webb, 2012). Therefore, environmental turbulence could be a factor that impacts the level of collaboration in ASCs and FSCs.

On the other hand, when environmental turbulence is high, PHFL levels are expected to be higher (Kader, 2010). PHFL levels are influenced by exogenous and endogenous environmental factors; it was found that PHFL levels are sometimes caused due to weather conditions, legislation, food safety and food quality standards (Paull et al., 1997; Kader et al., 2010). It can be seen that environmental turbulence experienced by producers and their buyers in FSCs has an impact on their collaboration level and on PHFL. Therefore, environmental turbulence factors could possibly affect both collaboration and PHFL levels.

However, there is no research examining the possible relationship among collaboration, PHFL and environmental turbulence factors. Without a complete understanding of the possible positive or negative influence of the environmental turbulence factors in the collaboration - PHFL relationship, researchers' ability to make recommendations to SC actors, managers and policy-makers about how to achieve PHFL reduction is hampered. Therefore, the **second research gap** identified concerns the lack of research regarding environmental turbulence factors in the EU ASC and the positive or negative impact that they might have on both collaboration and PHFL. This research will investigate the possible direct effect of collaboration and the interaction effects of the environmental turbulence factors with collaboration on PHFL.

1.3.3 The Greek Agricultural Supply Chain

The aforementioned changes in the EU's ASC environment impacted also the Greek ASC environment (Kaditi and Nitsi, 2010). Over the past few years there was a continuous decline in the performance of the Greek ASC (Paseges, 2012). It seems that the actors of the Greek ASC and producers particularly have not reacted and adjusted to the need for structural change as other EU ASC actors did (Kaditi, 2010). The Greek ASC environment is characterised as being highly turbulent due to the changes in EU's ASC environment (Kaditi and Nitsi, 2010). In fact, over the past few years there is a significant decline in the performance of the Greek ASC (Paseges, 2012). Moreover, research studies carried out about PHFL in the Greek ASC focus either at the firms or the household level (Abeliotis et al., 2012; Abeliotis et al., 2014; HSWMA, 2015) and ignore the potential effect of collaboration on the upstream producers. To the author's best knowledge there is no research examining the environmental turbulence factors in the Greek ASC context from the producers' perspective. Research would therefore benefit from a context specific conceptualisation of the collaboration - PHFL relationship and the different environmental turbulence factors that could possibly alter it. The **third research gap** identified is the identification of the relevant environmental turbulence factors in the Greek ASC and the examination of their impact on both collaboration and PHFL from the producers' point of view. The reasons for choosing producers are explained in section 2.4.1. In this research the local rather than the international collaborations with cooperatives will be investigated,

as there is absence of research regarding the domestic Greek ASC. Also, a single ASC product will be studied for the purposes of this study. The selected product is peach as there are high PHFL levels and also Greece is one of the major producers in EU.

1.4 Research Aim and Objectives

In the light of the research gaps identified above, the current study's *overall aim* is as follows:

To investigate the collaboration - PHFL relationship under the specific EU ASC context and to identify the relevant environmental turbulence factors that possibly impact this relationship from the producers' perspective.

1.4.1 Research Objectives

In order to fulfil the overall aim of this study, the research objectives of the current study are threefold as follows:

(1) To explore the relevance of the collaboration concept in the EU ASC (i.e. Greek ASC) and its possible impact on PHFL.

(2) To conceptualise and test the relationship between collaboration and PHFL.

(3) To identify the relevant environmental turbulence factors in the EU ASC (i.e. Greek ASC), conceptualise these, and examine their potential moderating effects in the collaboration - PHFL relationship.

The research objective (1) is addressed through exploratory research (see Chapter 3, section 3.3). In order to address the research objectives 2 and 3, this thesis adopts a Resource based-view of the firm and a Contingency Theory perspective. The aforementioned research theories enable the development of a sound conceptual framework for the fulfilment of this study's (2) and (3) research objectives.

The Resource Based-View of the firm (RBV) theory suggests that partners enter a collaborative relationship to access and acquire resources, skills and knowledge from partners (e.g. Sambasivan et al., 2013). The RBV argues that resources and capabilities provide firms with a competitive advantage that allows them to take advantage of opportunities and avoid threats in the general business environment (Wernerfelt, 1984; Barney, 1991). Resources are all assets, capabilities, organisational processes, knowledge and capabilties controlled by a firm that enable the firm to to conceived of and implement strategies that improve its efficiency and effectiveness (Barney, 1991, p.101). Lavie (2006) argued that a firm's competitive advantage depends both on organisational resources, but also on relative partners' resources. The collaboration - PHFL relationship could be conceptualised using the RBV theory. More precisely, ASC producers will seek to collaborate closer with their buyers / business partners in order to access and acquire resources, skills and knowledge from them to improve their business efficiency and effectiveness by reducing PHFL. PHFL is lost sales and through closer collaboration ASC producers could possibly find alternative ways to sell their produce and/or acquire new skills, capabilities and resources to help them achieve PHFL reduction.

Contingency Theory (CT) suggests that there is no best way to organise and that solutions are situational depending on the different environmental conditions (Wright and Ashill, 1996). CT advocates that the fit between an organisation and its external environment influences the performance of the firm (Calantone et al., 2003). The drivers for change in the ASC require upstream chain entities to develop and/or acquire new skills and knowledge in order to create new competences (Joshi et al., 2009). Thus, the CT could be used to study the ASC environment and in particularly the environmental turbulence factors. By combining both RBV and CT in this study it could be said that ASC producers will seek to collaborate closer with their buyers / business partners to access and acquire resources, capabilities and skills to improve their performance and to reduce and/or manage any uncertainties in their operating environment.

1.5 Envisaged Contributions of the Study

This research is expected to have theoretical, practical and policy implications. In the sections that follow all the envisaged contributions of this research are discussed.

1.5.1 Envisaged Theoretical Contributions

In addressing the identified research gaps, a number of benefits are expected to emerge on theoretical front. First of all, this research will contribute to the body of knowledge of FSC management literature by increasing understanding of a complex problem i.e. PHFL issue and by proposing collaboration as a solution. Although a number of studies examined the relationship between collaboration and PHFL, empirical research from the producers' perspective is absent from the literature. This research therefore will add to the existing literature about collaboration and PHFL (i.e. Mena et al., 2011; WRAP, 2011) and will contribute to the knowledge on this highly important relationship from the specific unit of analysis (i.e. producers).

Also, this study adds on the academic literature in the PHFL field. Although the issue of PHFL is well-presented in industry reports, there is limited academic research. Through this research specific PHFL estimates will be identified in the Greek ASC context and this could provide the baseline research for future PHFL academic studies regarding PHFL across the EU ASC. This research is also expected to contribute to the collaboration literature through the adaptation of existing collaboration measures (i.e. Cao et al., 2010) to the ASC context and to the producers unit of analysis. Thus, this study will deliver valuable insights into the nature of collaboration in ASCs. Another envisaged significant contribution of this study will be the identification of the different environmental turbulence factors in the Greek ASC context. To the author's best knowledge there is no research examining the different environmental turbulence factors in the specific ASC context (i.e. Greek ASC). Also, the study of the inter-relationship among collaboration, PHFL, and environmental turbulence factors is missing from the academic literature. This is the first study addressing this relationship and hence the first contribution in this area for academics.

On a conceptual level, this research contributes to the existing knowledge on collaboration, PHFL and environmental turbulence factors through the development of a conceptual framework. By developing and rigorously testing a conceptual framework it is believed that significant insights into the nature of the model's relationships and their inter-relationships will be provided. The conceptual framework of this study could be also replicated (a) to other EU countries ASCs, (b) to other sectors that face similar to PHFL issues (e.g. construction industry waste), and (c) to other/different products of the ASC and of the FSC in general. Thus, the conceptual framework of this study aims to encourage academic community to adopt a more holistic perspective for PHFL reduction studies, by considering a wide range of factors that might impact it (i.e. collaboration, environmental turbulence factors).

1.5.2 Envisaged Practical and Policy Related Contributions

This research will have significant practical and policy implications. First, this study will have direct impact on the environment and in the overall sustainability of the ASC and FSC. This is because PHFL reduction means more effective usage of the natural resources and reduction of food waste going to landfill. Identifying new ways to reduce PHFL will help to preserve world's natural resources for the generations to come. The societal impact of this research cannot be also ignored. Reducing PHFL through higher levels of collaboration means that more food will be available for people worldwide. As a result, people's livelihoods will be improved worldwide and food security will be increased. Moreover, through this research ASC producers will be able to assess their existing collaborative relationships and their impact on their business performance. Thus, producers will be able to see whether their existing collaborative relationships are beneficial for them or not. Through the results of this study producers and ASC entities will be able to decide when they should foster a collaborative relationship with a buyer and when they should discourage it.

Research about PHFL and collaboration will have significant impact on the overall performance of all the upstream ASC entities. This is because PHFL means waste of resources of all the resources used for production. Reductions in

energy, raw material usage, and human capital will reduce costs and will increase both financial and operational performance of all upstream ASC entities. By doing so, the upstream ASC entities financial performance could be increased and significant business growth could be expected. The data analysis of this study will also indicate to the upstream ASC members the critical activities to collaborate with their partners and the different contextual factors (i.e. environmental turbulence factors) that impact them. This study will provide ASC members with new ways of working together and will help them to get most of their relationships with their business partners. Innovative and effective ways of working with business partners will possibly lead to superior performance and competitive advantage.

Overall, this research will provide insights about collaborative relationships in the upstream ASC. The results of this study will provide a toolkit about how collaboration can address the PHFL problem. ASC entities, FSC entities and supply chain managers will be able to use this toolkit and reduce their products' PHFL. Also, supply chain consultants will be able to use the aforementioned toolkit to provide holistic solutions to their customers. Through this research the critical collaborative activities in the ASC are envisaged to be identified to help chain members reduce their impacts on the environment, increase their performance, increase their profits, minimize their impacts to the environment and enable future generations to have access to sufficient and nutritious food.

From the managerial perspective it could be argued that the pace of change of the EU ASC environment is accelerating. The identification of the best collaborative practices and the different environmental factors which can improve business performance are crucial elements for a company's/organisation's success. There is a lack of understanding of the appropriate collaborative practices as well as the relevant environmental factors in the specific EU ASC context. This research suggests concrete and important insights for managers about the appropriate collaborative practices in EU ASCs and the existent environmental turbulence factors that will lead to improved business performance.

For policy makers, this study will identify the relevant regulatory turbulence factors that impact ASC producers' relationships and business performance (i.e. PHFL). This study will show whether the endogenous and exogenous environment of an organisation has important implications for the success of organisational business performance. This means that not only the regulatory turbulence factors may impact ASC producers' relationships and business performance, but also other environmental turbulence factors such as economic conditions and political conditions. This study will give suggestions to policy makers about the impact and the effectiveness of the existing EU ASC policies and regulations.

Finally, the results of the study ought to uncover whether more collaborative ASC producer relationships can reduce PHFL levels and thus improve their business performance. In general it is hoped that the findings of this research will provide useful practical guidelines and recommendations for producers, ASC entities, FSC entities in general, supply chain managers, general managers and policy makers.

1.6 Thesis Outline

To achieve the research aim and objectives outlined above (i.e. section 1.4), this study is divided into seven chapters. The thesis chapters are laid as follows:

- Chapter 1 serves the purpose of introducing the research and arguing its relevance and value. In this chapter the research gaps, the research aim and objectives, and a brief overview of this study's intended contribution to theory, practice and policy are presented.

- Chapter 2 is a comprehensive literature review on the topics of PHFL, collaboration, and environmental turbulence factors. The chapter begins with an overview of FSC and its main characteristics. Then, the concepts of sustainability, food sustainability, and food security are discussed. Thereafter, the problem of PHFL in FSCs is presented, the collaboration as a solution to the PHFL problem is discussed and the different

environmental turbulence factors that possibly affect both collaboration and PHFL are explained.

- Chapter 3 proposes the conceptual framework and develops the hypothesis of this study based on the results drawn from the literature review chapter. In this chapter the choice of the unit of analysis and theoretical underpinnings (i.e. Resource based-view of the firm and Contingency Theory) of this study are discussed. The initial research questions and the refined research questions are presented as well as the process that was followed for the refinement. Both the initial and the final conceptual framework are discussed. Finally, the hypotheses of this research are presented and explained thoroughly.

- Chapter 4 describes in detail the research methodology followed in this study. Both qualitative and quantitative methods are adopted to fulfil the overall aim of this study. The data collection method and the sampling procedures are explained. The questionnaire design, the pre-test questionnaire, the pilot-test questionnaire and the main questionnaire of this study are also discussed.

- Chapter 5 contains the descriptive analysis of this study's survey questionnaire respondents. The respondents' organisational and individual characteristics and presented. In this chapter the six stage assessment approach for the psychometric soundness of this study's variables is explained. More precisely, tests of reliability, validity and scale dimensionality are discussed. This analysis is designed to further justify the inclusion of the chosen variables in the subsequent model testing process.

- Chapter 6 focuses on the results of this study's structural model and the structural model procedure that was followed. The chapter begins with a discussion of the main assumptions and the main issues of the structural equation modelling technique. Then, the results of this study's hypothesis are reported. The chapter concludes with an interpretation of the hypothesis and a discussion of the implication of the results.

- Chapter 7 focuses on the discussion of the conclusions drawn from the study results and their implications. The chapter begins with a discussion of the theoretical, practical and policy implications of this study's findings. Then, the research limitations and areas for future research are discussed. The chapter concludes with an overview of this study's aim, objectives, research gaps and hypothesis proven.

Chapter 2

Literature Review

2.1 Introduction

In this chapter the main streams of literature relevant to the conceptual development are discussed. First, an overview of the Food Supply chain is given and its classifications are discussed. Second, the concepts of Sustainability, Sustainable Food, Food Chain Sustainability, and Food Security are defined and explained. Third, the concept of Post Harvest Food Loss (PHFL), the unit of analysis of this research, the need to reduce PHFL in Food Supply Chains, the different ways proposed to reduce PHFL are discussed. Fourth, the concepts of collaboration in Supply Chains and collaboration in Agricultural Supply Chains are reviewed. Finally, the different environmental turbulence factors affecting collaboration and PHFL are presented.

2.2 Overview of the Food Supply Chain

This section starts with the definitions of Food Supply Chain (FSC) and Food Supply Chain Management (FSCM). After that, it continues with the description of the food chain classifications and their unique characteristics.

2.2.1 Definition of Food Supply Chain & Food Supply Chain Management

A Supply Chain (SC) is a network of organisations involved, through the upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer (Mangan et al., 2008). The upstream SC is usually comprised of producers, manufacturers, processors, distributors, and suppliers. The downstream SC is the customer end of the SC. Food Supply Chain (FSC) is defined as a network of organisations all working together in different processes and activities to deliver food products to the market and fulfil end consumer

demand (Maloni and Brown, 2006). The FSC involves organisations responsible for the production and the distribution of vegetable or animal based products (Van der Vorst et al., 2009). Hence, Food Supply Chain Management can be defined as managing the flows of food products and information throughout the SC, to balance product movement with demand management (Olsson and Skjoldebrand, 2008).

2.2.2 Food Supply Chain Classification

FSC can be classified into three different categories which are as follows: (a) Agricultural Supply Chain, (b) Livestock Supply Chain, and (c) Food Manufacturing Supply Chain (e.g. Bourlakis and Weightman, 2004; Mena et al., 2011).

(a) Agricultural Supply Chain (ASC)

The term Agricultural Supply Chain (ASC) describes the activities from production to distribution that bring agricultural or horticultural products from the farm to the table (Aramyan and Van Gogh, 2007). ASC's are formed by organizations responsible for production (producers), distribution, processing, and marketing of agricultural products to the final consumers.

There are two different types of ASCs. The first one is the SC of fresh agricultural products, and the second one is the SC for non-perishable agricultural products (Defra, 2006). Fresh agricultural products include highly perishable crops (e.g. fresh fruits and vegetables) whose shelf-life can be measured in days, while non-perishable agricultural products are those that can be stored for longer periods of time (e.g. grains, potatoes, and nuts). ASCs have some special characteristics which differentiate them from the other FSC classifications (Foresight, 2011a). Some of those characteristics are the following: limited shelf-life, price variability, importance of quality and dependence on weather conditions (FAO, 2002). The aforementioned characteristics increase the complexity of ASCs and make it more difficult to manage them than other FSCs. Producing and managing fresh agricultural products is more complex because of their limited shelf-life and the infrastructure needed to maintain them. This study focuses on ASCs and more details about this choice can be found on Chapter 3, section 3.5.

(b) Livestock Supply Chain

The Livestock Supply Chain is the animal products supply chain and it can be separated into three categories which are as follows: diary and dairy products, white meats (i.e. pigs and poultry) and red meats (i.e. beef, mutton and lamb) (Bourlakis and Weightman, 2004).

(c) Food Manufacturing Supply Chain

The Food Manufacturing Supply Chain uses inputs from the ASC or the Livestock Supply Chain to produce consumer goods with higher added value (Defra, 2006). Usually the processed food products are not that perishable due to the conservation processes that take place (Bourlakis and Weightman, 2004).

2.3 Sustainability, Food Sustainability, Food Chain Sustainability & Food Security

As mentioned in Chapter 1 (section 1.2) food provisioning in a resource constrained world must be done in sustainable way and also world's food insecurity is one of the major challenges that FSC is facing. In relation to that, in this section the concepts of sustainability, sustainable food, food chain sustainability and food security are discussed.

2.3.1 Definition of Sustainability

The most commonly accepted definition of sustainability is that of the Brundtland commission: ". . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 8). According to Elkington (1994) sustainability includes three different components: the natural environment, the society, and the profitability which are interrelated (Elkington, 1994). By balancing the social and the environmental elements within an organisation, long-term profitability can be achieved (Dao et al., 2011). Therefore, for a particular organisation this means that people, planet and profit need to be considered as a whole in order to achieve sustainability.

2.3.2 Definition of Sustainable Food

There are different definitions about how to enable sustainable food production and what exactly this involves. Sustain (2015) defines sustainable food as the food that is produced, processed and traded in ways that:

- Contribute to thriving local economies and sustainable livelihoods;
- Protect the diversity of both plants and animals, and avoid damaging natural resources and contributing to climate change;
- Avoid damaging or wasting natural resources or contributing to climate change;
- Provide social benefits, such as good quality food, safe and healthy products, and educational opportunities.

Beer and Lemmer (2011) stated that environmental sustainability is not enough; food produced must be politically, economically, and socially sustainable. Thus, from a SC perspective, sustainable food production involves adoption of sustainability practices and consideration of other operating environment factors across the supply chain, from production to consumption.

2.3.3 Definition of Food Chain Sustainability

SustainAbility (2011) defines a sustainable FSC as a reliable, resilient and transparent, which produces food within ecological limits, empowers food producers, and ensures accessible and nutritious food for all. A sustainable FSC must meet the words need for food and also avoid adverse environmental impacts (Defra, 2006). In the HM government report the 'Food 2030' (2010) is stated that sustainable food is food that is produced, processed and distributed to feed a growing global population in ways which use global natural resources sustainably, enable the continuing provision of the benefits and services, ensure a healthy natural environment provides, promote high standards of animal and welfare, protect food safety, and make significant contribution to rural communities.

In the UK's Strategy for Sustainable Farming and Food, the Government set out the following key principles for a sustainable FSC (Defra, 2006, p.9):

- "Produce safe, healthy products in response to market demands, and ensure that all consumers have access to nutritious food, and to accurate information about food products;
- Support the viability and diversity of rural and urban economies and communities;
- Enable viable livelihoods to be made from sustainable land management, both through the market and through payments for public benefits;
- Respect and operate within the biological limits of natural resources (especially soil, water and biodiversity);
- Achieve consistently high standards of environmental performance by reducing energy consumption, minimising resource inputs, and using renewable energy wherever possible;
- Ensure a safe and hygienic working environment and a high social welfare and training for all employees involved in the food chain; Achieve consistently high standards of animal health and welfare; and
- Sustain the resource available for growing food and supplying other public benefits over time, except where alternative land uses are essential to meet other needs of society".

From all above it could be concluded that FSC sustainability is about having the resources and the capabilities in the SC to create sustainable food consistently for now and for the future by balancing all three sustainability elements (i.e. people, planet, profit).

2.3.4 Definition of Food Security

The World Food Summit (1974) was the first to define food security as availability at all times of adequate world food supplies of basic food stuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices. FAO (1983) expanded the concept as: ensuring that all people at all times have both physical and economic access to the basic food that they need. The concept of food security went from a stability and volume of production perspective to a security of access by all people. In recent times, food security is defined as a situation that exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their

dietary needs and food preferences for an active an healthy life (FAO, 1996).This definition emphasizes the consistency of having enough food based on diversified dietary needs. More precisely, in order to achieve FSC security food availability is not enough; the food produced needs to meet the person's lifestyle and cultural needs.

Food security comprises of three elements which are the following (FAO, 2006; Defra, 2009):

- Food availability (i.e. consistent availability of sufficient quantity of food);
- Food access (i.e. having sufficient resources to obtain appropriate foods for a nutritious diet);
- Food use (i.e. appropriate use of food based on knowledge of basic nutrition and care, as well as adequate water and sanitation);

Many researchers indicated that there is a link between food sustainability and food security (e.g. IFPR, 2001; Aiking and De Boer, 2004; Krejci and Beamon, 2010). According to Krejci et al. (2010) sustainable long-term food security depends on a SC's ability to protect its natural environment and enhance its inputs and its ability to produce sufficient food. By adopting environmentally-sustainable principles in food production, food security can be increased and long-term environmental sustainability could be achieved (Premanandh, 2011). Hence, without long-term food sustainability, food security could not be achieved; continuous food sustainability will lead to future food security. Preserving the inputs (i.e. raw materials) in the FSC and using them as efficiently as possible can increase food security for now and for the future. Improving food availability can increase food security (Yang and Hanson, 2009). It is important to increase the production of food to feed an ever increasing population, however it is even more important to utilise the currently produced food (i.e. available food) effectively and without wasting it. This research aims to propose new ways of utilising currently produced food that will enable PHFL reduction and thus increase food sustainability and food security.

2.4 The Issue of Postharvest Food Loss (PHFL)

The literature review for this section was conducted using both academic and grey literature, as academic literature in PHFL is limited (Wagener et al., 2012). In this section the concept of PHFL and the unit of analysis of this research are defined, the need to reduce PHFL, the different ways proposed to reduce PHFL, and PHFL reduction are discussed.

2.4.1 Definition of PHFL and Unit of Analysis

There are many different definitions about PHFL in terms of where in the SC it is happening. From the literature reviewed it was observed that food waste and food loss are used as synonyms to PHFL (Kader, 2005; WRAP, 2009; Hodges et al., 2010; Atanda et al., 2011; Williams and Wikstrom, 2011). The World Economic Forum (2011) defines PHFL as upstream loss in agriculture and transport prior to processing, and food waste as food fit for human consumption that is wasted in all further downstream parts of the SC. Other authors refer to PHFL as a decrease of edible food mass throughout the SC from farm to fork or from production to consumption which is actually similar to the aforementioned definition (Paull et al., 1997; Kader, 2005; Sharma and Singh, 2011). In some cases food waste is termed as PHFL occurring at the end of the FSC (Hodges et al., 2010; The World Bank, 2011; FAO, 2012a).

Food waste is also defined as food loss occurring during the retail, final consumption and post-consumption stages due to the behaviour of retailers and consumers (Parfitt et al., 2010; FAO, 2011; Eriksson et al., 2012). Retailers and consumers intentionally throw away food. Whereas, in other stages of the SC (e.g. production, processing) food is unavoidably lost. In this research PHFL is defined as the decrease of edible food mass that occurs from producers until reaching consumers and includes all the edible food that was lost unintentionally. While, food waste in this research is defined as intentionally spillage of edible food mass and could happen from the producers and after harvesting until post-consumption stages. Food waste is generated due to a conscious decision to discharge food. As discussed in section 1.3.1 most of the research done on PHFL has focused either at retailers or at consumers. Hence, the unit of analysis of this research is the producers, where the majority of PHFL happens (FAO, 2011). The role of producers in reducing PHFL is also supported by Food

Agricultural Organisation (FAO, 2012b). Therefore, there is a need for research regarding PHFL from the producers' perspective (i.e. local investigation).

According to FAO (2010) PHFL falls into three categories: (a) physical losses resulting from spoilage where the product is diminished by weight and/or quality, (b) opportunity or monetary losses where sales might be lost or only be made in a lower value market, and (c) external losses that fall on both the value chain participants and the rest of the society (e.g. where the chemical pesticides used to protect grain impact on the environment or human health). In this research the physical losses will be considered as they are the ones that can be directly measured.

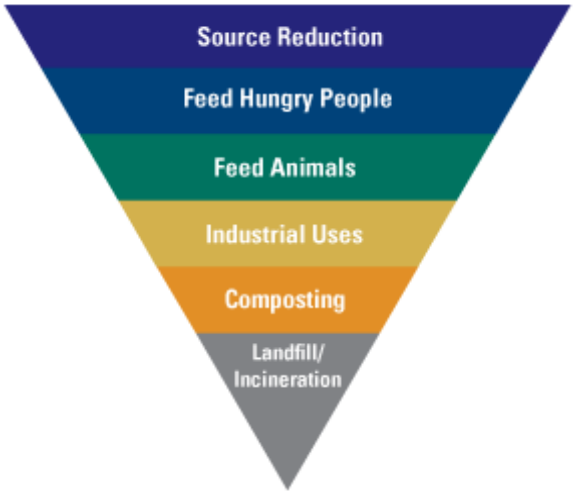
2.4.2 The Need to Reduce PHFL in Food Supply Chains

The need for PHFL reduction is not a new issue. According to Foresight (2010a) the World Food Conference in 1974 decided to reduce PHFL up to 50% by 1985 and a special action program for the prevention of PHFL was established with a technological focus (storage, on-farm). After that there is no recorded progress on PHFL reduction until 2008 when Lundqvist et al. have called for action to reduce PHFL from producers to consumers by 50% (to be achieved by 2025). In the past few years PHFL has been considered as an emerging issue in FSCs that needs to be addressed immediately (Hepker, 2014; Reuters, 2015; Lyons, 2015). Different PHFL reduction and PHFL management organisations have been established some of which are WRAP UK, Food Waste, Reduction Alliance (FWRA), and Love Food Hate Waste.

An important way to increase food supply and decrease the environmental consequences of current food production is to reduce PHFL (Godfray et al., 2010). In the Foresight report (2011a) it is stated that PHFL is a significant problem for economic, environmental and food security reasons. Although PHFL arises at every stage of the FSC, the causes of PHFL vary considerably depending on the stage of the SC. As mentioned in section 1.2, almost the 50% of food produced is wasted along the supply chain and does not reach consumers. PHFL is waste of resources used in production (e.g. land, water, energy, and crops), loss of economic value, and environmental damage (Foresight, 2011b).

Effective waste management will benefit all chain members. EPA (2011) proposed a PHFL recovery hierarchy (Figure 2.1). EPA suggests that reducing the amount of PHFL generated is the most important issue. Those that follow are: (a) feeding the hungry people, (b) feeding animals, (c) industrial uses of PHFL, (d) composting, and (e) landfill incineration.

Figure 2.1: PHFL Recovery Hierarchy (EPA, 2011)



Thus, PHFL reduction needs to be achieved as the implications of increasing PHFL levels are significant. Since reducing PHFL levels from happening is seen as a priority, different ways that could prevent it should be examined.

2.4.3 Different Ways Proposed to Address the PHFL Issue

The aim of this section is to describe the different ways that have been used so far to address the PHFL issue. Through an extensive literature review the different ways proposed so far to reduce PHFL from the producers' perspective have been identified and classified into five categories: (a) technological and infrastructural solutions, (b) industry related solutions, (c) development of alternative ways to process food, (d) development of knowledge and skills, (e) managing partners and development of collaborative relationships. The aforementioned PHFL reduction solutions are discussed below.

(a) Technological and Infrastructural Solutions

Investments in technology and technology transfer are considered to be essential for better processing of food and better management of processed food to avoid PHFL (Hodges et al., 2010; GIZ, 2012). Technological advancements in the processing and transportation of the products could diminish PHFL (e.g. Caixeta-Filho, 1999). This could involve new packaging solutions and / or innovations in cold chain logistics. Development of better infrastructure is a crucial step for reducing PHFL including creation of better warehouses and logistics development such as cold chain facilities and handling equipment (Caixeta-Filho, 1999; Choudhury, 2006; Kader, 2010).

The nature of the agricultural products requires them to be distributed on time and to be stored under the right conditions (Folinas et al., 2006; Zanoni and Zavanella, 2012). The lack of cold chain facilities or any delay in cooling of the products can result in quality deterioration or quality losses (Nunes et al., 2009). Temperature control during processing of the crops is a challenging task and fluctuating temperatures have an effect on product's quality (Brecht et al., 2003). Inadequate and improper management of cold chains leads to PHFL (Halder and Pati, 2011; Atanda et al., 2011). Perishability, shelf-life and quality variations are significantly influencing PHFL levels (Kantor et al., 1997; Paull et al., 1997; Mena et al., 2011). Both technological and infrastructural improvements are needed to enable PHFL reduction and their absence seems to be a major obstacle to achieve it.

(b) Industry related Solutions

Interventions to reduce PHFL need to consider specific market's characteristics (Shepherd, 1993). This means that interventions to reduce PHFL not only need to be technically correct, but also need to be matched with market's needs. Reducing PHFL requires consideration of the specific policy environment, matching with specific ASC market characteristics and socio-economic aspects (Tefera, 2012). Governments to eliminate any concerns about food safety, quality of food produced and transparency they are imposing new legislations (e.g. Beulens et al., 2005). Adoption and compliance with food safety and quality

standards can help to reduce PHFL (Lupien, 2008; Kader, 2010). PHFL levels found to be influenced by food safety, food quality standards and food regulations. Quality and safety standards vary considerably among and within countries this influences PHFL levels (Kader, 2010). There are many cases where supply chain entitles do not adopt and / or comply with food quality and safety standards and their products get rejected and this is how PHFL is created (Mena et al., 2011; Pruski, 2011; FAO, 2011). For example, a producer who wants to export his products in another country and his products do not comply with the food safety standards in this country (e.g. banned pesticides), the products will be rejected and all the crops will be wasted. Upstream FSC members must be well informed about the international and national food safety and quality regulations to prevent any non-compliance.

(c) Development of Alternative Ways to Process Food

Development of market institutions and formation of collective marketing groups to process unsold food are proposed as ways to reduce PHFL (Lupien, 2008; Kader, 2010). Segre et al. (2012) initiated the 'Last Minute Market' initiative that links shops and producers with unsold food to people and charities. Formation of marketing cooperatives or other forms of collaboration (e.g. clusters) are proposed as ways to increase efficiency in the distribution channels of the ASC and thus reduce PHFL (FAO, 2006; FAO, 2011; Sharma and Singh., 2011; Kader, 2010). Farmers' cooperatives might facilitate communication among farmers and increase knowledge transfer about PHFL reduction practices (Foresight, 2010b). Also, reduction of PHFL could be achieved by developing alternative ways to process food such as the creation of value adding activities (FAO, 2011). Creation of value adding activities means waste elimination either by preventing waste to happen or by converting waste into another product.

(d) Development of Knowledge and Skills

PHFL do not have only economic impacts, but also environmental and societal impacts (Bourne, 1977; Chapman, 2010). Economic impact means loss of profit, extra costs for processing (i.e. because of the pesticides used, human resources, and machinery) and losing resources that otherwise could have been sold. The

environmental impacts of PHFL are concerned with the loss of natural resources (i.e. energy, water, inputs) and with the environmental pollution (Chapman, 2010; FAO, 2012b). PHFL also have an impact on people's livelihoods by increasing the levels of undernourished people (FAO, 2011). However, the rate of reduction of PHFL is still low which probably means that upstream chain members are not aware or have not yet realised the impacts of PHFL.

On the other hand, lack of knowledge on how to handle crops and the need for training provision to upstream chain members has been recognized as a main barrier in reducing PHFL (Lupien, 2008; Hodges et al., 2010; Foresight, 2011a). ASC members lack skills in production, processing and value creation from the produce (Dani and Kanwar, 2012). Unskilled staff is a common cause of supply chain disruption and can lead to production waste (Mercantila, 1989; Vlajic et al., 2012). Except the technical skills that need to be developed, upstream ASC entities need to develop their business and marketing skills (The World Bank, 2011). Untrained farmers and old agricultural techniques impact the quality of the produce (Halder and Pati, 2011; Kitinoja et al., 2010). In order to reduce PHFL upstream chain members need to be educated and trained (Kader, 2010). Hence, ASC producers not only need to improve their technical skills, but they also need to be better organised, act collectively, and develop better marketing skills.

(e) Managing Partners and Development of Collaborative Relationships

Human management in terms of creation of formalised contractual agreements is found to accelerate PHFL reduction (FAO, 2011). Managing humans in ways that facilitate food production and simultaneously control relationships appears to be a crucial way in reducing PHFL. Another challenge that ASC's entities face is the development of collaborative relationships in order to exploit partners' capabilities and to increase the performance of the SC (Zuurbier, 1999).

Creation of learning alliances has been proposed as a way to reduce PHFL (World Bank, 2006). Learning alliances is about identifying, sharing and adapting good practices in research and development in specific contexts between research organisations, development agencies, policymakers and private business. World Bank's (2010) workshop on reducing PHFL in Africa proposed a strategy for developing communities of practice about PHFL in order to facilitate

information exchange and share knowledge about new technologies and strategies to manage crops. Collaboration between partners is important factor in achieving PHFL reduction. Establishment of producer cooperatives was proposed as a solution for PHFL reduction; producer cooperatives could handle all activities related to marketing and to production with the aim of reducing PHFL (Sharma and Singh, 2011; Kader, 2010). FAO (2006) also proposed the development of different partnerships such as clusters and cooperatives in order to reduce PHFL. Marketing cooperatives and improved market facilities should be able to reduce PHFL levels by increasing the efficiency of the distribution and the marketing channels (FAO, 2011).

Transparency in the form of information exchange and collaborative forecasting emerges as a significant way for the development of better relationships among partners. Better technology & Adoption of Collaborative Planning Forecasting replenishment (CPFR), Radio Frequency Identification (RFID), and Vendor Management Inventory (VMI) could enable PHFL reduction (WRAP, 2009; Hodges et al., 2010; FAO, 2010). Communication, coordination, cooperation, collaboration among ASC producers could significantly reduce PHFL levels (Mena et al., 2011; WRAP, 2011; Matopoulos et al., 2007; Fritz and Schiefer, 2009). Coordination involves more efficient communication among partners with regards to how they should work and act together (Lozano, 2007). Cooperation is about sharing goals and objectives, while collaboration involves creating common plans and sharing responsibilities (Denise, 1999). Collaboration among food chain members is speculated to be an initial step to address key factors contributing to PHFL (Mena et al., 2011). Better relations and collaborative action could enable reduction in PHFL (WRAP, 2011). Better collaboration between suppliers and retailers speculated to be a starting point to deal with the majority of root causes of PHFL (Mena et al., 2011; WRAP, 2011; Matopoulos et al, 2007; Fritz and Schiefer, 2009). In WRAP's (2011) recent report 'Reducing Food Waste through Retail Supply Chain Collaboration' is stated that better supplier - retailer relations and collaborative action could reduce PHFL.

2.4.4 Proposed Ways for PHFL Reduction in this Research

There is limited information in the academic literature on how to reduce and prevent PHFL in the upstream SC (Parfitt et al., 2010). Different ways have been

proposed to reduce PHFL in the upstream SC such as development of better infrastructure and storage facilities, adoption of new technologies (e.g. CPFR, RFID, VMI), provide training to chain members, investment in cold chain facilities and handling equipment and formation of cooperatives (Choudhury, 2006; FAO, 2010; Hodges et al., 2010; Kader, 2010).

There is a focus on technological and infrastructural interventions for PHFL reduction (IGD, 2008). However, even when technological interventions are made they will not be sustainable if there is no change in the behaviours of the people who use the technologies (Andraski and Novack, 1996; Gattorna, 2006). Past research on PHFL is also focused on behavioural change of consumers in order to reduce PHFL in the downstream supply chain (Parfitt et al., 2010). However, the key factors contributing to PHFL are not only related to consumers' behaviour, but also to the lack of coordination among the different actors in the upstream SC (FAO, 2011). Previous research on PHFL reduction is also focused on single point interventions in the SC: producer level, retailer level and consumer level (Stuart, 2009; The World Bank, 2011). Chapman (2010) referred to PHFL as a shrinkage problem and characterised it as a 'complex' problem that needs to be addressed in a collaborative manner involving wide range of stakeholders to get different perspectives and deliver holistic solutions. Thus, single point interventions for PHFL reduction do not seem appropriate. The interventions proposed to reduce PHFL in the upstream SC until now mainly facilitate coordination, collaboration and transparency among FSC members. Recent research showed that better supplier-retailer relations and collaborative action could possibly reduce PHFL (WRAP, 2011). Other researchers suggested that better and closer collaboration between suppliers and retailers can be a starting point to deal with the majority of root causes of PHFL (Mena et al., 2011). Improved coordination or collaboration among FSC members and particularly among upstream chain members will impact and possibly reduce PHFL levels (Stuart, 2009; World Economic Forum, 2011). Therefore, increased levels of collaboration could have a positive impact on PHFL reduction.

2.5 Collaboration in Supply Chains & Agricultural Supply Chains

A range of conceptual definitions have been used to define collaboration or else supply chain collaboration. Collaboration is defined as "two or more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits which result from greater profitability of satisfying end customer needs than acting alone" (Simatupang and Sridharan, 2002, p. 258). Collaboration has also been defined as fundamental agreement among supply chain partners to integrate their resources for mutual gain (Bowersox et al., 2003). Humphries and Wilding (2004) defined collaboration as working jointly to bring resources into a required relationship to achieve effective operations in harmony with the strategies and objectives of the parties involved, thus resulting in mutual benefit. The above definitions highlight the need for resource sharing and process sharing for higher profits and better satisfaction of customers' needs. Collaboration is not only about exchanging information and products but also exchange of people and resources (Ziggers and Trienekens, 1999). It has been observed that there is a change in the relationships among SC partners from arms-length transactions to collaborative relationships (Daugherty, 2011). Hence, SC partners started to share more resources, capabilities and processes with their business partners.

There are many benefits for SC partners achieving collaboration, some of which are the following: information exchange, improved planning and support, joint problem solving, gain of competitive advantage, reduced costs and reduction of negative bullwhip effect (Singh and Power, 2009; Daugherty, 2011). Closer collaboration can reduce business uncertainty, give access to resources and increase business productivity (Wilson, 1996; Dyer and Singh, 1998). Firms enter in a relationship to extend their resources and acquire skills from their business partners (Sambasivan et al., 2013). However, there are many cases where firms struggled or failed to achieve collaboration and get its expected benefits (Kampstra et al., 2006; Fawcett et al., 2010). There are a number of challenges mentioned in the literature as impediments in achieving collaboration. The main barriers associated with collaboration are the following: difficulties in implementation, over-reliance on technological solutions for collaboration, failure to differentiate with whom to collaborate with, and lack of trust between trading partners (Barratt, 2004; Ramesh et al., 2008).

Collaboration can be achieved in different forms such as vertical and / or horizontal and external and / or internal collaboration (Barratt, 2004). Vertical collaboration involves internal and external collaboration with customers and suppliers respectively. Horizontal collaboration involves internal collaboration, but also external collaboration with competitors and other organisations. Internal collaboration refers to an organisation's collaborative culture (e.g. existence of elements of trust and commitment). Organisations need first to be internally aligned and then to collaborate externally with suppliers, other institutions and customers (Van Hoek and Mitchell, 2006). A common case with internal collaboration is the dilemma arising between decisions to be made for the interest of all chain partners and / or the individual firm (Simatupang and Sridharan, 2002). External downstream collaboration involves customer relationship management, while external upstream collaboration involves supplier management.

Each entity in SC might collaborate in different levels; not all partner relationships need to be involved in high levels of collaboration (Holweg et al., 2005). Collaboration requires resources and effort from all partners (Whipple and Russell, 2007). Organisations do not need to collaborate closely with everyone in their SCs; they rather focus on a small number of strategic partners (De Leeuw and Fransoo, 2009). However, there is a dilemma with whom and in what level to collaborate with partners; collaborating internally, with customers, with suppliers, with competitors, with governments and / or other institutions.

There are different types / levels of collaboration such as transaction collaboration, cooperative collaboration and cognitive collaboration (Whipple and Russell, 2007; Vlachos et al., 2008). Transaction collaboration involves simple communication and partners exchanging data, while cooperative collaboration involves partners sharing data, processes and setting common supply chain objectives. Cognitive collaboration requires higher levels of involvement as partners work together in joint planning and decision making. In order to determine what level of collaboration is needed for a specific chain or a specific problem first the current levels of collaboration need to be assessed then ways to improve collaborative efforts / practices need to be identified (Simatupang and Sridharan, 2002). This research is focussed on the external upstream,

relationships of ASC producers with their buyers. Through this research the different levels of collaboration in the EU ASC will be assessed.

In order to solve common agricultural problems and natural resource problems ASC partners need to exploit, combine and compliment each others capabilities and work together (Pretty, 2008). There is need to develop knowledge and capabilities of ASC entities with regards to the food safety, and food quality standards to increase the productivity and efficiency of the chain (FAO, 2011; Kitinoja et al., 2010; Marucheck et al., 2011; Dani and Kanwar, 2012). A main challenge in ASCs is to develop collaborative relationships and through this to exploit partners' capabilities in order to increase the performance of the ASC (Zuurbier, 1999). Except the technical skills that need to be developed, upstream ASC entities need to develop their business and marketing skills (The World Bank, 2011). Creation of learning alliances has been proposed as a way to reduce PHFL (World Bank, 2006).

ASC entities seek to collaborate with their partners as they realise that working together can get them substantial benefits which cannot be achieved by operating alone (Matopoulos et al., 2007). Enhancing collaboration levels in ASCs has been seen as a source of competitiveness (Reynolds et al., 2009). Moreover, as discussed previous sections (sections 1.3.1 and 2.4) the possible relationship between collaboration and PHFL has been speculated. PHFL is a major challenge for ASC entities. Although ASC literature suggests that SC entities moved towards greater collaboration to deal with the new and upcoming challenges, it is not clear what are the appropriate collaboration practices and activities that will enable PHFL reduction. Therefore, this research aims to ascertain the relevant collaboration practices and activities that need to be employed by ASC producers to achieve PHFL reduction. The existent collaborative practices and activities employed by the ASC producers and their buyers will be also assessed in this research.

2.6 Environmental Turbulence Factors Affecting Collaboration & PHFL

Organisational environments change and organisations must adapt to the new environmental conditions to survive and prosper (Fritz and Schiefer, 2009). There have been many changes in the EU ASC's environment related to globalisation,

changing consumer attitudes and concerns, changing markets, increased competition, new technologies, commodity price fluctuations, demand for environmental sustainability, changes in food safety and quality standards and regulations, reformulation of the EU Common Agricultural Policy (CAP) (Ziggers and Trienekens, 1999; Bourlakis and Weightman, 2004; Reynolds et al., 2009; Van der Vorst et al., 2009; Spence and Bourlakis, 2009; Foresight, 2011a; Foresight, 2011b). The aforementioned changes in the ASC's environment shifted chain members towards closer collaboration (Matopoulos et al., 2007; Schiemann, 2007). In order to remain competitive, ASC partners need to collaborate closer and adapt to the changing environmental conditions (Ziggers and Trienekens, 1999; Smith, 2007). As mentioned in section 1.3.2, the EU ASCs environment can be characterised as a highly turbulent environment. The changes in the ASC environment require partners to develop and/or acquire new skills and capabilities. In order to understand the collaboration - PHFL relationship an understanding of the contextual factors that influence this relationship is needed.

Many authors investigated the importance to consider and study the context where a firm / organisation operate (Webster, 2002; Robertson and Chetty, 2000). Numerous studies identified different factors that should be considered when we study SCs in different contexts and settings (Ziggers and Trienekens, 1999; Saccani and Perona, 2007). Barratt (2004) stated that in order to define collaboration it needs to be put in a specific context. Specific contextual factors can influence the choice of collaboration levels in SCs (Danese, 2011). The intensity of collaboration in ASCs can be influenced negatively or positively by the nature of the products, the sector's structure, and the business environment (Matopoulos et al., 2007; Fischer et al., 2008; Fischer et al., 2010). Technological, regulatory and financial reasons in ASCs are shifting organisations towards greater collaboration (Hobbs and Young, 2000). Matopoulos et al. (2007) found that industry's structure and product's characteristics in ASCs hinder collaboration. Hence, different contextual factors could influence positively or negatively the collaboration levels in ASCs.

Governments in order to eliminate any concerns about food safety, food quality and transparency they are imposing new legislations (Beulens et al., 2005).

Sector specific regulations regarding food safety and quality standards are continuously changing causing turbulence in partners' relationships (Fischer et al., 2008). Specific ASC industry characteristics such as regulatory environment, competition and socio-economic changes influence the closeness of collaboration among business partners (Fischer et al., 2008). In response to the ASC challenges there is a need for models that include more realistic features such as the regulatory environment and quality and security of products (Ahumada and Villalobos, 2009). Companies fail to comply with the new food safety and quality standards; as the costs for certification and accreditation are increasing posing difficulties for companies under recession times (Trienekens and Zuurbier, 2008). The competitive environment of an organisation will also influence SC relationships (Christy and Grout, 1994). Competition in EU ASCs has been increased and SC entities need to respond fast to recent changes to keep up with competition (Ruteri and Xu, 2009). As discussed in section 1.3.2, PHFL levels are also influenced by exogenous and endogenous environmental factors; it was found that PHFL levels are sometimes caused due to legislation, food safety and food quality standards (Kader et al., 2010; Paull et al., 1997).

There are several studies addressing the impact of product characteristics on SC strategy and supply chain design (e.g. Fisher, 1997). The nature of the exchanged product will determine the choice of the relationship type (Webster, 2002). ASCs have some special characteristics that need to be considered to manage it effectively (Fritz and Schiefer, 2009; Zanoni and Zavanella, 2012; Luning et al., 2011). The special characteristics of the ASC are related to its structure, business environment and product characteristics (Reiner et al., 2004; Matopoulos et al., 2007). Luning et al. (2011) found that the contextual factors affecting FSCs depend on the product, process, organisational and SC characteristics. Zahra and Covin (1995) classified the contextual influences of ASCs in two categories: internal factors (i.e. organizational structure, culture, and systems), and external factors (i.e. operating environment, globalization, market, and governmental regulations). Therefore, when studying ASCs not only the nature of the product exchanged, the pattern of demand for it and the complexity of the network needs to be considered, but also regulatory, market, operating environment and specific SC characteristics.

Environmental turbulence is about changes in the operating environment of an organisation (see section 1.3.2). Those changes are related to technology, competition, regulations, and customer level changes (Calantone et al., 2003; Kuivalainen et al., 2004). There are two types of environmental turbulence in SCs: endogenous and exogenous (Van der Vorst, 2000; Trkman and McCormack, 2009). As mentioned earlier (section 1.3.2) the EU ASC environment could be characterised as a highly turbulent operating environment. Thus, by identifying the relevant environmental turbulence factors in the EU ASC a better understanding of the specific context could be achieved. The contextual factors of the collaboration - PHFL relationship will act as moderators as they will possibly enhance our understanding of the relationship between the two constructs (Walsh et al., 2008). The contextual influences that will be identified in this research will possibly influence both the strength and the form of the collaboration - PHFL relationship. Further research is required to ascertain the relevant environmental turbulence factors in the specific context of study.

2.7 Chapter Summary

The purpose of this chapter was to provide an overview of the literature relevant to the conceptual development for this research study. First, an overview of the food supply chain was given and its classifications were discussed. Second, the concepts of sustainability, sustainable food, food chain sustainability, and food security were defined and explained. Third, the concept of PHFL, the unit of analysis in this research, the need to reduce PHFL in food supply chains, the different ways proposed in the literature to reduce PHFL, and suggested ways for PHFL to be studied in this research were discussed. The concepts of collaboration in supply chains and collaboration in agricultural supply chains were also reviewed. Finally, the need to consider environmental turbulence factors / contextual factors in the collaboration - PHFL relationship was discussed.

To narrow down the information explained via the literature review and assist towards addressing the identified research gaps in this work, a conceptual framework is proposed in the chapter that follows. To complement the literature review, a preliminary study was conducted in the Chapter 3 (section 3.3). Both implementation procedure and findings are discussed.

Chapter 3

Conceptual Framework and Hypothesis Derivation

3.1 Introduction

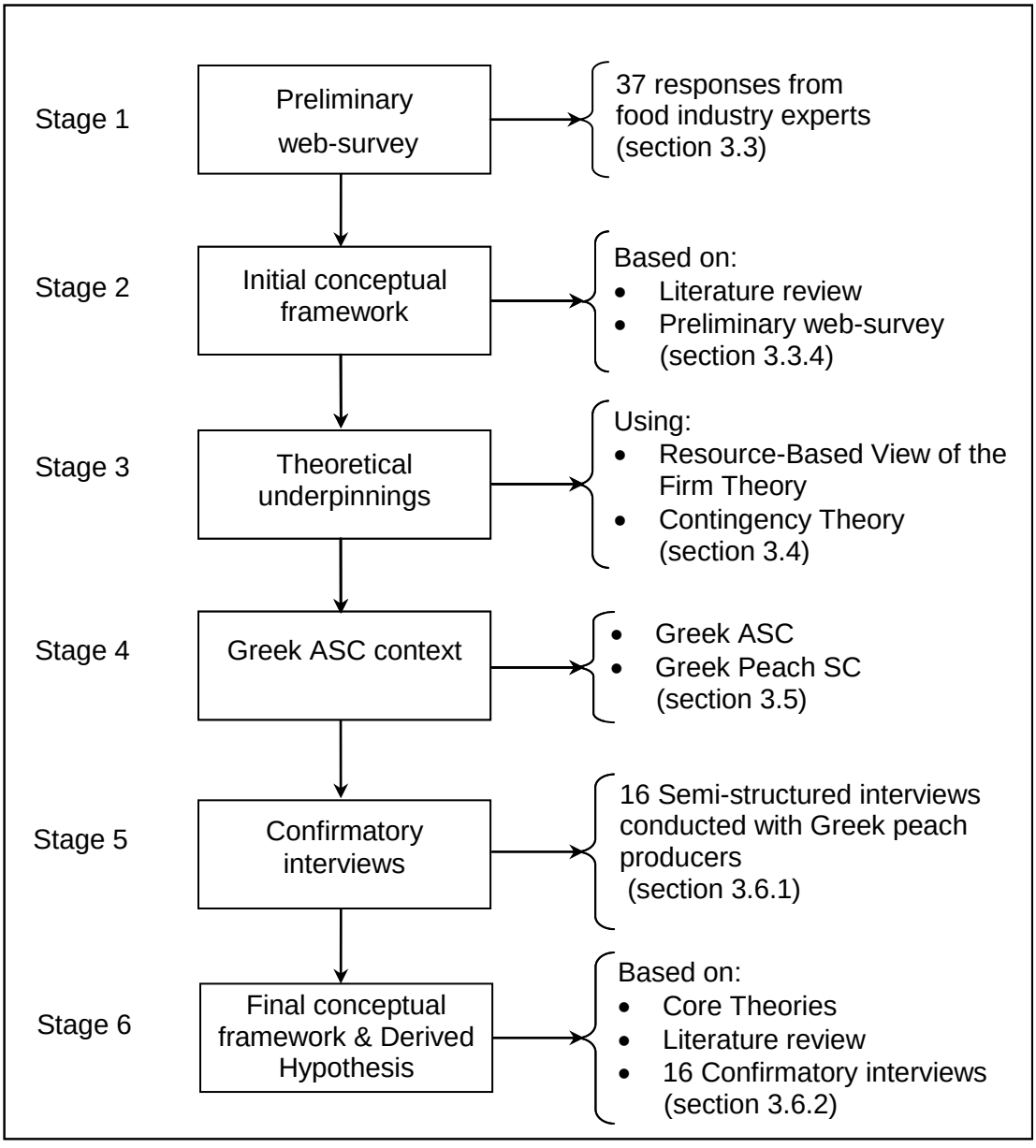
The aim of this chapter is to explain the process that was followed in order to develop this study's conceptual framework and hypothesis. A preliminary investigation that was conducted in this research is discussed and an initial conceptual framework is proposed. Core theories deployed to develop the conceptual framework are explained and the main characteristics of the Greek ASC and the Greek Peach SC are also presented. Interviews that were conducted for the purposes of validating of the proposed conceptual framework and the procedure employed are also presented. Finally, the conceptual framework is revised and the hypotheses are derived.

3.2 The Conceptual Framework Development & Hypothesis Formulation Process

The conceptual framework and hypothesis formulation process of this research is presented in Figure 3.1 as a six-stage process. In Stage 1, preliminary web-survey questionnaire is deployed to food industry experts to further explore the possible relationship between collaboration and PHFL. In Stage 2, based on the literature review and on the findings from the Stage 1 a conceptual framework of this research is proposed. In Stage 3, the theoretical underpinnings (i.e. Resource-based View of the Firm and Contingency Theory) of this research are discussed. In Stage 4, the specific context of this research is outlined. This includes the Greek ASC and in particular the Greek Peach SC. In Stage 5, sixteen semi-structured interviews were conducted with Greek Peach producers for the purposes of validating the proposed conceptual framework validation. In

Stage 6 and based on the core theories discussed in Stage 3, the literature reviewed, and the confirmatory interviews a final conceptual framework is proposed and the hypotheses of this research are discussed.

Figure 3.1: Six stage process for Conceptual Framework and Hypotheses Formulation



3.3 Preliminary Investigation

The literature review, as discussed in Chapter 2, revealed that the topic of PHFL is largely under-explored in the academic research. In order to fulfill the overall aim of this research and in particular the first research objective (i.e. to explore

the possible relationship of collaboration with PHFL), a preliminary investigation was conducted. A web-survey questionnaire was deployed to food industry experts in order to identify whether collaboration could be an enabler or barrier to PHFL reduction. This stage is key for this research and will help towards addressing all the remaining objectives of this study.

3.3.1 Overall Design of the Web-Survey Questionnaire

Based on the key factors contributing to PHFL (Despoudi et al., 2012), the respondents were asked to choose whether they agree or disagree with the factors listed as barriers and enablers to reduce PHFL. The different factors that were considered as barriers and enablers to PHFL are the following: (a) financial incentives to producers, (b) knowledge about how to reduce PHFL, (c) technology, (d) appropriate regulations and policies for PHFL reduction, (e) collaboration among business partners.

3.3.2 Data Collection Method and Sample

A web-survey questionnaire was deployed via 'surveymonkey' (i.e. on-line software for survey development) to respondents within the FSC. The survey questionnaire was posted in four LinkedIn groups related to PHFL and FSC management with 110 members in total. Out of the 110 members, 37 answers were received which accounts for 50.6% response rate. The two guiding research questions for the survey questionnaire development were the following:

- Is collaboration perceived as a barrier towards reducing PHFL?
- Is collaboration perceived as an enabler towards reducing PHFL?

The preliminary qualitative study conducted was according to Loughborough University's ethical guidelines for the following reasons: (a) the objectives of the study were clearly explained to the respondents, (b) confidentiality and anonymity was provided for all the respondents participating in the study, (c) the results of the survey questionnaire were offered to all participants, (d) respondents were made aware of their right to withdraw from the study at any stage for any reason.

3.3.3 Findings

The respondents were producers, processors, manufacturers, retailers, consultants and managers from the food sector. Participants of the conducted web-survey were based in India (45.2%), Europe (25.8%), Eastern Europe (6.5%), South East Asia (6.5%) and Africa (6.5%). 15 out of the 37 respondents were from small companies with less than 50 employees. In addition, 48 food industry experts attempted the questionnaire out of which 37 filled it in completed it, therefore the 11 questionnaire were eliminated.

The questions were formed in a 5-point Likert scale format. The respondents were asked to choose whether they agree or disagree with the factors listed out as barriers to reduce PHFL. Table 3.1 shows the different barriers in reducing PHFL and the different ranking for each factor. The results were depicted in three columns instead of five as the purpose of this questionnaire was to identify barriers and enablers.

All the factors identified as possible barriers of PHFL through the literature review, ranked as major barriers in achieving PHFL reduction. More precisely the rankings are as follows: lack of financial incentives (48.6%), lack of knowledge on how to reduce PHFL (62.1%), lack of appropriate technology (59.4%), lack of appropriate regulations and policies for PHFL reduction (62.1%), lack of collaboration among business partners (63.4%). Thus, lack of collaboration among business partners found to be perceived as the key barrier in achieving PHFL reduction.

Table 3.1: Key barriers in Reducing PHFL

Barriers in reducing PHFL	Disagree (%)	Maybe (%)	Agree (%)
Lack of financial incentives	29.7	21.7	48.6
Lack of knowledge how to reduce PHFL	16.7	21.6	62.1
Lack of appropriate technology	13.5	27	59.4
Lack of appropriate regulations and policies for PHFL reduction	13.6	24.3	62.1
Lack of collaboration among business partners	9.3	27.3	63.4

Table 3.2 shows the results for the key enablers for PHFL reduction. The key enablers in reducing PHFL, as identified in the literature, are rated as high impact factors with the following rankings: provision of financial incentives (62.5%), training provision about how to reduce PHFL (81.3%), investments in technology (75%), adoption of regulations and policies for PHFL reduction (65.5%), and better collaboration among business partners (71.9%). However, from Table 3.2 it can be seen that if maybe and agree columns are added the collaboration is the most important enabler of PHFL reduction. Therefore, collaboration was agreed to be one of the key enablers in reducing PHFL. However, further research should be conducted in this area to confirm these findings. This is because those who are registered LinkedIn users may be keener on collaborations.

Table 3.2: Key enablers in Reducing PHFL

Enablers in reducing PHFL	Disagree (%)	Maybe (%)	Agree (%)
Provision of financial incentives	15.6	21.9	62.5
Training provision about how to reduce PHFL	9.2	9.5	81.3
Investments in technology	9.4	15.6	75
Adoption of regulations and policies for PHFL reduction	18.8	15.6	65.6
Better collaboration among business partners	6.2	21.9	71.9

3.3.4 Initial Conceptual Framework

Previous research on PHFL reduction has focused on single point interventions in the SC i.e. producer level, retailer' level and consumer level (Stuart, 2009; The World Bank, 2011). Research about collaboration in the FSC has mainly focused on dyadic relationships such as producer-processor, manufacturer-retailer, supplier-retailer (Matopoulos et al., 2007; Vlachos and Bourlakis, 2006; Vlachos et al., 2008; Leat and Revoredo-Giha, 2008). The web-survey questionnaire responses indicated that collaboration among SC partners could enable PHFL reduction, while its absence found to be a considerable barrier towards PHFL reduction. Although collaboration has been proposed as a way to address the PHFL problem, no theoretical or empirical research has been undertaken in terms of examining the potential relationship between collaboration and its impact

on PHFL. Given the lack of academic research and in especially the lack of empirical research in the PHFL literature and the lack of exploration in the collaboration - PHFL relationship implies that this research topic is both underexplored and fruitful for further study. Figure 3.2 presents the proposed conceptual framework of this research showing the collaboration - PHFL relationship.

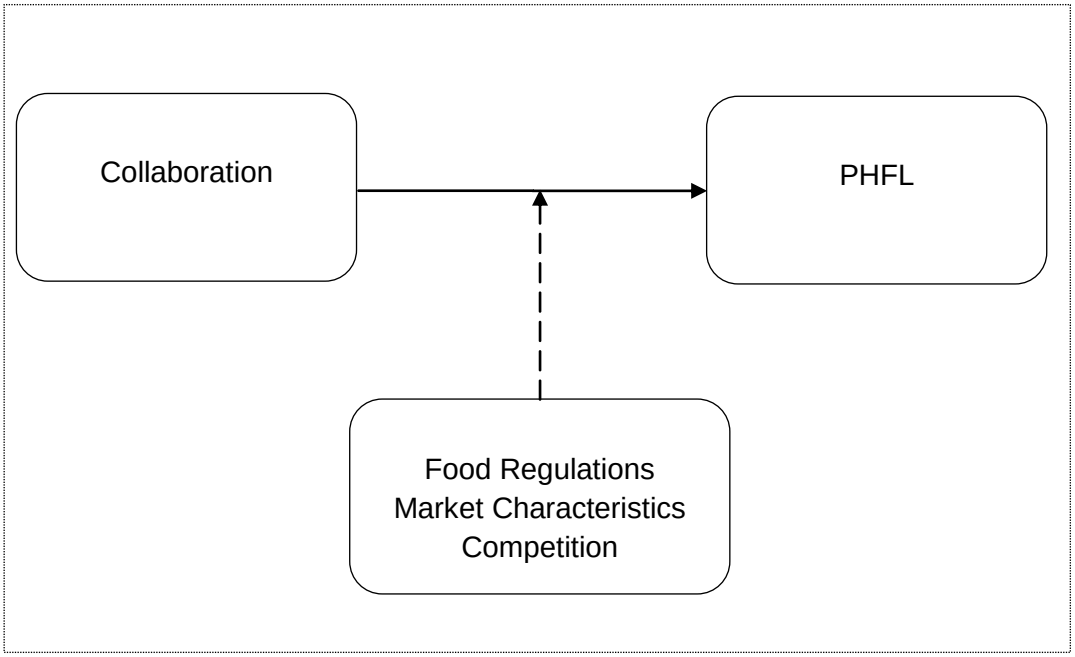
Additionally, through the preliminary investigation food regulations and policies found to be major barriers and enablers in reducing PHFL. Governments to eliminate any concerns about food safety, quality of food produced and transparency are imposing new regulations (Beulens et al., 2005). Sector specific regulations regarding food safety and quality standards are continuously changing causing turbulence in partners' relationships (Fischer et al., 2008). Specific ASC industry characteristics such as regulatory environment, competition and socio-economic changes could influence the closeness of collaborative relationships (Fischer et al., 2008). In response to ASCs challenges there is a need for models that include more realistic features such as the regulatory environment of the products (Ahumada and Villalobos, 2009). Companies fail to comply with the new food safety and quality standards, as the costs for certification and accreditation are increasing making it harder for them under recession times (Trienekens and Zuurbier, 2008). Adoption and compliance with food safety and quality standards can help to reduce PHFL (Lupien, 2008; Kader, 2010). However, food quality and food safety standards vary considerably among and within countries this impacts PHFL levels (Kader, 2010). There are many cases where SC entitles do not adopt and comply with food quality and food safety standards and their products get rejected (Mena et al., 2011; Pruski, 2011; FAO, 2011). Therefore, food regulations could influence the level of collaboration within the SC and PHFL levels.

The competitive environment of a firm and / or organisation will also influence SC relationships (Christy and Grout, 1994). Competition in ASCs has been increased and SC entities need to respond fast to any changes to keep up with competition (Ruteri and Xu, 2009). Interventions to reduce PHFL need to consider the specific market characteristics (Shepherd, 1993). This means that interventions to reduce PHFL not only need to be technically correct, but also need to be matched with a

specific market's needs. Reducing PHFL requires cooperation among chain members, consideration of the policy environment, ASC market characteristics and socio-economic causes (Tefera, 2012). Thus, competition and specific market characteristics could have an impact on PHFL. Since regulations, market characteristics and competition could possibly impact both collaboration and PHFL, the latter factors will be included in this study's conceptual framework.

The proposed conceptual framework, as seen in Figure 3.2, includes food regulations, competition and market characteristics were included to be further examined in relation to the negative relationship between collaboration and PHFL. Although this framework has been derived based on the results received through the preliminary web-survey, further work needs to be done for validating it.

Figure 3.2: Initial Proposed Conceptual Framework



Note:

Negative direct relationship ——→

Possible moderating relationship – – – –→

3.4 Theoretical Underpinnings

This section starts with an introduction to the need of using core theories to study the collaboration - PHFL relationship and its contextual influences. Then, the core theories adopted for this research are discussed.

3.4.1 The need of Core Theories to study the Collaboration-PHFL relationship & its Contextual Influences

Carter (2011) highlighted the need to develop context specific theories in SCM field. Theoretical development should be based on grounded understanding of real-world problems to provide novel contributions to theory and practice (Holweg, 2011). PHFL is a real-world problem that is unexplored within academic literature. Drawing upon Skilton (2011), Rindova et al. (2011), Whetten (1989) and Wacker (1998) who talk about theory development, the different theories that could be used to study the collaboration-PHFL relationship and its contextual influences will be discussed next.

There is a need to integrate multiple theoretical perspectives to explain SCM issues (Choi and Wacker, 2011). Using multiple theoretical perspectives enables the theorist to build bridges between different perspectives which lead to theoretical integration; the complexity of real-world problems stretches the need for development of multiple-lens of explanations (Okhuyen and Bonardi, 2011). The complexity of upstream ASC partners' relationships, the PHFL issue, and their contextual influences indicate that different theories need to be used in order to study these efficiently. In this research two different theories are proposed to study the aforementioned relationships: (a) the Resource - based view of the firm (RBV) theory, and (b) the Contingency theory (CT). Using core theories to investigate the aforementioned relationships will enable the researcher to set boundaries on the constructs studied (Ketchen et al., 2011), as well as develop propositions for empirical testing.

3.4.2 Resource-Based View of the Firm Theory

Different theories have been used to define, explain and describe collaboration in supply chains such as Transaction Cost Economics (TCE), Resource Dependence Theory (RDT), Resource Based View (RBV), and Contingency

Theory (CT) (e.g. Hobbs and Young, 2000). According to TCE an organization collaborates with others in order to achieve efficiency through reduced transactional costs (Gray and Wood, 1991). Furthermore, RDT argues that organizations are constrained and affected by their environments and thus they act to attempt to manage resource dependencies (Hillman et al., 2009). RDT characterizes the links among organizations as a set of power relations based on exchange resources (Pfeffer et al., 1978). However, in this research it is argued that the collaboration - PHFL relationship may be better conceptualized using both Resource - based view of the firm (RBV) and Contingency theory (CT) theories.

The RBV theory suggests that partners will enter a collaborative relationship to access and acquire resources, skills and knowledge from their partners (Sambasivan et al., 2013). The RBV argues that resources and capabilities provide firms with a competitive advantage that allows them to take advantage of opportunities and avoid threats in their operating business environment (Wernerfelt, 1984; Barney, 1991). Resources can be physical resources, human capital resources and organisational capital. Human capital resources can be the experience, the judgement and the intelligence of the workers in a firm (Barney, 1991). Lavie (2006) argued that a firm's competitive advantage depends both on organisational resources, but also on the relative partners' resources.

The drivers of change in EU ASCs require upstream chain entities to develop and / or acquire new skills and knowledge in order to create new competences (Joshi et al., 2009). Training provision to ASC partners is needed to bridge the gap between local norms and international expectations (Roth et al., 2008). ASC entities seek to collaborate with their partners as they realised that working together can get them substantial gains which cannot be achieved by operating alone (Matopoulos et al., 2007). Enhancing collaboration levels in ASCs is seen as a source of competitiveness (Reynolds et al., 2009). Barratt (2004) stated that in order to define collaboration it needs to be put in a specific context. Specific contextual factors can influence the choice of collaboration levels (Danese, 2011). The intensity of collaboration in the ASC can be influenced negatively or positively by the nature of products, sector's structure, business environment (Ziggers and Trienekens, 1999; Fischer et al., 2010). Technological, regulatory

and financial reasons in ASCs are shifting organisations towards greater collaboration (Hobbs and Young, 2000).

Using the RBV theory is this study, collaboration in ASCs is defined as interactions among partners to manage, access and integrate resources, knowledge and skills to fulfil demand in a way that could not be achieved by acting alone. Those interactions could range from transactional to collaborative and could contain different elements: partners' size, intensity, scope, maturity. Collaboration among producers and their business partners will be influenced from the relative resources, skills and knowledge their partners possess. If for example producers or processors lack of knowledge and skills about food safety standards or about handing the crops the other partner might not want to collaborate closely. This has to do with the existence of inter-organisational capabilities, but also with the perceptions about partners' capabilities. RBV in this research is used to study the perceptions of ASC producers about collaborative relationships with their buyers and how this could impact their business performance (i.e. PHFL).

3.4.3 Contingency Theory

According to CT there is no best way to organise and that solutions are situational depending on the different environmental conditions (Wright and Ashill, 1996). CT recognises that solutions are situational rather than absolute and that they may become inappropriate under different environmental conditions (Wright and Ashill, 1996). CT aims to identify organisational designs or structures (i.e. the patterns of interactions among individuals) that promote organisational adaptation to environmental, technological and information processing contingencies (Zeithalm et al., 1988).

CT involves identification of three variables: (a) contingency variables which represent situational characteristics usually exogenous to the organisation,(b) response variables which is about organisational actions taken in response to current or anticipated contingency factors and (c) performance variables which are about the relative match between the contingency and response variables (Zeithalm et al., 1988). Firms that have a match with their environment can improve their performance easier than firms with a mismatch (Miles and Snow,

1974). However, not all contextual factors that exist within a specific operating environment will impact an organisation's effectiveness (Donaldson, 2001).

Environmental turbulence has been described as an important contingency factor of an organisations external environment (Glazer and Weiss, 1993; Robertson and Chetty, 2000). Environmental turbulence in the SC can be classified in terms of its origin, as endogenous (within a chain) and exogenous (from the outside environment) turbulence or uncertainties (Trkman and McCormack, 2009; Van der Vorst, 2000). Endogenous turbulence can be measured by studying the different environments in which a firm operates in terms of competitors, market, technological and regulatory turbulence (Cadogan and Paul, 1999). Exogenous turbulence involves discrete events (e.g. terrorist attacks, workers strikes, contagious diseases) and continuous uncertainties (e.g. price changes, weather changes, political changes; Trkman and McCormack, 2009). When there is high environmental uncertainty, partners will move towards closer collaboration (Wong et al., 2008; Danese, 2011). Closer collaboration can reduce business uncertainty, gain access to resources and increase organisational productivity (Dyer and Singh, 1998). Organisations enter in a relationship to extend their resources and acquire skills from partners (Sambasivan et al., 2013). Thus, the intensity of collaboration will be influenced by the relative environmental uncertainty and the relative resources and skills that a business partner possesses.

CT is this research is used to identify and study the relevant contextual factors (i.e. environmental turbulence factors) of the EU ASC operating environment that could possibly impact the collaboration - PHFL relationship.

3.4.4 Integration of Theories

The RBV theory suggests that organisations enter a collaborative relationship to access and acquire resources, skills and knowledge from other organisations (e.g. Sambasivan et al., 2013). The RBV argues that resources and capabilities provide firms with a competitive advantage that allows them to take advantage of opportunities and avoid threats or uncertainties in their business environment (Wernerfelt, 1984). Resources are all assets, capabilities, organisational processes, knowledge and capabilties controlled by an organisation that enable

the organisation to identify and implement strategies that improve its efficiency and effectiveness (Barney, 1991, p.101). RBV in combination with CT could be used to identify the relevant environmental contigencies that could possibly influence organisational actions (Hillman et al., 2009). In this research, the collaboration - PHFL relationship and the contextual factors that possibly impact this relationship are seen from a RBV and CT perspective, as ASC producers will seek to collaborate closer with their partners to access and acquire resources, capabilities and skills to improve their performance and reduce any uncertainties in their operating environment.

3.5 The Greek Agricultural Supply Chain

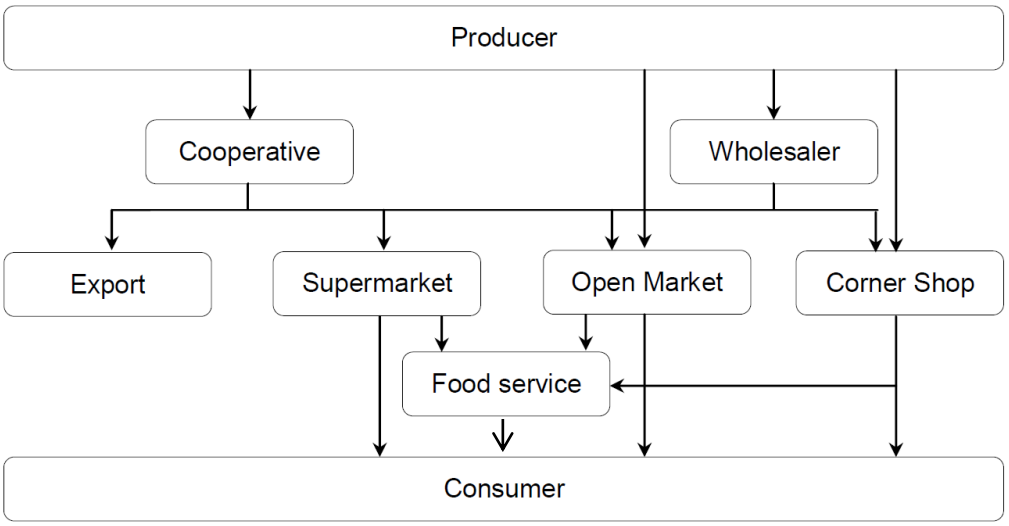
The EU has set a target of reducing PHFL levels by half until 2030 (European Union, 2016). Hence, the Greek ASC was chosen as a representative ASC of all the different EU ASCs for the sampling purposes of this research. According to Eurostat (2012) 1.2 million people were working on Greek farms in 2010 which is one of the largest agricultural labour forces within the EU-28 and in 2010 there were 723,010 agricultural holdings in Greece. Although 94,050 farms ceased their activity between 2000 and 2010, Greece was one of the EU Member States with the largest number of holdings in 2010 (Eurostat, 2015). Greek agricultural land consists 51% of arable land which is essentially made up of cereals (29%), industrial crops (7.6%), fodder crops (6.4%) and fallow land (4.3%). The Common Agricultural Policy (CAP) reform, first implemented in 1992, aimed to enhance the sustainability of the EU farming system through common policies (CAP, 2012). However, there have been many criticisms of the CAP reform regarding the expected benefits, its effectiveness and its cost to the EU budget (Jeffery, 2003; BBC, 2013). In Greece, the number of holdings practising organic farming increased dramatically between 2000 and 2007 from 1,460 to 27,700 (Eurostat, 2015). In 2010, however this almost halved to 14,530 farms, accounting for 2.0% of the country's holdings (Eurostat, 2015). This is because many producers do not seem to fully understand the system or are unwilling to comply with the organic farming regulations (Galanopoulos et al., 2006).

Fruit and vegetables, along with olive oil and wheat constitute a large part of the national agricultural economy in Greece, expressed in terms of employment,

production area, volume and value (Kaditi, 2010). The most important vegetables in terms of production are tomatoes, potatoes and asparagus. The most important fruits are grapes, peaches, oranges, apples and watermelons (Kaditi, 2010). Greece is the fourth largest producer of fresh agricultural products in Europe (Lemanowicz and Krukowski, 2009). The majority of production of fresh agricultural products in Greece is based in Macedonia, Sterea Ellada, Peloponnese, Thessaly and Crete. Fresh agricultural products are the main exporting agricultural products of Greece (Manos and Manikas, 2010).

The marketing channels of the Greek fresh agricultural products SC have many different structures. The most common marketing channels can be seen in Figure 3.3. The majority of agricultural products are being sold through the agricultural cooperatives (Manos and Manikas, 2010). However, the number of cooperatives in Greece is declining as they are functioning poorly (Lamprinopoulou and Tregea, 2006). A large proportion of the agricultural products in Greece are sold in central local markets or to local corner grocery shops. Another type of marketing channel of the fresh agricultural products is through wholesalers; this is usually the case where the producers are not members of any cooperative. In this type of marketing channel the producers deal with different wholesalers and decide where to sell their products depending on the best price offered to them by the wholesalers. The case of producers selling their products directly to retailers is not a common case (almost rare) in the Greek fresh agricultural products sector However, the retail sector is highly concentrated as there are a few major players dominating the Greek agricultural products market (McKinsey, 2012). Also, producers may export their products only through the cooperatives.

Figure 3.3: Different Marketing Channels in the Greek ASC



3.5.1 The Greek Peach Supply Chain

The fresh peach agricultural product was selected as a representative product of the Greek ASC for the purposes of this research. This is because the peaches are highly perishable products and thus they will probably high PHFL (Parfitt et al., 2010). Also, the selection was done on the basis that Greece is the fourth largest producer of fresh agricultural products in EU (FAO, 2012a). In 2012, Greece was the fourth largest producer of peaches and nectarines worldwide, after China, Italy, and United States of America (FAO, 2012b). According to Elstat, in 2006 there were in total 17,952,716 peach trees with a production of 767,938 peaches (Elstat, 2011). As seen in Table 3.3, from 2010 to 2015 there were fluctuations in peach production in Greece (Elstat, 2015).

Table 3.3: Production development of peaches from 2010 to 2015
(production in 1,000 tonnes) (Elstat, 2015)

Year	2010	2011	2012	2013	2014	2015*
Peach production	711,4	722,6	576	371,6	655	670

*Paseges estimation

The majority of the peach production in Greece is based in the regions of Thessaly, Central Macedonia and Macedonia (Elstat, 2011). Therefore, the

validation as well as the testing of this study's conceptual framework will be performed with peach producers from these regions in Greece.

3.6 Revised Conceptual Framework

3.6.1 Confirmatory Semi-structured Interviews

When the phenomenon of interest is new, dynamic or complex, such as the PHFL the relevant concepts cannot be easily identified and core theories are not enough to explain the phenomenon under study (Malhotra, 2009). In this situation a qualitative approach is often preferred to build grounded understanding in detailed description of the phenomenon generated by collecting field data (Malhotra, 2009). Qualitative case interviews can be used to build theory which means describing key variables, identify linkages between variables and identify why those relationships exist (Voss et al., 2000).

Since the total number of Greek fruit and vegetable producers is not registered anywhere, a total number of 30 peach producers were approached from personal contacts. Out of the 30 producers, 16 were interviewed which accounts for 66.6% response rate. Hence, for the purpose of this study sixteen semi-structured interviews have been conducted with Greek producers from the fruit and vegetable sector (i.e. peach producers). The overall aim of conducting the semi-structured interviews was to check the face validity of the conceptual framework that has been created through literature review analysis. The objectives for conducting the interviews were the following: (a) explore the relevance of collaboration under the specific context, (b) identify the relevant environmental turbulence factors from the producers' perspective, (c) explore whether there are any other environmental turbulence factors that impact both producers' collaboration levels and PHFL levels, and (d) understand whether producers are knowledgeable about the topic and that they are the appropriate respondents.

As mentioned earlier, endogenous turbulence can be measured by studying the different environments in which a firm operates in terms of competitors, market, technological and regulatory turbulence (Cadogan and Paul, 1999), whereas exogenous turbulence involves discrete events (e.g. workers strikes, contagious

diseases) and continuous uncertainties (e.g. inflation rates, price changes; Trkman and McCormack., 2009). These classifications of both exogenous and endogenous environmental turbulence factors were used here to develop the interview questions regarding the turbulence factors. The respondents were asked twelve questions about collaboration, PHFL, and the exogenous and endogenous environmental turbulence factors in their operating environment. An interview guide was used to guide the interview process which will included the subject that will be covered in the interview, the set of questions to be used in the interview and the specific data required. A well designed interview guide will enhance the reliability and validity of the research (Yin, 1994). The structured interview questionnaire included both open-ended and close-ended questions in order to allow flexibility in the answers, to reveal any new constructs and to understand collaboration and PHFL relationship better. The structured interview questionnaire was piloted before conducting the interviews by using experts from the field. The interviewed producers were asked the following questions:

(1) Collaboration in the SC:

- Please describe what collaboration with partners' means for you.
- What are the activities you usually collaborate with partners?

(2) PHFL:

- Do you have PHFL?
- If yes, how do you estimate PHFL?

(3) ASC Environment (i.e. Environmental Turbulence Factors):

- Are there many changes in regulations in your industry?
- What are the different regulations in your industry about?
- Are these changes predictable and / or rapid?
- Is customer demand and taste predictable?
- Is technology in your industry changing all the time?
- Is competition in your industry intense?
- Are there many disruptions in your SC due to unexpected events (e.g. floods, storms)?
- Are there many disruptions in your SC due to continuous risks (e.g. price changes)?

The confirmatory interviews conducted were according to Loughborough University's ethical guidelines: (a) the objectives of the study were clearly explained to the respondents, (b) confidentiality and anonymity was provided for all the respondents participating in the study, (c) the results of the survey questionnaire were offered to all participants, (d) respondents were made aware of their right to withdraw from the study at any stage for any reason. All interviewees signed an informed consent form and a confidentiality agreement.

3.6.2 Findings of the Confirmatory Interviews

As the aim of the interviews was to validate the initial conceptual framework, the interview findings are discussed based on each of the concepts included in the initial conceptual framework. The detailed interview transcripts can be found in Appendix 1.

(a) Collaboration in the SC

Significant differences in collaboration levels found to exist among peach producers and their business partners. The majority of the interviewed producers collaborated with cooperatives or producer organisations; only a few interviewees collaborated with wholesalers. Even among those producers that collaborate with cooperatives there seems to be significant differences in the activities and in the levels that the partners collaborate. Producers who collaborate with wholesalers found to have very low levels of collaboration as they perform only basic transactions. Producers who collaborate with cooperatives were found to collaborate in different levels including different activities such as exchange of information, demand planning, sharing knowledge and sharing resources and facilities. Thus, collaboration is relevant in the ASC context and different collaboration levels seem to exist. In this study only the producers who collaborate with cooperatives will be considered as collaboration between producers and cooperatives includes only the exchange of products. However, it should be noted that since the sample of this study is identified through cooperatives it is expected that they may have stronger collaborations and compliance with regulations compared to those collaborating with wholesalers.

(b) PHFL

The majority of the interviewed producers found to have PHFL. Producers measure PHFL in tonnes and / or percentages. The peach producers estimate their total production and then they estimate the losses; usually this is done when they sell their produce to the cooperative or wholesaler. When producers estimate PHFL levels in collaboration with the cooperatives their produce might be rejected at the sales point. In the case of cooperatives, the producers usually give their produce to them and an agriculturist takes a sample of their produce to check for its quality and for any remaining of pesticides. If the produce does not comply with the quality and regulatory standards then the produce is rejected. In the case of wholesalers, the wholesaler checks the quality and the pesticides content of the produce even before the harvesting of the product. Wholesalers might change their purchase quantity of the produce even after a deal was made.

(c) Contextual Factors in the ASC Environment

- Endogenous Turbulence Factors in the ASC Environment

There were many changes in food regulations in the last few years; however the impact of those food regulations on producers has not been yet examined. The main regulations that ASC members in the EU need to comply and adopt are as follows: (a) food safety regulations, (b) food quality regulations, (c) food labelling and packaging regulations, (d) food traceability regulations, (e) food transport and handling regulations, and (f) organic food regulations. From the interview data it was clear that not all the Greek producers have adopted and implemented all the food regulations suggested for implementation by the EU. It was found that in many cases food regulations might not have the expected benefits and would impact the Greek producers negatively. Although the new pesticides and fertilisers introduced by the EU are more environmentally friendly the producers believe that these lead to higher PHFL levels, as the produce is more sensitive to insect infestations. Most of the interviewed producers stated that the main reason of non-compliance to all the food regulations is the cost of implementing them; specifically the prices of the pesticides and fertilisers; thus making it hard for individual producers to buy them. In other cases the producers were not aware of any changes in food regulations or what are the food regulations they needed to

adopt as mainly agriculturists or the cooperatives told them what they needed to do.

Therefore some of the interviewed producers perceived that there are no specific guidelines on what food regulations they need to adopt and comply with. However, the rate of PHFL due to non-compliance has been significantly reduced in the last few years in Greece. When the produce is to be exported to be sold in another country the compliance to food regulations and audits of the produce are stricter. Some of the interviewed producers, who export said that there are many changes in food regulations and they have adopted integrated management of the produce to control every single point in the growing, harvesting, handling and transportation process.

Also, when the producers sell their produce to wholesalers, the uncertainty regarding compliance of the produce to food regulations is higher. This is because the wholesalers demand that producers should use specific fertilisers on their produce and in case the order changes or is cancelled the producer has to find another buyer and market to sell his produce. One of the interviewees clearly stated: '*the wholesaler that we use to sell our produce in order to export them to Russia told us not to spray a specific pesticide that we use to spray our produce to protect it from insects. And then at the last moment the wholesaler closed down the business. All of the producers that were going to sell their produce to him haven't sprayed for this insect protection pesticide and we tried to spray it last minute, but it was too late, as the produce were full of insects*.' Thus, the different food regulations that identified as relevant to the specific context will be included in this study's final conceptual framework as they found to be a major factor of environmental turbulence.

- Exogenous Turbulence Factors in the ASC Environment

(1) Technological Turbulence & Market Turbulence

Technological and market turbulence found not to be a relevant factors for peach producers. They do not use any special machines for the collection of the peaches as they do it manually. They usually buy some machines for spraying the pesticides, but they change the machines every seven years or more. Peach

producers found not to be aware of the changes in their customers demand and taste. So, after the third interview the specific questions were not asked to the rest of the interviewees. Hence, technological and market turbulence will not be included in this study's final conceptual framework as they were found not to be relevant to the specific context.

(2) Weather, Political, and Economic Conditions

A common factor of supply chain disruption in the peach supply chain in Greece found to be changes in weather patterns that impact the quality of the produce. All the interviewees stated that due to the high perishability of the peaches, weather conditions affect them significantly. According to the Greek peach producers, political instability due to changes in regulations or policies is existent in their operating environment. The interviewed producers found to be significantly influenced by the economic and political instability in their country. Therefore, weather, political and economic conditions on peach producers will be included is this research's final conceptual framework to ascertain their positive or negative impact.

(3) Intensity of Competition

Competitive intensity in this research is defined as the extent of tension, imposed by an organization's rivals that might stimulate the focal firm's strategic response (Wu and Pangarkar, 2010). The majority of the interviewed producers stated that competition is quite intense among peach producers. Greek producers were found to compete in product quality, knowledge about agricultural methods, volume of production and product prices (i.e. who is going to sell his produce in higher prices). Thus, competitive intensity will be considered as an exogenous environmental turbulence factor in this study's final conceptual framework.

3.6.3 Revised Conceptual Framework & Hypothesis

A revised conceptual framework of this research can be seen in Figure 3.4. In the sections that follow the derivation of the hypotheses and the development of the updated conceptual framework are discussed.

(a) Collaboration & PHFL Relationship

Recently a number of researchers (Mena et al., 2011; WRAP, 2011) have examined either the consumers' side or the retailers' side with efforts to reduce PHFL in the SC, considering the different points in the chain where PHFL occur. However, there is a lack of research concerning the producers' side where the majority of the PHFL is said to occur.

Different ways have been suggested to address the PHFL problem such as improving technology, developing better storage and cooling facilities etc (e.g. Hodges et al., 2010). There is a focus on technological solutions for PHFL reduction. The human element and to be more precise the interactions among upstream chain members have not be considered in the academic literature of SCM. It seems that there is a gap in the literature among supply chain actors interactions and their practices towards collaboration and PHFL reduction. In this research it is argued that even when all the technological or infrastructural improvements are implemented there will not be sufficient and sustainable reduction in PHFL and that collaboration is the basis to all the different actions that have been proposed to resolve this issue.

In order to solve common agricultural problems and natural resource problems (e.g. the PHFL issue), ASC partners need to exploit, combine and complement each other's capabilities and work together (Pretty, 2008). A main challenge in the ASC is to develop collaborative relationships and to exploit partners' capabilities in order to increase the performance of the supply chain as a whole (Zuurbier, 1999). Also, the drivers of change in the ASC require upstream chain entities to develop and acquire new skills and knowledge in order to create new competences (Joshi et al., 2009). ASC members need to be educated to bridge the gap between local norms and international expectations (Roth et al., 2008). There is need to develop knowledge and capabilities of ASC entities regarding food safety, food quality standards and appropriate usage of cold chain facilities to increase the productivity and the efficiency of the chain (e.g. FAO, 2011; Dani and Kanwar, 2012). Lack of knowledge on how to handle crops and the need for training provision to upstream chain members has been recognized as a main barrier in reducing PHFL (Hodges et al, 2010). In order to reduce PHFL, upstream chain members need to be educated and trained (Kader, 2010).

Gaining access to acquire resources, skills and knowledge though a business partner is a motivation to enter a collaborative relationship. Therefore, ASC producers could gain new resources, skills and knowledge by entering in a more collaborative relationship.

The RBV theory suggests that organisations enter a collaborative relationship to access and acquire resources, skills and knowledge from other organisations (Sambasivan et al., 2013). In this research, the collaboration - PHFL relationship is seen from a RBV perspective, as ASC producers will seek to collaborate closer with their partners to access and acquire resources, capabilities and skills to improve their performance.

As already stated, from the preliminary study conducted it was found that collaboration is an enabler for PHFL reduction. After analysing the confirmatory interviews it was found that the producers who collaborated in higher levels with their partners were more satisfied with their collaborating partner and seemed to have lower PHFL levels. Hence, there is another indication for the possible relationship between collaboration and PHFL. Although collaboration has been proposed as a way to address the PHFL problem, no theoretical or empirical research has been undertaken in terms of examining the potential relationship between collaboration and PHFL in the upstream SC. Thus, the impact of collaboration in PHFL reduction in the upstream supply chain (i.e. producers) needs to be further explored.

Based on the above, it is proposed that:

Hypothesis 1 (H1): *Collaboration is negatively related to PHFL.*

(b) The Moderating Contextual Factors in the Collaboration - PHFL Relationship

Barratt (2004) stated that in order to define collaboration we need to put it into a specific context. Contextual factors can influence the choice of collaboration levels; the context where a firm operates will influence the success of its relationships with partners (Danese, 2011). ASC entities seek to collaborate with their partners as they have realised that working together can get them

substantial gains which cannot be achieved by operating alone (Matopoulos et al., 2007). Enhancing collaboration levels in ASC's is seen as a source of competitiveness (Reynolds et al., 2009). Research in ASC relationships must consider country, commodity and chain stage specific characteristics (Fischer et al., 2010). Ziggers and Trienekens (1999), and Trienekens and Zuurbier (2008) state that the special market and product characteristics of the ASC are pushing SC partners towards higher levels of collaboration. The intensity of collaboration in the ASC can be influenced negatively or positively by the nature of products, the sector's structure and the business environment (Fischer et al., 2010). Zuurbier (1999) found that industry, firm, product and relationship specific factors between suppliers and retailers can influence the choice of coordination type. Technological, regulatory and financial reasons in the ASC are shifting organisations towards greater collaboration (Hobbs and Young, 2000). Thus, when we study partners' relationships in the ASC we need to consider product, industry, country, firm and relationship specific factors as they influence the choice of relationship level (i.e. intensity).

When there is high environmental uncertainty, partners will move towards closer collaboration (Wong et al., 2008; Danese, 2011). Closer collaboration can reduce business uncertainty, gain access to resources and increase organisational productivity (Dyer and Singh, 1998). Organisations enter in a relationship to extend their resources and acquire skills from partners (Sambasivan et al., 2013). Therefore, the choice of collaboration level will be influenced by the relative environmental uncertainty. Increasing environmental uncertainty in SCs makes it hard for SC partners to decide in what changes they need to react and how they should react (Van der Vorst, 1998). In the ASC environment there are high levels of inter-period change and the future environmental conditions cannot be accurately predicted due to the high levels of uncertainty (Galanopoulos et al., 2011). Many researchers examined product characteristics, process technology and characteristics of actors, but no one has examined the actual impact of them on SCs and whether those uncertainties cause SC disturbances such as PHFL.

Many studies have investigated the impact of environmental turbulence on SC partners' relationships (Sambasivan et al., 2012; Fynes et al., 2004). Partners' relationships in the ASC are influenced by industry's specific environmental

characteristics. PHFL levels are also influenced by exogenous and endogenous environmental factors such as regulations (Kader et al., 2010; Paull et al., 1997). It can be seen that environmental turbulence experienced by producers has an impact both on their relationships with partners' relationships and on PHFL levels. Therefore, the different environmental turbulence factors could possibly impact both collaboration and PHFL. A moderator is defined as a variable which systematically modifies the form and / or the strength of the relationship between a predictor and criterion variable (Sharma, 1996). The moderating relationships are discussed below. CT will be used to study the different environmental turbulence factors in the specific Greek ASC context.

- The Moderating Effect of the Endogenous Turbulence Factors in the Collaboration - PHFL relationship

Through the confirmatory interviews the main endogenous turbulence factors in the Greek ASC found to be the different food regulations. There were many changes in the EU food regulations in the last few years; however the impact of those food regulations on producers has not been yet examined. The main regulations that ASC members in the EU need to comply and adopt are related to the following issues: food safety regulations, food quality regulations, organic food regulations, food traceability regulations, and food transport and handling regulations.

It was also found that the majority of Greek ASC producers implement only the required food regulations which are related to food safety, food quality, and food traceability regulations. Producers who collaborated with cooperatives, and thus collaborated in higher levels, were found to comply with food quality, food safety, organic food, food traceability regulations, and food transport and handling regulations. This is because being a part of the cooperative requires compliance with all the EU food regulations. In the case of the organic food regulations the interviewed producers said that compliance to these regulations is not a requirement; this is probably because organic food products are considered the same as the local food products (Grace, 2016). EU has also the lowest market share in organic foods (European Union, 2015). On the other hand, in cases where producers collaborated with wholesalers, the lowest level of collaboration,

they either have the freedom to choose the fertilizers and pesticides they are going to use or they act according to their buyers requirements. Therefore, producers who sell their produce to wholesalers are not sure if their produce complies with the general EU food regulations.

The interviewed producers stated that food regulations do not have the expected benefits and their production might be impacted in a negative way. It can be seen that there are different types of food regulations that impact the Greek ASC producers and possibly impact and moderate the collaboration - PHFL relationship. In this study all the different EU food regulations related to the Greek ASC will be examined separately in relation to the collaboration - PHFL relationship. As explained previously the relationship between collaboration and PHFL is expected to be negative. The perceived negative or positive impact of the different food regulations could possibly influence the collaboration - PHFL relationship. In cases where the perceived impact of the food regulations is positive, collaboration levels are expected to be higher and PHFL level low. Whereas, when the perceived impact of food regulations is negative collaboration levels will be lower and PHFL levels higher.

Thus, the following hypotheses are drawn:

Hypothesis 2 (H2): The relationship between collaboration and PHFL is moderated by food safety regulations; the greater the extent of the negative impact of the food safety regulations, the stronger the negative relationship between collaboration and PHFL.

Hypothesis 3 (H3): The relationship between collaboration and PHFL is moderated by food quality regulations; the greater the extent of the negative impact of the food quality regulations, the stronger the negative relationship between collaboration and PHFL.

Hypothesis 4 (H4): The relationship between collaboration and PHFL is moderated by organic food regulations; the greater the extent of the negative impact of the organic food regulations, the stronger the negative relationship between collaboration and PHFL.

Hypothesis 5 (H5): The relationship between collaboration and PHFL is moderated by food traceability regulations; the greater the extent of the negative impact of food traceability regulations, the stronger the negative relationship between collaboration and PHFL.

Hypothesis 6 (H6): The relationship between collaboration and PHFL is moderated by food transportation and handling regulations; the greater the extent of the negative impact of food transport and handling regulations, the stronger the negative relationship between collaboration and PHFL.

- The Moderating Effect of the Exogenous Turbulence Factors in the Collaboration - PHFL relationship

(1) Weather, Political and Economic Conditions

Through the confirmatory interviews the possible impact of weather, economic and political conditions on both collaboration and PHFL was established. Based on the confirmatory interviews with the Greek ASC producers, changing weather conditions, economic conditions, and political conditions are perceived to have a less negative effect on them when producers are engaged in collaborative relationships. Whereas, when the producers are not collaborating with their business partners in high levels the changing weather conditions, economic conditions, and political conditions are impacting them in a more negative way. As discussed before the relationship between collaboration and PHFL is expected to be negative.

The perceived negative or positive impact of the weather, economic and political conditions could possibly influence the collaboration - PHFL relationship. In cases where the perceived impact of the weather, economic and political conditions is positive, collaboration levels are expected to be higher and PHFL level low. Whereas, when the perceived impact of the weather, economic and political conditions is negative collaboration levels will be lower and PHFL levels higher.

Therefore, it can be stated that:

Hypothesis 7 (H7): The relationship between collaboration and PHFL is moderated by weather conditions; the greater the extent of the negative impact of weather conditions, the stronger the negative relationship between collaboration and PHFL.

Hypothesis 8 (H8): The relationship between collaboration and PHFL is moderated by political conditions; the greater the extent of the negative impact of political conditions, the stronger the negative relationship between collaboration and PHFL.

Hypothesis 9 (H9): The relationship between collaboration and PHFL is moderated by economic conditions; the greater the extent of the negative impact of economic conditions, the stronger the negative relationship between collaboration and PHFL.

(2) Competitive Intensity

Competition within a SC is a key environmental factor that provides firms and organisations benefits and challenges to collaborate with business partners (Harrigan, 1988; Wu and Pangarkar, 2010). It is said that as the intensity of competition increases, higher collaborative relationships will emerge (Auh and Menguc, 2005). This is because as competition increases organisations will have a greater need for information acquisition regarding market needs (Ang, 2008). In cases where competitors collaborate, the risks of the collaborative relationship are high (Bunger et al., 2014). This is because business partners engaged in collaboration share resources, share information, and skills. Thus, all business partners are becoming vulnerable to each other (Pfeffer and Salancik, 2003).

However, many researchers examined the relationship between collaboration and competition and suggested that they should be considered as interrelated relational processes (Mariani, 2007; Bunger, 2012). Collaborating with a competitor could produce a sustainable competitive advantage for competing collaborators (Brandenburger and Nalebuff, 1996). This competitive advantage will be achieved by creating efficiencies, developing innovative products, managing risks faster, and adapting faster to changing environmental conditions (Snavely and Trac, 2002). Thus, when business partners engage both in

collaboration and competition this is named as co-opetition (Bunger et al., 2014). In the case of co-opetition both competition and collaboration are high. On the other hand, when competition is high there will be more PHFL, as the producers might not get the chance to sell their produce. However, as mentioned above when co-opetition is existent business partners are likely to create competitive advantages and thus all their produce will be sold.

Co-opetition also found to be present in Greek ASC producers relationships, as competition among producers is healthy competition and makes them perform better. To be more precise, one of the interviewed producers said that '*we want competition among us because it makes us have better quality and higher volumes of produce*.' Producers who collaborated in lower levels with their partners said that there is no competition among producers, while those who collaborate in higher levels they stated that among producers there is high competition. The competition among the producers is in terms of having better produce (i.e. quality, colour, and odour) and higher yield.

As discussed earlier the relationship between collaboration and PHFL is possibly negative. The perceived competitive intensity among the producers could possibly influence the collaboration - PHFL relationship. In cases where the perceived competitive intensity is high, collaboration levels are expected to be higher and PHFL levels low. Whereas, when the perceived competitive intensity is low, collaboration levels will be lower and PHFL levels higher.

Based on the above, the following is drawn:

Hypothesis 10 (H10): The relationship between collaboration and PHFL is moderated by competitive intensity; the higher the extent of the competitive intensity, the stronger the negative relationship between collaboration and PHFL.

(d) Control Factors

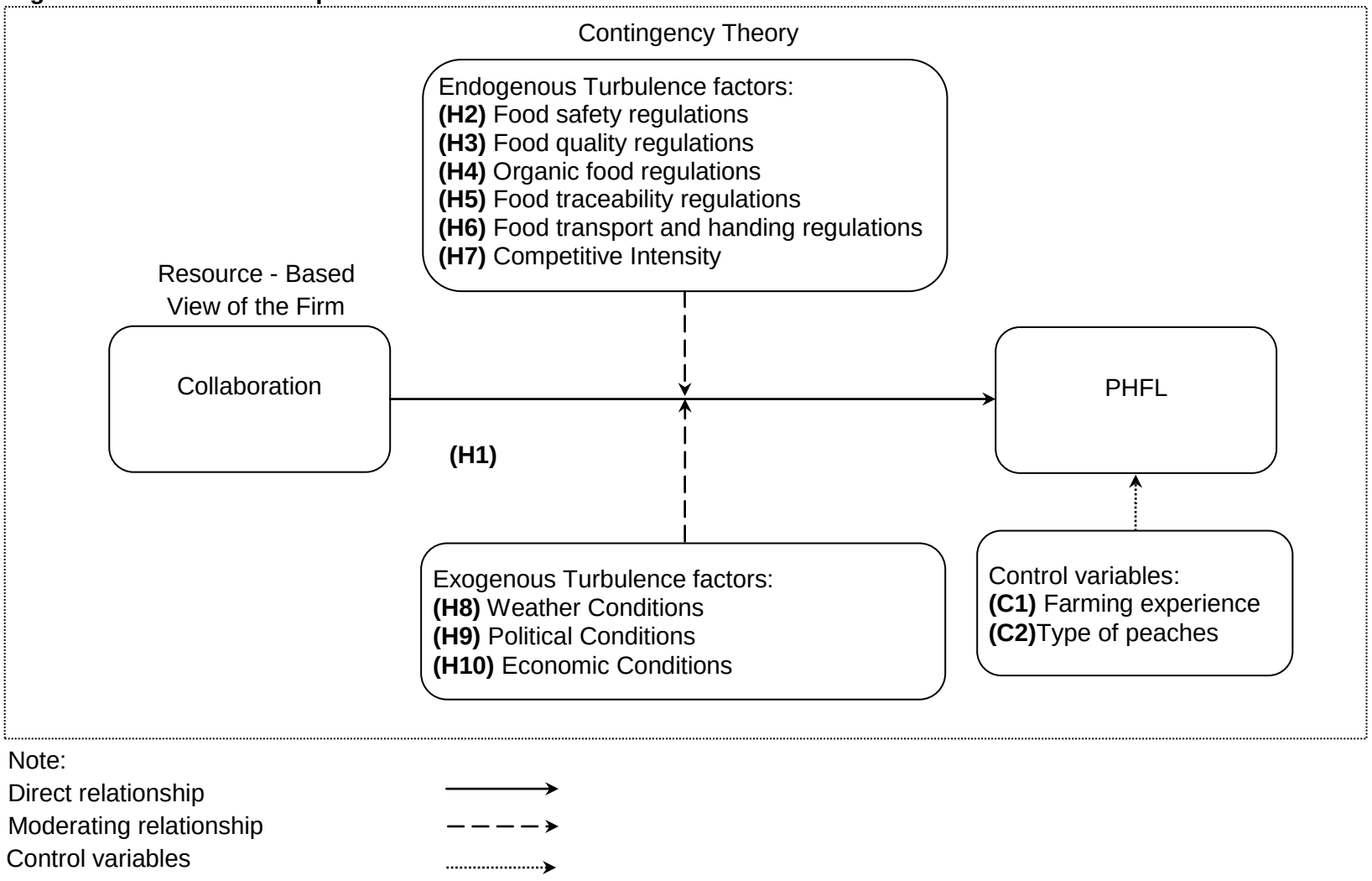
Through the interviews some other factors appeared to influence the PHFL levels and they will be used as control factors in this study. Those are the following: the farming experience, and the type of peaches. The unwillingness of the producers to change existing farming practices has been highlighted in the literature (Kaditi, 2010). Greek producers act based on their experience (Daoutopoulos and

Pirovetsi, 2002). Thus, the relative experience of the producers in farming will possibly influence the way they treat their produce and might increase or decrease PHFL levels. Hence, the farming experience will be used as a control variable in this research.

Regarding the type of the peaches, there are two types of peaches: (a) table peaches (i.e. peaches sold straight for human consumption), and (b) processing peaches (i.e. peaches that go through processing in order to become a value added product such as canned peaches or marmalades). The table peaches due to the fact that they are sold directly to consumers they should have better appearance (e.g. being damage free, having nice shape and good size). Also, table peaches are more sensitive to insect infestation and go through stricter inspections for any fertilisers left before being sold. Table peaches seem also to have higher profit margins for the producers, but because of the short shelf-life it is important that the produce is sold as soon as possible after its harvesting so that quality it is maintained. On the other hand, processing peaches due to the fact that their main purpose of cultivating them is to have them processed, quality is not a major issue. Even when the produce is a little bit damaged, the produce can still be sold for processing. The profit margin of the producers selling processing peaches is very low. Therefore, the two different types of peaches (i.e. Table and Processing types of peaches) will be used as control variables in this study.

Based on the analysis made the proposed conceptual framework now looks as seen in Figure 3.4. The collaboration - PHFL relationship is a negative direct relationship. The exogenous and endogenous turbulence factors as discussed earlier represent a positive moderating relationship. The two control variables (i.e. type of peaches and farming experience) can also be seen on Figure 3.4.

Figure 3.4: Revised Conceptual Framework



3.7 Chapter Summary

In this chapter, the conceptual framework of this study was presented. The hypotheses were developed based on literature review analysis, a preliminary web-survey questionnaire, and confirmatory semi-structured interviews. It was proposed that the relationship between collaboration and PHFL is negative. Also, the moderating role of the endogenous and exogenous turbulence factors in the collaboration - PHFL relationship identified and propositions made. In particular, food regulations (i.e. food safety, food quality, organic food, food traceability, and food transport and handling regulations), weather conditions, political conditions, economic conditions, and competitive intensity are likely to moderate the collaboration - PHFL relationship. Farming experience and the type of peaches were also identified to be examined as control factors in the collaboration - PHFL relationship. Next chapter that follows presents the research methodology employed in the current study.

Chapter 4

Research Methodology

4.1 Introduction

This chapter outlines the research methodology that is employed to collect data for this research study. Given this study's overall research aim, research objectives, and hypotheses that have been presented earlier, it is important that a detailed research plan is set to explain how the aforementioned will be fulfilled. The chapter begins with a presentation of the research design and an explanation of the choice of the cross-sectional research design. Then, the sampling process is explained including the definition of the target population, the determination of the sampling frame, the selection of sampling technique, and the sample size determination. Next, the different data collection methods available and the choice of a particular data collection method (i.e. personal interview surveys) are discussed. This is followed by the questionnaire design section in which the measurement of the questionnaire's constructs and the elimination of any measurement errors are explained. In addition, the response rate enhancement methods and the pre-test of the questionnaire are outlined. The chapter concludes with the pilot study of this research's questionnaire.

4.2 Research Design

Research design can be defined as a detailed blueprint that guides a research study towards achievement of its objectives (Bryman, 2004). A good research design ensures that the information collected will be relevant and useful to the research problem and that the research will be conducted effectively and efficiently (Malhotra, 2009). There are two main types of research design, the exploratory and the conclusive (Malhotra and Birks, 2007). The exploratory research design is concerned with the discovery of ideas and insights (Churchill,

1999). Whereas, conclusive research design aims to examine the relationships between variables by either determining the relationships between the variables or indentifying cause and effect relationships (Parasuraman et al., 2007). Based on the research objectives of the study, researchers might choose an exploratory or a conclusive research design (Bryman, 2004). Usually, a conclusive research design is used to verify the insights gained from an exploratory research (Churchill and Iacobucci, 2005).

In the current study an exploratory research design was employed for the preliminary exploration of the collaboration - PHFL relationship and the environmental turbulence factors that impact the latter relationship in ASCs (see Chapter 3, sections 3.3 and 3.6.1). Through an exploratory web-survey further insights have been given for the collaboration - PHFL relationship (Chapter 3, section 3.3). Also, the qualitative semi-structured interviews enabled the researcher to understand the problem and build a conceptual framework (Chapter 3, section 3.6.1). Thus in this research study, exploratory research was employed for the purposes of gathering further insights regarding the existence and the relevance of the collaboration - PHFL relationship and the different environmental turbulence factors that possibly impact it. Although, the information collected through the exploratory research helped to formulate the specific hypothesis it is not sufficient for making generalizable conclusions.

A conclusive design is adopted in this study to test the hypotheses formulated through the exploratory research design and examine the relationships between the constructs (i.e. collaboration, PHFL, environmental turbulence factors). The conclusive research design consists of the descriptive research design and the causal research design (Iacobucci and Churchill, 2009). The purpose of a causal research design is to determine cause-and-effect relationships, while a descriptive research design aims to determine relationships between variables (Churchill and Iacobucci, 2005). The descriptive research design was selected for the examination of the relationships of this study's variables, as there is no cause-and-effect relationship. The descriptive research design can be further classified into cross-sectional and longitudinal research designs (Lee and Lings, 2008). The cross-sectional research design refers to the collection of data on more than one case at a single point in time in order to gather data about two or more variables; by doing so any patterns of associations among the constructs

could be observed (Bryman, 2004). On the other hand, longitudinal research design involves repeated measures on the same sample over a longer period of time (Bagozzi, 1991). Hence, the latter research design is an extension of the cross-sectional research design. The longitudinal research design helps to eliminate any common method bias concerns, as multiple respondents as employed, multiple data types are obtain, data over multiple periods are gathered (Rindfleisch et al., 2008).

In order to collect data for this research, a cross-sectional research design is employed. This is because time and cost constraints do not allow this research to adopt a longitudinal research design. In the particular case of a doctoral study with a limit of three to four year completion and within specific budget limitations the longitudinal design is a less desirable option. Any concerns about the common method bias in this study are addressed both in the design of the main study's questionnaire and after the data collection (see section 4.5.2). Longitudinal research designs have been also criticised for the 'panel conditioning effect' which is about the respondents continuous participation in the study affecting the way they respond to a study's questions (Bryman, 2004). Therefore, considering the time and cost limitations and the disadvantages of the longitudinal research design the cross-sectional design was chosen instead. A questionnaire was developed to examine this study's relationships and multiple informants were employed at a single point of time.

4.3 Sampling Process

According to Malhotra and Birks (2006) there are four stages that should be followed in the sampling process which are the following: (a) definition of the target population, (b) determination of the sampling frame, (c) selection of the sampling technique, and (d) determination of the sample size. In the sections that follow each of these stages are discussed.

4.3.1 Definition of Target Population

As mentioned in Chapter 2, section 2.4.1, the unit of analysis of this research is the producers. However, in order to get generalizable results a single SC and a

single ASC product had to be considered. In Chapter 3, section 3.5.1 the reasons for choosing the Greek ASC and the peach product were explained. Therefore, the population of interest of this study is consisted of all the Greek ASC peach producers. However, the actual number of Greek ASC peach producers is not registered anywhere, as producers in Greece are not classified as for example peach or orange producers. Elstat (2011) provided the researcher with figures for the numbers of peach trees in different regions in Greece. According to Elstat (2011) the majority of peach trees are based in Central Macedonia (i.e. 699,731 trees), Thessaly (i.e. 29,376 trees), Western Macedonia (30,402 trees), and Eastern Macedonia (i.e. 245 trees). Thus, the target population of this study is all the peach producers operating in the aforementioned geographical regions as those areas are representative of the whole population of peach producers.

4.3.2 Determination of Sampling Frame

After determining the target population, a list of the eligible sampling units needs to be created (Hair et al., 2010). Usually the sampling frame is created by identifying lists of companies or customers lists (Lee and Lings, 2008). However, since the Greek peach producers are not registered anywhere the sampling frame of this study was developed by approaching the cooperatives that the producers sell their produce in the geographical regions mentioned in section 4.3.1. All the cooperatives selling peaches in Central Macedonia, Thessaly, Western Macedonia, and Eastern Macedonia were identified through internet search and a total number of thirty cooperatives that sell peaches were selected. Therefore, the sampling frame of this research is thirty cooperatives.

4.3.3 Selection of Sampling Technique

The term sampling technique refers to the process according to which a sample is obtained and can be broadly classified as ‘non-probability sampling’ and ‘probability sampling’ (Burns et al., 2003). In the non-probability sampling technique the sample selection relies on the personal judgement of the researcher rather than the chance to select random sample elements (Malhotra and Birks, 2006). On the other hand, in the probability sampling the sample units are selected by chance (Malhotra, 2009). For this study, the non-probability

sampling technique was selected as there is no specific list with the names of the peach producers in Greece. Personal contacts of peach producers, and peach cooperatives were used as an initial pool of respondents. Then, the peach producers were approached through the cooperatives and producer organisations.

4.3.4 Determination of Sample Size

In order a research study's data to be generalizable, the sample size of the research needs to be representative of the population under study (Malhotra and Birks, 2006). However, given the fact that the total number of Greek peach producers is not written anywhere the sample size of this study cannot be estimated considering the total population. According to Spector (1992) at least 100 to 200 cases are necessary to adequately assess the validity and reliability of the measures. Hair et al. (2010) also suggested that a minimum 150 to 200 cases are needed to test a model using multivariate techniques. Thus, the sample size of this research was estimated based on the selection of the data analysis technique. A target of 220 completed questionnaires was set.

4.4 Data Collection Method

After explaining the choice of cross-sectional research design the most plausible and appropriate method for collecting a study's data needs to ascertained. In the paragraphs that follow, different data collection methods are evaluated considering this study's research objectives. The data collection methods that have been used as part of fulfilling the research objective 1 were discussed in Chapter 3. The data collection methods that were used to collect data to address the research objectives 2 and 3 are explained in the sections that follow.

As mentioned in Chapter 2, research in the PHFL area is limited and there is no data available with PHFL levels of the Greek ASC (Fusions, 2015). Since no secondary data is available, primary data needs to be collected. There are different methods for collecting primary data such as telephone interviews, personal interview survey questionnaires, postal and on-line survey questionnaires (Lee and Lings, 2008). Given the large sample size required to test this study's conceptual framework and the number of questions that had to

be asked to the respondents and the nature of the questions (i.e. sensitive information), the telephone interviewing method was not a preferred method for the current study (Bryman, 2004). Also, the telephone interviewing method could not be used to collect data for this study as there is no list available with the telephone numbers of the respondents as identified in the sampling frame.

The postal and on-line questionnaire methods are other data collection methods. The main advantages of the postal and on-line survey questionnaires are as follows: (a) ease of completion and analysis, (b) access to dispersed respondents, (c) getting answers to sensitive questions, and (d) accuracy of responses (Oppenheim, 1992). Data collection through postal and on-line survey questionnaires was not an appropriate method for collecting data for this research due to the unit of analysis of this study. As mentioned in section 4.3.1, the unit of analysis is all the ASC Greek peach producers and the exact number of them as well as their contact details are not registered anywhere. Thus, postal and e-mail survey questionnaires could not be posted and / or e-mailed to them.

Given the problems associated with the telephone interviews and the postal and e-mail survey questionnaires, the personal interview survey questionnaire method was chosen for the following reasons: (a) enables the operationalization of the hypotheses formed and their testing using statistics, (b) gives access to a wide range of respondents by approaching them through the cooperatives that they collaborate, (c) enables the collection of data regarding sensitive issues (i.e. how they collaborate with their partners and their PHFL levels), and (d) allows the use of larger frame obtaining more generalizable results (Forza, 2002).

After defining the relationships of the concepts of interest and forming the conceptual framework of a study, the theory created needs to be tested (Lee and Lings, 2008). "Theory testing in this case means testing the adequacy of the concepts developed in relation to the phenomenon, of hypothesized linkages among concepts and of the validity of the boundary models" (Forza, 2002, p. 155). Thus, the aim of deploying a personal survey questionnaire for this research is to test the soundness of the proposed conceptual framework.

However, there are some drawbacks associated with personal interview survey questionnaires (Churchill and Iacobucci, 2005). First, the major disadvantage of

using personal interview surveys is the cost of conducting them (Oppenheim, 1992). This issue was overcome in this research through the identification of the main cooperatives operating in the geographical regions as mentioned in section 4.3.2. After having a throughout plan of the overall costs for the data collection, the researcher presented it to the supervisory team of this research. The supervisory team decided that the costs of data collection could be covered by Loughborough University. Secondly, another common consideration in employing the personal interview surveys is the time constrains (Malhotra and Birks, 2006). In line with the planning of the cost of data collection the time required to collect the data was estimated too. The questionnaire as it will be explained in the following sections takes approximately 40 minutes to be completed. Considering the 220 responses required, twenty five days will be required for conducting approximately ten personal interviews per day. The data collection of this research was performed during July and August of 2013. Thirdly, personal interview surveys have been criticised for reflecting interviewer bias and for interviewers asking questions in different ways (Churchill and Iacobucci, 2005).

In order to eliminate any interviewer bias only one person administered the personal survey questionnaires using flashcards. The flashcards used in this research can be seen in Appendix 2. The flashcards were used in every personal interview survey in combination with a structured survey questionnaire. The respondents were given the flashcards at the beginning of the interview; the interviewer was asking questions and the interviewee had to choose the answer that represented their opinion by saying a number from the flashcard. Thus, the purpose of using flashcards in this study was to facilitate the personal interview surveys process and reduce any interviewer bias.

4.5 Questionnaire Design

There are no specific guidelines about how to design the best questionnaire. However, there are recommendations about what a questionnaire should include (Churchill, 1991). According to Churchill (1991) and Malhotra and Birks (2007) the following aspects need to be considered in the questionnaire development process: (a) the information to be sought in every questionnaire needs to be explicit (i.e. constructs and measurement), (b) the content and wording of each

question has to be decided in relation to the response format, (c) re-examination of the questionnaire by pre-testing it, and (d) revision of the questionnaire.

4.5.1 Constructs & Measurement

A literature search was performed to identify any suitable scales to measure the constructs under study (i.e. collaboration, endogenous and exogenous environmental turbulence factors, and PHFL). Most of the measurement scales chosen for this study's constructs were drawn from existing scales (i.e. collaboration and competitive intensity constructs) by adapting them appropriately to the specific unit of analysis and ASC context. Whereas, the rest of this study's constructs (i.e. food regulations, weather, economic and political conditions) new measures have been created based on the information needs of this research. The final questionnaire of this research can be seen in Appendix 3. In the sections that follow all the measurement scales included in the questionnaire of this study are explained.

(a) Collaboration

For the measurement of the collaboration construct a scale by Cao et al. (2010) was adopted. Cao et al.'s (2010) collaboration measures were adapted to the producers rather than the company's unit of analysis that they were used before. Collaboration in this study is defined as 'a long-term partnership process where SC partners with common goals work closely together to achieve mutual advantages that are greater than the one's firms would achieve individually' (Cao et al., 2010, p. 6617). Based on the analysis by Cao et al. (2010) the researcher formulated seven different sub-constructs. According Cao et al. (2010), in order to measure collaboration effectively, seven different sub-constructs need to be measured to capture the different aspects of collaboration which are as follows: (a) information sharing, (b) goal congruence, (c) decision synchronisation, (d) incentive alignment, (e) resource sharing, (f) collaborative communication, and (g) joint knowledge creation. Cao et al. (2010) measures have been adapted to fit this study's purposes. The definitions of each collaboration sub-construct as defined by Cao et al. (2010) have been used to adapt the sub-constructs and make them relevant to the producers unit of analysis and the ASC context. More

items have been added for each sub-construct in order to capture its definition effectively. For most of the collaboration constructs reverse coded items (indicate with R) have been added in order to prevent common method bias from happening (see also section 4.5.2). Tables 4.1, 4.2, and 4.3 present the different sub-constructs of collaboration, their definitions and their respective items as developed by from Cao et al. (2010) and adapted to this study. The items were measured on a 7-point Likert scale, ranging from 1= strongly disagree to 7=strongly agree.

Table 4.1: Information Sharing and Goal Congruence Sub-constructs of Collaboration

(1) Information sharing (IS)

Definition: The extent to which a firm shares a variety of relevant, accurate, complete and confidential ideas, plans, and procedures with its supply chain partners in a timely manner

I and the cooperative:

- share information openly (IS1)
- keep each other informed about events or changes that might affect the other party (IS2)
- inform each other in advance of changing needs (IS3)
- willingly share even confidential information that might be useful to both parties (IS4)
- share information with each other on a regular basis (IS5)
- only provide information with each other according to pre-specified agreements (IS6 - R)

(*2) Goal congruence (GC)*

Definition: The extent to which supply chain partners perceive their own objectives are satisfied by accomplishing the supply chain objectives

I and the cooperative:

- support each other's objectives (GC1)
- share the same goals in the relationship (GC2)
- have agreement on the importance of improvements that benefit us (GC3)
- have compatible business goals (GC4)
- jointly develop plans to achieve our goals (GC5)
- have aligned business goals (GC6)
- have different goals (GC7 - R)

Table 4.2: Decision Synchronisation, Incentive Alignment and Resource Sharing Sub-constructs of Collaboration

(3) Decision synchronisation (DS)

Definition: The process where supply chain partners orchestrate decisions in supply chain planning and operations that optimise supply chain benefits

I and the cooperative:

- tend to jointly plan about production (e.g. product assortment) (DS1)
- try to synchronise our decisions in planning of demand and supply (e.g. volume of peaches) (DS2)
- tend to jointly work out solutions (DS3)
- try to work together in planning all aspects of the delivery of the produce (DS4)
- try to coordinate decisions to solve any packaging issues (DS5)
- tend to work together to fulfil customers orders (DS6)
- make efforts to cooperate when planning operations (DS7)

(4) Incentive alignment (AS)

Definition: The process of sharing costs, risks, and benefits among supply chain partners

I and the cooperative:

- share each other performance (AS1)
- share costs incurred in order changes (AS2)
- share benefits (e.g. better return on sales) (AS3)
- share any risk that can occur in unforeseen situations (AS4)
- share costs on practices that minimize damaging routines (AS5)
- align benefits with cost and/or risk (AS6)
- volunteer to share any additional cost or benefits (AS7)

(*5) Resource sharing (RS)*

Definition: The process of leveraging capabilities and assets and investing in capabilities and assets with supply chain partners

I and the cooperative:

- share resources (e.g. personnel, facilities and equipment (RS1)
- often pool financial and non-financial resources (e.g. time, money and training) (RS2)
- have mutual resources contribution in this relationship (RS3)
- often combine resources to aid business activities (RS4)
- both contribute resources to deal with any business problems (RS5)
- both allocate resources to improve business processes (RS6)

Table 4.3: Collaborative Communication and Joint Knowledge Creation Sub-constructs of Collaboration

(6) Collaborative communication (CM)

Definition: The contact and message transmission process among supply chain partners in terms of frequency, direction, mode, and influence strategy

I and the cooperative:

- have open two-way communication (CM1)
- try to keep informal communication between us (CM2)
- have frequent contacts on weekly basis (CM3)
- have different channels to communicate (e.g. fact-to-face, text messages, e-mails) (CM4)
- influence each other's decisions through discussion rather than request (CM5)
- give each other opportunities to express essential information (CM6)
- find it hard to inform each other about any business activities (CM7 - R)

(7) Joint knowledge creation (KC)

Definition: The extent to which supply chain partners develop a better understanding of and response to the market and competitive environment by working together

I and the cooperative:

- by working together we expand our business 'know-how' (KC1)
- our working relationship provides opportunities to enhance our understanding of how to do better business (KC2)
- collectively identify how to improve our business practices (KC3)
- our understanding of the business processes has improved by working together (KC4)
- jointly generate better ideas to cope with market uncertainties (KC5)
- by attending seminars together, we develop better business methods (KC6)
- do not access any new knowledge by working together (KC7 - R)

Three years of collaboration relationship duration with the particular business partner was set as a minimum in order to participate in the current study. This was because perceptions about a collaborative relationship can be assessed after some years of experiencing this relationship and we are interested only in long-term collaborations. Also, since PHFL was measured for the past three years for consistency reasons and for the respondents to be able to provide the required information for the past three years a minimum of three years of collaboration was set.

(b) Endogenous and Exogenous Turbulence Factors

Since there are no existing scales to measure the endogenous and the exogenous environmental turbulence factors (i.e. food regulations, weather conditions, economic conditions, and political conditions) in ASCs new measurement scales have been created to measure these constructs. The new measurement scales have been created based on their respective hypotheses (see Chapter 3, section 3.6.3). The aim of the endogenous and the exogenous environmental turbulence factors hypotheses, except the competitive intensity, was to ascertain the extent that endogenous and exogenous turbulence factors have negative or positive effect on producers. Based on the hypotheses and the reflective scale development logic (Diamantopoulos, 1999), the endogenous and exogenous environmental turbulence factors scales were created. The notion behind the reflective scale development logic is that all the items of a construct need to reflect the meaning of the construct; the definition of the construct determines the indicators (Bollen and Lennox, 1991). The reflective scale development process addresses a major assumption in the sampling theory which is about all the items that belong to the same concept should correlate highly (Churchill, 1979; Sharma, 1996). All the items comprising the endogenous and the exogenous environmental turbulence factors scale were measured on a 7-point Likert scale, with anchors ranging from 1= negatively to a great extent to 7= positively to a great extent. Tables 4.4 and 4.5 show the measures all the five food regulation constructs (i.e. food safety regulations, food quality regulations, organic food regulations, food traceability regulations, and food transport and handling regulations), whereas Tables 4.6 and 4.7 show the measures for the weather, political and economic conditions.

Table 4.4: Food Safety Regulations Construct

(1) Food safety regulations (FSR)
Over the past 3 years, food safety regulations: • have affected me • have impacted my business • have changed the way I operate • have indirectly affected me

Table 4.5: Food Quality, Organic Food, Food Traceability and Food Transport and Handling Regulations Constructs

(2) Food quality regulations (FQR)

Over the past 3 years, food quality regulations:
- have affected me
- have impacted my business
- have changed the way I operate
- have indirectly affected me

(3) Organic Food regulations (OFR)

Over the past 3 years, food quality regulations:
- have affected me
- have impacted my business
- have changed the way I operate
- have indirectly affected me

(4) Food Traceability regulations (FTR)

Over the past 3 years, food quality regulations:
- have affected me
- have impacted my business
- have changed the way I operate
- have indirectly affected me

(*5) Food transport and handling regulations (FHR)*

Over the past 3 years, food transport and handling regulations:
- have affected me
- have impacted my business
- have changed the way I operate
- have indirectly affected me

Table 4.6: Weather Conditions Construct

(1) Weather conditions (W)

Over the past 3 years, weather conditions:
- have affected me
- have impacted my business
- have changed the way I operate
- have indirectly affected me

Table 4.7: Political and Economic Conditions Constructs

(2) Political conditions (P) Over the past 3 years, political conditions: • have affected me • have impacted my business • have changed the way I operate • have indirectly affected me (*3) Economic conditions (E)* Over the past 3 years, economic conditions: • have affected me • have impacted my business • have changed the way I operate • have indirectly affected me

For the competitive intensity construct existing measurement scales from Jaworski and Kohli (1993) and Jambulingam et al. (2005) have been used and adapted accordingly from. The measures from the aforementioned studies have been reformed appropriately for this study's purposes. Competitive intensity in this study is defined as a situation where competition is fierce due to the number of competitors in the market and the lack of potential opportunities for further growth (Jaworski and Kohli, 1993). Table 4.8 shows the different items that were used to measure the competitive intensity construct.

Table 4.8: Competitive Intensity Construct

Competitive intensity (CI) • competition is fierce (CI1) • competition is aggressive in my markets (CI2) • in this business competitors are always out to get you (CI3) • competitors are quick to take advantages of any mistakes (CI4) • competition is unsubstantial (CI5 - R)

(c) PHFL

The PHFL construct was measured in tonnes for the past three years. Based on the discussions that the researcher had with Greek ASC producers the producers

sort their production in two different categories, the ‘A sorting’ produce’ and the ‘B sorting’ produce’ categories. The ‘A sorting’ produce’ category includes all the peaches that are sold either for processing or for selling them to consumers, while the ‘B sorting produce’ category is the wasted produce that is not being sold. Thus, PHFL is called ‘B sorting produce’ in the producers’ language and this is how it is going to be presented in the questionnaire. Table 4.9 shows the measures that have been used to measure the ‘B sorting produce’ (i.e. PHFL).

Table 4.9: The PHFL Construct

PHFL (in tonnes) Total volume of ‘B sorting’ produce • 2009-10 • 2010-11 • 2011-12

(d) Profiling variables

In total 14 profiling variables were used in this study for the purposes of profiling the respondents and the organisations (i.e. cooperatives and producer organisations) that they work with. As mentioned in Chapter 3 (section 3.6.3) two control variables have been included in this study’s conceptual framework which are: the farming experience and the type of the peaches (i.e. processing and table peaches). Some other profiling variables were included in this study’s questionnaire for the purposes of understanding the general characteristics of the population of interest, such as (1) farming experience, (2) type of peaches produced, (3) organisational type, (4) total amount of fruit and vegetable production per year, (5) total amount of peach producer per year, (6) geographical location, and (7) role in the cooperative or producers organisation. Table 4.10 show the items of the latter measurement constructs.

Table 4.10: Profiling Variables

(1) Farming experience

- farming experience in years

(2) Type of peaches produced

- (a) table peaches, (b) processing peaches

(3) Organisational type

Please select the type of organisation that you sell the majority of your produce to: (a) producer organisation, (b) cooperative, (c) other

(4) Total amount of fruit and vegetable production per year

- number in tonnes

(5) Total amount of peach production per year

- number in tonnes

(6) Geographical location

- (a) Central Macedonia, (b) Eastern Macedonia, (c) Thessaly, (d) Western Macedonia

(7) Role in the cooperative or producer organisation

- (a) member, (b) admin member, (c) sales director, (d) general director, (e) elected head of the cooperative, (f) other

4.5.2 Measurement Error

Measurement error can be defined as the extent to which the observed values are not representative of the true values (Hair et al., 2006). In cases of measurement error occurrence the research conclusions drawn from a study might not be valid (Bagozzi et al., 1991). There are two types of errors, the random and the systematic (Spector, 1992). However, the latter type of error is the one that might create problems in the validity of a study's conclusions (Podsakoff et al., 2003). This is because the systematic error might provide an alternative explanation to the constructs under study than the one hypothesised (Podsakoff et al., 2003). Thus, systematic error should be eliminated in any research study.

Common method variance (CMV) is one of the most common types of systematic error (Podsakoff and Organ, 1986). "CMV refers to the shared variance among measured variables that arises when they are assessed using a common method" (Simsen et al., 2010, p.2003). Podsakoff et al. (2003) indicated that there are four broad sources of CMV which are: (a) having a single source (i.e. the same respondent providing answer for both the predictor and the criterion variable), (b) poor quality item design (e.g. item ambiguity), and (c) measurement context effects (e.g. measurement of predictor and criterion variables one after the other in the same questionnaire). In order to eliminate the occurrence of CMV, due to usage of the same respondent to answer all the questions of a questionnaire, it is suggested to involve different respondents for different questions and at different points in time (Podsakoff and Organ, 1986). In this study having more than a single source to collect data was not possible due to time and cost constraints. However, any CMV concerns in this study have been eliminated though the study's questionnaire design (i.e. it is explained below), the data analysis method used, and the Harman's single-factor test (see Chapter 6, section 6.2.2 (d)).

In order to eliminate the occurrence of CMV through the questionnaire design any construct development errors have been prevented. Construct development error relates to a construct's ambiguity (Podsakoff et al., 2003). To avoid any construct development errors in this research, the items for the questionnaire's questions of collaboration were sourced from ABS list four star ranking journals (see section 4.5.1(a)). Regarding the constructs that were newly developed for this study (i.e. food regulations, weather, economic and political conditions, and PHFL) effort was placed in avoiding ambiguity and complicated wording (Churchill and Iacobucci, 2005). Also, during the translation process of the questionnaire (see section 4.7) effort was made to use as simple language as possible in order to be clear to the respondents. Negatively worded items (i.e. reverse coded items) were also used in the questionnaire in order to act as cognitive 'speed bumps' that will make respondents to engage more controlled (Hinkin, 1995). During the pre-test of this study's questionnaire revisions were implemented as appropriate to eliminate any construct errors. The simplicity of the questions was also reassured by the inclusion of Greek peach producers in the pre-testing of the questionnaire. In this way any questionnaire items that were not very clear were

reworded or further explanation added (e.g. in the decision synchronisation construct in DS1 an example was added i.e. product assortment).

Another way to minimize CMV is to use different scales and formats of responses in a questionnaire (Podsakoff et al., 2003). In the questionnaire of this research both close-ended and open-ended questions were used. More precisely, the collaboration construct and the endogenous and exogenous environmental turbulence constructs were measured in 7-point Likert scale, while the PHFL and the profiling variables were measured with both open-ended and close ended questions. The selection of the 7-point scale was done in order to allow respondents to answer with more specificity (Brandy et al., 2005). This is because using 5-pont scale has been criticised for not allowing respondents to be too specific for their answers. The numbers of each ranking were written on the questionnaire, but as already mentioned in section 4.4 the respondents of the questionnaire were given flashcards to answer the questionnaire. Moreover, in order to embed remedies for CMV in the questionnaire design, the predictor and the criterion variable were put away from each other in the questionnaire (Podsakoff et al., 2003). Hence, the respondents would not be able to make a connection between the predictor and criterion variable and change their responses.

Data analysis error is associated with the inappropriateness of the data analysis technique selected (Hair et al., 2010). A two-stage analytical procedure was employed is this study. First, the measurement model was estimated and then the structural model. The employment of the aforementioned analytical procedure ensured that the measures of the study are reliable and valid before proceeding to hypothesis testing (see Chapters 5 and 6). By having valid and reliable measures, valid conclusions of the tested hypotheses could be achieved (Anderson and Gerbing, 1988). Therefore, there was no concern regarding data analysis errors.

4.6 Response Rate Enhancement

Response rate enhancement was not a major issue in this study. This is because of the face-to-face questionnaire administration method. Face-to-face

questionnaires have higher response rate and allow the interviewer to give explanations in highly complex questionnaires (Forza, 2002). However, different methods have been considered in order to enhance response rate of the self-administered surveys. In order to enhance the response rate of this study's self-administered questionnaire the following methods have been used (Oppenheim, 1992):

- pre-testing of the questionnaire to identify any wording or format problems;
- inclusion of confidentiality agreement and informed consent form;
- enhancement of the physical appearance of the questionnaire (e.g. add University's logo);
- having a cover letter and a summary of the research in the beginning;
- conducting telephone pre-notification of the cooperatives;
- using flashcards to familiarise respondents with questionnaires;
- offering the results of the research as a consulting opportunity.

4.7 Pre-testing

This study's questionnaire was translated from English to Greek in order the Greek peach producers to be able to understand it and answer it. A parallel or else called double translation process was undertaken to ensure that the meaning on the questionnaire's questions was the same in both languages (Hambleton, 1993). The latter process involves translation of a questionnaire by a team of experts (Douglas and Craig, 2007). The team members need to have knowledge of the study's questionnaire as well as have the cultural and the linguistic skills to translate it into the appropriate versions (Harkness, 2003). This is because if a questionnaire is not adapted to the particular culture of the target language, the translation might not be accurate (McKay et al., 1996). Moreover, it is recommended that the translation of the questionnaire should be combined with the pre-testing of the questionnaire in order to ensure its comprehensiveness and accuracy for a particular study's respondents (Harkness et al., 1998). Thus, in the questionnaire translation process it is important that the translated version of a questionnaire is not only accurate compared to the original text, but also that the questionnaire is clear and comprehensive to the target population of the study. For the purposes of translation of this study's questionnaire a team of

experts was employed. More precisely, two translators, five academics (i.e. from the FSC area) and twenty three Greek peach producers participated in the questionnaire pre-testing and translation process.

The pre-testing phase of a questionnaire includes the protocol analysis and the debriefing (Diamantopoulos et al., 1994). Protocol analysis is an interview where the respondent is asked to think out loud while completing the questionnaire (Malhotra, 2004). Whereas, debriefing occurs after the questionnaire has been completed (Hair et al., 2011). The latter one involves explaining to the respondents the objectives of the questionnaire who in turn have to justify their answers and any difficulties that they faced while answering the questions (Reynolds et al., 1993). Both protocol and debriefing interviews were used to pre-test this study's questionnaire. Initially the English version of the questionnaire was given to two translators whose their mother tongue is Greek, but they are specialised in English. After the two translators provided the translated questionnaires in Greek, three protocol interviews and two debriefing interviews were conducted with academics from the FSC management area. Both the protocol and debriefing interviews lasted for approximately 30 to 45 minutes.

Finally, both protocol and debriefing interviews were conducted with Greek peach producers. The pre-test of the questionnaire was conducted with Greek peach producers from Macedonia and Central Macedonia. In total twenty three peach producers filled-in the questionnaire during the pre-testing phase. The reason for conducting twenty three interviews with Greek peach producers was in order to pre-test the following aspects: (a) the individual questions and their translation accuracy, (b) the overall questionnaire design, (c) the whole process of questionnaire administration and (d) the reliability of the measurement scales. Considering that the questionnaire was translated in another language and that some measures were reformed to the producers unit of analysis (i.e. firm unit to producers unit), and the development of some new measurement constructs, the pre-testing with as many as possible respondents was essential.

4.7.1 Questionnaire Revision

During the pre-testing of the questionnaire different issues have been raised about the questionnaire. A main concern was the length of the questionnaire. The Greek peach producers stated that a seventeen page questionnaire is too long

for them to complete. However, the length of the questionnaire could not be reduced as all the constructs included are important for this study.

The changes implemented in this study's questionnaire after the pre-testing are the following:

- The subject information sheet before the questionnaire was shortened and simplified; the respondents thought it was too long for no reason (see Appendices 3 and 4);
- The questionnaire was reformed in Optical Mark Recognition (OMR) form for the ease of the researcher.
- The provisional contact information lines were removed from the beginning of the questionnaire to the end. This is because the respondents felt not so comfortable answering the questionnaire by providing their contact details;
- The definitions of each of the collaboration constructs, before the sections were not included as they were confusing for the respondents. Thus, the definitions have been removed;
- The explanations for each collaboration construct were simplified as the academic wording of the constructs seemed to be confusing for the respondents;
- The scale of the resource sharing construct was changed from 1=strongly disagree / 7=strongly agree to 1=not at all / 7=to an extreme extent. This was a recommendation from the academics interviewed, as the content of this question can be better measured and understood by the extent of resource sharing between business partners instead of the agreement for doing it or not;
- In the decision synchronisation construct some examples were added in parenthesis in order to make it more relevant to the ASC producers. The same was done for the resource sharing and communication constructs. Those recommendations were given from both the academics and the Greek peach producers.

No problems or complains were highlighted in terms of the questionnaire layout. After the questionnaire's revision the pilot study was conducted.

4.8 Pilot Study

The pilot study of the questionnaire was conducted with seven academics and six Greek peach producers. The purpose of including the academics in the pilot test was to confirm that the questions were represented and were asked correctly. Six Greek peach producers also participated in the pilot study of this research. Both the academics and the producers confirmed that the questionnaire was clear and understandable. Thus, no further revisions needed. The final questionnaire of this study in English and in Greek can be seen in Appendices 3 and 4.

4.9 Chapter Summary

In this chapter the methodological approach employed in this study was outlined. The reasons for choosing a cross-sectional quantitative research design were explained. Then, the selection of the target population, the sampling frame, the sampling technique, and the sample size were discussed. The personal survey questionnaire data collection method was described as well as the reasons for choosing it for the current study. Then, the questionnaire design was delineated including the constructs, their measurement and the avoidance of measurement errors. The chapter concluded with the pre-test and pilot test of this study's questionnaire and its respective updates.

Chapter 5

Descriptive Analysis and Scale Development Procedures

5.1 Introduction

This chapter outlines the descriptive analysis of the sample and the scale development strategy that is used in order to prepare the measures to be used for hypothesis testing. First, the need for no missing value analysis and reversed items are explained and the sample characteristics are presented. The descriptive analysis of the sample gives an overview profile of the sample. Secondly, the psychometric soundness of the multi-item measures is evaluated. Exploratory Factor Analysis (EFA), reliability assessment, validity assessment, Confirmatory Factor Analysis (CFA) and normality assessment methods are used to purify the measures. EFA is used to examine the underlying structure among the items of the scales and their dimensionality, while CFA shows how well the proposed structured identified fits the data. Continuous assessment of the reliability and validity of the measures after the EFA and the CFA is also performed for optimal measure purification.

5.2 Missing Value Analysis & Reverse Coded Items

Once the questionnaires were collected the data was entered into an SPSS spreadsheet. Due to the fact that the questionnaire data was collected through face-to-face interviews there were no missing values (i.e. no questions left answered). As it was explained in the Research Methodology Chapter (i.e. Chapter 4) reverse coded items were used in this study's questionnaire to prevent response bias. All the questionnaire's items were worded in a positive direction except the four reverse coded items (i.e. IS6, GC7, CM7 and KC7).

Before proceeding to further analysis the reverse coded items were transformed using SPSS. This needs to be done as all the items of a questionnaire need to be coded in the same positive direction before analyzing them (Pallant, 2013). Therefore, the transformed items of the reversed coded items were used for the measure purification process. The rest of the questionnaires items remained the same and could be used for further analysis.

5.3 Sample Characteristics - Preliminary Data Analysis

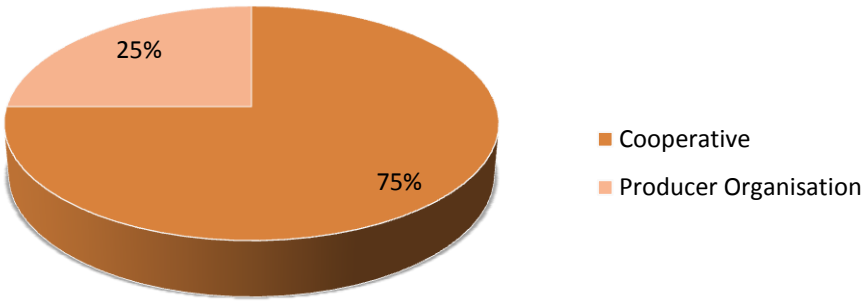
After making sure that there were no missing values and the reversed items were transformed, preliminary data analysis was performed using the IBM SPSS Statistics 22 software package. In total 710 peach producers have been conducted out of which 220 completed the questionnaire which gives a 44.9% response rate. The sample of this study is representative of the studied population as 181 of the respondents were from Central Macedonia, 20 from Thessaly, and 19 from Western Macedonia. This initial stage of the analysis involved analysis of the descriptive statistics of the respondents' organisational and individual characteristics. The purpose of this section was to provide an account of the general characteristics of the respondents involved in this study. This initial stage of the analysis was very important in order to understand the subject studied and to generate a first impression about the main characteristics of the sample. The variables analyzed in this section could be categorized in two types which were the following: (a) organisational characteristics (i.e. organizational type, total volume of fruit and vegetables produced, total volume of peach production, total volume of 'A sorting' peaches produced, total volume of 'B sorting' peaches produced, type of peaches, geographical location), and (b) individual / respondents characteristics (i.e. farming experience, role in the cooperative or other organization). This was because the collaborative relationships of the producers under study vary in all those aforementioned different dimensions. From the variables analyzed in this section only the type of peaches and the farming experience were used in the main data analysis of this study. This is because the type of peaches and the farming experience were identified from the literature review as control variables. However, it was important to have a good understanding of the respondents' characteristics. The

initial analysis of the sample characteristics involved tests for frequency, means, standard deviation, minimum and maximum value of the variables.

5.3.1 Organizational Type

The variable organizational type refers to type of the organization that the respondents sell the majority of their produce. The respondents were given three options which are the following: (a) producer organization, (b) cooperative, (c) other type. However, the respondents of this study fell into the first two categories. As shown in Figure 5.1, 75% of the respondents sold the majority of their production to cooperatives, while 25% of the respondents sold most of their produce to producer organizations. Producer organization is a relative new form of cooperative action in the agricultural sector in Greece. Thus, the majority of producers in Greece sell their produce to cooperatives.

Figure 5.1: Frequency Pie Chart of Organizational Type



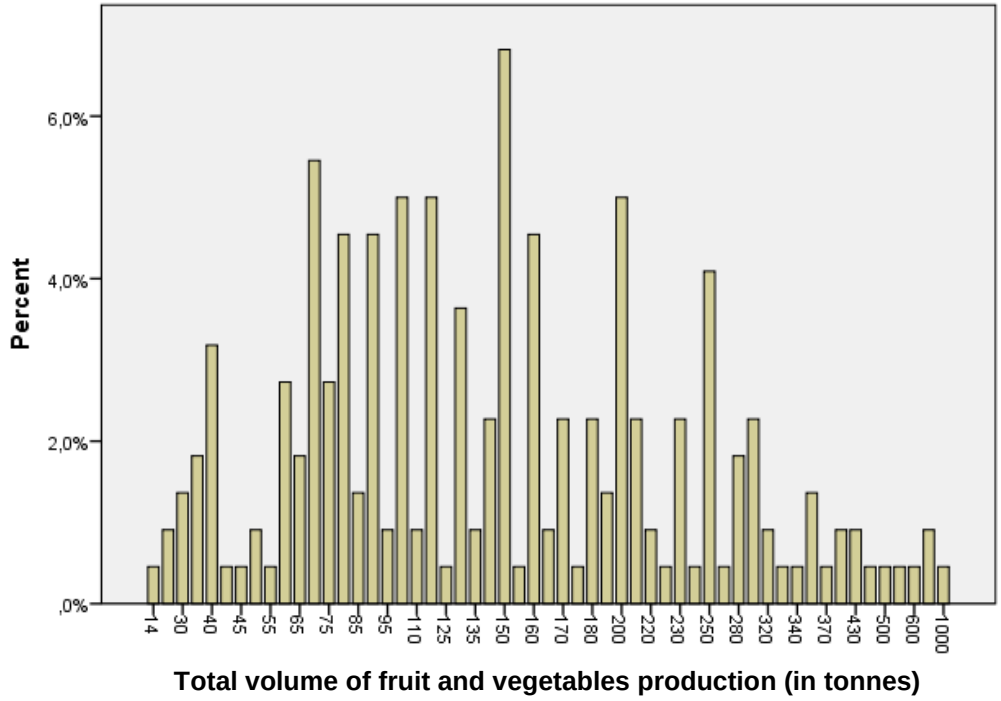
5.3.2 Total Volume Fruit & Vegetables Produced

The total volume of fruit and vegetables produced in tonnes is a variable of this study. Table 5.2 shows the descriptive characteristics of this variable. The minimum value of fruit and vegetables produced from the respondents was 14 tonnes and the maximum is 1000 tonnes. The respondents of this study seemed to be professional producers by having such volumes of fruit and vegetables produced. It can be seen from Figure 5.2 that the cumulative percentage of this variable, the majority of the respondents had total production of fruit and vegetables around 150 tonnes.

Table 5.1: Descriptives of Total Volume of Fruit and Vegetables Produced

Mean	162.24
Standard Deviation	2123.65
Minimum	14
Maximum	1000

Figure 5.2: Cumulative percentage of Total Volume of Fruit and Vegetables Produced



5.3.3 Total Volume of Peach Production

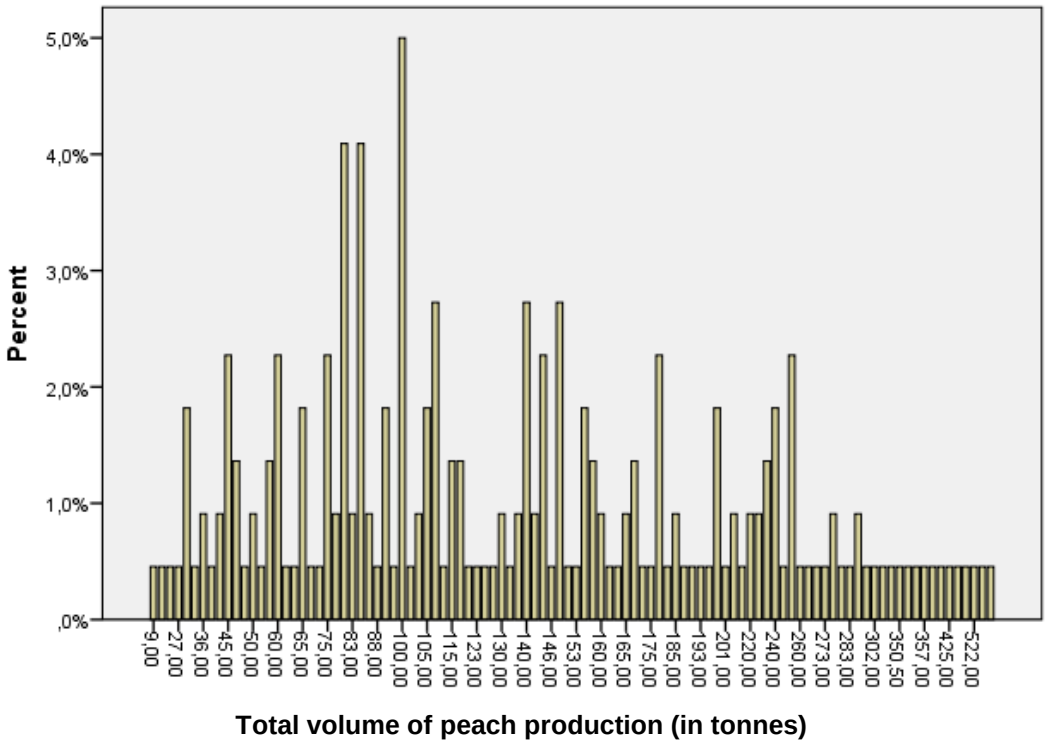
The total amount of peaches produced is another variable of this study. The respondents were asked to write down the total amount of peaches produced in tones for the years of 2009-10, 2010-11 and 2011-12. The average of the three years was taken and the total volume of production across the three years variable was estimated. It can be seen from Table 5.2 that the smallest value for this variable is 9.67 tonnes of peaches, while the largest value is 605 peaches in tonnes. Figure 5.3 shows the cumulative percentage of this variable and it can be seen that 5% of the respondents produced 100,000 tonnes of peaches between 2009 and 2012. Producers participated in this study produced less than 200

tonnes of peaches in the last three years, with the majority of them having a production approximately 90 tonnes of peaches. Less than 3% of the respondents produced around 600 tonnes of peaches.

Table 5.2: Descriptives of Total Volume of Peach Production

Mean	147.3106
Standard Deviation	210.60816
Minimum	9.67
Maximum	605

Figure 5.3: Cumulative percentage of Total Volume of Peach Production



5.3.4 Type of Peaches

The type of peaches produced is another variable that is considered as an important one for this study and as mentioned earlier it was used as a control variable. From Figure 5.4 98% of the respondents had table peaches, leaving 2% for those that they did not have. This means that the majority of this study's respondents had table peaches which are more easily rejected from the market; thus easily categorized as 'B sorting' produce. Figure 5.5 shows the frequency pie chart of processing peaches produced where 43% of the respondents had processing type of peaches, while 57% of the respondents did not have. Therefore, less than a half of the respondents had processing peach type.

Figure 5.4: Frequency Pie Chart of Table Peaches Produced

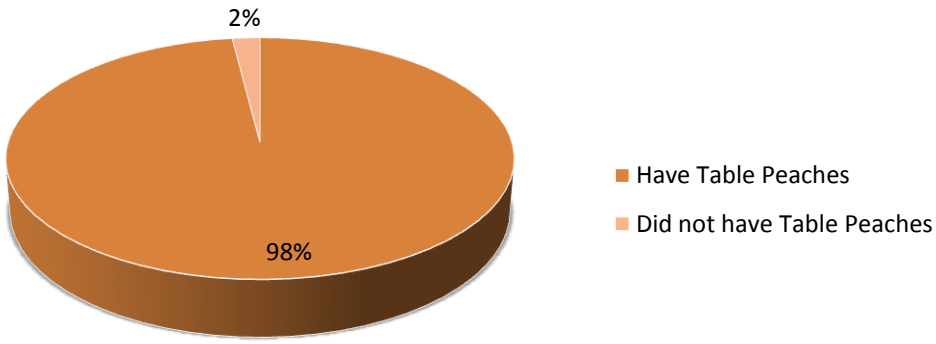
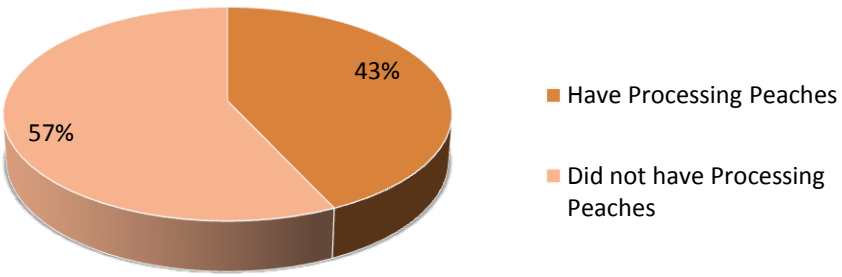


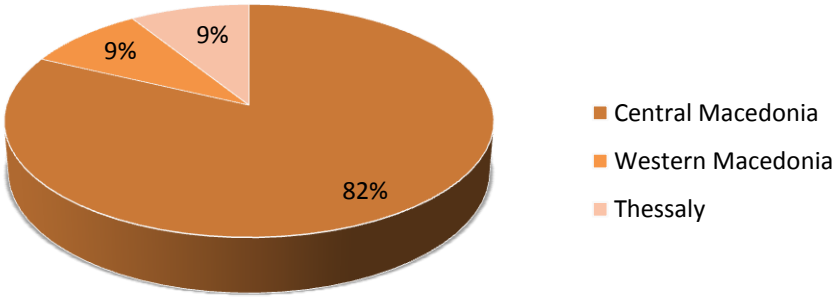
Figure 5.5: Frequency Pie Chart of Processing Peaches Produced



5.3.5 Geographical Location

The majority of peach producers in Greece is based in Central Macedonia, and then follows Western Macedonia and Thessaly. It can be seen from Figure 5.6 that 82% of the respondents were from Central Macedonia, 9% from Western Macedonia and 9% from Thessaly. As mentioned in the Research Methodology Chapter (i.e. Chapter 4), there are three main peach production areas in Greece which are Central Macedonia, Thessaly and Western Macedonia (Bettini, 2013; Statistics Year Book, 2011). Since the exact number of peach producers is not available, the sampling frame was established based on the majority of peach trees per geographical location. It was recorded in 2011 that in total in Central and Western Macedonia there were 730,133 peach trees, while in Thessaly 29,376 peach trees (Hellenic Statistical Authority, 2011). This means that the sample size of this study is representative of the studied population.

Figure 5.6: Frequency Pie Chart of Geographical Location



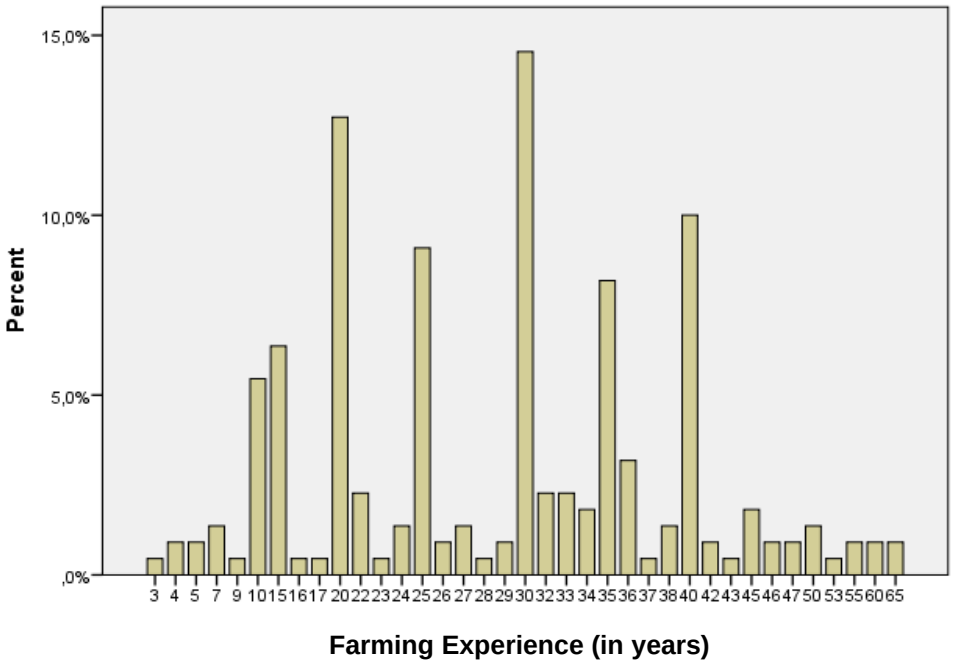
5.3.6 Farming Experience

As already mentioned in Chapter 3, the farming experience variable was used as control variable in this research. The respondents of this study were asked about the number of years of their farming experience. The descriptives of this variable can be seen in Table 5.3; the maximum years of farming experience were 65 years. Figure 5.7 a cumulative percentage of this variable. The majority of the respondents had 20 - 30 years of farming experience.

Table 5.3: Descriptives of Farming Experience

Mean	25,58
Standard Deviation	11,708
Minimum	3
Maximum	65

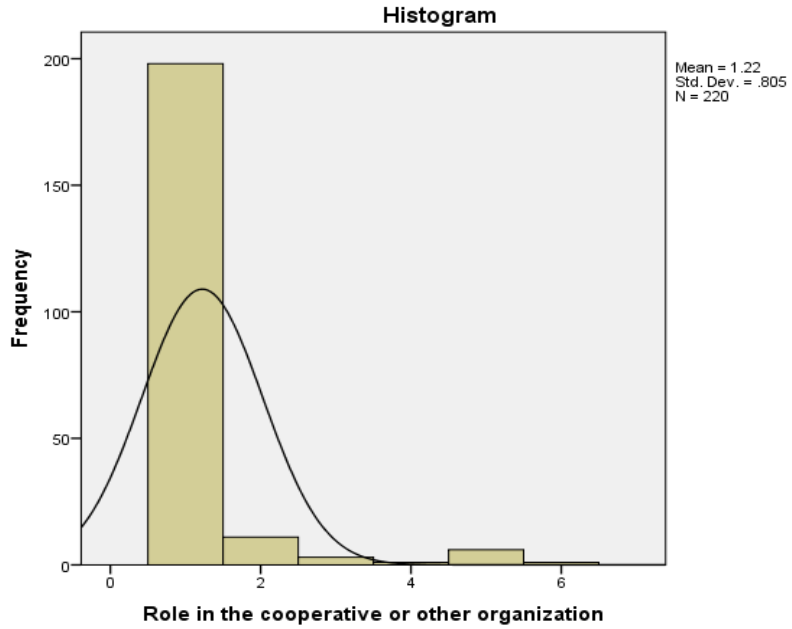
Figure 5.7 Cumulative percentage of Farming Experience



5.3.7 Role in the Cooperative or Other Organization

Finally, the respondents were asked about their role in the cooperative or in other type of organization that they sell the majority of their produce. Six different categories were used to measure this variable. The categories are: (1) member, (2) admin member, (3) sales director, (4) general director, (5) elected head of the organization, and (6) other. It can be seen from Figure 5.8 that the frequency distribution of this variable is positively skewed. Almost all respondents are members of the organization that they sell their produce to.

Figure 5.8: Frequency Histogram of Role in the Cooperative or Other Organization

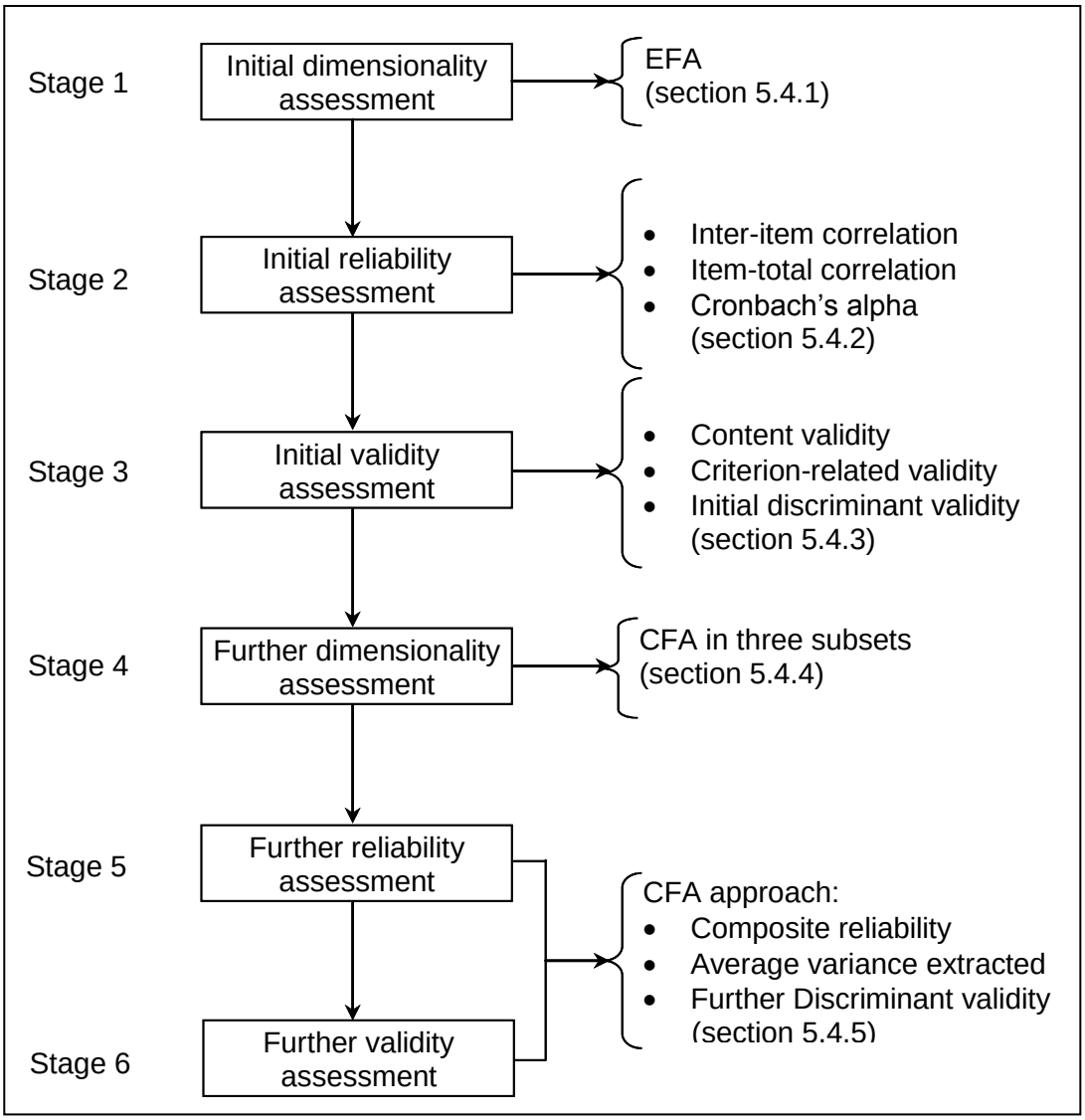


After analysing the sample characteristics, the next step is to assess the psychometric properties of the scales and to develop reliable and valid measures to be used for hypothesis testing which is described next.

5.4 Measure Development Procedures

A good measure needs to have good 'psychometric properties' (DeVellis, 2000). The 'psychometric properties' of a scale refer to its dimensionality, reliability and validity. Before proceeding to hypothesis testing, the measures need to be both reliable and valid. The measure purification literature was followed in order to develop measures that are reliable and valid (Churchill, 1991; DeVellis, 2000; Spector, 1992). This stage of the data analysis involves identification and elimination of poorly performing items (Diamantopoulos and Siguaw, 2000). Figure 5.9 shows the six stage measure development procedure that was followed in this research study.

Figure 5.9: Measure Development Procedure



In Stage 1, an initial dimensionality assessment was performed using Exploratory Factor Analysis (EFA). In Stage 2, the reliability of the measures was assessed through the inter-item and item-total correlation matrices and the Cronbach's alpha. In Stage 3, the initial validity of the measures was established by examining the content validity, the criterion-related validity and an initial assessment of the discriminant validity of the measures. In Stage 4, the final dimensionality assessment of the measures was established through Confirmatory Factor Analysis (CFA). Finally, in Stages 5 and 6, the final reliability and validity of the measures was established through the estimation of composite reliability, average variance extracted and further discriminant validity tests.

Dimensionality, reliability and validity

There have been opposite views regarding dimensionality and reliability and the order that they should be performed. Some researchers such as Churchill (1979) advocates that reliability assessment with Cronbach's alpha should precede the dimensionality assessment. The author states that during the measure development process any 'bad' items might produce error, due to the fact that we might end with many more dimensions than can be conceptually defined. This means that we might have a good value for Cronbach's alpha for one construct, but the items of this construct might not represent one factor and thus they will not measure the same thing. However, other scholars argue that having a reliable measure does not mean that it is unidimentional as well (Gerbing and Anderson, 1988). This is based on the fact that even multidimensional measures can have high internal consistency (i.e. Cronbach's alpha) scores.

The dimensionality or else homogeneity of a scale can be better assessed through exploratory factor analysis (Bollen and Lennox, 1991). By performing exploratory factor analysis, new constructs might emerge that were not thought to be measured. In that case, new constructs might be identified which are variations of the original constructs (DeVellis, 2000). On the other hand, reliability assessment involves correlating each item with the total score and then selecting the items with the highest item-total correlations. The rationale is that the individual items of a scale should all be measuring the same construct and thus should be highly correlated (Hair et al., 2011). Further dimensionality assessment could be achieved through confirmatory factor analysis (Hair et al., 2014). Before proceeding to hypothesis testing the measures need to be re-assessed for their reliability and validity.

5.4.1 Dimensionality Assessment - Factor Analysis Procedures

Defining Factor Analysis

Factor analysis can be used to analyse interrelationships among a large number of variables and to explain the variables in terms of their common underlying dimensions (Hair et al., 1998). The factor analysis technique aims "to find a way to summarise the information contained in a number of original variables into a smaller set of new, composite dimensions with minimum loss of information" (Hair

et al., 2010, p.107). "The goal of factor analysis is to explain the covariance and correlations between many observed variables by means of relatively few underlying latent variables" (Bollen, 1989, p. 206). In order to achieve that, the data might be reduced to few underlying dimensions (Hair et al., 2010). Those underlying dimensions are often referred as factors. Factor is a construct or hypothetical entity that is assumed to underlie a set of items (Kerlinger, 1964). The items that are related, load on factors in a manner that maximizes the variance within the data explained by that factor. The unique factor that emerges from the data may subsequently represent a construct (Hair et al., 2006).

Exploratory versus Confirmatory Factor Analysis

There are two types of factor analysis: Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA). In EFA the researcher makes no assumption about the observed and latent variables; the structure of the factor models indicates the structure of the data (DeVellis, 2000). While, in CFA the number of the variables and its items are hypothesized beforehand. EFA was performed first as any underlying structure of the data should be identified at this stage. The collaboration measures of this study were adopted from Cao et al. (2010) and modified in order to fulfil the purpose of this study. More precisely the collaboration measures of Information Sharing, Goal Congruence, Decision Synchronization, Incentive Alignment, Resource Sharing, Collaborative Communication and Joint Knowledge Creation were modified in order to match the producers unit of analysis and to simplify the wording. As mentioned in Chapter 4, collaboration measures that were taken from Cao et al. (2010) were about companies unit of analysis. The reformed measures have the following names: Information Sharing, Goal Congruence, Decision Synchronization, Activity Sharing, Resource Sharing, Communication and Joint Knowledge Creation. Thus, it is possible to have any changes in the structure of variables. The rest of the measures of this study were developed by the researcher (i.e. new measures). However, due to the fact that they are single-item measures there is no need to assess their dimensionality as they already have only one dimension. Changes in the structure of the variables mean that some measures - variables might be found to measure the same concept. After achieving a good EFA, the next step is to confirm the structure of the measures by performing

CFA. CFA was performed to ascertain the existence of any deviations between the factor structure of the data and the hypothesized one (Sharma, 1996). Before performing the CFA an initial assessment of the reliability and validity of the measures was performed. If the purified measures after the EFA are not reliable and valid, the researcher should not proceed to further purification of the measures (i.e. CFA; Churchill, 1979).

(a) Exploratory Factor Analysis

EFA was used to check whether the proposed dimensionality of the measures is consistent with the data. In EFA the inter-item correlation of the measures is used in order to determine the factors (i.e. dimensions) that account for the correlations in the data (Sharma, 1996). More precisely, EFA groups together the variables that have high correlations with each other or else how much of an item's variance is shared with other items (Hair et al., 2006). When an item correlates highly with another item, this means that they share common variance. For the collaboration measures of this study it is expected that all seven measures will have items that will correlate in seven different factors. As mentioned in Chapter 4, the Competitive Intensity (CI) construct is another multi-item measure that was adapted from Jaworski and Kohli (1993) and Jambulingam et al. (2005) to be used in this study and its dimensionality was assessed using EFA.

- *Common Factor Analysis versus Principal Component Analysis*

Two major factor extraction methods are often used, which are the principal component analysis and common factor analysis (Hair et al., 2006). There are also other factor analysis methods such as maximum likelihood and alpha analysis, but they are not widely used by researchers (Chou et al., 1995). The selection of the factor extraction method is based on the objectives of the factor analysis and the previous knowledge about the variance of the variables (Hair et al., 2014). "Principal component analysis is used when the aim is to summarise most of the original information in a minimum number of factors. While, common factor analysis is used to identify underlying factors or dimensions that reflect what the variables share in common" (Hair et al., 2006, p.117). Common factor analysis was performed as the aim of the EFA for this study is to identify the dimensions of the constructs represented in the original values. For the purposes

of scale development, it is recommended that common factor analysis using Principal Axis Factoring (PAF) should be used. This is because the PAF assumes that any covariation in a dataset is caused by a set of common factors (Sharma, 1996), rather than reducing the number of variables to a minimum to explain the maximum amount of variance in the data. Since the measures used in this study reflect the meaning of the concept, by using PAF different factors with shared covariance are expected to emerge using EFA.

- *Rotation of the Factors*

The factors of an EFA are usually rotated in order to increase the interpretability of this specific method. There are two types of rotation: (a) orthogonal and (b) oblique rotations. The orthogonal method assumes that the factors do not correlate with each other (Hair et al., 2014), whereas oblique rotation method allows factors to correlate instead of maintaining their independence. The oblique rotation as provided in SPSS (i.e. direct oblimin is SPSS) was chosen for this study as the factors should be allowed to correlate in order to identify any hidden relationships among the measures.

- *Factor loadings*

By using the appropriate EFA methods the aim was to identify any items of the measures that are not relevant (i.e. having less than 0.50 factor loading, having cross-loadings, having missing values) and thus they should be deleted (Peterson, 2000). Factor loadings represent the correlation between an item and a factor (Spector, 1992). In the final table of EFA all measures items should have values higher than 0.50 and each of the constructs items should be correlated. However, as some of our measures have not been tested before, EFA is useful but not enough. The appropriateness of factor analysis was judged using different statistical tests such as Kaiser-Meyer-Olkin (KMO) and Barlettt's test of sphericity; both of which are discussed next.

- *Barlett's Test of Sphericity and Kaiser-Meyer-Oilkin Test*

Barlett's test of sphericity is a statistical test that diagnoses the statistical significance of the correlation matrix (i.e. presence of significant correlations

among the variables). This test needs to be significant and having value higher than 0.05. The Kaiser-Meyer-Oilkin Test (KMO) concerns the sampling adequacy of an EFA and it is used to assess the degree to which indicators of a construct can be grouped together (Sharma, 1996). It represents the ratio of the squared correlation between variables to the squared partial correlation between variables (Field, 2009). According to Hair et al. (2014) KMO can take values between 0 and 1 and its values can be interpreted in the following way: below 0.50 is unacceptable, from 0.50 to 0.59 is miserable, from 0.60 to 0.69 is mediocre, from 0.70 to 0.79 is middling, and from 0.80 and higher is meritorious. If the KMO value is close to 1, it means that the patterns of correlations are relatively compact and the results of the EFA is likely to be significant and meaningful (Field, 2009). While, if the KMO value is close to 0, it means that the sum of partial correlations is very large compared to the sum of correlations; indicating diffusion in the pattern of results and inappropriate EFA results. When the Bartlett's test of sphericity is large and significant and KMO value is above 0.60, it could be assumed that the EFA is appropriate and meaningful. The results of both tests are presented next.

(b) Exploratory Factor Analysis Results

After performing the EFA analysis for different combinations of the variables, a set of eight factors was identified (see Tables 4.1, 4.2, 4.3, and 4.8 for the variables abbreviations). Any cases of possible cross-loadings, missing values and / or factor loadings less than 0.50 were eliminated. The final EFA pattern matrix can be seen in Tables 5.4 and 5.5; all measures items were above 0.50 and for each measure its items were correlated. The final set of factors included all collaboration constructs and items except the item CM3. CM3 item was deleted as the factor matrix could not converge when this item was included. The Competitive Intensity construct was included in the EFA as it is multi-item measure and its dimensionality should be assessed. The rest of the measures that are this study's moderators (i.e. Food Safety Regulations (FSR), Food Quality Regulations (FQR), Organic Food Regulations (OFR), Food Traceability Regulations (FTR), Food Transport and Handling Regulations (FHR), Weather Conditions (W), Political Conditions (P), and Economic Conditions (E)) were not entered into the EFA as they are treated as single-item measures.

Table 5.4: Final EFA Pattern Matrix (Factor loadings per measure and Items)

Items	*IS*	*GC*	*DS*	*AS*	*RS*	*CM*	*KC*
IS1	0.986						
IS2	0.974						
IS3	0.987						
IS4	0.951						
IS5	0.887						
IS6	0.958						
GC1		-0.987					
GC2		-0.992					
GC3		-0.989					
GC4		-0.998					
GC5		-0.974					
GC6		-0.998					
GC7		-0.996					
DS1			0.790				
DS2			0.891				
DS3			0.919				
DS4			0.929				
DS5			0.870				
DS6			0.603				
DS7			0.893				
AS1				-0.849			
AS2				-0.927			
AS3				-0.946			
AS4				-0.954			
AS5				-0.963			
AS6				-0.938			
AS7				-0.912			
RS1					-0.979		
RS2					-0.978		
RS3					-0.972		
RS4					-0.986		
RS5					-0.956		
RS6					-0.980		
CM1						0.980	
CM2						0.992	
CM4						0.987	
CM5						0.976	
CM6						0.984	
CM7						0.960	
KC1							0.682
KC2							0.684
KC3							0.685
KC4							0.690
KC5							0.831
KC6							0.863
KC7							0.579

Table 5.5: Final EFA Pattern Matrix for the Competitive Intensity Construct

Items	*IS*	*GC*	*DS*	*AS*	*RS*	*CM*	*KC*	*CI*
CI1								0.931
CI2								0.916
CI3								0.913
CI4								0.917
CI5								0.839
CI6								0.875

The appropriateness of the EFA was judged using Barlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure. KMO found to be 0.972 > 0.60 and Barlett's test of sphericity was significant and higher than 0.05 (i.e. 35696.905, Table 5.6). Thus, the set of factors identified was appropriate to be used for further analysis.

Table 5.6: KMO and Barlett's Test of Sphericity Values

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.972
Bartlett's Test of Sphericity	Approx. Chi-Square	35696.905
	df	1326
	Sig.	.000

5.4.2 Initial Reliability Assessment

After re-specifying our model using factors analysis, the next step was to examine how reliable our measures are. Reliability concerns the extent to which any measuring procedure generates replicable results across repeated applications (Churchill, 1979). Reliability is usually assessed through internal consistency assessment (Lee and Lings, 2008). Internal consistency means that "multiple items designed to measure the same construct will inter-correlate with one another" (Spector, 1992, p.6). A couple of different reliability indicators can be estimated to assess the internal consistency our constructs such as Cronbach's alpha (a value of 0.70 usually is a good indicator), item-total correlation (a value of 0.30 is usually a good indicator) and inter-item correlation (a value of 0.50 is usually a good indicator). The Cronbach's alpha table will indicate whether a model's constructs measure what the researcher wants them to measure and if any of them need to be deleted from the conceptual model. The item-total correlation will indicate the degree and strength of the relationship

between the different variables. In the inter-item correlation table it is expect to see the items of the constructs to correlate among them and having values higher than 0.50; any items with less than 0.50 need to be removed. After that, the inter-item correlation matrix needs to be reproduced to check if the values of rest of the items are improved or not after this deletion.

The same iterative process was followed until all the measures were reliable; the latter is called measurement purification process. In all measures' item-total correlations were higher than 0.30 and inter-item correlations were higher than 0.50. All Cronbach's alpha values of the measures were higher than 0.70 (Table 4.9). However, for some of our constructs Cronbach's alpha was very high, almost 1. This probably is because of common method variance (see Chapter 3). When a variable has Cronbach alpha value of 1, means that this measure is perfect as all the items of this measure are measuring exactly what the researcher wanted (Churchill, 1979). However, this is impossible to happen in the real world. Also, having a very high Crobach alpha value might mean that the respondents of the questionnaire did not pay that much attention to each item of every question and they chose the same answer for all the items; this is the meaning of common method variance (Hair et al., 2014). In order to avoid this from happening, the reverse coded items were entered in the questionnaire. Also, Harman's test for common method variance occurrence in our measures will be performed before hypothesis testing. This is because after performing the CFA probably some more items will be deleted and thus might affect the occurrence of common method variance. It is suggested that some items should be deleted in order to reduce Cronbach's alpha value. After re-performing the reliability analysis with the aim of deleting items, the Cronbach's alpha values of some constructs were decreased. In order to achieve that items with high Cronbach's alpha values have been deleted. The indication of the SPSS output for which items will increase the Cronbach's alpha value was used here with the aim of deleting the items that cause very high alpha values. Table 5.7 shows the initial Cronbach's alpha values and the Cronbach's alpha values after deleting some items for each measure.

Table 5.7: Initial Cronbach's alpha values, Cronbach's alpha values after deleting items and items deleted.

Variable name	*Initial Cronbach's alpha*	*Cronbach's alpha after deleting items*	*Items deleted*
Information Sharing	0.991	0.987	IS3
Goal Congruence	0.999	0.998	GC1, GC2
Decision Synchronisation	0.978	0.970	DS3
Activity Sharing	0.994	0.991	AS4
Resource Sharing	0.998	0.998	none
Communication	0.997	0.995	CM3, CM6
Knowledge Sharing	0.982	0.982	none
Competitive Intensity	0.991	0.991	none

Six items have been deleted in total at this stage, which means that there are 46 items and thus 8 factors (i.e. 8 different constructs) in the EFA. After deleting the items, EFA was re-performed and the factor loadings were the same as before. The KMO and Barlett's test were re-estimated and it can be confirmed that the set of factors identified is appropriate to be used for further analysis. KMO was 0.970 and Barlett's test of sphericity was significant and higher than 0.05 (i.e. 29545.973).

5.4.3 Initial Validity Assessment

Validity is defined as the extent to which a scale accurately represents the concept of interest, and to be more precise it is about whether the scale - measure measures what it was intended to measure (Lee and Lings, 2008). Construct validity concerns the accuracy of measurement of our constructs. In other words, construct validity is about the theoretical relationship of a construct with the other constructs (DeVellis, 2000). There are different ways of assessing the validity of a measure such as the manner in which the scale was constructed and its relationship to measures of other constructs (DeVellis, 2000). There are three main types of validity assessment which are as follows: content validity, criterion-related validity, convergent validity and discriminant validity. In this section the content validity, the criterion-related validity and the initial discriminant

validity assessment are discussed. Further validity assessment tests are performed after the final CFA.

(a) Content Validity Assessment

Content validity is concerned with whether or not the construct is adequately captured by the measure (DeVellis, 2000). Content validity of a scale can be achieved when the researcher uses pre-existing reliable scales or when the construct is newly developed by interviewing experts. In the current research, for the collaboration construct a pre-existing scale was used that was borrowed from Cao et al. (2010; 2011) where the collaboration scale (consisting of seven sub-constructs; 7-point Likert scale) was tested for its validity and it seemed to be fully captured by its measures. For the different environmental turbulence factors (i.e. regulatory conditions, external conditions and competitive hostility) and the PHFL measure the researcher created the single-item scales and tested their validity by pilot-testing the questionnaire with academics, translators and producers.

(b) Criterion-related Validity Assessment

Criterion-related validity can also be termed as concurrent and / or predictive validity depending on "whether the criterion precedes, follows or coincides with the measurement in question" (DeVellis, 2000, p. 51). Correlation analysis can be used to check the criterion-related validity of our constructs. As discussed earlier in section 5.4, correlation matrices for each of the constructs were produced to assess the inter-item correlation of each measure and thus assess the criterion-related validity of this study. The pattern of the inter-item correlation matrix indicated high correlation of all the items measured. Therefore, the items of the individual measures were highly interrelated which means that they effectively predicted the measures.

(c) Initial Discriminant Validity Assessment

Discriminant validity is the extent to which a latent variable (i.e. a variable that cannot be directly observed) discriminates from other latent variables (Fornell and Larcker, 1981). Discriminant validity can be established by examining the

correlations of the latent measure (Anderson and Gerbing, 1988). To assess the discriminant validity of each measure the summated scales of the measures were created and the correlation matrix of them was assessed. In this correlation matrix all the latent measures (i.e. both multi-item and single-item) of this study were included in order to check for discriminant validity. All latent constructs correlations should be less than 0.85. The correlation matrix produced showed that there are no extreme / significant correlations among the latent measures of this study. Therefore, the researcher could proceed to further analysis (see Appendix 5). Further assessment of discriminant validity will be performed using the results from the final CFA of this study.

5.4.4 Further Dimensionality Assessment - Confirmatory Factor Analysis

CFA was performed using the LISREL software in order to further validate empirically each item and measures used in this study. According to Gorsuch (1997) the difference between EFA and CFA is that in the former one the statistical method used determines the number of factors, while in the latter the proposed model's fit is being checked for its fit with the data (i.e. goodness-of-fit). Netemeyer et al. (2003) state that CFA is a tool that sufficiently validates the theoretical framework of the constructs. Also, through the CFA the reliability and the validity of the constructs are well established (Ping, 2004).

By performing CFA not only the covariance among the constructs themselves can be analysed, but also the covariance between the constructs (Gerbing and Anderson, 1988). As discussed in section 5.4.1 through the EFA the shared variance of the measures was examined. By using CFA the shared variance among the measures can be examined. To be more precise, performing CFA for this study's model is essential as the covariance of each of the collaboration constructs separately needs to be analysed, but also the covariance between the different constructs (e.g. information sharing, communication etc.). CFA examines the error terms associated with the items of the model's measures and their inter-correlations and impacts on the items values (Anderson and Gerbing, 1988). According to Gerbing and Anderson (1988, p.186) CFA "offers a stricter interpretation of the unidimensionality that can be provided by more traditional method". The dimensionality assessment of measures in CFA often produces

different results about the acceptability of the scales. CFA was performed in this study to further assess the dimensionality, reliability and validity of the measures.

Different criteria are used for CFA model assessment (Kelloway, 1998). These criteria include the model fit criteria, small standardised residuals, modification indices, significant factor loadings, composite reliability and average variance extracted. Several CFA model re-specifications might be needed before a good CFA model is achieved. The CFA model assessment criteria, the model re-specifications and the results of CFAs for this research study are discussed below.

(a) Assessing the Model Fit

When conducting CFA, three most common fitting criteria can be used. Those are criteria are as follows: (1) ordinary least square (OLS), (2) the generalised least square (GLS), and (3) the maximum likelihood (ML) (Diamantopoulos and Siguaw, 2000). The ML is the most commonly used fitting method, as it is known to produce consistent and reliable results for relatively small samples (Bentler and Chin-Ping, 1993; Hair et al., 2006). In this study the LISREL 8.5 software package was used and the ML fitting method was chosen. The ML fitting method allows for reliable parametric statistical results (Hair et al., 2006). This is the reason why this method was chosen.

There are two categories of fit indices which are the absolute fit measures and the relative or else incremental fit measures (Bollen and Long, 1993). In assessing the absolute fit of a CFA model the most popular measure is the chi-square statistic (χ^2) and its associated degrees of freedom (Diamantopoulos and Siguaw, 2000). Through the χ^2 estimation the null hypothesis is tested which is about the model fitting perfectly the sample population (Hu and Bentler, 1998). This means that a statistically significant χ^2 will cause a rejection of the null hypothesis. More precisely, χ^2 is a test of the error differences between the data's covariance matrix and the theoretical model (Marsh et al., 1988). An ideal χ^2 value for good fit to be established is close to zero with a significant p-value higher than 0.05. However, χ^2 is sensitive to sample size and tends to increase as sample size increases (Hu and Bentler, 1999). Therefore, in order to assess the goodness-of-fit other absolute fit measures are used too.

The χ^2/df ratio or else normed χ^2 is another absolute fit index measure. The degrees of freedom (df) value concerns the difference between the number of observations and the number of parameters that the CFA model estimates (Marsh et al., 1988). The χ^2/df ratio takes into account the χ^2 test compared to the sample size. A value from 2-1 and 3-1 recommends an acceptable fit.

The Goodness-of-fit index (GFI) is similar to R^2 in regression analysis and it indicates the proportion of the observed covariance explained by the model's covariance (Joreskog and Yang, 1996). GFI "shows how closely the model comes to perfectly reproducing the observed covariance matrix" (Diamantopoulos and Siguaw, 2000, p. 87). While, Adjusted goodness-of-fit (AGFI) is the GFI index adjusted to the degrees of freedom. The values of both indices should range from 0 to 1; values above 0.90 indicate acceptable fit (Kelloway, 1998).

The Root Mean-Square Error of approximation (RMSEA) index shows the standardised summary of the average covariance residuals. Thus, the specific index is based on the analysis of the errors or else residuals. "The term residuals refer to the individual differences between the observed covariance terms and the fitted covariance matrix" (Hair et al., 2006, p. 796). The smaller the residuals, the better the model fit. A value of 0.08 recommends a reasonable fit, while a value of 0.05 or less recommends a good fit.

Relative fit indices show "how much better the model fits compared to a baseline model, usually the null or else independent model" (Hu and Bentler, 1999, p. 82). The independent model is a model in which all variables are assumed to be uncorrelated. The Normed Fit Index (NFI) is a relative fit index that indicates the percentage of improvement of the hypothesized model to the baseline model (Diamantopoulos and Siguaw, 2000). The aforementioned index can take values from 0 to 1; values over 0.9 indicate a good fit to the data. Non-normed fit index (NNFI) is a similar index to NFI, however the former one is adjusted to the degrees of freedom. Comparative fit index (CFI) indicates the percentage of improvement of the hypothesized model to the baseline model which ranges from 0 to 1 (Hu and Bentler, 1999).

The most common model fit assessment criteria used from researchers are as follows: χ^2, df χ^2/df, RMSEA, CFI, NNFI, GFI. Therefore, both absolute and

relative fit indices will be used to assess this study's CFA models. The results of this study's CFA models are explained in section (c) of this section

(b) Model Re-specification

In order a good CFA model to be achieved several model re-specifications might be needed. This can be achieved by deleting non-significant paths and/or adding new paths to the model (Kelloway, 1998). Non-significant paths are the relationships that the researcher hypothesized to exist, but according to the data they do not exist. Adding a new path is about exploring new relationships that might be significant, but have not hypothesized beforehand in the conceptual framework of a research. There are different parameters that the researcher has to examine in order to remove or add an item. First, the estimated factor loadings need to have a high value; a minimum value of 0.5 or ideally a value above 0.7 (Brown, 2006). Secondly, the residuals and the standardised residuals need to be examined for having high values (Hu and Bentler, 1998). When a good model fit is achieved the standardised residuals should have small values. A high standardised residual value indicates that the degree of error is high and this item should probably be removed. Examination of modification indices is another way to re-specify a CFA model. The aforementioned indices that are estimated by the LISREL software concern the amount of change in a model's χ^2 by assuming that each parameter in the model is set to zero (Kelloway, 1998). Modification indices show how much the χ^2 value will be reduced by deleting this path and thus the model will be improved (Hair et al., 2014). Any model modifications must be meaningful and theoretically justified (MacCallum et al., 1992). To achieve a good CFA model several model iterations might be needed. However, in all model iterations the theoretical underpinning of the model should be considered. To sum up, the overall aim of this stage is to assess the dimensionality of the measures and to ensure that the data collected fit adequately with the theoretical underpinning of this study.

(c) Confirmatory Factor Analysis Results

Following the measure development procedure as seen in Figure 5.13, all items that passed the EFA evaluation, the reliability and validity assessment were entered into CFA models for further analysis. Using the LISREL 8.5 (Joreskog

and Sorbom, 2004) and the ML estimation method two sub-models and one full measurement model were run. In order to perform a CFA the 5:1 rule for the data needs to be met (Hair et al., 2014). This means that for each one item of the data, five responses are needed. For a sample size of 220, 44 items could be included in a single CFA. After the EFA as discussed in section 5.4.1 (b) and as seen in Table 5.8 the collaboration items were 40, the outcome variable was 1, the control variables were 3 (i.e. Fexp, Table, Proc) and the variables that will be used as moderators were 9; which is a total of 53 items. Thus, due to the model's complexity and to the 5:1 rule the variables were assessed initial in two separate CFA's.

The first set of CFA included all the collaboration items and the control variables, a total of 43 items. In second set of CFA all the single-item variables were entered in one CFA which is a total of 9 items. The final set of CFA included all of this study's items, after them being purified through the run of the first and second set of CFA. For the final set of CFA a total of 35 items were included which met the criteria of the 5:1 rule. A total of 19 items were deleted. The decision to delete the items was based on the assessment of the absolute and incremental fit measures and then the model was re-specified as explained in Section 5.4.4 b). However, the item reduction was not a concern as the multi-item measures used had at least 6 items per measure. Also, two item measures were considered to be enough for CFA assessment and for model's complexity to be reduced. The procedures discussed in section 5.4.4 were followed in order a good model to be achieved. Also, the fit indices were examined to assess the fit of the theoretical model with the data collected.

- *CFA model - Set One*

The initial results of the CFA did not provide a good fit to the data (χ^2= 2229.31, df= 851, p-value= 0, χ^2/df= 2.619, RMSEA= 0.086, CFI= 0.85, NNFI = 0.833, GFI = 0.684). After several model modifications, 18 items were deleted in order a good CFA model to be achieved. In Table 5.8 the deleted items of each measure for the set one of CFA can be seen.

Table 5.8: Deleted Measure Items of Set One CFA

Variable name	*Items deleted*
Information Sharing	IS6
Goal Congruence	GC3, GC5
Decision Synchronisation	DS2, DS6
Activity Sharing	AS1, AS3 , AS6
Resource Sharing	RS2, RS3,RS6
Collaborative Communication	CM4, CM5
Knowledge Sharing	KC2, KC4, KC5,KC6, KC7

The final CFA of set one provided an excellent fit (χ^2= 219.769, df= 248, p-value= 0.901, χ^2/df= 0.89, RMSEA= 0, CFI= 1, NNFI = 0.981, GFI = 0.982). All the factor loadings of this CFA had values higher than 0.70. The factor loadings shown in Table 5.9 were taken from LISREL's output of Lambda-X completely standardised solution.

Table 5.9: Factor Loadings for Final Solution of Set One CFA

	Factor loadings per measure							
Items	IS	GC	DS	AS	RS	CM	KC	Controls
IS1	0.993							
IS2	0.994							
IS4	0.974							
IS5	0.948							
GC4		0.997						
GC6		0.998						
GC7		0.994						
DS1			0.851					
DS4			0.998					
DS5			0.904					
DS7			0.985					
AS2				0.990				
AS5				0.995				
AS7				0.976				
RS1					0.984			
RS4					0.999			
RS5					0.994			
CM1						0.997		
CM2						0.996		
CM7						0.955		
KC1							0.998	
KC3							0.997	
Fexp*								0.904
Table*								0.896
Proc*								0.894

*Fexp: Farming experience variable
Table: Table types of peaches variable
Proc: Processing types of peaches variable

- *CFA model - Set Two*

All the measures included in set two CFA were single-item measures except the Competitive Intensity (CI) measure. Although CFA provides useful results for multi-item measures, it was essential to perform a CFA even with single item measures since they will be used for hypothesis testing. The aim of this CFA was to achieve good model fit and to have significant factor loading in order to be able to proceed to further data analysis. The initial results of the CFA set two as seen in Table 5.10 indicated an acceptable fit to the data (χ^2= 40.987, df= 26, p-value= 0.0311, χ^2/df= 1.57, RMSEA= 0.0513, CFI= 0.994, NNFI = 0.984, GFI = 0.970). In order to further improve the model's fit, an examination of the standardised residuals and the modification indices was conducted. After deleting CI4 (i.e. item 4 of the Competitive Intensity construct) the model's fit was substantially improved. This is because the CI4 item had high standardised residual value i.e. 7.36. The results for the final CFA of set two were as follows: χ^2= 23.213, df= 16, p-value= 0.108, χ^2/df= 1.45, RMSEA= 0.0454, CFI= 0.996, NNFI = 0.987, GFI = 0.981. Table 5.10 shows the factor loadings for CFA model set two, with all the factor loadings being higher than 0.7.

Table 5.10: Factor Loadings for Final Solution of Set Two CFA

	Factor loadings per measure								
Items	FSR	FQR	OFR	FTR	FHR	W	P	E	CI
FSR	0.894								
FQR		0.899							
OFR			0.894						
FTR				0.847					
FHR					0.765				
W						0.896			
P							0.895		
E								0.894	
CI1									0.969
CI4									0.992
CI5									0.912

- *CFA model - Final Set*

To further establish the robustness and stability of the measures a model with all the measures was estimated. This means that all the remaining items from CFA set one and CFA set two were entered into one CFA. A total of 36 items was entered in this CFA which fulfils the 5:1 rule for a sample of 220. The results of

the CFA final set indicate an excellent model fit (χ^2= 460.217, df= 26, p-value= 0.593, χ^2/df= 0.98, RMSEA= 0, CFI= 0.998, NNFI = 0.997, GFI = 0.9). The factor loadings remained the same as presented in the two previous CFA's. To conclude to this final CFA model not only the fit indices were examined in every CFA, but also the modification indices and the standardised residuals were assessed simultaneously.

5.4.5 Further Measure / Construct Reliability & Validity assessment

A good model fit does not mean that the model is valid (Kelloway, 1998). Therefore, the reliability and the validity of the purified measures need to be assessed next.

(a) Construct Reliability (CR) Assessment

A scale cannot be valid if it is not reliable (DeVellis, 2000). Although the scales of this study were assessed for their reliability after the EFA (as discussed in section 5.4), reassessment of the measures reliability needs to be performed after their final purification. As mentioned in section 5.4, Cronbach's alpha coefficient is an estimate that is commonly used to assess the reliability of a scale. However, at this stage of this research we do not need to recalculate Cronbach's alpha coefficient. This is because the results of the LISREL Output of the final CFA allow the estimation of Construct Reliability (CR). CR is used to further assess the scale reliability of this study. It is recommended that CR should be 0.7 or higher (Hair et al., 2006). The calculation of CR is performed manually using the formula below (DeVellis, 2000 and Netemeyer et al., 2003; equation 5.1).

The formula used has been proposed by Werts et al. (1974) (see Bagozzi, 1981; Bollen, 1989; Fornell and Larcker, 1981). This latent variable reliability of a measure x, with indicators (items) x1, x2, ..., xn, is given by the formula below:

$$p_x = \frac{(\Sigma\lambda_i)^2 Var(X)}{(\Sigma\lambda_i)^2 Var(X) + \Sigma Var(e_i)} \qquad (5.1)$$

As shown in equation 5.1 e_i denotes the measurement error for x_i indicators, while λ_i is the loading of x_i on X , $Var(X)$is the error free variance of X , and Σ is the notation of summation.

CR is another indicator of convergent validity (Hair et al., 2006). Convergent validity is ascertained when the construct behaves as expected with respect to the other constructs to which it is theoretically related (Churchill, 1991). Thus, further assessment about the measures' convergent validity will be performed through the CR estimation.

(b) Average Variance Extracted (AVE) Assessment

The average percentage of variance extracted (AVE) is another indicator of convergent validity. The AVE measure is used to "assess the amount of variance captured by a set of items in a scale relative to measurement error" (Netemeyer et al., 2003, p.153). AVE represents the average of squared factor loading. According to Fornell and Larcker (1981) AVE values over 0.5 are acceptable and as such demonstrate convergent validity. If any AVE value is less than 0.5, it indicates that the variable has more error, rather than the variance explained by the latent construct (Whitten and Leidner, 2006). The AVE can be calculated manually using the formula 5.2 (equation 5.2; Fornell and Larcker, 1981); where λ is the standardised factor loading, n is the number of items):

(5.2)

$$AVE_x = \frac{(\Sigma\lambda_i^2)Var(X)}{(\Sigma\lambda_i^2)Var(X) + \Sigma Var(e_i)}$$

(c) Construct Reliability (CR) & Average Variance Extracted (AVE) Results

The CFA set three (i.e. final CFA of all measures) was used to calculate the CR and the AVE values for the multi-item measures of this study. Table 5.11 shows the values for both CR and AVE. All CR values were above 0.7 which indicates high reliability of the measures. While, all AVE values were over 0.5 and thus convergent validity of the measures was demonstrated. More precisely, high convergent validity of the measures showed that this study's multi-item measures reflect the same construct and therefore they were good measures.

Table 5.11: Construct reliability and Average variance extracted values

	IS	*GC*	*DS*	*AS*	*RS*	*CM*	*KC*	*CI*
CR	0.987	0.998	0.966	0.991	0.995	0.988	0.997	0.971
AVE	0.952	0.993	0.877	0.974	0.985	0.966	0.995	0.918

(d) Further Discriminant Validity Assessment

In order for a measure to be valid it needs to be assessed for its discriminant validity. An initial validity assessment was performed in this study after the final EFA. However, since the final EFA the measures have been further purified. Discriminant validity is the degree to which a latent construct is distinct from other latent constructs in the analysis (Peter, 1981). According to Fornell and Larcker (1981), discriminant validity can be assessed by comparing the AVEs for any two constructs with square correlations between them. In order to achieve discriminant validity the largest squared correlation between any two measures should be lower than the lowest AVE.

(e) Further Discriminant Validity Assessment Results

As seen in Table 5.12 all the AVEs estimated appeared to be higher than any squared correlations which provide a good evidence of discriminant validity. AVEs values were compared with the squared correlations from the standardised PHI matrix that was produced in the final CFA model (Kelloway, 1998). The AVE values can be seen in bold in the diagonal, whereas squared correlations can be seen in the upper triangular; above the AVE values.

Table 5.12: Correlation matrix and Discriminant Validity of the Measures

	IS	*GC*	*DS*	*AS*	*RS*	*CM*	*KC*	*CI*
IS	**0.952**	0.126	0.330	0.375	0.320	0.330	0.362	0.326
GC	0.356	**0.993**	0.301	0.256	0.455	0.319	0.286	0.412
DS	0.575	0.549	**0.877**	0.416	0.315	0.272	0.354	0.550
AS	0.613	0.506	0.645	**0.974**	0.425	0.330	0.253	0.595
RS	0.566	0.675	0.562	0.652	**0.985**	0.306	0.344	0.602
CM	0.575	0.565	0.522	0.575	0.554	**0.966**	0.362	0.330
KC	0.602	0.535	0.595	0.503	0.587	0.602	**0.995**	0.659
CI	0.571	0.642	0.742	0.772	0.776	0.575	0.812	**0.918**

To sum up, the measures / constructs examined demonstrated high construct reliability and discriminant validity. However, before hypotheses testing, it is necessary to assess the normality of the obtained measures (see section 6.2.1).

5.5 Chapter Summary

The purpose of this chapter was to provide a descriptive analysis of the sample data and to purify the measures used in this study. First, the reason for having no

missing data was explained. Then, by following the recommended measure development procedures, all measures were assessed for their dimensionality, reliability and validity. More precisely, the unidimensionality, construct reliability, construct convergent validity and construct discriminant validity were established using EFA and CFA assessment methods. In terms of reliability the measures were also assessed for their inter-item correlation, item-total correlation and Cronbach's alpha values. The results of the aforementioned reliability analysis showed that all measures were reliable. Also, the validity of the measures was further established through the content-validity and criterion-related validity assessments.

Chapter 6

Hypothesis Testing and Results

6.1 Introduction

This chapter outlines the hypotheses tests of this study and the analysis of their results. A number of methodologies are used for hypothesis testing, but for the purpose of this study the Structural Equation Modelling (SEM) technique has been employed. The SEM hypothesis testing technique and its underlying assumptions related to normality, linearity, homoscedasticity, and independence of observations are discussed. In addition, other major issues related to SEM technique are discussed such as: multicollinearity, test power, influential observations and common method variance assessment and the structural model assessment criteria. The results of the hypotheses tests for both individual and moderating effects are presented and conclusions are drawn towards the end of this chapter.

6.2 Structural Equation Modelling for Hypothesis Testing

The purpose of the CFA, as shown in Chapter 5, was to assess this study's conceptual model fit with the data. However, CFA has limited ability to examine the nature and magnitude of relationships between constructs. Another multivariate modelling technique is needed to test this study's hypotheses.

There are different statistical analysis methods / multivariate modelling techniques that could be used for testing and analyzing hypothesized relationships such as multiple regression, logistic regression, Poisson regression (Hair et al., 2006). These multivariate modelling techniques as well as others can examine only a single relationship between independent and dependent variables at a time (Hair et al., 2014). However, researchers might need to model and test many relationships at the same time (Anderson and Gerbing, 1988). The latter

applies to the current study as the aim is to test the overall effect of all the seven collaboration sub-constructs (i.e. information sharing, goal congruence, decision synchronisation, activity sharing, resource sharing, communication, joint knowledge creation) to PHFL simultaneously.

For the purposes of this study the SEM technique is used to analyse the hypothesized relationships of this study's conceptual model. SEM can test theories that contain multiple equations involving dependent relationships series (Hair et al., 2014) and enables researchers to estimate a series of separate, but interdependent multiple regression equations (Byrne, 2005). Hence, SEM seems to be the most appropriate technique to be used in this study, as the researcher aims to identify the effect of all the different collaboration constructs on PHFL simultaneously. The SEM technique was also employed by Cao et al. (2010) from which this study's collaboration measures were adopted. LISREL 8.5 software for SEM is used with the Maximum Likelihood estimation method as it is appropriate for relatively small samples (Joreskog and Sorbom, 2004). Further explanation regarding the reasons for using the Maximum Likelihood method were explained in Chapter 5 (section 5.4.4)

In order to test for the structural relationships the error variance of the constructs needs to be calculated. The error variance could be calculated using the formula $[(1 – \alpha)^* \delta^2]$ (Jöreskog et al., 1993), where α is the composite reliability and δ^2 the sample variance of the construct (Cadogan et al., 2006). The score of obtained error variance is set in the LISREL spj (i.e. LISREL coding file). In this way any variance of the indicators coming from other sources than the measured concept itself is constrained. For the current research the composite reliability (α) of the multi-item scales was estimated in Chapter 5 (see Figure 5.13). The sample variance (δ^2) for the latent constructs was calculated precisely as well. However, for single-indicant variables which here are the control variables and the moderator variables, α value was set at 0.7 (the minimum critical value of reliability as suggested by Cadogan et al. (2006). This is because for single-indicant measures the reliability cannot be estimated and it is assumed that is 0.7.

6.2.1 Main Assumptions of the Structural Equation Modelling Technique

There are four major assumptions in the SEM technique and in order to draw valid conclusions from the structural analysis, all assumptions should be met (Hair et al., 2006). These assumptions are as follows: normality, linearity, homoscedasticity, and independence of observations.

(a) Normality Assessment

Before proceeding to hypothesis testing the purified measures should be assessed for their normality. This is because normality is a main assumption in multivariate data analysis (Hair et al., 2010). "Normal is used to describe a symmetrical, bell-shaped curve, which has the greatest frequency of scores in the middle, with smaller frequencies towards the extremes" (Pallant, 2013, p. 61). If the measures deviate significantly from normality, multivariate data analysis cannot be performed as the results will be considered invalid (Srivastava, 2002). The normal Quantile - Quantile Plot (Q - Q Plot) is initially used to assess the normality of this study's variables. Q-Q plots can be used to plot the quantiles of a variable's distribution against the quantiles of the normal distribution (Oztuna et al., 2006). For values sampled from a normal distribution, the Q-Q plot shows all the points lying on or near a straight line drawn through the middle half of the points. Scattered points lying away from the line are suspected outliers that may cause the sample to fail a normality test.

Moreover, to further confirm the normality of this study's variables the most commonly test for normality assessment of a scale is used, which is the Kolmogorov-Smirnoff (KS) test for normality. A non-significant result of KS with a value greater than 0.05 would mean that the distribution is normally distributed (Hair et al., 2006). However, the KS test is extremely sensitive to any small deviations from normality. In order to address the aforementioned issue, the z-values of the skewness and kurtosis of the measures will be computed. "Kurtosis is a measure of the peakedness or flatness of a distribution when compared with a normal distribution, while skewness is measure of the symmetry of a distribution" (Hair et al., 2006 p. 40-41). The most commonly used critical values of Zkurtosis and Zskewness are ± 2.58 (p=0.1) and ±1.96 (p=0.05). However, in large samples (200 or more) with small standard errors, this criterion should be changed to ± 2.58 (Field, 2009). If z-values exceed the critical value the

distribution is considered to be not normal (Hair et al., 2006). A negative kurtosis value of z-value indicates a platykurtic (flatter) distribution, while a positive value shows that the distribution is leptokurtic (peaked). A negative skewness value of Z statistic denotes that the distribution is shifted to the right, while a positive skewness value denotes that the distribution is shifted to the left. The aim of performing normality assessment of the measures is to examine whether the observed distribution of the measures differs significantly from normal distribution using the KS test and the z-values of skewness and kurtosis.

- Normality Assessment Results

The Q-Q plots of this study's variables were drawn using IBM SPSS 22 software package. All variables found to be normally distributed as all the points of each variable were lying in a straight line. The Q-Q plots can be found in Appendix 6. A further assessment of the measures' normality was performed through the estimation of the z-values of skewness and kurtosis. The latter showed that both z-values of skewness and kurtosis were between ±1.96 and ±2.58 for an alpha level of 0.05. Thus, the measures could be used for hypothesis testing. Therefore, all variables of this study seem to follow the normal distribution curve and no transformations of the variables is needed.

(b) Linearity and Homoscedasticity Assessment

The linearity assumption is about having linear relationship between two variables. Linearity could be assessed looking at the variables scatterplots and observing a straight line, not a curve (Pallant, 2013). The homoscedasticity refers to the variability of the scores of each variable and it assumes that the variability of scores for one variable should be similar to all values of another variable (Hair et al., 2006). The homoscedasticity assumption could be also examined using the scatterplots of the variables. The inspection of the scatterplots of selected variables of this study as seen in Appendix 7 showed no serious violations of the linearity and homoscedasticity rules. The variables found to form a straight line and the data seemed to have sufficient variability.

(c) Independence of Observations Assessment

The assumption of independence of observations refers to the fact that each respondent completed only one questionnaire and that there was no

communication among the respondents while filling-in the questionnaires. For this study the independence of observations was established through the random sampling of the respondents and the face-to-face administration of the questionnaires.

6.2.2 Other Issues of the Structural Equation Modelling Technique

After confirming that all the SEM assumptions have been met, the researcher should address some additional issues related to multivariate data analysis. These issues are about: (a) the multicollinearity of the variables, (b) the test power, (c) influential observations, and (d) the common method variance and are discussed next.

(a) Multicollinearity Assessment

Multicollinearity occurs when there is high correlation between the independent variables of a conceptual model (Field, 2009). It is a major concern in multivariate statistical analysis, as it creates shared variance among the independent variables (Hair et al., 2006). Having high shared variance among the independent variables creates difficulty in separating the unique importance and effect of each of the independent variable on the dependent variable (Sharma, 1996). There are different strategies that could be adopted by a researcher to diagnose and deal with the problem of multicollinearity such as correlation matrix, Average Variance Extracted (AVE), and orthogonalization of the moderator variables (Bollen, 1989; Fornell and Larcker, 1981; Ping, 1994). All correlations between variables should be less than 0.8 (Hair et al., 1998) and should be examined in relation to the AVE values of the variables. The AVE values of each correlated variable should be greater than their squared correlations (Fornell and Larcker, 1981). The AVE values as estimated in Chapter 5, were used to assess the discriminant validity of the constructs. According to Grewal et al. (2004) if the discriminant validity is reassured through the examination of the AVE values, then the multicollinearity is unlikely to exist.

To diagnose any multicollinearity issues for this study's independent variables a correlation matrix containing all the correlations was produced (see Chapter 5, Table 5.15). The AVE values of the independent variables can be seen in the diagonal in bold, whereas above the diagonal their Pearson correlations of the

independent variables are presented. The correlation values among the independent variables do not reveal any multicollinearity concern. The highest correlations were between resource sharing and goal congruence (0.675), activity sharing and decision synchronisation (0.645), and resource sharing and activity sharing (0.652). Most correlations are less than 0.8 and thus these correlation values above 0.6 and less than 0.8 do not warrant any further attention. The latter could be happening due to the fact that the correlation matrix was taken from LISREL output and correlation values tend to be higher than in SPSS (i.e. LISREL considers measurement error). Thus, multicollinearity is not an issue in this study's constructs.

In addition, all variables included in multiplicative interactions should be orthogonalised in order to reduce the potential threat of multicollinearity (Little et al., 2006). Orthogonalised variables are variables that are not correlated to each other. The need to orthogonalised variables arises when modelling the relationship between an outcome variable and a predictor variable that have been measured discretely with a finite range and there is the possibility that there is some correlation between them (Little et al., 2006). Since the moderator variables are created by multiplying the independent variables and the possible moderator variable, including this multiplicative interaction variable in a structural model might cause serious multicollinearity issues. For this reason all this study's moderator variables were orthogonalised using the residual-centring approach as suggested by Little et al. (2006). The steps followed using the SPSS software are as follows: (1) creation of a new variable (i.e. XZ) by multiplying the existing moderator variable (i.e. X) and the independent variable (i.e. Z), (2) conducting linear regression using as dependent variable new variable XZ and as independent the X and the Z variables and saving the unstardardised residual (i.e. RES). The RES variable is the variable that is used for estimating the error variance of the moderator variables and then testing the moderator hypothesis. The reason for using this approach is because by creating the XZ variable to be able to test the hypotheses of this study it is possible between the XZ variable some correlation exists. However, using the hypotheses testing procedure it is assumed that our variable do not correlation with each other otherwise the results will be biased. Therefore, without orthogonalizing the moderator variables before testing them in a structural model there is a great chance that the independent

variables will be highly correlated (Lance, 1988). Thus, any multicollinearity concerns for this study's variables are ruled out.

(b) Test Power Assessment

The test power refers to the probability that an incorrect model will be rejected (Diamantopoulos and Siguaw, 2000). By testing a model's fit using the chi-square test, the probability of making a Type I error is emphasized (Churchill, 1999). Type I error indicates the probability level of rejecting the null hypothesis when it should be accepted and it is captured by the significance level. A significant chi-square value indicates that the null hypothesis is true and thus the probability of incorrectly rejecting is low (Diamantopoulos and Siguaw, 2000).

Power test is associated with sample size (Hair et al., 2014). For performing SEM analysis usually a minimum of 200 responses is required for stable parameter estimation (Kelloway, 1998). A sample of less than 200 responses or a sample of more than 500 and larger might lead to inaccurate parameter estimates due to low fit indices or very high fit indices (Marsh et al, 1988; Hair et al., 2014). In order to address the sample size issues and affect on the parameter estimates, a 5:1 (i.e. at least five responses for every item) ratio is recommended (Hair et al., 2006). The sample size of this study is 220 and thus it fulfils the 5:1 rule. Therefore, the power test should provide stable parameter estimations.

(c) Influential Observations Assessment

Influential observations or else outliers "are observations with a unique combination of characteristics identifiable as distinctly different from the other observations" (Hair et al., 2010, p.64). Outliers are extreme data points with either very low or very high values (Pallant, 2013). The results of a structural model could be affected by outliers, and thus extreme values should be deleted from the data (Malhotra, 2004). In the current study, all variables have been examined for outliers. In the case of the collaboration constructs, the moderator variables and the control variables a rating scale ranging from 1 to 7 was used. This reassured that there are no influential observations falling out of the rating scale. The PHFL construct was closely examined for any outliers since it was not measured on a rating scale. Careful examination of the PHFL observations

showed that there are no outliers for this variable. Thus, it was concluded that there is no need to delete any observations from the dataset.

(d) Common Method Variance Assessment

As discussed in Chapter 4 many different methods were adopted in the design of this study to prevent Common Method Variance (CMV) from occurring. According to Podsakoff et al. (2003, p. 879): "CMV is a variance that is attributable to the measurement method rather than to the constructs the measures represent". CMV could influence the results of the study and thus it is important to ascertain that is not happening. Harman's single factor test could be used to evaluate a model's fit for a multi-factor model (i.e. unconstrained) and compare it with a constrained or else single-factor model (Podsakoff et al., 2003). The unconstrained model should fit the data better than the constrained one in order not to have CMV. In order to assess for CMV, all scales and items of multi-item measures should be estimated together with a single unmeasured latent method factor.

The fit for the measurement model is considerably better than for the single factor model. The results of the CMV-adjusted model indicated deterioration in the χ^2 and all other fit indices examined (RMSEA, CFI, NNFI, GFI). The one factor model yielded a χ^2= 1303.87 (d.f.= 247; P= 0.00), RMSEA= 0.140, CFI= 0.868, NNFI= 0.840, GFI= 0.677, whereas for the multi-factor model the following results were obtained: χ^2= 1154 (d.f.= 247; P= 0.00), RMSEA= 0.129, CFI= 0.872, NNFI= 0.844, GFI= 0.703. Although the multi-factor model fit the data better than the single-factor model the effect of CMV cannot completely ruled out. However, the aforementioned comparison of the models suggests that CMV is not substantial in this study and thus is unlikely to influence the relationship between the constructs.

6.2.3 Model Assessment Criteria

The fit of the structural model is assessed in the same way as the CFA model fit. However, a good model fit is not sufficient to assess the rejection or acceptance of the proposed hypotheses. In order for the researcher to decide whether a hypothesis is to be rejected or accepted the following should be examined: (1)

the model fit indices, (2) the parameter estimates (i.e. positive or negative), (3) the significance of the parameter estimates using the t-values, and (4) the 'squared multiple correlation' R^2 value (Byrne, 1998; Diamantopoulos and Siguaw 2000).

The model fit indices that are usually reported are: χ^2, χ^2/df, RMSEA, CFI, and NNFI (are same as in the CFA assessment). In order for a hypothesis to be accepted the parameter estimates should be in the direction that the researcher hypothesized. However, even when the parameter estimates are in the hypothesised direction, the hypothesis could not be accepted if the respective t-value of the parameter is not significant. The significance of the parameter estimates and its corresponding t-value refers to the Type I error as discussed in the Power Test Assessment (see section 6.2.2). The t-values of the parameters allow for the evaluation of the Type I error of significance. The critical t-values for one-tailed hypotheses can be seen on the Table 6.1 below (Churchill, 1999).

Table 6.1: Critical Values of T-statistic for One-Tailed Tests

Significance level	*Critical value of t statistic*
0.10	1.282
0.05	1.645
0.01	2.326

The squared multiple correlation R^2 shows the amount of variance that is explained in the dependent variables by the independent variables (Diamantopoulos and Siguaw, 2000). The higher the R^2 value, the greater the explanatory power of the hypothesized constructs.

6.3 Overall Approach to Hypotheses Testing and Results

The hypothesis testing for the current study is carried out in three steps. Firstly, the hypothesis relating to the main effect of the Collaboration construct on PHFL construct is tested in a formal structural model. Second, the moderating effects of the endogenous factors (i.e. food regulation constructs), and the exogenous factor constructs (i.e. weather, economic, political conditions, and competitive intensity constructs) on the collaboration - PHFL relationship are tested.

6.3.1 Hypothesis for the Collaboration - PHFL relationship

H1*: Collaboration is negatively related to PHFL*

The first hypothesis accounts for the possible direct effect of the collaboration construct on PHFL. The Hypothesis (H1) argues that collaboration would be negatively related to PHFL. In this context the independent variable is collaboration and the dependent is PHFL. The results of the structural model for the collaboration construct indicate a good fit to the data with (χ^2= 12.54, df= 7, p-value= 0.241, χ^2/df= 1.571, RMSEA= 0.008, CFI= 0.999, NNFI = 0.987, GFI = 0.991). The collaboration construct in the model explains the 85.3% (i.e. R^2) of variance in PHFL. Table 6.2 shows the structural equation modelling (SEM) results for the collaboration construct with PHFL.

The results show that there is a strong negative relationship between collaboration and PHFL (γ= -1.45, p < 0.01). Thus, Hypothesis (H1) is supported. This indicates that a higher level of collaboration will result in lower PHFL values. The support of this hypothesis adds to the collaboration - PHFL relationship debate. As discussed earlier (see Chapters 1, 2, and 3), past research proposed the existence of a possible negative relationship between collaboration and PHFL (Mena et al., 2011; WRAP, 2011). Thus, this study provides empirical evidence about this relationship. This result also supports other studies in the PHFL research area that have argued for an association between collaboration and PHFL (FAO, 2011; World Economic Forum, 2011). Additionally, prior studies suggested that better collaboration among SC members could have positive impact on business performance (Hyvonen and Tuominen, 2007; Zacharia et al., 2009; Rosenweig, 2009). Considering the PHFL issue as lost sales, this study adds to that literature by empirically proving that higher levels of collaboration have positive impact on business performance as lost sales (i.e. PHFL) will be reduced. Therefore, the results of the current research confirm that collaboration is negatively related to PHFL.

Table 6.2: SEM results of Collaboration - PHFL relationship (Hypothesis 1)

Antecedents	*Postharvest Food Loss*	
	Gamma (γ)	*t-value*
H1: Collaboration	-1.450	-5.327*

Note:
One-tailed tests are used due to directional hypothesis
*significant at 1% level (t-value > 2.326)

The control variables, table and processing type of peaches, found to have significant effect on PHFL (see Table 6.3). More precisely, the table type of peaches has a strong positive relationship with PHFL (γ= 2.36, $p < 0.10$). While, the processing type of peaches has a very strong negative relationship with PHFL (γ= -4.703, $p < 0.05$). This suggests that the higher the processing type of peaches the lower the PHFL, whereas the higher the table type of peaches the higher the PHFL. Thus, the type of peaches found to have a significant effect on the PHFL levels. As mentioned in Chapter 3 (see section 3.6.3 (d)) table peaches are easier rejected from the market as they are sold for direct human consumption, whereas the processing type of peaches even in cases where they are damaged can still be sold to processors for value adding activities. Moreover, as seen in Table 6.3 the farming experience does not have a significant effect on PHFL. Although, Greek ASC producers act based on their experience and they are not willing to adopt new farming practices (Daoutopoulos and Pirovetsi, 2002) this found not to impact the level of PHFL that they have.

Table 6.3: SEM results of the control factors in the Collaboration - PHFL relationship

	Gamma (γ)	*t-value*
H*: Farming Experience	-0.912	0.586
H*: Table Peaches	2.367	1.408*
H*: Processing Peaches	-4.703	-2.207**

Note:
One-tailed tests are used due to directional hypothesis
*significant at 10% level (t-value > 1.282)
**significant at 5% level (t-value > 1.645)
H*: unhypothesized path (i.e. control variable)

6.3.3 Hypotheses for the Moderating Effects in the Collaboration - PHFL relationship

Since H1 is supported the researcher can now test for the possible moderator effects. Using the structural model of H1, the moderator variables of this study have been tested. As described in section 6.2.2, the moderator variables of this study have been orthogonalised before they entered in the structural model. Table 6.4 shows the SEM results for moderation effects of the endogenous

turbulence factors, including the gamma values, the t-values and the significance level.

Table 6.4: SEM Moderator Effect of Food Regulation Constructs Results

Moderators	*Postharvest Food Loss*	
	Gamma (γ)	*t-value*
H2: Food safety regulations x CO	-0.453	-2.503*
H3: Food quality regulations x CO	-0.581	-4.992*
H4: Organic food regulations x CO	-0.581	-0.608
H5: Food traceability regulations x CO	-0.490	-5.878*
H6: Food transportation and handling regulations x CO	-0.930	-0.136

Note:
One-tailed tests are used due to directional hypothesis
*****significant at 1% level (t-value > 2.326)

(a) Hypotheses for the Moderating Effects of the Endogenous Turbulence Constructs

The hypotheses of the moderating effects of the endogenous turbulence constructs include hypotheses tests of the constructs food safety regulations, food quality regulations, organic food regulations, food traceability regulations, and food transport and handling regulations in the collaboration - PHFL relationship. Each of the endogenous turbulence constructs has been tested separately in the aforementioned relationship and the results are explained below.

Hypothesis 2 (H2): The relationship between collaboration and PHFL is moderated by food safety regulations; the greater the extent of the negative impact of the food safety regulations, the stronger the negative relationship between collaboration and PHFL.

H2 proposes that the negative relationship between collaboration and PHFL becomes stronger when food safety regulations have negative impact on producers. The results of the hypothesis test reveal that that there is a significant negative relationship between food safety regulations and PHFL ($\gamma = -0.453$, $p < 0.01$). As such, it can be concluded that food safety regulations do moderate the association of collaboration with PHFL. The negative coefficient of the interaction term (γ) suggests that the relationship between collaboration and PHFL becomes

more negative as the negative impact of the food safety regulations increases. Thus, H2 is supported.

In cases where food safety regulations are perceived to have negative impact, collaboration has a strong negative relationship with PHFL. While, in cases of food safety regulations having positive impact, the relationship between collaboration and PHFL weakens. When collaboration levels are higher between producers and cooperatives, the PHFL levels will be low and the perceived impact of the food safety regulations will be positive. On the other hand, when low collaborative relationships exist between producers and cooperatives, PHFL levels will be high and the perceived impact of the food safety regulations will be negative. This means that producers who are engaged in higher collaborative relationships, they not only have lower PHFL levels, but also food safety regulations affect them in a positive way. Producers who are engaged in less collaborative relationships, found to have higher PHFL levels as they are negatively impacted from food safety regulations. The moderation of the food safety regulations variable provides a better understanding of the negative relationship between collaboration and PHFL. The results of this hypothesis suggest that although food safety regulations are about making the produce safer for consumption, they seem to have a negative impact on producers.

The lack of administrative, technical and scientific capabilities will act as a barrier to comply with dynamic and increasingly strict food safety standards (Henson and Jaffee, 2006). On the other hand, when there is a strong institutional base, food safety regulations could be regarded as competitive advantage (Jaffee and Henson, 2004). This is because food safety standards could be considered as a development and differentiation opportunity in order to be able to compete in the global marketplace. In the latter cases the impact of the food safety regulations from the organisation's (i.e. producers) perspective will be considered as positive. While in cases where institutional weaknesses are existent, the impact of the food safety regulations will be regarded as negative. Thus, H2 adds on the aforementioned literature by empirically proving that in higher collaborative relationships the impact of food safety regulations will be regarded as positive, and in lower collaborative relationships will be regarded as negative.

The surrounding policy and regulatory framework might affect the ability of the SC actors to reduce PHFL levels (HLPE, 2014). When food safety rules are well designed, they will enable PHFL reduction (HLPE, 2014). According to Waarts et al. (2001), in Europe private food safety regulations are the main reason of PHFL occurrence. This is because food products are getting rejected due to non compliance to the private food safety standards. The lack of coordination of the different food regulations at regional level could be one of the major causes of PHFL (FAO, 2013). Therefore, food safety regulations could have a negative impact on PHFL levels. H2 proved that PHFL levels will be higher when the perceived impact of food safety regulations is negative and collaboration levels are low. This suggests that producers who are engaged in higher collaborative relationships with stronger institutional base perceive that the impact of food safety regulations is positive.

Hypothesis 3 (H3): The relationship between collaboration and PHFL is moderated by food quality regulations; the greater the extent of the negative impact of the food quality regulations, the stronger the negative relationship between collaboration and PHFL.

H3 postulates that the negative relationship between collaboration and PHFL will be enhanced when the perceived negative impact of food quality regulations is high. The results indicate that H3 is supported, as the relationship between food quality regulations and PHFL found to be negative and significant ($\gamma = -0.581$, $p < 0.01$, see Table 6.4). Thus, food quality regulations do moderate the association between collaboration and PHFL. In cases where food quality regulations are perceived to have negative impact, collaboration has a strong negative relationship with PHFL. While, in cases of food quality regulations having positive impact, the relationship between collaboration and PHFL weakens.

When collaboration levels are higher between producers and cooperatives, the PHFL levels will be low and the perceived impact of the food quality regulations will be positive. Whereas, when less collaborative relationships exist between producers and cooperatives, PHFL levels will be high and the perceived impact of the food quality regulations will be negative. Producers who are engaged in higher collaborative relationships found to have low PHFL levels and their perceived impact of food quality regulations on their ‘business’ is positive.

However, this is not the case for producers who collaborate in lower levels, as the latter found to have high PHFL levels and the perceived impact of food quality regulations on them is negative. According to HLPE (2014), the high quality standards in the ASC seem to be one of the causes of the PHFL levels. Thus, H3 provides empirical support on the aforementioned indication of HLPE (2014).

Hypothesis 4 (H4): The relationship between collaboration and PHFL is moderated by organic food regulations; the greater the extent of the negative impact of the organic food regulations, the stronger the negative relationship between collaboration and PHFL.

H4 states that when the perceived negative impact of organic food regulations is high, the negative relationship between collaboration and PHFL will be stronger. The results indicate that organic food regulations do not have a significant association with PHFL (γ= -0.680, t = -0.608, see Table 6.4). This means that organic food regulations provide no value in enhancing and explaining the relationship between collaboration and PHFL. The result of this hypothesis is rather surprising as the organic food regulations which are about using environmental friendly fertilisers to the produce argued to have negative impact on the PHFL levels (Fort et al., 2009). Different research studies examined the possible impact of organic food regulations on the deterioration of the produce (Ruben and Fort, 2012; Bolwig et al., 2009; Alvarez, 2011). According to Bolwig et al. (2009) organic farming practices are associated with lower yields. According to the confirmatory interviews conducted with the Greek peach producers, the organic fertilisers do not protect their product from insect infestations as they are not strong enough. However, the results of the H2 indicated that organic food regulations do not have any impact on PHFL. This might be because of the specific type of food product examined in this research, as organic food regulations will not impact the quality of all the different types of food products (Alvarez, 2011). Therefore, it could be concluded that organic food regulations are not perceived to have negative impact on the collaboration - PHFL relationship for the peach type of products.

Hypothesis 5 (H5): The relationship between collaboration and PHFL is moderated by food traceability regulations; the greater the extent of the negative impact of food traceability regulations, the stronger the negative relationship between collaboration and PHFL.

H5 postulates that the higher the negative impact of food traceability regulations, the stronger the negative relationship between collaboration and PHFL. The hypothesis results show a significant negative association between food traceability regulations and PHFL ($\gamma = -0.490$, $p < 0.01$). Therefore, food traceability regulations moderate the relationship between collaboration and PHFL. The finding of H5 suggests that producers, who have high PHFL levels and low collaboration levels, are affected more negatively from food traceability regulations, while producers who have low PHFL levels and higher collaborative relationships perceive that food traceability regulations have positive impact of them. When collaboration levels are higher between producers and cooperatives, the PHFL levels will be low and the perceived impact of the food traceability regulations will be positive. On the other hand, when less collaborative relationships exist between producers and cooperatives, PHFL levels will be high and the perceived impact of the food traceability regulations will be negative.

According to the European Information Council (2014) traceability is the ability to track any food, feed, food-producing animal or substance that will be used for consumption through all stages of production, processing and distribution. When a food incident happens food traceability regulations will enable the identification and withdrawal or recall of the unsafe food from the market (European Information Council, 2014). The Traceability article 18 (Food Government UK, 2015) requires all food companies to keep information and records of all their food related suppliers, so in case of an incident all the information will be available. According to the confirmatory interviews that have been conducted, producers who collaborate in higher levels with a cooperative or producer organisation found to follow specific food regulations and food traceability regulations. While, producers who collaborate in lower levels found not to follow specific food regulations, as they are usually told from the local agriculturist about the food regulations that they need to comply. Therefore, the producers who have

higher PHFL levels are negatively impacted from food traceability regulations as the latter regulations might be the reason for their producer rejection.

Hypothesis 6 (H6): The relationship between collaboration and PHFL is moderated by food transportation and handling regulations; the greater the extent of the negative impact of food transport and handling regulations, the stronger the negative relationship between collaboration and PHFL.

H6 proposes that when the perceived negative impact of the food transport and handling regulations is high, the negative relationship between collaboration and PHFL will be stronger. However, the results of this hypothesis indicated that the food transport and handling regulations do not have an effect of PHFL levels. This is because the association between food transport and handling regulations and PHFL was found not to be significant (γ= -0.930, t = -0.136). This non-significant association is surprising given the fact that during transport and handling of the peaches there are many damages to the produce and thus high PHFL levels. However, the results of the hypothesis (H6) suggest that the existing food transport and handling regulations do not impact PHFL levels. Probably the producers make the appropriate arrangements to avoid any damage of their produce.

(b) Hypotheses for the Moderating Effects of the Exogenous Turbulence Constructs

The same procedure as with the endogenous turbulence constructs was followed for the constructs of the exogenous turbulence factors of this study**.** These variables were orthogonalised too before proceeding to hypothesis testing. H1 was used to test for the possible moderator effects of the exogenous turbulence factors. The hypotheses of the moderating effects of the exogenous turbulence constructs include hypotheses tests of the following constructs: weather conditions, political conditions, economic conditions, and competitive intensity. Table 6.5 shows a summary of the SEM moderator effect results of the exogenous factors constructs, including the gamma values, the t-values and the significance level.

Table 6.5: SEM Moderator Effect of Exogenous Factors Constructs Results

Moderators	*Postharvest Food Loss*	
	Gamma (γ)	*t-value*
H7: Weather conditions x CO	-0.553	-4.524*
H8: Political conditions x CO	0.107	0.480
H9: Economic conditions x CO	-0.770	-1.059
H10: Competitive intensity x CO	-0.429	-4.072*

Note: One-tailed tests are used due to directional hypothesis, *****significant at 1% level (t-value > 2.326)

Hypothesis 7 (H7): The relationship between collaboration and PHFL is moderated by weather conditions; the greater the extent of the negative impact of weather conditions, the stronger the negative relationship between collaboration and PHFL.

H7 hypothesises that a negative / low effect of the weather conditions will make the collaboration PHFL relationship stronger. This relationship is supported because the standardised parameter estimates are significant and negative ($\gamma = -0.553$, $p < 0.01$, Table 6.5). Therefore, negative weather conditions affect significantly both collaboration levels and PHFL levels. When the producers have good collaborative relationships weather conditions seem not to be such a problem for them. PHFL levels as it was expected are influenced by negative weather conditions.

Due to ongoing climate change the frequency and severity of extreme weather events, both in Europe and globally, are predicted to increase annually (Vidal, 2013). This will have severe socioeconomic impacts (Diaz and Murnane, 2011) as well as affecting the production and distribution of food; food supply chains are significantly affected by extreme weather incidents (FAO, 2009). Severe weather conditions can significantly impact the amount and quality of the produce (Benton et al., 2012). The results indicated that indeed negative weather conditions can impact PHFL levels. This adds to the existing literature who theoretically claimed the impact of weather conditions has on PHFL (Kader, 2010; Hodges et al., 2010; FAO, 2006; Mena et al, 2011; Aulakh and Regmi, 2014) based on empirical analysis now.

Hypothesis 8 (H8): The relationship between collaboration and PHFL is moderated by political conditions; the greater the extent of the negative impact of

political conditions, the stronger the negative relationship between collaboration and PHFL.

H8 stated that when the perceived negative impact of organic food regulations is high, the negative relationship between collaboration and PHFL will be stronger. However, the results of H8 indicated that this hypothesis is not supported. The data of this study show that there is no significant association between the political conditions and PHFL (γ= 0.107, t = 0.480). Interestingly, although the relationship of collaboration with PHFL is affected by food safety, food quality and food traceability regulations, the political environment does not affect it. This finding is opposite to what Kumu et al. (2014) stated about PHFL levels impacted from the political conditions. However, the high political instability existent in the Greek economic environment could justify this finding (Williams, 2015). The majority of the interviewed producers stated that political conditions impact them in a negative way irrespective of having high or low PHFL levels.

Hypothesis 9 (H9): The relationship between collaboration and PHFL is moderated by economic conditions; the greater the extent of the negative impact of economic conditions, the stronger the negative relationship between collaboration and PHFL.

H9 proposed that the negative relationship between collaboration and PHFL will be enhanced when the perceived negative impact of economic conditions is high. The results show that H9 is not supported. The relationship of collaboration with PHFL is not affected by the economic conditions (γ= -0.770, t = -1.509, Table 6.5). According to HELPE (2014) the economic conditions in FSCs are one of the major causes of PHFL. Aramyan and Van Gogh (2014) stated that the adverse economic conditions will impact PHFL levels. Kumu et al. (2012) indicated that PHFL reduction is getting more difficult due to economic factors. The result of this H9 is quite unexpected, as adverse economic conditions might impact the produce of the farmers in a negative way as well as their relationships with partners. However, this finding could be explained due to the fact that economic crisis in EU has a crucial negative influence on all the producers.

Hypothesis 10 (H10): The relationship between collaboration and PHFL is moderated by competitive intensity; the lesser the extent of the competitive intensity, the stronger the negative relationship between collaboration and PHFL.

H10 proposes that the negative relationship between collaboration and PHFL gets stronger when competitive intensity is low. H10 is supported by the data: a significant negative relationship was found to exist between competitive intensity and PHFL (γ= -0.429, $p < 0.01$, Table 6.5). As such, it is concluded that competitive intensity moderates the collaboration - PHFL relationship. When collaboration levels are high between producers and cooperatives, the PHFL levels will be low and competitive intensity will be high. Whereas, when less collaborative relationships exist between producers and cooperatives, PHFL levels will be high and competitive intensity will be low. The finding of H10 adds on the existing literature regarding the relationship of collaboration and competition conducted by Auth et al. (2005), Mariani (2007), and Bungler et al. (2014). Moreover, this finding is a complete new finding that has not been examined before neither in the academic or grey literature, as it indicates that there is a negative relationship between competitive intensity and PHFL.

6.4 Chapter Summary

The purpose of this chapter was to present the results of this study's hypotheses. Before proceeding to the results the main assumptions and issues related to the SEM technique were explained. The data of this research were found to follow the normality, linearity, homoscedasticity, and independence of observations rules. The dataset was also successfully assessed for its multicollinearity, test power, influential observations and common method variance. The structural model assessment criteria were clearly explained. Then, the hypotheses results of both the individual and the moderating effects were presented. The results provide empirical support for the negative relationship between the aggregate collaboration construct and PHFL. This is in line with what was suggested in literature. The results of the moderator effects of the food regulation constructs provided empirical support for the relationship of the food safety, food quality and food traceability regulations with collaboration and PHFL. The possible moderation of the organic food regulations and food transportation and handling

regulations in the collaboration - PHFL relationship was not supported by the data. Regarding the possible moderation of the exogenous turbulence factors, the weather conditions and the competitive intensity constructs were found to have significant effect on the collaboration - PHFL relationship. Finally, the economic and political conditions possible moderation effect was not supported.

Chapter 7

Discussion and Conclusions

7.1 Introduction

The aim of this chapter is to conclude the entire research by discussing the major findings of this research, draw implications for theory development, and reflect on the practical and policy contributions of this study. First, a brief summary of this research is presented. Second, the theoretical, practical and policy contributions of this research are discussed. Third, the limitations of the study are discussed and avenues for future research are proposed.

7.2 Research Summary

FSC and particularly food security has received a great deal of attention in the recent years due to issues related to scarcity of natural resources, population growth, fluctuating food prices, changing consumer habits, climate change etc. (FAO, 2011). It has been estimated that between 25% and 50% of food produced is lost or wasted along the supply chain and does not reach consumers, depending on its position in the supply chain (FAO, 2010; Lundqvist et al., 2008). Reducing PHFL can increase grain supply, food availability and food security without wasting any other resources such as land, labour, water and inputs (APO, 2006). Hence, there is a need for identifying solutions for PHFL reduction.

Different ways have been suggested to address the PHFL problem such as improving technology, developing better storage and cooling facilities etc. (e.g. Hodges et al., 2010; see Chapter 2). Recent research suggested that better and closer collaboration between suppliers and retailers can be a starting point to reduce PHFL levels and a possible direct relationship between collaboration and PHFL was indicated (Mena et al., 2011; WRAP, 2011). Most of the research about PHFL focuses either at retailers' or at consumers' point in the supply chain;

there is lack of research about collaboration and PHFL from the producers' perspective. The current research investigated the collaboration - PHFL relationship from the producers' perspective rigorously with substantial outcome.

Different authors indicated that in environments with high environmental turbulence business partners will collaborate closer in order to reduce and / or manage this turbulence (Danese, 2011). On the other hand, when environmental turbulence is high, PHFL levels are expected to be higher (Kader, 2010). Thus, environmental turbulence factors could impact both collaboration and PHFL. This research via investigating the collaboration - PHFL relationship under the EU ASC context identified also the relevant environmental turbulence factors that possibly impact this relationship from the producers' perspective.

To sum up, in the current study the relationship between collaboration and PHFL in the EU ASC context was examined. The endogenous and exogenous environmental turbulence factors that possibly impact the aforementioned relationship were examined too. The conceptual framework development of the study was based on literature analysis (Chapter 2) and two exploratory investigations (Chapter 3). The purpose of the first exploratory study as explained (see Chapter 3, section 3.3) was to explore the possible relationship between collaboration and PHFL, as there is no empirical research indicating this relationship. The results of the exploratory study indicated that collaboration could be enabler for achieving PHFL reduction and its absence could be a considerable barrier. Hence, the research objective (1) was met (i.e. to explore the relevance of the collaboration concept in EU ASC and its possible impact on PHFL). Based on the latter exploratory study and on literature review analysis the initial conceptual framework of this research was developed. Drawing on CT and RBV theories, considering the specific EU ASC context and the findings of a second exploratory study (Chapter 3, section 3.6) a revised conceptual framework of this research was established with its respective hypotheses (Chapter 3, section 3.6.3). The revised and final conceptual framework of this study included the collaboration - PHFL relationship and as possible moderators the following constructs: food safety regulations, food quality regulations organic food regulations, food traceability regulations, food transport and handling

regulations, weather conditions, political conditions, economic conditions, and competitive intensity.

Following a thorough research design, a survey questionnaire was developed to collect data for the purposes of testing the latter constructs hypotheses. After collecting 220 completed questionnaires the data were assessed for its dimensionality, reliability, and validity to prepare them for hypotheses testing (Chapter 5). Before proceeding to hypotheses testing all the main assumptions of the Structural Equation Modelling technique used for hypothesis testing were met (Chapter 6). The hypotheses tests indicated that six out of the ten hypotheses were proved. More precisely, the main hypothesis of this research was proved (i.e. collaboration - PHFL relationship) and this confirmed the existing negative relationship between the two constructs. From the hypotheses of the possible moderator constructs, the moderating effects supported in this study are: food safety regulations, food quality regulations, food traceability regulations, weather conditions, and competitive intensity (see Chapter 6, section 6.3.3).

On the other hand the remaining constructs: organic food regulations, food transport and handling regulations, political conditions, and economic conditions proved not to be supported. Based on this analysis, the relevant environmental turbulence factors in the collaboration - PHFL relationship were identified. Thus, research objectives (2) and (3) were met (i.e. to conceptualise and test the relationship between collaboration and PHFL, and to identify the relevant environmental turbulence factors in the EU ASC, conceptualise these, and examine their moderating effects in the collaboration - PHFL relationship). Therefore, the overall research aim, which was to investigate the collaboration - PHFL relationship under the specific context and to indentify the relevant environmental turbulence factors that possibly impact this relationship from the producers' perspective, was met too.

7.3 Theoretical Contributions

The overall theoretical contribution of this study can be divided into five major contributions as explained below.

7.3.1 Contribution to the PHFL Literature & Food Supply Chain Research

Identifying ways to reduce PHFL is an important issue in the FSC research. This is because research in this area is still in its infancy and there are no clear conclusions on the factors that could reduce PHFL. Chapman (2010) referred to PHFL as a shrinkage problem and characterised it as a 'complex' problem that needs to be addressed with a collaborative manner involving wide range of stakeholders to get different perspectives and deliver holistic solutions. This research contributes to the body of knowledge of FSC management literature by increasing understanding of a complex problem i.e. PHFL issue and by proposing collaboration as a solution. Also, this study contributes to the academic literature in the PHFL research field. Since there is limited academic research and no data available in this area (Fusions, 2015), this study provided specific PHFL estimates as identified in the Greek ASC context. To the best knowledge of the researcher of this study there is no academic research that investigated PHFL levels and collected data in the Greek ASC.

7.3.2 Contribution to the Empirical Relationship of Collaboration with PHFL

Although a number of studies examined the relationship between collaboration and PHFL, empirical research from the producers' perspective is absent from the literature. The hypothesis test of the collaboration - PHFL relationship showed that there is a significant negative relationship among the two constructs. Thus, this research adds to the existing literature about collaboration and PHFL (i.e. Mena et al., 2011; WRAP, 2011) and indicates its significance from the producers unit of analysis. Specifically, this study provides empirical evidence for the negative relationship between collaboration and PHFL. Moreover, through this research the collaborative practices that enable PHFL reduction have been identified as being the following: information sharing, goal congruence, decision synchronisation, incentive alignment, resource sharing communication, and joint knowledge creation. Hence, the findings of this research showed that indeed the different sub-constructs of collaboration reflect its meaning and have an impact on PHFL when averaged and summed. This study is also a novel contribution to the academic literature regarding the collaborative practices that lead to better business performance (i.e. through PHFL reduction) from the producers' perspective. As mentioned in Chapter 1 (section 1.3.1) different studies have

examined the controversial relationship of collaboration with business performance (Hyvonen and Tuominen, 2007; William and Filippini, 2009). Considering the PHFL as an indicator of business performance, this research provides evidence that indeed collaboration has a positive relationship with business performance from the producers' perspective in ASCs; collaboration can reduce the lost sales (i.e. PHFL).

7.3.3 Contribution to Collaboration Measurement in ASCs

A range of conceptual definitions have been used to define collaboration among chain members. Collaboration is defined as "two or more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits which result to greater profitability of satisfying end customer needs than acting alone" (Simatupang and Sridharan, 2002, p.13). Humphries and Wilding (2004) defined collaboration as "working jointly to bring resources into a required relationship to achieve effective operations in harmony with the strategies and objectives of the parties involved, thus resulting in mutual benefit". The above definitions highlight the need for resource sharing and process sharing for higher profits and better satisfaction of customers' needs. Collaboration is not only about exchanging information and products, but also exchange of people and resources (Ziggers and Trienekens, 1999). Thus, collaboration is about effective and efficient interactions among business partners.

Barratt (2004) stated that in order to define collaboration it needs to be put it into a specific context. Contextual factors can influence the choice of collaboration levels (Danese, 2011). Hence, the meaning of collaboration will depend on the context. Cao et al. (2010) was the first to provide a comprehensive measurement of the collaboration construct from the company's unit of analysis. However, to the author's best knowledge there is no research measuring the collaboration construct from the producers unit of analysis considering the interaction among business partners. This research gap was filled through this study, as a comprehensive measure of the collaboration construct in the ASCs was developed. The collaboration measure developed in this study has been tested for its reliability and validity. Therefore, this research contributes to the

collaboration literature through the adaptation of existing collaboration measures (i.e. Cao et al., 2010) to the ASC context and to the producers unit of analysis.

7.3.4 Contribution to the Inter-relationship of the Environmental Turbulence Factors, Collaboration & PHFL

The EU ASC operating environment has been characterised as highly turbulent (Galanopoulos et al., 2011). The relationship of collaboration with the environmental turbulence factors has been examined in the literature (Ziggers and Trienekens, 1999; Fisher et al., 2010). PHFL levels are also found to be influenced by environmental turbulence factors (Paull et al., 1997; Kader et al., 2010). However, there is no research examining the possible moderation of the environmental turbulence factors in the collaboration- PHFL relationship. There are two types of environmental turbulence factors, the endogenous and the exogenous (Chapter 1, section 1.3.2). Endogenous turbulence factors could be the regulations and the market characteristics. While, exogenous could be continuous uncertainties such as weather and political changes. Through the exploratory study (section 3.3) and the confirmatory interviews (section 3.6.1) the relevant environmental turbulence factors have been identified in the Greek ASC context in order to test them with the collaboration - PHFL relationship. The study of the interrelationship among collaboration, PHFL, and environmental turbulence factors is missing from the academic literature. This is the first study addressing this opportunity and thus making a novel contribution in this area for academics. Literature also regarding the impact of the different environmental turbulences factors on collaboration and PHFL is missing.

However, the results of the study showed that not all the environmental turbulence factors identified through literature review and the exploratory investigations moderate the latter relationship. For the endogenous turbulence factors the following moderating relationships were supported: food safety regulations, food quality regulations, food traceability regulations. For the endogenous turbulence factors the weather conditions and the competitive intensity constructs were proved to be moderators. The findings support that food safety regulations, food quality regulations, food traceability regulations change the relationship between collaboration and PHFL. This means that when

collaboration is absent from a business relationship the existing food quality regulations, food traceability regulations have a negative impact on producers and on their PHFL levels. This study demonstrated that food safety regulations, food quality regulations, food traceability regulations, weather conditions and competitive intensity moderate the collaboration - PHFL relationship. On the other hand for organic food regulations, food transport and handling regulations, political conditions and economic conditions the moderating hypotheses were not supported.

7.3.5 Contribution to the Environmental Turbulence Factors in the EU & Greek ASC

Another contribution of this study is the identification of the different environmental turbulence factors in the Greek ASC context. To the author's best knowledge there is no research examining the different environmental turbulence factors in the Greek ASC context. The environmental turbulence factors in the Greek ASC from the producers' perspective as identified in this research are: food safety regulations, food quality regulations, food traceability regulations, weather conditions and competitive intensity. Therefore, this study added into the existing literature discussing generally about the different environmental turbulence factors in the Greek ASC environment (Kaditi and Nitsi, 2010) by identifying those specific environmental turbulence factors.

7.4 Practical and Policy Contributions

This study has both practical and policy contributions. First the practical contributions divided in three sections are discussed, and then the policy contributions of this research are presented.

7.4.1 Practical Implications

(a) Increased Sustainability & Performance in ASCs and FSCs

PHFL reduction means more effective usage of the natural resources and reduction of food waste going to landfill. Identifying new ways to reduce PHFL helps to preserve world's natural resources for the generations to come. The findings of this study indicated that collaboration can reduce PHFL levels. Thus,

through higher levels of collaboration in ASCs the natural resources could be preserved, less food will be wasted and future generations are more likely to have access to sufficient quality and quality of food. This means that this research has environmental (i.e. preservation of natural resources), social (i.e. increase world's food security) and economic contributions as it helps to increase the overall sustainability of ASCs and FSCs.

Focussing on the economic contribution of this research in ASCs and FSCs, reduction of PHFL means less energy, raw material, and human capital usage. Hence, both the financial and the operational performance of all upstream ASC entities could be improved. This study's findings also suggest that ASC entities should be engaged in higher collaboration levels as those relationships are more beneficial for them. By engaging in successful collaborative relationships significant business growth is expected for ASC entities. The benefits of collective action have been clearly indicated in the literature (Hellin et al., 2008; Narrod et al., 2009). Through this research collective action in ASCs has been clearly indicated as beneficial for producers as they achieve lower PHFL levels and thus improved performance.

(b) PHFL & Collaboration in ASCs

The most important implication that the outcome of this study justifies is to raise awareness of the impact of collaboration on PHFL in ASCs. PHFL is recognised as a global issue in ASCs. Different factors that possibly contribute to PHFL reduction have been explored in the literature (Hodges et al., 2010; Parfitt et al., 2010). The importance of collaboration as a solution to PHFL has been considered in the literature (Mena et al., 2011; WRAP, 2011), but it has never been empirically tested and proven to exist. This study's empirical findings suggest that higher levels of collaboration between producers and cooperatives could lead to lower PHFL levels. Therefore, ASC entities need to rethink their collaborative practices in order to reduce their PHFL levels.

Moreover, the findings of this research could be used as a toolkit to assess existing collaborative relationships in ASCs. ASC entities and in particularly producers could use the collaboration sub-constructs identified in this research (i.e. information sharing, goal congruence, decision synchronisation, incentive

alignment, resource sharing communication, and joint knowledge creation) as a checklist to assess their existing collaborative relationships with business partners. By doing so, producers will be able to see whether their existing collaborative relationships are beneficial for them or not and whether their PHFL levels are reduced or not through this relationship. Thus, based on the latter assessment, ASC entities will be able to identify the most beneficial collaborative relationships for them and avoid any disadvantageous collaborative commitments.

Overall, through this research the critical collaborative activities in the ASC have been identified that will enable ASC entities reduce their impacts on the environment, increase their performance, increase their profits, minimize their impacts to the environment and enable future generations to have access to sufficient and good quality food.

(c) Lessons for Managers

The pace of change of the EU ASC environment is accelerating. The identification of the best collaborative practices and the different environmental turbulence factors which can improve business performance are crucial elements for a company's and / or organisation's success. ASC entities, FSC entities and supply chain managers could use this study's results as a toolkit to assess collaborative relationships with business partners and reduce their products' PHFL levels. Through this study's findings the collaborative practices that could lead to reduced PHFL levels have been identified. The existent environmental turbulence factors that impact collaboration and PHFL have been also ascertained. Therefore, this study provides supply chain managers with a comprehensive overview of collaboration, PHFL and the different environmental turbulence factors in ASCs. Supply chain managers could use this study's conceptual framework and results to identify the inter-relationship among collaboration, PHFL, and environmental turbulence factors in their operating environments.

7.4.2 Policy Implications

Several implications for policy-makers can be derived from this study's results. The results of this study indicated that when ASC producers collaborate in higher levels with their business partners (i.e. cooperatives and producer organisations) have lower PHFL levels. Hence, policy-makers should find ways to encourage the formation of collaborative practices in ASCs as it has a substantial impact on PHFL levels.

Moreover, there is a need for improving ASC competitiveness in EU as PHFL levels are still high. This study suggests that there is a pressing need to reassess the impact of the EU ASC regulations on producers. The results of this study indicated that food safety regulations, food quality regulations, and food traceability regulations have an effect on both collaboration and PHFL levels of ASC producers. Specifically, it was found that the latter regulations affect negatively PHFL levels. The Greek ASC producers indicated that when food safety regulations, food quality regulations, and food traceability regulations are considered as having negative impact on them the PHFL levels are higher and collaboration is low. This study suggests that policy makers should rethink the impact and the effectiveness of the existing EU ASC policies and regulations and reform them appropriately.

In particular, policy-makers should consider the establishment of demand-side and supply-side policies in order to promote economic growth as this study found that economic conditions have negative effect on the majority of the Greek peach producers. Regarding the demand-side policies, policies that could increase the aggregate demand should be used. These policies could be related to lower interest rates to reduce the cost of borrowing and encourage investments in the ASC sector. Also, they may include cutting tax policies that could increase the disposable income and provide economic stimulus to the Greek peach producers. On the other hand, supply-side policies could be implemented in the Greek ASC in order to increase its productivity and economic efficiency. For example, deregulation policies by reducing the level of regulations for producers could decrease cost of productivity and improve profitability. Moreover, small business grants could be given to producers as well and not only to cooperatives; this could foster small-scale producers growth. The promotion of free trade could also

improve the economic conditions of the Greek peach producers as currently they are not able to export their produce by themselves, but only though the cooperatives.

Competition even among ASC producers is becoming fiercer and this has implications to their relationships with business partners and PHFL levels. This study suggests that increased competitive intensity makes ASC producers to collaborate more strategically and that enables PHFL reduction. An important implication for policy makers is that competitive intensity as defined for this research (Chapter 3, section 3.6.3 (b)) is making ASC producers perform better as it is healthy competition. Thus, this type of competition should be encouraged in ASCs through appropriate policies.

The economic and political conditions included in this study's conceptual framework found not to be moderators in the collaboration - PHFL relationship. However, this is because the economic and political conditions in the Greek ASC are considered to have negative impact on all producers. Therefore, for those two constructs there was no variance in the responses and this is why they found not to moderate the main hypothesis of this research. Policy-makers need to create an appropriate operating environment in the Greek ASC in order to enable producers to survive and prosper.

7.5 Research Limitations & Future Research Directions

As a first empirical study on PHFL from the producers unit of analysis, it does come with certain limitations but also provides avenues for future investigations. In the sections that follow both this study's limitations and the future research directions are discussed.

7.5.1 Measurement of Collaboration and PHFL

The collaboration measure in ASCs as developed in this thesis provides an initial basis for future research into the collaboration measurement in different EU ASCs and FSCs and from different units of analysis (e.g. processors, retailers, wholesalers, manufacturers). Also, the conceptual framework of this study should be checked for its generalizability to other Greek ASC products. Hence, future

research may reveal whether the results of this study are generalizable to Greece as a whole and / or to other EU ASCs, and with different units of analysis. Also, this study investigated only the Greek peach producers of specific geographical regions in Greece. Further future research is need to collect more data in Greece and consider different ASC products and different geographical regions. Data should be also collected regarding collaboration, PHFL, and environmental turbulence factors for other EU ASCs.

Alternative measurement of collaboration in ASCs should also be investigated in the future. This research adapted Cao et al.'s (2010) measures to the ASC context and producers unit of analysis. However, in the future other measures of collaboration could be explored. Moreover, the PHFL levels in this study were measured in tonnes as this was found to be the most appropriate and easily comparable measure. Future research could also consider measuring the economic loss of PHFL and measuring PHFL levels for different agricultural and food products (i.e. not only peaches). Future research should also examine the direct effect of the environmental turbulence factors on PHFL and not only the moderating one through collaboration.

For the purposes of testing the conceptual framework proposed in this research, data was collected from the producers unit of analysis and in the questionnaire the respondents were asked to answer the questions thinking only about one collaborative relationship that they have. Future research should investigate all the different collaborative relationships that producers have. Also, a minimum of three years was set as a requirement for Greek peach producers in order to participate in this study. Hence, future research should examine even less than three years collaborative relationships.

In order to increase the generalizability of this study's results, only the relationships that the producers have with cooperatives have been considered. This is because the relationships between producers and wholesalers are purely transactional and do not involve any collaborative activities. Therefore, only producers that sell their produce to cooperatives, producer organisations or any other type of organisation that involves more than basic transactional relationships were included in this research. Future research should collect data

from the wholesalers point too to identify any other factors that might inhibit PHFL reduction.

Moreover, the conceptual framework of this study aims to encourage academic community to adopt a more holistic perspective for PHFL reduction studies, by considering a wide range of factors that might impact it (i.e. collaboration, environmental turbulence factors). Future research could explore other factors that might impact PHFL such as trust between business partners. This is because trust may vary across different collaboration levels. Firm's attitude towards regulations should be also explored in future research, as the latter may impact a firm's negative or positive perception of the different regulatory conditions.

7.5.2 Alternative Methodological Approaches to Investigate PHFL Reduction

The methodology followed in this thesis has certain limitations. The data collected to test this study's conceptual framework was collected via a cross-sectional research design. This means that the conclusions drawn in this study are based on information collected at one point in time. As mentioned in Chapter 4 (section 4.2) a longitudinal research design would be more appropriate in eliminating any common method bias from occurring and collect more data. However, due to time and cost constraints a cross-sectional research design was chosen. Thus, a potential fruitful research opportunity is a longitudinal study in which the researcher would be able to collect data for different points in time. This approach may provide more holistic understanding of this study's conceptual framework as collaborative relationships may evolve over time. Therefore, future research should consider a longitudinal study to examine differences in this study's variables over time.

Second, the data of this research was obtained from Greek ASC producers. Although flashcards were used to facilitate the face-to-face interview questionnaire and producers from different cooperatives and producer organisations were interviewed, self-reported bias represents a potential threat to the study. However, the study has been assessed for CMV occurrence and no evidence of it was found. Future research could include respondents from other

cooperatives and producer organisations in Greece to further increase the reliability and validity of the study.

7.5.3 General Methodological Issues

The SEM technique employed to test the hypotheses of this study assumes that the relationships between the constructs are linear. Thus, the results of this study are valid for the linear relationship between collaboration, PHFL and the environmental turbulence factors. The non-linear relationship among the aforementioned constructs could be examined in future research. A non-linear relationship between two variables means that for example the relationship between collaboration and PHFL is positive up to a point and then it becomes negative.

The control variables used in this research (i.e. farming experience, type of peaches) aimed to control for any other factors that might affect PHFL. The farming experience found not to be a factor affecting PHFL levels in this study, whereas the type of the peaches has an effect on PHFL levels. These control variables used in this study's conceptual framework testing are the ones identified as being relevant in this research. The same rule applies to the moderator variables of this study. However, there might be some other control and / or moderator variables that possibly affect the collaboration - PHFL relationship which have not been included in this study's conceptual framework. The next stage of this research could include more sophisticated models and suggest other control and moderator variables too such as the years in collaboration construct. Tests for endogeneity should be performed as suggested by Antonakis et al. (2010). The endogeneity test involves correlation of the errors of the dependent and independent variables in order to identify any hidden relationships. In cases of no correlation between the dependent and independent variables, it is unlikely that there are any other external causes of relationship between the latter variables. Thus, by performing endogeneity test for this study any hidden relationships among collaboration and PHFL could be ascertained. By correlating the errors of the latter variables causality between them could be established and any endogeneity concerns will be diminished.

7.6 Concluding Remarks

In summary, this study makes a contribution to both theory and practice and adds to the collaboration - PHFL relationship as well as the environmental turbulence factors relationship with collaboration and PHFL. The main finding of the current work is the empirical relationship between collaboration and PHFL. According to this research collaboration and PHFL have a negative relationship. This study also identified the relevant endogenous and exogenous environmental turbulence factors that affect the collaboration - PHFL relationship in the Greek ASC. The results show that the endogenous environmental turbulence factors that moderate the collaboration - PHFL relationship are food safety regulations, food quality regulations, food traceability regulations, while significant exogenous environmental turbulence factors are weather conditions and competitive intensity (see Table 7.1).

Table 7.1: Summary of Hypotheses Results of this Study

Hypotheses	*Postharvest Food Loss*
	Results
H1: Collaboration	Supported (γ = -1.450)
H2: Food safety regulations x Collaboration	Supported (γ = -0.453)
H3: Food quality regulations x Collaboration	Supported (γ = -0.581)
H4: Organic food regulations x Collaboration	Not Supported (γ = -0.680)
H5: Food traceability regulations x Collaboration	Supported (γ = -0.490)
H6: Food transportation and handling regulations x Collaboration	Not Supported (γ = -0.930)
H7: Competitive intensity x Collaboration	Supported (γ = -0.429)
H8: Weather conditions x Collaboration	Supported (γ = -0.553)
H9: Political conditions x Collaboration	Not Supported (γ = 0.107)
H10: Economic conditions x Collaboration	Not Supported (γ = -0.770)

This study acknowledged its limitations in terms of the measurement of the constructs, the alternative methodological approaches to study PHFL, and the general methodological issues. Therefore, even though a number of hypothesised relationships were proved, this study can be considered as a

preliminary study in the research PHFL area. Future research needs to address the limitations of this study.

Overall, this doctoral thesis has shown that PHFL reduction could not be achieved only through technological solutions. The human element and more specifically the interactions among ASC entities (i.e. collaboration) need to be considered too. However, in a continuously changing operating environment SC entities need to constantly adapt to these changes. The impact of these changes in SC entities relationships needs to be considered. Guided by those ideas, it is hoped that the findings of this study will stimulate further research in the highly important area of collaboration, PHFL, and environmental turbulence factors in ASCs and FSCs.

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Appendices

Appendix 1: Semi- structured Interview Transcripts

Interview 1

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	Every year we decide to whom we want to sell the produce. We can sell our production to whoever we want to, there is no restriction. Depending on what variety of peaches you produce you have to choose where to sell them to cooperative or wholesaler. If you want to produce canned peaches you should give it to cooperative because cooperatives work with processors. If you want to produce table peaches you have to give to a wholesaler
Do you have PHFL?	yes
If yes, how do you estimate PHFL?	We estimate it in tonnes and we say this year according to the age of the trees we will have x production.
Are there many changes in regulations in your industry? What are the different regulations about?	Yes, there are changes. For example even until yesterday we were going to spray an x fertilizer and now they've changed it. Generally regulations change all the time. In terms of the packaging and labeling is getting better; the packaging is improved and different types of packaging are being used; others they use cardboard boxes, others wooden, others plastic or canvas. The packaging depends on the variety of the produce. But there is no specific regulation for the packaging; it depends also on how the buyers want the product. Regulations are getting stricter. We adopted the integrated management, the spraying periods are specified. Especially when they peaches are to be exported, it is even stricter because they a check them. Once every producer could spray whatever pesticides they wanted and then they started to do more checks as we needed to get in a right line.
Are these changes predictable and/or rapid?	no

Is technology in your industry changing all the time?	No. wholesalers, processors and cooperatives have all the technology. We do not use any refrigerators or anything like that; we get the produce straight to the wholesalers and they do the packaging and put them into refrigerators.
Has competition in your industry intensified in the last few years?	No, no there are many buyers to sell your produce. The important thing is to find a wholesaler that you can trust. Generally I don't think there is competition between the producers.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	Yes. For example, today morning we had some issues as the outside temperature was -2C. I want to check the peaches and I saw that some early varieties we have problem as the cactus of some peaches has been frozen.
Are there many disruptions in your SC due to transportation disruption (e.g. strikes, accidents)?	No. this usually happens to producers from islands or to wholesalers that do exports.

Interview 2

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	With cooperatives we just give the produce and we take the money. They don't give us any advice, this the job for agriculturists do. Every producer has its own agriculturist. Cooperatives are like politics, when you have to do with fresh products you can't really manage it. for example when you produce cotton you can store it and not sell it, but in the case of peaches this is not possible.
Do you have PHFL?	Yes
If yes, how do you estimate PHFL?	The loss is estimated in tonnes.
Are there many changes in regulations in your industry?	No. I wouldn't say that. There have been many changes but in very low pace. Now the pesticides and the fertiliser are not that strong, they use to be more dangerous. Now they have banned many of them and that's good. Regulations are generally stable.
What are the different regulations about?	There are some safety rules in terms of how many days before the collection of the peaches you should spray them. For example, if I spray them today I

	can't go and collect and sell the produce after 4 days; this is a crime. There are quality standards for peaches but they are stable, they don't change. Every producer should have its own quality assurance certification e.g. ISO. With regard to the packaging of the peaches they are not set rules, but the best is the cartoon box.
Are these changes predictable and/or rapid?	They are predictable
Has the competition in your industry intensified in the last few years?	I can't really tell you about competition. In Greece peach production is like a monopoly so every producer can sell what it produces.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 3

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	Our producer organization is a very healthy business now, we have a good president and we have good results. We have been awarded a prize from the ministry of agriculture for the great quality of peaches and the volume of exports we do. We have seminars 3 times per year. The administration of the prod.org give us all the information we need to know and also they send us e-mails of text messages to tell us about how we should treat the peach trees (spraying and fertilizers), about quality, everything. All the peach producers we talk to each other, for example when someone tries something different in his production and he gets better results we share it. Every time we give the produce to prod.org an agriculturist comes and checks our produce. The audit is really intensive. For example when it is time for me to spray the peach trees they come to my house and check everything; they check the spraying machine and the chemical

	also.
Do you have PHFL?	No I don't have any. Generally in our organisation we don't have any PHFL. When we see that the market is blocked and the price is stable then we sell it to our buyers in lower prices in order to give the product. In these cases we lower the prices because we don't want anything to be left, we seldom throw away products.
If yes, how do you estimate PHFL?	In tonnes
Are there many changes in regulations in your industry?	Yes, they change it all the time but believe we are happy to see that. It might be a bit annoying. In the last decade we are given specific guidelines about what pesticides and fertilizer we should use or not. They change every year. The fertilizers are all approved by the EU, we have integrated/controlled management of the produce. I'm not allowed to spray whatever I want to. Everything that I do to the produce is written down and signed by the prod.org and also all the chemical ingredients are written. In the last decade many chemical substances have been taken out of the market, more than 1000 substances that we used to use for the produce. They check us all the time, for example 3 days before I collect the peaches the agriculturist comes and take some samples of the produce. When I give the produce to the prod.org they take again samples of the produce and they send it to a laboratory for analysis. Then we the produce will be put into the refrigerator trucks, again they take samples and every canvas/packaging has the producers name on it, a special code for each producer, the signature of the producer and the stamp of the producer. Whatever it might happen with the produce they can find the producer and sue him. 4 years ago a producer for our prod.org sprayed a chemical that he shouldn't and they found this substance when they sent the produce to Russia. We found the producer and we deleted him from the prod.org and he also had to pay a fine of 1000 euros in the

	ministry of agriculture.
Are these changes predictable and/or rapid?	They are unpredictable
Has the competition in your industry intensified in the last few years?	There is competition between the producers in terms of whim will get the best produce.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	Yes, from frost and hail.

Interview 4

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	After the harvesting with give the produce straight to the cooperative. We just give our produce to them. The cooperative has a new system and they send us text messages to tell us about spraying issues and other things. We also gather in the cooperative to talk about production issues and they give us all the information we need. Also the cooperative has its own agriculturist and you can go and ask any questions.
Do you have PHFL?	yes
If yes, how do you estimate PHFL?	We estimate it in tonnes
Are there many changes in regulations in your industry? What are the different regulations about?	In terms of the quality there are some standards. For example when we go to the cooperative the agriculturist might say to us that next time the peaches should be more mature. Or when the peaches are too mature they say to use that they can't buy them because they will get more mature and they won't be able to process them, thus we send them for juice.
Are these changes predictable and/or rapid?	They are quite rapid
Has the competition in your industry intensified in the last few years?	Yes, there is competition among producers and this helps us perform better
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	Weather conditions mainly.

Interview 5

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	The wholesaler goes to the production place to check the peaches and he offers you a price for it. If he likes the peach he will give you a better price and accordingly you decide what to do depending on what it better for you. No they don't help us at all. We are responsible for finding an agriculturist and he says to us what and when we should put on the tree.
Do you have PHFL?	Yes.
If yes, how do you estimate PHFL?	Yes in tonnes.
Are there many changes in regulations in your industry? What are the different regulations about?	Yes, there are changes in regulations. We are told by the agriculturist what we should use. Usually we are given the same 'medicine' depending on what the agriculturist wants to give us. We do whatever he says to us. There are different types of packaging; it depends of the size of the peach. It terms of the quality the size matters as you can get a higher price for bigger peaches.
Are these changes predictable and/or rapid?	We are not sure about what changes will occur every year.
Has the competition in your industry intensified in the last few years?	No, I wouldn't say that. I have the same peaches with any other peach producer; we are on the same level. Maybe there is a little competition is terms of the size of the peaches others produce bigger peaches; it depends on how they treating the tree.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	Yes due to weather conditions mainly

Interview 6

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	All the peaches are given to the cooperative. The transport of the peaches to the cooperative is being done with farming car, they go to the cooperative and then they are put into refrigerator trucks and the final

	destination is the processor. The logic behind the creation of the cooperative is that as a group of producers you can get better prices from the processor that as a producer you won't be able to get. The president of the cooperative never decides himself about anything; he takes decisions together with the board team. In the cooperative we are approximately 180 people.
Do you have PHFL?	We have PHFL every year.
If yes, how do you estimate PHFL?	In tonnes and percentage
Are there many changes in regulations in your industry? What are the different regulations about?	No, no the regulations do not change every year. We are being checked at random times.
Are these changes predictable and/or rapid?	I am not sure about it
Has the competition in your industry intensified in the last few years?	I don't think so
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 7

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	We do not have any special collaboration with the cooperative. It doesn't provide us any particular benefits. From time to time some agriculturists come and talk to us and whoever wants can attend it. For us it is the same if we sell our produce to a wholesaler or to the cooperative as we do not get any further benefits we just give the produce.
Do you have PHFL?	Yes
If yes, how do you estimate PHFL?	We estimated the loss based on the volume of total production in tonnes.
Are there many changes in regulations in your industry?	Not really.

What are the different regulations about?	
Are these changes predictable and/or rapid?	The agriculturist gives us information about the changes and he also give us guidance about when and what 'medicines' to spray and put in the peach tree. The quality standards do not really change from year to year. We almost put the same fertilizer every year.
Has the competition in your industry intensified in the last few years?	I am not so sure about it
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	Yes, weather conditions are damaging out produce

Interview 8

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	We give the produce to the cooperative; they check it, every time we give them the produce they tell us about the tonnes of good and bad peaches. The cooperative does not provide us anything; it doesn't inform us about anything. They just do the basic check for us. The cooperative finds the buyer and also they do the packaging. We just use some canvas and some cartoon boxes to carry the peaches and then we give them back to the cooperative. They also give us a list with the pesticides and fertiliser that we need to use.
Do you have PHFL?	Yes
If yes, how do you estimate PHFL?	The estimated in percentage and tonnes. We see how many tones we have produced and then we estimate a percentage to check our performance from year to year. Some of the peaches we give to the cooperative are quality A and some quality B; the quality B peaches are the PHFL. will be paid in juice price. Even the peaches

Are there many changes in regulations in your industry? What are the different regulations about?	Every year the cooperative gives us a list with the 'medicines' we should use and what are allowed to be used. Some medicines that were allowed last year this year are forbidden. Medicines are removed from the market all the time. The cooperative doesn't provide us with the agriculturist they just give us the list and tell us what is allowed to use or not and we buy it from the local agriculturist.
Are these changes predictable and/or rapid?	Some medicines have been forbidden to use. The quality standards are the same.
Has the competition in your industry intensified in the last few years?	No, it is healthy competition. For example the competition might be in terms of how many tonnes of peaches you collected and how many I collected or whether you had a good production of peaches and it stops there. Generally they producers want to know who had a good production and who doesn't. We do not compete in terms of quality but I terms of you got paid from the cooperative!
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 9

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	The cooperative has its own agriculturist and he also gives us advice on how to treat the peach trees and the produce. We regularly attend seminars that are organised by the cooperative. For example when there is a prediction that adverse weather will hit our region, the cooperative organises meetings for all producers to give us some advice.
Do you have PHFL?	yes
If yes, how do you estimate PHFL?	We usually estimate the loss in canvas. We don't have that much loss.
Are there many changes in regulations in your industry?	Not really, the agriculturists tell us whether there are any changes and what 'medicines' we need to use every

What are the different regulations about?	year.
Are these changes predictable and/or rapid?	There are specific quality standards and integrated management of the produce.
Has the competition in your industry intensified in the last few years?	Of course there is. The producers compete in terms of putting the best ingredients/ medicines to the trees. We ask each other what they sprayed or put on the peach trees
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	. Weather conditions mainly.

Interview 10

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	Generally I'm happy with my relationship with the cooperative. They provide us with some seminars about peaches and they give us all the information we need in terms of the 'medicines' we need to use.
Do you have PHFL?	I don't really have PHFL.
If yes, how do you estimate PHFL?	The losses are estimated in tonnes or in canvas; it's up to us.
Are there many changes in regulations in your industry? What are the different regulations about?	Every year we change the pesticides and fertilisers we use, depending on what the agriculturist suggest to us.
Are these changes predictable and/or rapid?	Some pesticides are out of the market every year. New pesticides are suggested to us. The cooperative tell us about those changes; they also have a medicine station. The cooperative also tell us about the quality standards.
Has the competition in your industry intensified in the last few years?	No I don't think there is competition between the producers, but among cooperatives and wholesalers.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 11

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	The cooperative we collaborate with doesn't provide us with any particular benefits, only the basics. The cooperative is responsible for the organisation of the reception and dispatch of the peaches from the farmers and to the processors accordingly. The cooperative doesn't provide us with nay seminars or any advice in terms of the fertilizers and pesticides we need to use. The medicines we need to use for the produce is an issue between us and the agriculturist. Every producer has its own agriculturist. The agriculturist is responsible for all the supervision of the peach trees until they are harvested. After the harvesting when you give the peaches to the cooperative they have their own agriculturist and they check the produce.,
Do you have PHFL? If yes, how do you estimate PHFL?	Yes. In the end of every year we check how many tonnes we have sold to the cooperative as good peaches and how much was PHFL.
Are there many changes in regulations in your industry? What are the different regulations about?	8 years ago there was a big change, in the right direction I believe and they asked from the producers to do all the spraying at a specific time and in 3 days for all the producers. The reason for that it was because if a producer sprayed the peach trees one day and the next day the other producer then the insects will go from one tree to the other. Also they told us to spray more safe medicines in order to reduce residues of them when they will go for processing.
Are these changes predictable and/or rapid?	I'm not sure whether the medicines are the same every year, but the spraying period is the same. There are quality standards and the processors set the size and weight that the peaches must be, but is might change depending on the availability of peaches every year. When there are not that many peaches in the market the processors offer better prices because they want to buy good quality

	of peaches and they might also lower their quality standards. For example if hail hits the trees they will be more flexible in terms of the size and the damage of the peaches.
Has the competition in your industry intensified in the last few years?	I don't think so. There is no competition among producers and this is the meaning of being member of a cooperative.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 12

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	The agriculturists of the cooperative do regular seminars to us. For example now we just finished pruning and they did us a seminar about the medicines we need to put to the trees and what else we need to do. It is a very well organised cooperative.
Do you have PHFL?	yes
If yes, how do you estimate PHFL?	Yes in tonnes
Are there many changes in regulations in your industry? What are the different regulations about?	No, it depends. It is the same thing that happens with the normal medicines in the pharmacies; the pharmacists promote the drugs that they get more money. Whichever company gives the best offer. There are some standard checks in the customs. For example, when we transport the produce from the cooperative to Russia, before you enter the country they check for any medicine left to the produce if it is good they let us get into the country, if it is not they reject it. Our cooperative is also certified by ISO and other certifications and they also check us. They usually perform audits twice per year to check about cleanliness, residues of medicines in the produce and if the produce is good to export it or not. Once it happened, not to our cooperative, they went to Russia and

	there they rejected the produce as there were high residues of medicine. There are also quality standards for the peaches. for example, we are certified by ISO, GlobalGAP etc.
Are these changes predictable and/or rapid?	They are not easily predicted
Has the competition in your industry intensified in the last few years?	Competition should not exist among producers. But because we know each other there is a kind of jealousy e.g. I got better production than you. But this I good because in that way we try for the best and this benefits our production. If you have good quality and big production is the ideal. The price you are going to get from the cooperative depends on how good your product is. For example, I might get paid 50p per kilo and you because your produce is better you might get paid 1euro per kilo. For everything we give to the cooperative we get a receipt with the date, the quantity and the variety. The prices that the producers receive from the cooperative vary. For example, one might be the best producer and he will get more money.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 13

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	Generally we do everything ourselves. We are not getting any information from anyone.
Do you have PHFL?	Yes we do
If yes, how do you estimate PHFL?	In tonnes
Are there many changes in regulations in your industry? What are the different regulations about?	For the medicines we go to one of the two agriculturists that we have in our village. We don't really ask them what we should buy; we just go there and ask for the medicine. we don't ask for their advice. Once we got into an EU

	program and they use to check us all the time and we had to follow the regulations. There no specific regulations about the packaging; it depends on what the wholesaler wants. It terms of the quality of the produce, the size and the colour of the fruit matters.
Are these changes predictable and/or rapid?	
Has the competition in your industry intensified in the last few years?	There is a little competition.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	yes

Interview 14

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	We just deliver the peaches to the cooperative. It is a very straightforward relationship, agree the peaches to produce and give them the peaches. The manager of the cooperative use to reinvest the profits in the cooperative in buying new refrigerators in whatever.. In terms of sharing the benefits it is neutral I would say because the cooperative is the one that has the more benefits. If there are any risks we kind of share them. For example, if the regulations change and the producer has already given the peaches to to cooperative the farmers will get paid. But in the case that the producers had not given the the produce to the cooperative they might be in trouble. From the time that the produce is given to the cooperative and the receipts have been given the cooperative has to pay the producers. The cooperative was working more like a wholesaler; there was no staff to take decisions for us. There is communication but it is a bit neutral in our case.
Do you have PHFL?	yes
If yes, how do you estimate PHFL?	In tonnes
Are there many changes in regulations	There are many food regulations which

in your industry? What are the different regulations about?	are given by the agriculturist. There are packaging regulations and food safety ones.
Are these changes predictable and/or rapid?	
Has the competition in your industry intensified in the last few years?	There no that much competition among the products regarding to how much they will produce.. There is competition I will say it differently, regarding what variety they will plant. depending on the variety, there are some varieties that are concentrated in one period those varieties get the lowest prices because there is too much production. when you have biggest size of peaches you will get higher prices and also when you have very good quality of peaches you will sell more peaches.
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	There are many weather changes that damage our produce.

Interview 15

Please describe what collaboration with partners' means for you. What are the activities you usually collaborate with partners?	For me collaboration should be a mutual thing. Here the cooperatives are not very good they act as wholesalers. We meet the manager of the cooperative in the beginning of each year and we agree on the approximate amount of peaches that they want us to produce and then we do everything ourselves. We get any advice about what to spray from the local agriculturist. The cooperative gives us the list with the medicines but sometimes these might change or sometimes we might put the slightly different medicines. To be honest I prefer the organic ones that they cannot really harm your produce. When the produce we just give it to the cooperative and there our job is done.
Do you have PHFL?	yes
If yes, how do you estimate PHFL?	If course we do, we measure it in tonnes or kilos depending on the extent

	of the loss
Are there many changes in regulations in your industry? What are the different regulations about?	Yes, there a changes I think. From time to time we change the spraying things and even when we sell to the wholesaler he might ask us for particular medicines. The food quality regulations depend from year to year; if there are not many peaches produced the standards will be lower and the opposite.
Are these changes predictable and/or rapid?	
Has the competition in your industry intensified in the last few years?	No there is no competition
Are there many disruptions in your SC due to unexpected events (e.g. floods, storms, and earthquake)?	Rain and hail mainly

Appendix 2: Flashcards

Συνεργασία και Ανάπλεια προϊόντος μετά την συγκομιδή: στην εφοδιαστική αλυσίδα των ροδάκινων

Stella Despoudi

Στέλλα Δεσπούδη

Loughborough University

διαφωνώ απόλυτα	διαφωνώ	διαφωνώ λίγο	ούτε συμφωνώ ούτε διαφωνώ	συμφωνώ λίγο	συμφωνώ	συμφωνώ απόλυτα
1	2	3	4	5	6	7

Στέλλα Δεσπούδη

Loughborough University

1

καθόλου	σε πολύ μικρό βαθμό	σε μικρό βαθμό	σε μέτριο βαθμό	σε σημαντικό βαθμό	σε μεγάλο βαθμό	σε πολύ μεγάλο βαθμό
1	2	3	4	5	6	7

Στέλλα Δεσποίνη

Loughborough University

2

1

αρνητικά σε μεγάλο βαθμό	αρνητικά σε μέτριο βαθμό	αρνητικά σε μικρό βαθμό	καθόλου	θετικά σε μικρό βαθμό	θετικά σε μέτριο βαθμό	θετικά σε μεγάλο βαθμό
-3	-2	-1	0	+1	+2	+3

Στέλλα Δεσποίνη

Loughborough University

3

Appendix 3: Questionnaire in English

SUPPLY CHAIN COLLABORATION AND POSTHARVEST FOOD LOSS IN THE PEACH SUPPLY CHAIN

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Research Project Title
Supply chain collaboration and Postharvest food loss: in the peach supply chain

SUBJECT INFORMATION SHEET

As a Doctoral Candidate at Loughborough University School of Business and Economics, I am currently undertaking a large-scale nationwide study of Greek peach producers. My research is about collaboration and of post-harvest food losses among producers and cooperatives or producer organisations.

The results will provide practical guidelines for improving relationships among peach producers and their supply chain partners and they will also suggest the current levels of postharvest food loss levels at this stage. This research also will identify the main environmental factors that impact peach producers.

I would like to thank you for agreeing to participate in this study. Please let me first assure you that the information collected will be treated in the strictest confidence. Only my supervisors (Dr. Grammatoula Papaioannou and Dr. Samir Dani) and I will have access to individual questionnaire responses.

All responses and analysis of data will be treated as confidential. Your personal details will only be used to contact you if needed for further research. If you would like a summary of the study findings, please provide me with your private e-mail or mail address at the end of the survey.

In advance, thank you very much for your help; it is invaluable to the success of my project.

Yours sincerely,

Stella Despoudi
Doctoral Candidate in Supply Chain Management
Loughborough University School of Business and Economics
U.K.

Section 1: Supply Chain Collaboration

Supply chain is a system of organisations, people, activities, information, and resources involved in moving a product from production to consumption.

The following questions are about collaboration between you and the cooperative or the producer organisation or any other similar type of organisation/partner that you sell the majority of your produce to. Please fill-in this questionnaire considering **ONLY ONE** of the aforementioned **relationships** that you had for the **last 3 years**.

Please neatly fill in the correct circle with a **dark** mark like this: 1 → ●

1. Please select the type of organisation that you sell the majority of your produce to:

a. Producer organisation 1

b. Cooperative 2

c. Other 3 If other, please state**……**

The following questions are about the relationship between you and the organisation you thought of in Question 1 above; please consider ONLY ONE organisation.

2. How many years have you been collaborating with this organisation?

☐ (years)

If you are collaborating for more than 3 years, please respond to the rest of the questions.

3. Please choose the number that best reflects your opinion with the following statements concerning *information sharing* between you and the cooperative.

I and the cooperative:	strongly disagree	disagree	slightly disagree	neither agree nor disagree	slightly agree	agree	strongly agree
	1	2	3	4	5	6	7
1. share information openly	1	2	3	4	5	6	7
2. keep each other informed about events or changes that might affect the other party	1	2	3	4	5	6	7
3. inform each other in advance of changing needs	1	2	3	4	5	6	7
4. willingly share even confidential information that might be useful to both parties	1	2	3	4	5	6	7
5. share information with each other on a regular basis	1	2	3	4	5	6	7
6. only provide information with each other according to pre-specified agreements	1	2	3	4	5	6	7

4. Please choose the number that best reflects your opinion with the following statements concerning yours and the cooperative's *goals*.

I and the cooperative:	strongly disagree	disagree	slightly disagree	neither agree nor disagree	slightly agree	agree	strongly agree
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. support each other's objectives	1	2	3	4	5	6	7
2. share the same goals in the relationship	1	2	3	4	5	6	7
3. have agreement on the importance of improvements that benefit us	1	2	3	4	5	6	7
4. have compatible business goals	1	2	3	4	5	6	7
5. jointly develop plans to achieve our goals	1	2	3	4	5	6	7
6. have aligned business goals	1	2	3	4	5	6	7
7. have different goals	1	2	3	4	5	6	7

5. Please choose the number that best reflects your opinion with the following statements concerning *decision synchronization* between you and the cooperative.

I and the cooperative:	strongly disagree	disagree	slightly disagree	neither agree nor disagree	slightly agree	agree	strongly agree
	1	2	3	4	5	6	7
1. tend to jointly plan about production (e.g. product assortment)	1	2	3	4	5	6	7
2. try to synchronise our decisions in planning of demand and supply (e.g. volume of peaches)	1	2	3	4	5	6	7
3. tend to jointly work out solutions	1	2	3	4	5	6	7
4. try to work together in planning of all aspects of the delivery of the produce	1	2	3	4	5	6	7
5. try to coordinate decisions to solve any packaging issues	1	2	3	4	5	6	7
6. tend to work together to fulfil customers' orders	1	2	3	4	5	6	7
7. make efforts to cooperate when planning operations	1	2	3	4	5	6	7

6. Please choose the number that best reflects your opinion with the following statements concerning *sharing of activities* between you and the cooperative.

I and the cooperative:	strongly disagree	disagree	slightly disagree	neither agree nor disagree	slightly agree	agree	strongly agree
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. share each other's performance	1	2	3	4	5	6	7
2. share costs incurred in order changes	1	2	3	4	5	6	7
3. share benefits (e.g. better return from sales)	1	2	3	4	5	6	7
4. share any risk that can occur in unforeseen situations	1	2	3	4	5	6	7
5. share costs on practices that minimize damaging routines	1	2	3	4	5	6	7
6. align benefits with cost and/or risk	1	2	3	4	5	6	7
7. volunteer to share any additional cost or benefits	1	2	3	4	5	6	7

7. Please choose the number that best reflects your opinion with the following statements concerning *resource sharing* between you and the cooperative.

I and the cooperative:	not at all	to a very slight extent	to a very small extent	to a moderate extent	to a considerable extent	to great extent	to an extreme extent
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. share resources (e.g. personnel, facilities and equipment)	1	2	3	4	5	6	7
2. often pool financial and non-financial resources (e.g. time, money and training)	1	2	3	4	5	6	7
3. have mutual resources contribution in this relationship	1	2	3	4	5	6	7
4. often combine resources to aid business activities	1	2	3	4	5	6	7
5. both contribute resources to deal with any business problems	1	2	3	4	5	6	7
6. both allocate resources to improve business processes	1	2	3	4	5	6	7

8. Please choose the number that best reflects your opinion with the following statements concerning *communication* between you and the cooperative.

I and the cooperative:	strongly disagree	disagree	slightly disagree	neither agree nor disagree	slightly agree	agree	strongly agree
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. have open two-way communication	1	2	3	4	5	6	7
2. try to keep informal communication between us	1	2	3	4	5	6	7
3. have frequent contacts on weekly basis	1	2	3	4	5	6	7
4. have many different channels to communicate (e.g. face-to-face, text messages, e-mails)	1	2	3	4	5	6	7
5. influence each other's decisions through discussion rather than request	1	2	3	4	5	6	7
6. give each other opportunities to express essential information	1	2	3	4	5	6	7
7. find it hard to inform each other about any business activities	1	2	3	4	5	6	7

9. Please choose the number that best reflects your opinion with the following statements concerning *joint knowledge creation* between you and the cooperative.

I and the cooperative:	strongly disagree	disagree	slightly disagree	neither agree nor disagree	slightly agree	agree	strongly agree
	1	2	3	4	5	6	7
1. by working together we expand our business 'know-how'	1	2	3	4	5	6	7
2. our working relationship provides opportunities to enhance our understanding of how to do better business	1	2	3	4	5	6	7
3. collectively identify how to improve our business practices	1	2	3	4	5	6	7
4. our understanding of the business processes has improved by working together	1	2	3	4	5	6	7
5. jointly generate better ideas to cope with any market uncertainties	1	2	3	4	5	6	7
6. by attending training seminars together, we develop better business methods	1	2	3	4	5	6	7
7. do not access any new knowledge by working together	1	2	3	4	5	6	7

Section 2: Environmental Conditions

1. Regulatory Conditions

Please choose the number which best indicates the degree of positive or negative effect that each of the following regulatory elements generally has on your 'business' over the **last 3 years**.

1. 1. Over the last 3 years, food safety regulations:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly affected me	1	2	3	4	5	6	7

a. Over the last 3 years, food quality regulations:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly	1	2	3	4	5	6	7

affected me							

1. 3. Over the last 3 years, organic food regulations:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly affected me	1	2	3	4	5	6	7

1. 4. Over the last 3 years, food traceability regulations:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly affected me	1	2	3	4	5	6	7

1. 5. Over the last 3 years, food transportation and handling regulations:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly affected me	1	2	3	4	5	6	7

2. External Conditions

Please choose the number which best indicates the degree of positive or negative effect that each of the following external conditions generally has on your 'business' over the **last 3 years**.

2.1. Over the last 3 years, weather conditions:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly							

affected me	1	2	3	4	5	6	7

2.2. Over the last 3 years, political conditions:

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly affected me	1	2	3	4	5	6	7

2.3. Over the last 3 years, economic conditions:
(e.g. increased cost of inputs and raw materials and price fluctuations)

	negatively to a great extent	negatively to a moderate extent	negatively to a slight extent	not at all	positively to a slight extent	positively to a moderate extent	positively to a great extent
	-3	-2	-1	0	+1	+2	+3
1. have affected me	1	2	3	4	5	6	7
2. have impacted my business	1	2	3	4	5	6	7
3. have changed the way I operate	1	2	3	4	5	6	7
4. have indirectly affected me	1	2	3	4	5	6	7

3. Competitive intensity among producers

Please choose the number which best indicates the degree of positive or negative effect that each of the following ***competitive intensity*** elements generally has on your 'business' over the **last 3 years**.

	strongly disagree	**disagree**	**slightly disagree**	**neither agree nor disagree**	**slightly agree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. competition is fierce	1	2	3	4	5	6	7
2. competition is aggressive in my markets	1	2	3	4	5	6	7
3. in this business, competitors are always out to get you	1	2	3	4	5	6	7
4. competitors are quick to take advantage of any mistakes	1	2	3	4	5	6	7
5. it is hard to keep afloat from competition	1	2	3	4	5	6	7
6. competition is unsubstantial	1	2	3	4	5	6	7

Section 3: Food losses and Post-harvest Food Losses

The following questions are about food losses and post-harvest food losses of **PEACHES**. Please answer the questions below considering the levels and impact of your own post-harvest food losses in **PEACHES** that you had over the **last 3 years**.

> **Food loss** is the decrease of edible food mass that occurs from the farm stage, during harvesting and transport of the produce prior to processing; from producers to the first buyers of the produce (i.e. cooperatives, producer organisations etc.)

1. Post-harvest food losses

> **Post-harvest food loss** is the loss of the produce that happens after the harvesting of the produce and before or at the cooperative level. It involves sorting out the produce into different qualities i.e. 'A sorting' and 'B sorting' peaches. This type of loss usually happens due to non-conformance of the produce to food safety and quality standards (i.e. size, colour, texture). The 'B sorting' peaches can be transformed to value added products e.g. juice, marmalade.

1.1. Please state the total volume of 'B sorting' peaches that you sold over the last 3 years:

	Total volume of 'B sorting' produce sold (tonnes)
2009-10	
2010-11	
2011-12	

Section 4: General Information

1. **Total amount of fruit and vegetable production per year:** ☐ (tonnes)

2. **Type of peaches produced:**

a. Table peaches α

b. Peaches for processing β

3. Location:

α. Central Macedonia A

b. Eastern Macedonia B

c. Thessaly χ

d. Western Macedonia δ

4. Role in the cooperative:

a. Member A

b. Admin member B

c. Sales Director X

d. General Director Δ

e. Elected head of the cooperative E

f. Other Φ

Please state ……...

5. Farming experience: ☐ (years)

6. Contact Information

Name: ……..……
Tel: .....
E-mail: ……...……..

This concludes the questionnaire.
Thank you for your time and valuable contribution to the study.
To receive a free copy of the final report of this study, please enter your mail or e-mail address below (please use block capitals):

_____.

Appendix 4: Questionnaire in Greek

ΣΥΝΕΡΓΑΣΙΑ ΚΑΙ ΑΠΩΛΕΙΑ ΠΡΟΪΟΝΤΟΣ ΜΕΤΑ ΤΗΝ ΣΥΓΚΟΜΙΔΗ ΣΤΗΝ ΕΦΟΔΙΑΣΤΙΚΗ ΑΛΥΣΙΔΑ ΤΩΝ ΡΟΔΑΚΙΝΩΝ

ΕΡΕΥΝΗΤΙΚΗ ΟΜΑΔΑ:

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Τίτλος Ερευνητικού Προγράμματος

Συνεργασία και απώλεια προϊόντος μετά την συγκομιδή:
στην εφοδιαστική αλυσίδα των ροδάκινων

ΕΝΗΜΕΡΩΤΙΚΟ ΔΕΛΤΙΟ ΘΕΜΑΤΟΣ

Ως Υποψήφιος Διδάκτορας στο Πανεπιστήμιο του Loughborough στη σχολή Διοίκησης και Οικονομίας, η ερευνά μου έχει να κάνει με τους παραγωγούς ροδάκινων στην Ελλάδα. Η έρευνα μου ασχολείται με την συνεργασία και την απώλεια της μετά της συγκομιδής προϊόντων μεταξύ των παραγωγών και των συνεταιρισμών ή ομάδων παραγωγών.

Τα αποτελέσματα θα παρέχουν πρακτικές οδηγίες για τη βελτίωση των συνεργατικών σχέσεων μεταξύ των ροδακινοπαραγωγών και των όποιων συνεργάζονται στην εφοδιαστική τους αλυσίδα, αλλά και θα προτείνουνε τα τρέχοντα επίπεδα της μετά της συγκομιδής απώλειας προϊόντων (ροδάκινων) σε αυτό το στάδιο. Επίσης, μέσω της έρευνας αυτής θα εντοπιστούν οι κύριοι περιβαλλοντικοί παράγοντες που επηρεάζουν τους ροδακινοπαραγωγούς.

Θα ήθελα να σας ευχαριστήσω που δεχτήκατε να συμμετάσχετε σε αυτή τη μελέτη. Καταρχήν, θα ήθελα να σας διαβεβαιώσω ότι οι πληροφορίες που συλλέγονται θα αντιμετωπιστούνε με απόλυτη εχεμύθεια. Μόνο οι καθηγητές μου (Dr. Grammatoula Papaioannou και Dr. Samir Dani) θα έχουν πρόσβαση στις απαντήσεις των ερωτηματολογίων.

Όλες οι απαντήσεις και η ανάλυση των δεδομένων θα γίνουν με εχεμύθεια. Τα προσωπικά σας στοιχεία θα χρησιμοποιηθούν μόνο σε περίπτωση που χρειαστώ να επικοινωνήσω μαζί σας για μελλοντική έρευνα. Αν επιθυμείτε να σας αποσταλεί μια περίληψη των αποτελεσμάτων αυτής της έρευνας, παρακαλώ συμπληρώστε τα στοιχεία της ταχυδρομικής σας διεύθυνσης ή της διεύθυνσης του ηλεκτρονικού σας ταχυδρομίου στο τέλος της έρευνας.

Σας ευχαριστώ εκ των προτέρων για τη βοήθειά σας, είναι πολύτιμη για την επιτυχία της ερευνάς μου.

Με εκτίμηση,

Στέλλα Δεσπούδη
Doctoral Candidate in Supply Chain Management
Loughborough University, School of Business and Economics
UK

Μέρος 1: Συνεργασία στην Εφοδιαστική Αλυσίδα

Με τον όρο **εφοδιαστική αλυσίδα** εννοούμε την ροή υλικών, πληροφοριών, υπηρεσιών και των τελικών προϊόντων από τους παραγωγούς μέχρι τους τελικούς καταναλωτές.

Οι ερωτήσεις που ακολουθούν αφορούν τη συνεργασία ανάμεσα σε εσάς και τον συνεταιρισμό ή την ομάδα παραγωγών ή κάποιο παρόμοιο οργανισμό στον οποίο πουλάτε το μεγαλύτερο μέρος της παραγωγής σας. Παρακαλώ συμπληρώστε αυτό το ερωτηματολόγιο λαμβάνοντας υπόψιν **ΜΟΝΟ ΕΝΑΝ** από τους παραπάνω αναφερόμενους οργανισμούς που συνεργάζεστε τα τελευταία **3 χρόνια**.

Παρακαλώ σημειώστε την απάντησή σας **σκιαγραφόντας** τον κατάλληλο για εσάς κύκλο όπως εδώ: 1

1. Παρακαλώ επιλέξτε το είδος του οργανισμού που πουλάτε το μεγαλύτερο μέρος της παραγωγής σας:

1. Ομάδα Παραγωγών 1

2. Συνεταιρισμός 2

3. Άλλο 3 Παρακαλώ αναφέρετε**……**

Οι ερωτήσεις που ακολουθούν αφορούν τη σχέση σας με τον οργανισμό που επιλέξατε στην Ερώτηση 1. Παρακαλώ λάβετε υπόψιν σας ΜΟΝΟ ΕΝΑΝ οργανισμό.

2. Πόσα χρόνια συνεργάζεστε με τον οργανισμό / συνεταιρισμό αυτό;

☐ (χρόνια)

Αν συνεργάζεστε απο 3 χρόνια και άνω, παρακαλώ συνεχίστε με τις επόμενες ερωτήσεις.

3. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με την *ανταλλαγή πληροφοριών* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**διαφωνώ απόλυτα**	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. ανταλλάσουμε ανοιχτά πληροφορίες	1	2	3	4	5	6	7
2. ενημερώνουμε ο ένας τον άλλον για γεγονότα ή αλλαγές που μπορούν να επηρεάσουν τον άλλον	1	2	3	4	5	6	7
3. ενημερώνουμε ο ένας τον άλλον εκ των πρωτέρων για τυχόν ανάγκη αλλαγών	1	2	3	4	5	6	7
4. ανταλλάσουμε πρόθυμα ακόμη και εμπιστευτικές πληροφορίες που μπορούν να φανούν χρήσιμες και στους δύο	1	2	3	4	5	6	7
5. ανταλλάσουμε πληροφορίες μεταξύ μας σε τακτικά διαστήματα	1	2	3	4	5	6	7
6. ανταλλάσουμε πληροφορίες μεταξύ μας μόνο σύμφωνα με προκαθορισμένες συμφωνίες	1	2	3	4	5	6	7

4. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με τους *κοινούς στόχους* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**διαφωνώ απόλυτα**	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. υποστηρίζουμε ο ένας τους στόχους του άλλου	1	2	3	4	5	6	7
2. έχουμε κοινούς στόχους στη σχέση αυτή	1	2	3	4	5	6	7
3. συμφωνούμε σχετικά με την σημασία των βελτιώσεων που ωφελούν και τους δύο μας	1	2	3	4	5	6	7
4. οι επιχειρηματικοί στόχοι μας συμφωνούν	1	2	3	4	5	6	7
5. αναπτύσσουμε από κοινού σχέδια για την επίτευξη των στόχων μας	1	2	3	4	5	6	7
6. έχουμε συγκίνοντες επιχειρηματικούς στόχους	1	2	3	4	5	6	7
7. έχουμε διαφορετικούς στόχους	1	2	3	4	5	6	7

5. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με τον *συγχρονισμό αποφάσεων* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**διαφωνώ απόλυτα**	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. έχουμε την τάση να σχεδιάζουμε από κοινού την παραγωγή (π.χ. ποικιλία προϊόντων)	1	2	3	4	5	6	7
2. προσπαθούμε να συνχρονίζουμε τις αποφάσεις μας σχετικά με τον σχεδιασμό της ζήτησης και της προσφοράς (π.χ. όγκος παραγωγής ροδάκινων)	1	2	3	4	5	6	7
3. έχουμε την τάση να βρίσκουμε από κοινού λύσεις για τυχόν προβλήματα	1	2	3	4	5	6	7
4. προσπαθούμε να συνεργαστούμε στον σχεδιασμό όλων των πτυχών της παράδοσης του προϊόντος	1	2	3	4	5	6	7

5. προσπαθούμε να συντονίσουμε τις αποφάσεις μας για την επίλυση τυχόν προβλημάτων σχετικά με την συσκευασία του προϊόντος	1	2	3	4	5	6	7
6. έχουμε την τάση να συνεργαζόμαστε για την διεκπεραίωση των παραγγελιών	1	2	3	4	5	6	7
7. προσπαθούμε να συνεργαζόμαστε για τον συντομισμό των λειτουργιών	1	2	3	4	5	6	7

6. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με τον *μοιρασμό δραστηριοτήτων* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**διαφωνώ απόλυτα**	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. μοιραζόμαστε τις επιδόσεις μας	1	2	3	4	5	6	7
2. μοιραζόμαστε τα έξοδα που μπορεί να προκείψουν από τυχόν αλλαγές σε παραγγελίες	1	2	3	4	5	6	7

3. μοιραζόμαστε τα οφέλη (π.χ. μεγαλύτερη απόδοση πωλήσεων)	1	2	3	4	5	6	7
4. μοιραζόμαστε τους κινδύνους που μπορεί να προκύψουν από απρόβλεπτες καταστάσεις	1	2	3	4	5	6	7
5. μοιραζόμαστε τα έξοδα ενεργειών που ελαχιστοποιούν τις καταστροφικές επιπτώσεις	1	2	3	4	5	6	7
6. εξισοροπού με τα οφέλη με τη ζημία και τον κίνδυνο	1	2	3	4	5	6	7
7. προθυμοποιούμαστε να μοιραστούμε οποιαδήποτε επιπλέον ζημία ή οφέλος	1	2	3	4	5	6	7

7. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με την *<u>κατανομή πόρων</u>* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**καθόλου**	**σε πολύ μικρό βαθμό**	**σε μικρό βαθμό**	**σε μέτριο βαθμό**	**σε σημαντικό βαθμό**	**σε μεγάλο βαθμό**	**σε πολύ μεγάλο βαθμό**
	1	**2**	**3**	**4**	**5**	**6**	**7**

1. μοιραζόμαστε πόρους (π.χ. προσωπικό, εγκαταστάσεις και εξοπλισμό)	1	2	3	4	5	6	7
2. συχνά ενώνουμε οικονομικούς και μη οικονομικούς πόρους (π.χ. χρόνο, χρήμα, και εκπαίδευση)	1	2	3	4	5	6	7
3. συνεισφέρουμε από κοινού πόρους στην σχέση αυτη	1	2	3	4	5	6	7
4. συχνά συνενώνουμε τους πόρους μας προκειμένου ενισχύσουμε τις επιχειρηματικές μας δραστηριότητες	1	2	3	4	5	6	7
5. έχουμε κοινή συνεισφορά πόρων για την αντιμετώπιση τυχόν επιχειρηματικών προβλημάτων	1	2	3	4	5	6	7
6. διαθέτουμε πόρους από κοινού για την βελτίωση των επιχειρηματικών μας διαδικασιών	1	2	3	4	5	6	7

8. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με την *<u>επικοινωνία</u>* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**διαφωνώ απόλυτα**	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. έχουμε ανοιχτή αμφίδρομη επικοινωνία	1	2	3	4	5	6	7

2. προσπαθούμε να τηρήσουμε την άτυπη επικοινωνία μεταξύ μας	1	2	3	4	5	6	7
3. έχουμε συχνές επαφές σε εβδομαδιαία βάση	1	2	3	4	5	6	7
4. έχουμε πολλούς τρόπους επικοινωνίας (πχ. πρόσωπο με πρόσωπο, μηνύματα στο κινητό, e-mail)	1	2	3	4	5	6	7
5. επηρεάζουμε τις αποφάσεις του άλλου μέσω συζήτησης και όχι απαίτησης	1	2	3	4	5	6	7
6. δίνουμε ευκαιρίες ο ένας στον άλλον για να εκφράσουμε σημαντικές πληροφορίες	1	2	3	4	5	6	7
7. δυσκολευόμαστε να ενημερώσουμε ο ένας τον άλλον σχετικά με τις διάφορες δραστηριότητες στη δουλειά μας	1	2	3	4	5	6	7

9. Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με την *<u>δημιουργία γνώσης από κοινού</u>* με τον συνεταιρισμό.

Εγώ και ο συνεταιρισμός:	**διαφωνώ απόλυτα**	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**

1. με το να δουλεύουμε μαζί επεκτείνουμε την επιχειρηματική μας τεχνογνωσία	1	2	3	4	5	6	7
2. η εργασιακή μας σχέση μας δίνει τη δυνατότητα να κατανοήσουμε καλύτερα το πώς να βελτιώσουμε τον τρόπο που δουλεύουμε	1	2	3	4	5	6	7
3. βρίσκουμε από κοινού τρόπους για να βελτιώσουμε τις επιχειρηματικές μας τακτικές	1	2	3	4	5	6	7
4. η κατανόηση σχετικά με τον τρόπο λειτουργίας μας έχει βελτιωθεί μέσω της συνεργασίας μας	1	2	3	4	5	6	7
5. από κοινού ανακαλύπτουμε ιδέες για την αντιμετώπιση τυχόν αβεβαιοτήτων-προβλημάτων της αγοράς	1	2	3	4	5	6	7
6. παρακολουθώντας σεμινάρια εκπαίδευσης μαζί, έχουμε αναπτύξει καλύτερες επιχειρηματικές μεθόδους	1	2	3	4	5	6	7
7. δεν έχουμε πρόσβαση σε νέες γνώσεις μέσω αυτής της συνεργασίας	1	2	3	4	5	6	7

Μέρος 2: Περιβαλλοντικοί Παράγοντες

10. Κανονισμοί τροφίμων

Παρακαλώ επιλέξτε τον αριθμό που εκφράζει καλύτερα την άποψή σας σχετικά με την θετική ή αρνητική επίδραση των παρακάτω κανονισμών τροφίμων στην δουλειά σας τα τελευταία **3 χρόνια**.

1.1. Τα τελευταία 3 χρόνια, οι κανονισμοί ασφάλειας τροφίμων:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην 'επιχείρησή' μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7
4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

1.2. Τα τελευταία 3 χρόνια, οι κανονισμοί ποιότητας τροφίμων:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην 'επιχείρησή' μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7

4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

1.3. Τα τελευταία 3 χρόνια, οι κανονισμοί <u>βιολογικών τροφίμων</u>:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην ‘επιχείρησή’ μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7
4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

1.4. Τα τελευταία 3 χρόνια, οι κανονισμοί <u>ιχνηλασιμότητας τροφίμων</u>:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην ‘επιχείρησή’ μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7

4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

1.5. Τα τελευταία 3 χρόνια, οι κανονισμοί <u>μεταφοράς</u> και <u>χειρισμού τροφίμων</u>:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην ‘επιχείρησή’ μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7
4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

2. Εξωτερικοί Παράγοντες

Παρακαλώ επιλέξτε τον αριθμό που εκφράζει καλύτερα την άποψή σας σχετικά με την θετική ή αρνητική επίδραση των παρακάτω εξωτερικών παραγόντων στην δουλειά σας τα τελευταία **3 χρόνια**.

2.1. Τα τελευταία 3 χρόνια, οι <u>καιρικές συνθήκες</u>:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην 'επιχείρησή' μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7
4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

2.2. Τα τελευταία 3 χρόνια, οι <u>πολιτικές συνθήκες</u>:

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην 'επιχείρησή' μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας	1	2	3	4	5	6	7

μου							
4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

2.3. Τα τελευταία 3 χρόνια, οι <u>οικονομικές συνθήκες</u>:
(π.χ. αύξηση κόστους εισροών και πρώτων υλών και διακυμάνσεις τιμών)

	αρνητικά σε μεγάλο βαθμό	**αρνητικά σε μέτριο βαθμό**	**αρνητικά σε μικρό βαθμό**	**καθόλου**	**θετικά σε μικρό βαθμό**	**θετικά σε μέτριο βαθμό**	**θετικά σε μεγάλο βαθμό**
	-3	**-2**	**-1**	**0**	**+1**	**+2**	**+3**
1. με έχουν επηρεάσει	1	2	3	4	5	6	7
2. έχουν αντίκτυπο στην 'επιχείρησή' μου	1	2	3	4	5	6	7
3. έχουν αλλάξει τον τρόπο λειτουργίας μου	1	2	3	4	5	6	7
4. με έχουν επηρεάσει έμμεσα	1	2	3	4	5	6	7

3. Ένταση Ανταγωνισμού μεταξύ των παραγωγών
Παρακαλώ σημειώστε τον αριθμό που εκφράζει καλύτερα την άποψή σας με τις ακόλουθες δηλώσεις σχετικά με τα στοιχεία της ***<u>εντασης του ανταγωνισμού</u>*** μεταξύ των παραγωγών στον κλάδο σας τα τελευταία **3 χρόνια**.

	διαφωνώ απόλυτα	**διαφωνώ**	**διαφωνώ λίγο**	**ούτε συμφωνώ ούτε διαφωνώ**	**συμφωνώ λίγο**	**συμφωνώ**	**συμφωνώ απόλυτα**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. ο ανταγωνισμός είναι έντονος	1	2	3	4	5	6	7
2. ο ανταγωνισμός στην αγορά είναι επιθετικός	1	2	3	4	5	6	7

3. σε αυτή τη δουλειά οι ανταγωνιστές επιδιώκουν να σε ξεπεράσουν	1	2	3	4	5	6	7
4. οι ανταγωνιστές σπεύδουν να επωφεληθούν από τυχόν λάθη μας	1	2	3	4	5	6	7
5. ο ανταγωνισμός κάνει δύσκολη την δουλειά μας	1	2	3	4	5	6	7
6. ο ανταγωνισμός είναι μηδαμινός	1	2	3	4	5	6	7

Μέρος 3: Απώλεια προϊόντος και απώλεια προϊόντος μετά την συγκομιδή

Οι παρακάτω ερωτήσεις αφορούν την απώλεια προϊόντος μετά την συγκομιδή των **ΡΟΔΑΚΙΝΩΝ**. Παρακαλώ απαντήστε στις ερωτήσεις που ακολουθούν σκεπτόμενοι τα επίπεδα απώλειας που είχατε στα **ΡΟΔΑΚΙΝΑ τα τελευταία 3 χρόνια**.

Απώλεια προϊόντος είναι η μείωση της ποσότητας του προϊόντος που εμφανίζεται στο χωράφι, κατά την συγκομιδή των προϊόντων και της μεταφορά τους πριν από την επεξεργασία τους. Απώλεια προϊόντος υπάρχει από τους παραγωγούς έως τους πρώτους αγοραστές του προϊόντος (δηλαδή συνεταιρισμούς, ομάδες παραγωγών κλπ).

1. Απώλεια προϊόντος μετά την συγκομιδή

Απώλεια προϊόντος μετά την συγκομιδή είναι η απώλεια του προϊόντος που συμβαίνει μετά την συγκομιδή του προϊόντος και πριν ή κατά το στάδιο του αγοραστή και περιλαμβάνει την διαλογή του προϊόντος σε διαφορετικές ποιότητες, δηλαδή σε καλή και κακή ποιότητα ροδάκινων. Αυτός ο τύπος απώλειας συνήθως οφείλεται στη μη τήρηση των κανονισμών ασφαλείας, των προδιαγραφών ποιότητας και των προδιαγραφών μεγέθους των προϊόντων. Τα ροδάκινα κακής ποιότητας μπορούν να μετατραπούν σε άλλα προϊόντα (π.χ. χυμό, μαρμελάδα).

1.1. Παρακαλώ αναφέρεται τον συνολικό όγκο των 'Β διαλογής' ροδάκινων που πουλήσατε τα τελευταία 3 χρόνια:

	Συνολικός όγκος 'Β διαλογής' προϊόντων που πουλήθηκαν τόνοι
2009-10	
2010-11	
2011-12	

Μέρος 4: Γενικές Πληροφορίες

1. Συνολική ποσότητα παραγωγής φρούτων και λαχανικών ανά χρόνο:

☐ (τόνοι)

2. Είδος ροδακίνων που παράγετε:

α. Επιτραπέζια ροδάκινα α

b. Συμπήρινα ροδάκινα β

3. Τοποθεσία:

α. Κεντρική Μακεδονία	Α	c. Θεσσαλία	χ
b. Ανατολική Μακεδονία	Β	d. Δυτική Μακεδονία	δ

4. Θέση στον συνεταιρισμό / ομάδα παραγωγών:

a. Μέλος	Α	e. Πρόεδρος	Ε
b. Στέλεχος	Β	f. Άλλο	Φ
c. Διευθυντής Πωλήσεων	Χ	Παρακαλώ αναφέρετε ……...	
d. Γενικός Διευθυντής	Δ		

5. Εμπειρία στον κλάδο: ☐ (χρόνια)

6. Στοιχεία Επικοινωνίας:

Ονοματεπώνυμο: ……..……..…….....
Τηλ: .....
E-mail: ……..…….....

Αυτό είναι το τέλος του ερωτηματολογίου.
Σας ευχαριστώ πολύ για το χρόνο σας και την πολύτιμη συμβολή σας σε αυτήν την έρευνα. Εάν επιθυμείτε να λάβετε ένα δωρεάν αντίγραφο των αποτελεσμάτων αυτής της έρευνας παρακαλώ εισάγετε την ταχυδρομική σας διεύθυνση ή το e-mail σας παρακάτω (παρακαλώ χρησιμοποιήστε κεφαλαία γράμματα):

_____.

Appendix 5: Correlation Matrix of the Summated Scales of the Variables

Correlations

		TOTALIS	TOTALGC	TOTALDS	TOTALAS	TOTALRS	TOTALCM	TOTALKC	TOTALCH
TOTALIS	Pearson Correlation	1	.352**	.663**	.609**	.567**	.563**	.635**	.561**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000
	N	220	220	220	220	220	220	220	220
TOTALGC	Pearson Correlation	.352**	1	.561**	.708**	.688**	.570**	.629**	.644**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000
	N	220	220	220	220	220	220	220	220
TOTALDS	Pearson Correlation	.663**	.561**	1	.744**	.768**	.613**	.795**	.738**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000
	N	220	220	220	220	220	220	220	220
TOTALAS	Pearson Correlation	.609**	.708**	.744**	1	.802**	.570**	.762**	.765**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000
	N	220	220	220	220	220	220	220	220
TOTALRS	Pearson Correlation	.567**	.688**	.768**	.802**	1	.550**	.785**	.777**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000
	N	220	220	220	220	220	220	220	220
TOTALCM	Pearson Correlation	.563**	.570**	.613**	.570**	.550**	1	.600**	.561**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000
	N	220	220	220	220	220	220	220	220
TOTALKC	Pearson Correlation	.635**	.629**	.795**	.762**	.785**	.600**	1	.800**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000
	N	220	220	220	220	220	220	220	220
TOTALCH	Pearson Correlation	.561**	.644**	.738**	.765**	.777**	.561**	.800**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	
	N	220	220	220	220	220	220	220	220

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

Abbreviations:

TOTALIS= summated scale of the Information Sharing Construct

TOTALGC= summated scale of the Goal Congruence Construct

TOTALDS= summated scale of the Decision Synchronisation Construct

TOTALAS= summated scale of the Activity Sharing Construct

TOTALRS= summated scale of the Resource Sharing Construct

TOTALCM= summated scale of the Collaborative Communication Construct

TOTALKC= summated scale of the Knowledge Sharing Construct

TOTALCH= summated scale of the Competitive Intensity Construct

Appendix 6: Q - Q Plots of this Study's Variables

Figure 1: Q-Q plot for the Information Sharing (IS) Construct

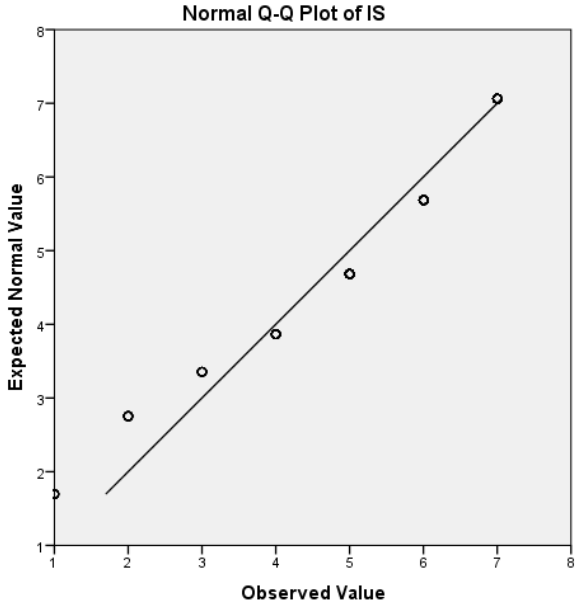


Figure 2: Q-Q plot for the Goal Congruence (GC) Construct

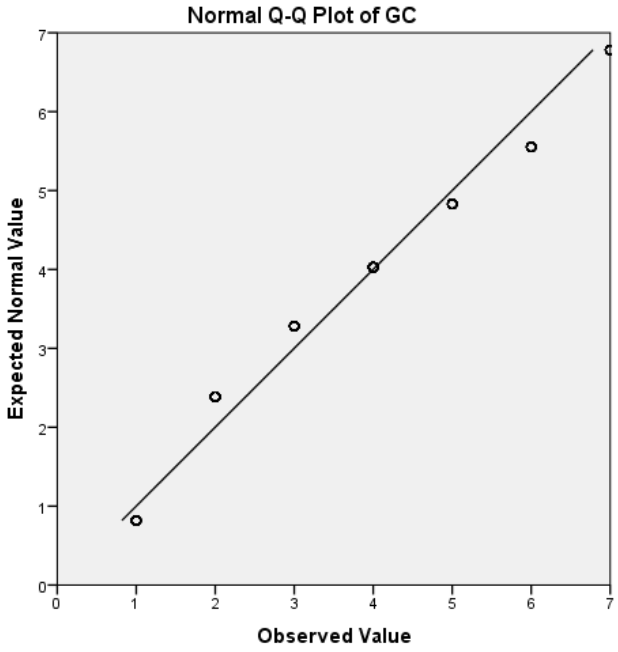


Figure 3: Q-Q plot for the Decision Synchronisation (DS) Construct

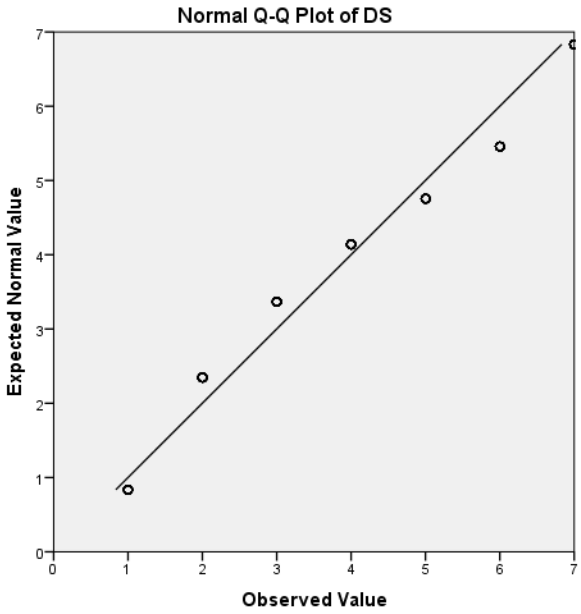


Figure 4: Q-Q plot for the Activity Sharing (AS) Construct

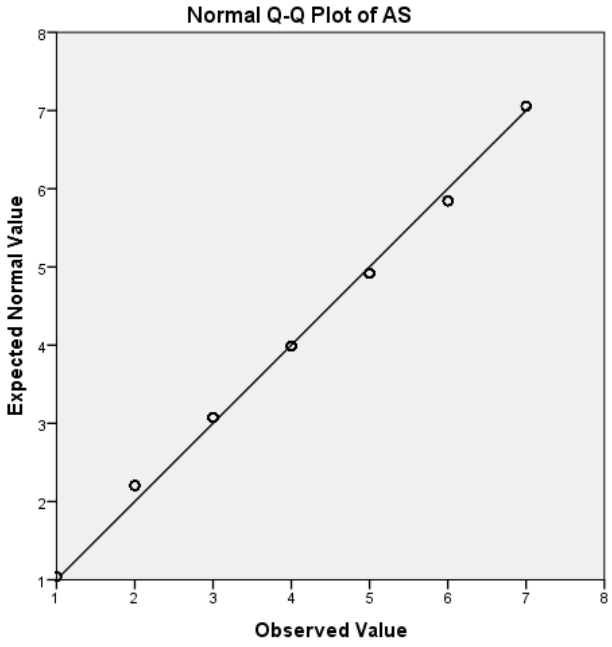


Figure 5: Q-Q plot for the Resource Sharing (RS) Construct

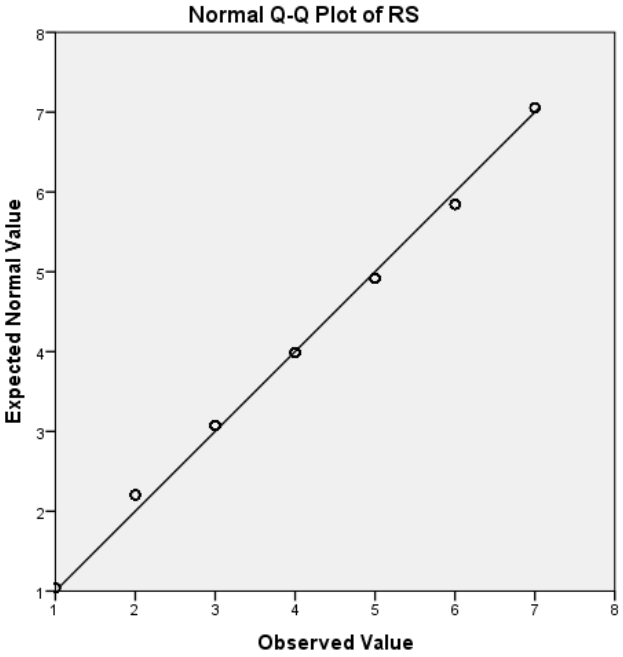


Figure 6: Q-Q plot for the Communication (CM) Construct

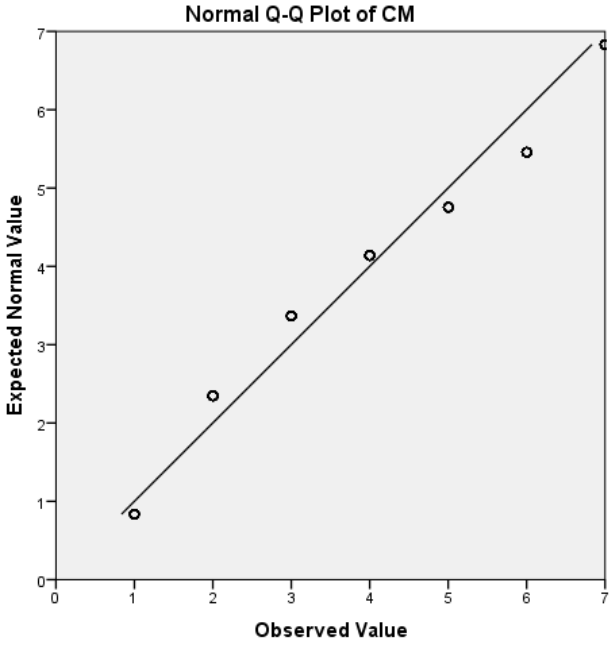


Figure 7: Q-Q plot for the Knowledge Creation (KC) Construct

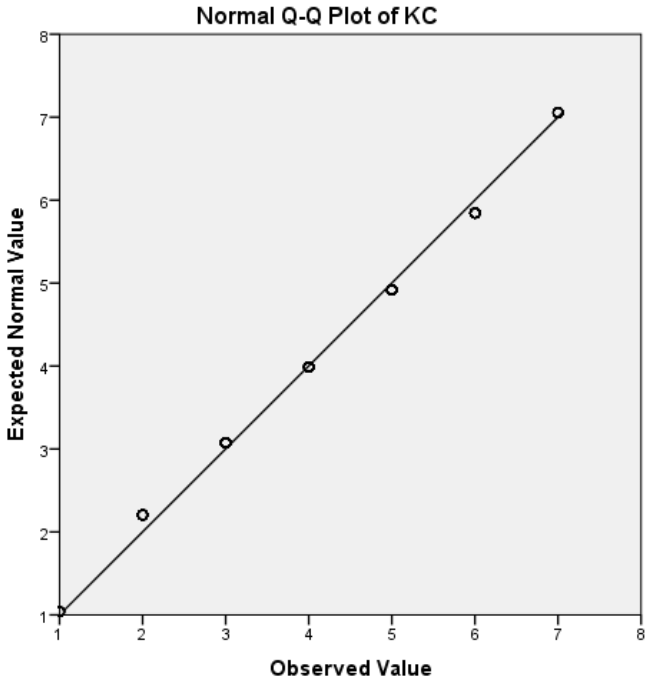


Figure 8: Q-Q plot for the Food Safety Regulations (FSR) Construct

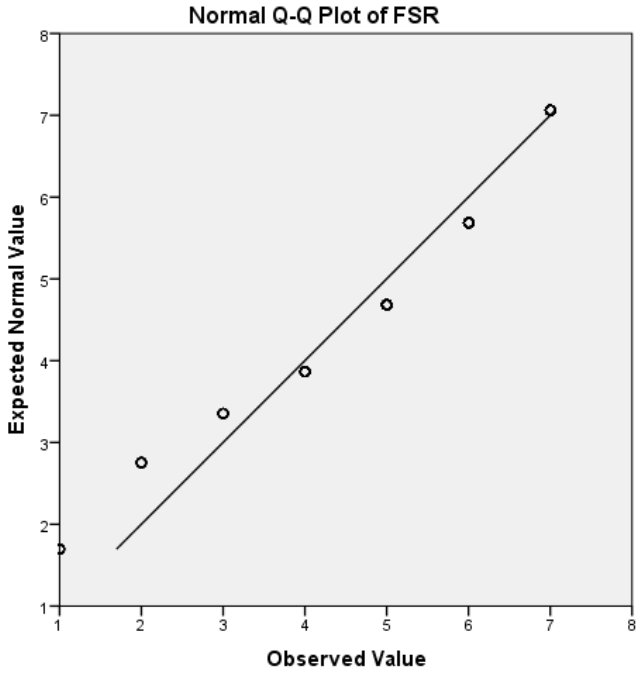


Figure 9: Q-Q plot for the Food Quality Regulations (FQR) Construct

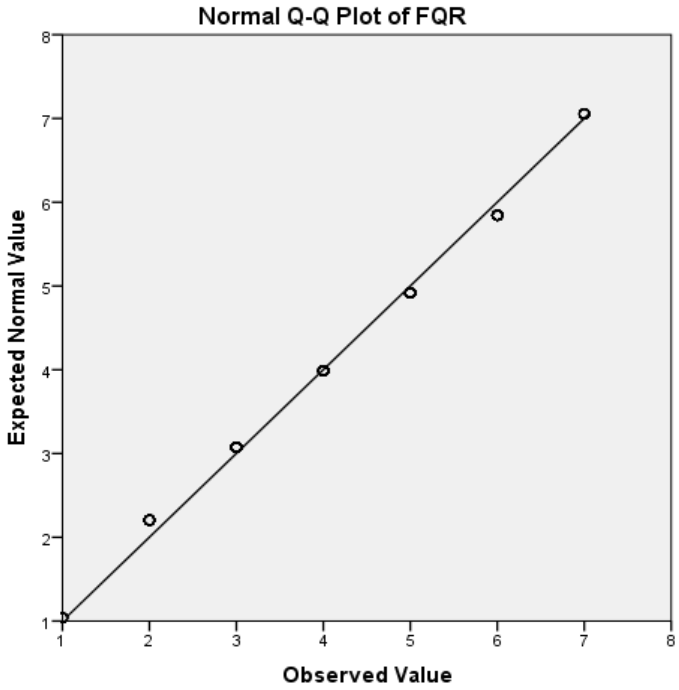


Figure 10: Q-Q plot for the Organic Food Regulations (OFR) Construct

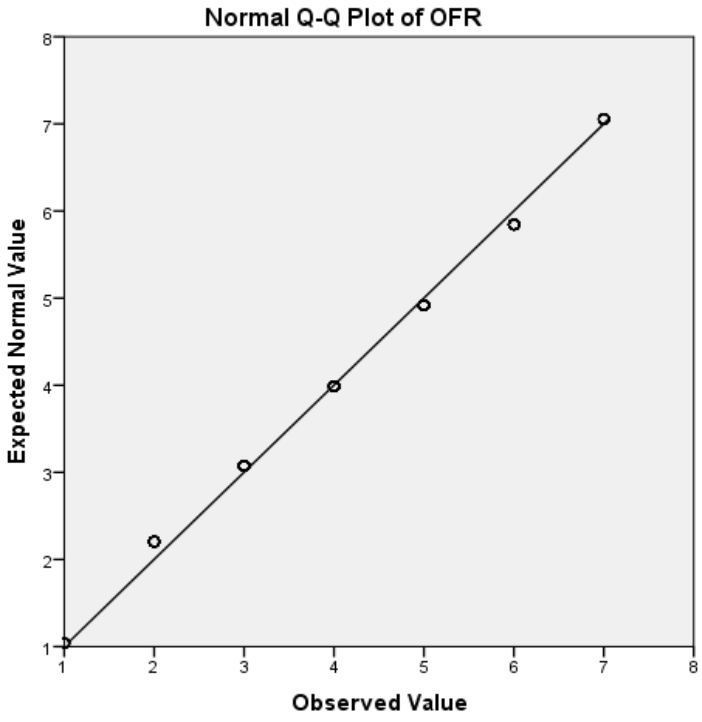


Figure 11: Q-Q plot for the Food Traceability Regulations (FTR) Construct

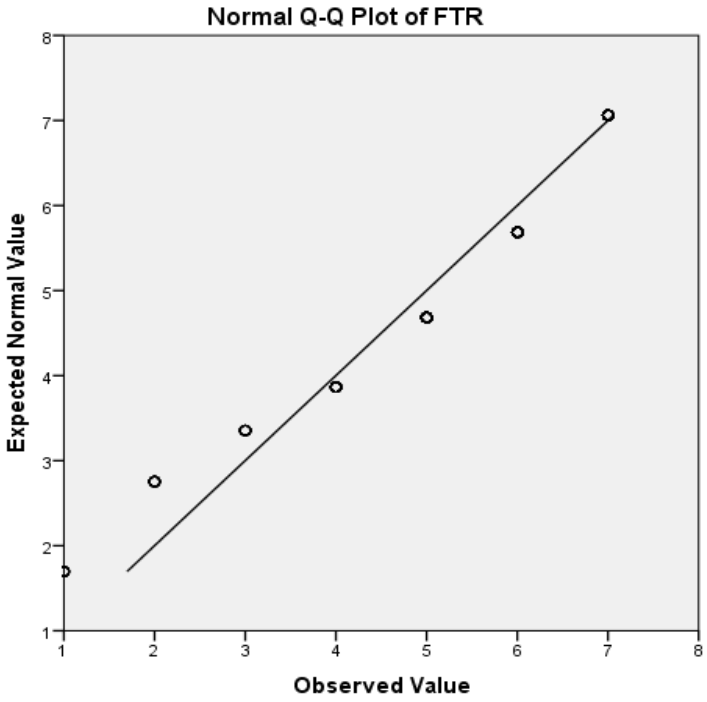


Figure 12: Q-Q plot for the Food Transport and Handling Regulations (FHR)

Construct

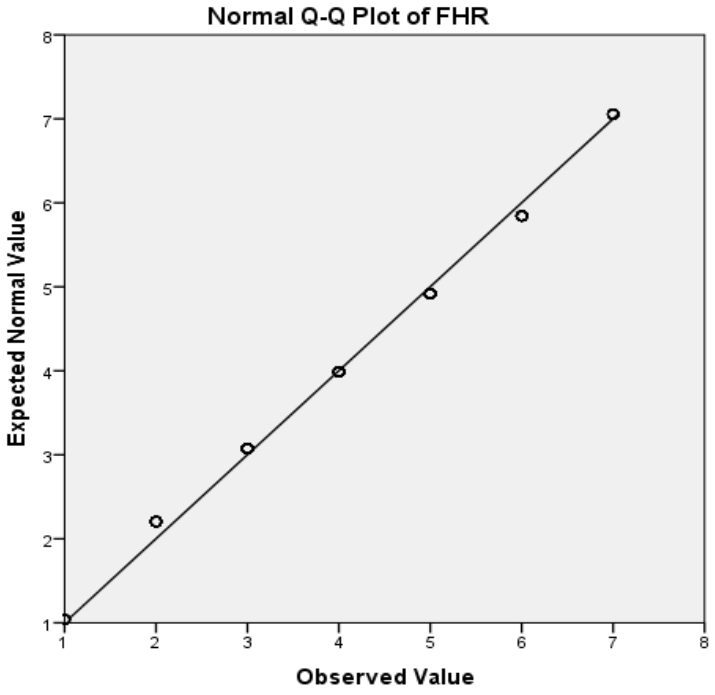


Figure 13: Q-Q plot for the Weather Conditions (W) Construct

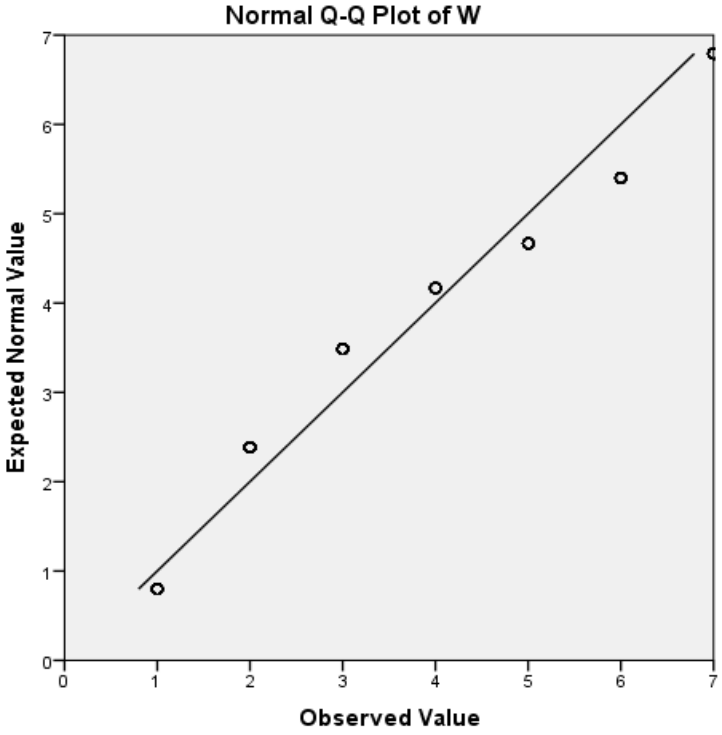


Figure 14: Q-Q plot for the Political Conditions (P) Construct

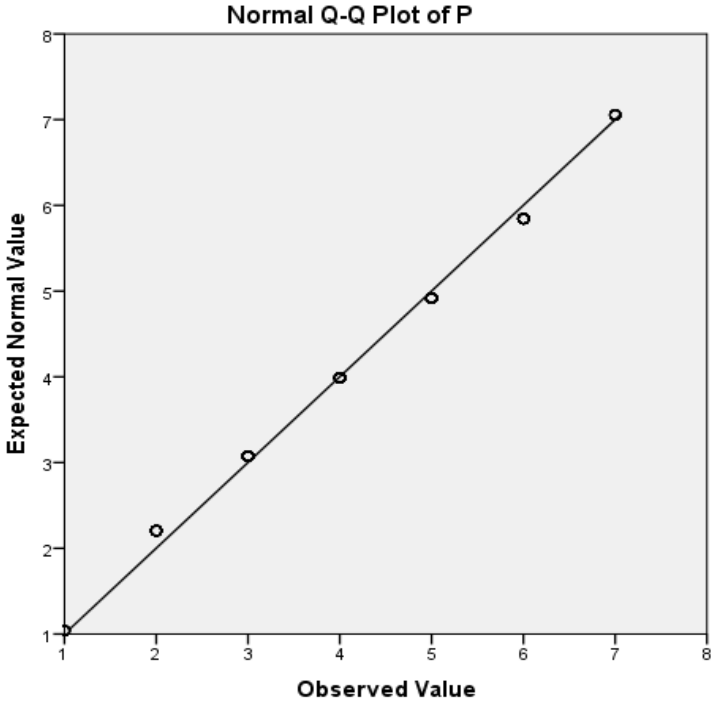


Figure 15: Q-Q plot for the Economic Conditions (E) Construct

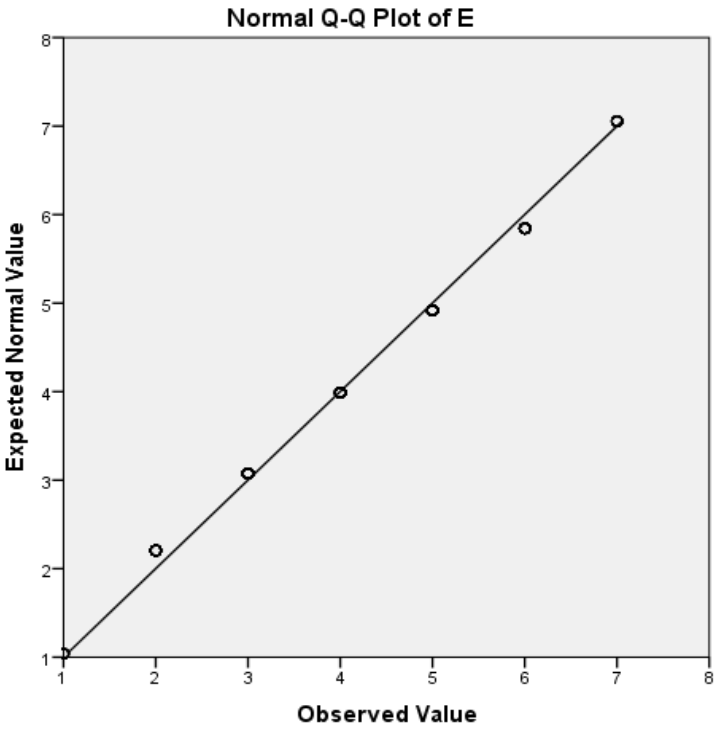


Figure 16: Q-Q plot for the Competitive Intensity (CI) Construct

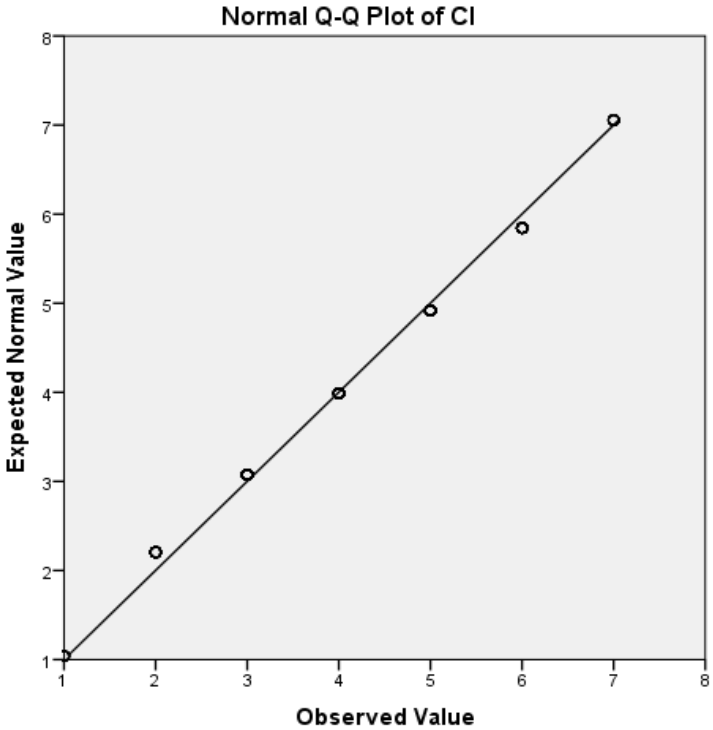


Figure 17: Q-Q plot for the PHFL Construct

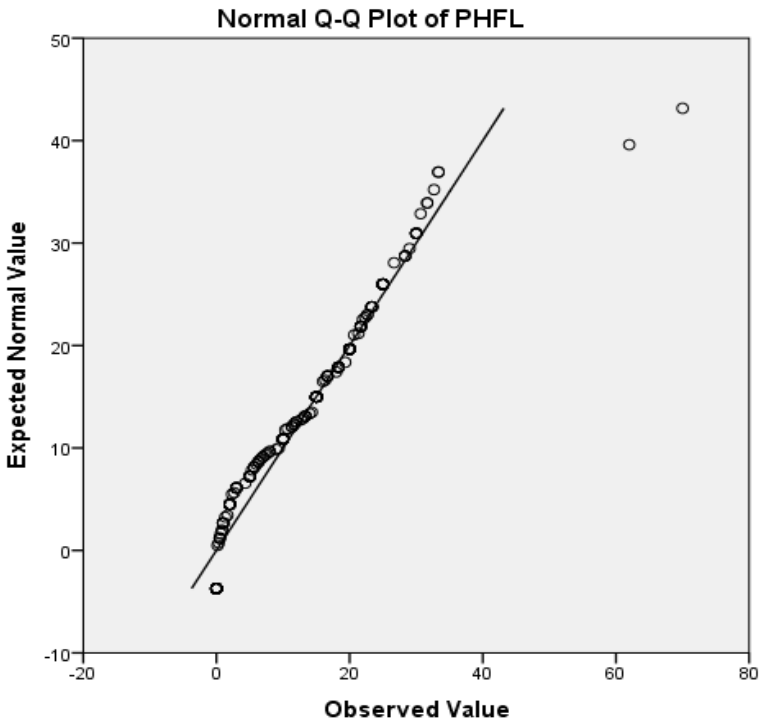


Figure 18: Q-Q plot for the Collaboration (CO) Construct

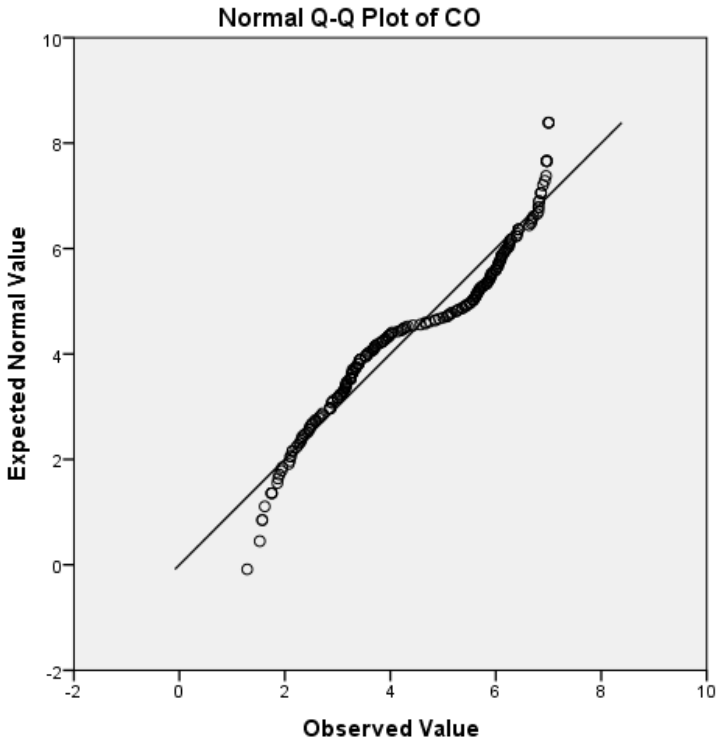
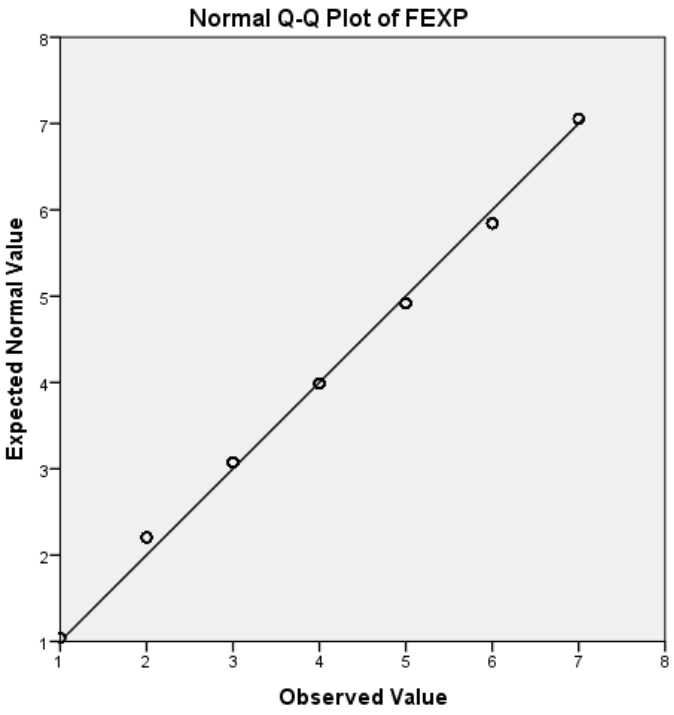


Figure 19: Q-Q plot for the Farming Experience (FEXP) Construct



Appendix 7: Scatterplot of this Study's Dependent and Independent Variables

Figure 1: Scatterplot of the Collaboration - PHFL relationship