

Producers Responding to Environmental Turbulence in the Greek Agricultural Supply

Chain: Does Buyer Type Matter?

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Abstract

There are many changes in the EU Agricultural Supply Chain (ASC). These changes cause environmental turbulence for supply chain entities operating in this sector. In the Greek ASC, there is a significant decline in its performance in particular at producers' level. Based on the Contingency Theory this paper aims to identify the relevant environmental turbulence factors in Greek ASC context from the producers' perspective and ascertain their impact on producers based on their choice of buyer type i.e. collaboration type. Twenty in-depth semi-structured interviews were conducted with Greek ASC producers. Thematic analysis was used to analyse the interviews. The findings suggest the existence of six major environmental turbulence factors at producers' level which are: regulatory, market, competitive, weather, economic and political turbulence factors. Producers selling their products to cooperatives were found to be significantly impacted by the different environmental turbulence factors. Future research directions as well as managerial and policy implications are identified.

Keywords: agriculture, collaboration, environmental uncertainty, producers

1. Introduction

Today's Agricultural Supply Chain (ASC) is facing many pressures due to issues related to fewer natural resources available, limited agricultural land available, population growth, world's food insecurity, climatic change, dietary changes, governance of the food system, and food waste (Oderanti et al. 2017; FAO 2011; 2017, Defra 2020; EU 2017; Govindan 2018; Despoudi 2020). The major natural resources i.e. food, energy and water are becoming scarce (FAO 2011). The future scarcity of the natural resources indicates the need to be preserved and not to be intentionally wasted. The agricultural land is also limited; new ways to grow crops need to be found in places that until now it 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 2017). 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 2011; Despoudi 2019). 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 limited agricultural land available, and the high levels of food waste rise major concerns about world's food insecurity.

Climatic 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). Climatic change also has and will continue to have in the future severe negative consequences to the ASC (Bereuter et al. 2014; Askew 2019). Weather changes in the form of extreme weather events, the rise of global temperature, and the increase of greenhouse gas emissions are the main causes of climate

change that will impact significantly the ASC. 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 ASC as high caloric diets require more natural resources to be spent. The governance of the global ASC at both national and international levels is another challenge that the ASC is facing (FAO 2017; EU 2017). The globalisation of the markets led to changes in power imbalance in the ASC and this creates governance issues in the sector. More precisely, producers are the less powerful in the ASC, while large-scale retailers dominating the sector (Delloite 2013; EU 2017).

According to a study conducted by the FAO titled 'Global Food Losses and Food Waste' (Gustavsson et al. 2010, 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 ASC. The majority of food is lost from the producers to the retailers point in the supply chain (Gustavsson et al. 2010). Food sustainability refers to the reliable and transparent production of food within the ecological limits, that empowers food producers, and ensures accessible and nutritious food for all (Sustainability 2011). There is a need for developing a sustainable and fair ASC (Driscoll 2012). Smallholder producers despite producing more than 70% world's food, they represent more than half of the world's hungriest people (Gidney 2015).

There have been many changes in the ASC in order to respond to the aforementioned challenges and pressures to increase its sustainability (Bourlakis et al. 2004; Van der Vorst et al. 2009; Otles et al. 2014; Despoudi 2020). These continuous changes in the ASC's environment cause turbulence due to the high levels of inter-period change, uncertainty and unpredictability, but also because of the increased competitive intensity characterising the chain (Galanopoulos et al, 2011). Uncertainty in ASC's operating environment may also

impact supply chain partners relationships (Despoudi 2016). The Greek ASC environment is characterised as being highly uncertain due to the changes in EU's ASC environment (Kaditi and Nitsi et al. 2010; Michalopoulos 2019) and over the past few years there was a continuous decline in the performance of the Greek ASC (Paseges 2012; Kyrkillis and Symeon 2015; Papadimas and Triantafyllou 2019; Galanopoulos and Tugwell 2019; TNH 2019; Manifava 2019). Research studies about environmental uncertainty and collaboration have focused at the firms' level (Matopoulos et al. 2007) and there is lack of research under the specific context and unit of analysis i.e. producers (Despoudi 2016; Despoudi et al. 2018).

Producers in the EU ASC sell their products either to cooperatives or wholesalers (Europa 2018). Cooperatives or else called agricultural cooperatives were formed in an effort to support collective action in the ASC and support producers (EU 2014). However, there have been criticisms about the benefits for producers when selling their produce to cooperatives (Valentinov 2005; Nilsson et al. 2012; Chinaki and Sergaki 2018; Michalopoulos 2020). Due to that, many producers decide not to join a cooperative and they sell their produce to wholesalers. Different buyers' types may have an impact on how Supply Chain (SC) entities perceive and manage environmental uncertainties (Srinivasan et al. 2011; Lehoux et al. 2014). Many authors highlighted the importance to consider the context where an organization operates. Based on the Contingency Theory, this paper aims to identify the relevant environmental turbulence factors under the specific context i.e. the Greek ASC and unit of analysis i.e. producers. Also, the impact of each of these factors on the Greek ASC producers will be ascertained according the collaboration type i.e. selling to cooperative or to wholesaler. The paper is organised as follows: Section 2 presents the literature review, section 3 outlines the research methodology, section 4 discusses the findings. Finally, in Section 5 the paper concludes with managerial and policy implications as well as future research avenues.

2. Literature Review

2.1 Environmental Turbulence Factors in ASC

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, 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, 73). The role of supply chain management should be to reduce and eliminate those uncertainties to improve supply chain performance (Van der Vorst 1998).

Environmental turbulence is defined as the degree to which technological, competitive, regulatory, and customer levels change within an industry and affect managerial decisions of an organisation (Calantone et al. 2003; Kuivalainen et al. 2004). The main characteristics of turbulent environments are the following: 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). Companies in response to the increasing environmental turbulence

need to continuously adapt to changes in their operating environment and hence the ability of traditional supply chain management models to manage it is questioned (Christopher and Holweg 2011). Therefore, environmental turbulence or else environmental uncertainty 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 SC can be classified in terms of its origin, as endogenous (i.e. within a supply chain) and exogenous (i.e. from the external environment) turbulence or else called uncertainty (Van der Vorst 2000; Trkman and McCormack 2009). 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 and continuous uncertainties (e.g. weather changes, political changes) (Trkman and McCormack 2009).

The ASC exhibits 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 the ASC depend on the product, process, organisational and SC characteristics. Zahra and Covin (1995) classified the contextual influences of the ASC in two categories: (i) internal factors (i.e. organizational structure), and (ii) external factors (i.e. operating environment, market, and governmental regulations). Therefore, when studying the ASC not only the nature of the product exchanged needs to be considered, but also the operating environment and the specific SC characteristics.

In the EU's 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; Hernandez et al. 2018). Thus, all the aforementioned changes are the causes of a highly turbulent operating environment.

Moreover, climatic change will continue to have severe effects on the ASC worldwide (Askew 2019). 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 ASC environment (Warner 2014; Winchester 2015; EY 2019). Hence, it could be said that EU's ASC 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.

2.2 Collaboration in the ASC

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, 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. Derrouiche et al. (2010) describe collaboration as a close cooperation among autonomous partners that jointly participate to meet end users' needs. 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.

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 activities to collaborate with business partners. There are different types/levels of collaboration such as transaction collaboration, cooperative collaboration and cognitive collaboration based on the different collaborative activities (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 activities of collaboration need to be assessed, and then the different ways to improve collaborative efforts/practices need to be identified (Simatupang and Sridharan 2002). This research focusses

on the external upstream, relationships of ASC producers with their buyers and their collaborative activities.

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 the knowledge and the 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; Boshkoska et al. 2019). A main challenge in the ASC is to develop collaborative relationships and through this to exploit partners' capabilities in order to increase the performance of the ASC (Zuurbier 1999). 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) and thus enhancing collaboration levels in the ASC is seen as a source of competitiveness (Reynolds et al. 2009). ASC producers have always been practitioners of collaboration (Despoudi et al. 2018). Cooperatives and wholesalers are the main buyers of ASC producers' products in the EU (Europa 2018). Cooperatives involve more formal avenues of collaboration and they may facilitate the production, distribution and marketing of the produce (EU 2014) which is usually not the case for producers who sell their produce to wholesalers (Valentinov 2005, Lehoux et al. 2014). The EU is encouraging ASC producers to collaborate with cooperatives as it could bring them many benefits such as access to markets and better management of uncertainties (Europa 2018). However, collaboration between cooperatives and their members in EU is becoming more heterogonous due to the EU market deregulation (Hovelaquet al. 2009). Cooperatives have also been criticised for their effectiveness and whether they actually support producers to respond better to market requirements, and to improve their business performance (Valentinov 2005). There is a need for cooperatives to identify new ways of addressing member disengagement and heterogeneity

(EEFP 2014). Therefore, it is not clear from the literature which type of ASC buyer is more beneficial for ASC producers. This research will shed light in this aspect, regarding whether collaboration with cooperatives or with wholesalers is helping ASC producers to respond better to market requirements and to manage uncertainties.

2.3 Environmental Uncertainty and Collaboration in the ASC

Organisational environments change, and organisations need to adapt to the new environmental conditions to survive and prosper (Fritz and Schiefer, 2009). Many authors investigated the importance to consider and study the context where a firm/organisation operates (Webster 2002; Robertson and Chetty 2000). Numerous studies identified different factors that should be considered when we study supply chains 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 collaborator type in supply chains (Danese 2011).

There have been many changes in the EU's ASC environment, and these changes shifted the SC 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). Collaboration among upstream ASC 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; Hernandez et al. 2017). Many studies investigated the impact of environmental turbulence factors on supply chain partners' relationships (Fynes et al. 2004; Saccani and Perona 2007; Trkman and McCormack 2009; Srinivasan et al. 2011; Sambasivan et al. 2013). Partners' relationships in the 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; Arora and Webb 2012). Therefore, environmental turbulence is a factor that may impact collaboration in the ASC.

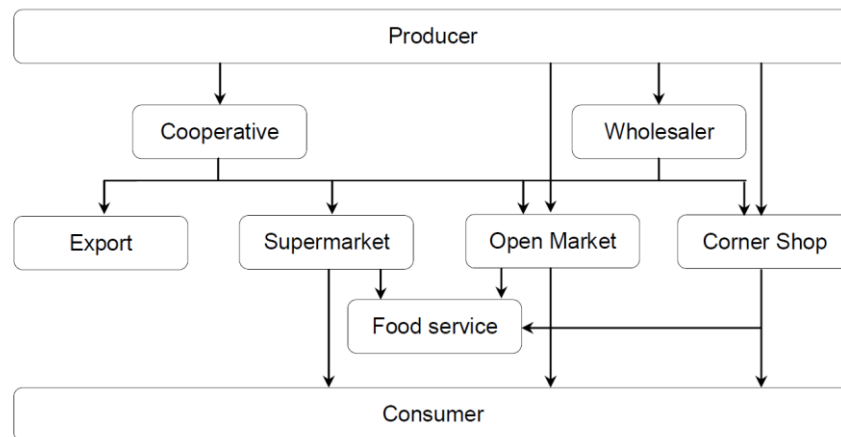
The intensity of collaboration in the ASC can be influenced negatively or positively by the nature of the products, the sector's structure, and the business environment (Matopoulos et al. 2007; Fischer et al. 2008; Fischer et al. 2010). Technological, regulatory and financial reasons in the ASC are shifting organisations towards greater collaboration (Hobbs and Young 2000). 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 food quality standards are continuously changing causing turbulence in partners' relationships (Fischer et al. 2008). Specific ASC industry characteristics such as the 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 research that considers more realistic features such as the regulatory environment and the 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 and they are 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's ASC has increased, and SC entities need to respond fast to the changes to keep up with competition (Ruteri and Xu 2009).

2.4 The Greek ASC and theoretical lens

According to Eurostat (2019a) 1.6 million people work on Greek farms which is one of the largest agricultural labour forces within the EU-28, with 684,950 agricultural holdings in Greece. Greece is the fifth largest producer of fresh produce in Europe (Eurostat 2019b). Fresh agricultural products are the main exported agricultural products of Greece (Manos and Manikas 2010; Eurostat, 2019a).

The marketing channels of the Greek ASC can be seen in Figure 1. The majority of agricultural products are sold through the cooperatives (Manos and Manikas 2010). However, the number of cooperatives in Greece is declining as they are functioning poorly (Lamprinopoulou et al. 2006; Michalopoulos 2020). Another type of marketing channel in the Greek ASC is wholesalers; this is usually the case where the producers are not members of any cooperative. A small proportion of the fresh produce in Greece is sold in central local markets or to local corner grocery shops. The case of producers selling their products directly to retailers is not a common case (almost rare) in the Greek ASC. The retail sector is highly concentrated as there are a few major players dominating the Greek ASC market (McKinsey 2012). This research is focussing on producers that sell their produce to cooperatives and wholesalers as the majority of the Greek ASC fresh produce products are sold through them (Minagri 2017).

Figure 1: The different marketing channels in the Greek ASC



The Greek ASC environment was impacted from the operating environment changes in the ASC environment (Kaditi et al. 2010). The performance of the Greek ASC declined significantly over the past years (Paseges 2012; Despoudi et al. 2015; Kyrkillis and Symeon 2015; Papadimas and Triantafyllou 2019). Although other EU ASC actors reacted to the operating environment changes, the Greek ASC actors and in particular the producers seem not to have reacted and adapted to those changes (Kaditi et al. 2010). A highly uncertain operating environment was created due to the Greek ASC producers being confused and not fully understanding the need to adapt in this continuously changing environment (Galanopoulos et al. 2011).

According to Contingency Theory (CT) there is no best way to organise as this will depend on the different environmental conditions (Wright et al. 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 advocates that the performance of a firm will be determined by the fit between an organisation and its external environment (Calantone et al. 2003). 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). Therefore, based on CT this paper aims to identify the relevant environmental turbulence factors in Greek ASC context from the producers' perspective and ascertain their impact on producers based on their choice of buyer type i.e. collaboration type.

3. Methods

3.1 Sampling and recruitment

The exploratory nature of this research and absence of research regarding the environmental turbulence factors and their impact on producers in the Greek ASC context called for a grounded theory approach. This approach is appropriate as it enables an in-depth exploratory investigation of the phenomenon under study (Voss et al. 2016) and stems from the literature as 'theory elaboration' (Ketokivi and Choi 2014). The aim of this research is to complement the literature and elaborate further on the theory supporting the existence of different environmental turbulence factors (Cadogan and Paul 1999; Sivestre 2015) focusing in the Greek ASC environment, which is highly uncertain (Kaditi and Nitsi et al. 2010; Michalopoulos 2019; Galanopoulos and Tugwell 2019; TNH 2019; Manifava 2019), considering two buyer types. For the purpose of this study, the perspectives of twenty respondents comprising producers and their downstream relationships have been explored. The Greek peach supply chain was chosen as representative SC of the Greek ASC for the purposes of this research as (i) peach is a highly perishable product and therefore producers need to sell it immediately (Parfitt et al. 2010), (ii) Greece is the 2nd largest producer of peaches in EU (EU 2018; Eurostat 2019c), and (iii) the producers perceptions of environmental turbulence factors may vary across products, and thus focusing on a single product will give more reliable and valid results.

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. According to Elstat (2017) the majority of peach trees are in Central Macedonia (i.e. 342,597 trees), Thessaly (i.e. 26,302 trees), Western Macedonia (i.e. 20,266 trees), and Eastern Macedonia (i.e. 2,103 trees). Since the Greek peach producers are not registered anywhere the sampling frame of this study was developed by approaching producers from the Central Macedonia region as the majority of the peach production is based in this region.

For this study, the non-probability snowball sampling technique was selected as there is no specific list with the names of the peach producers in Greece. The peach producers were identified through internet search. Personal contacts of the initially interviewed peach producers were then used as a further pool of respondents. The initial choice of informants provided a preliminary understanding of the main environmental turbulence factors based on the two different buyer types i.e. wholesalers, and cooperatives of peach production in Greece. For validity purposes, we endeavoured to conduct interviews with producers likely to represent a diverse range of views regarding environmental turbulence factors by selecting producers selling to the two different types of buyers. Twenty interviews were conducted in total, 10 with producers selling to cooperatives and 10 with producers selling to wholesalers. The number of the interviews was decided based on the saturation (Marshall et al. 2013) and the importance of having 20 or less participants which improve the exchange of information (Crough and McKenzie 2006).

3.2 Data collection

In-depth semi-structured interviews were conducted with Greek ASC producers with data been collected at the beginning of 2013 (Despoudi 2016). The Greek ASC environment is still

considered turbulent and uncertain in terms of the different environmental turbulence factors examined in this paper (Michalopoulos, 2019; Papadimas and Triantafyllou 2019; Galanopoulos and Tugwell 2019; TNH 2019; Manifava 2019). The in-depth interview method enables insights to be gained into the respondents' interpretations of their environments and enhances the researcher's ability to understand underlying issues (Miles and Huberman 1994). Through the interviews we aimed to understand the environmental turbulence factors as perceived by ASC producers under the context based on the buyer type. An interview protocol was developed based on the objectives of this study and it was used to keep the questions consistent across the different interviewees. Validation was also reassured by selecting participants from the peach SC who had substantial experience and represented a valid picture of the research matter (Creswell, 2003). The duration of the interviews varied from 30 to 40 minutes and the respondents agreed to be audio recorded. Informed consent forms and confidentiality agreements were given to each interviewee prior to interview. During the interview process the respondents were encouraged to elaborate on their answers and on anything that they considered to be relevant to this topic in order to explore in-depth any other issues (Macfarlane 1972; Smith 1975). Thematic analysis with coding was used to identify themes reflecting the interview guide. As soon as the data was collected two researchers coded each interview first to identify whether there is a need for any additional interview and secondly to forward the transcripts back to the interviewees for checking. Following this process, results were obtained, and the identified six categories based on the environmental factors were validated together with the collaborative activities involved.

4. Findings and analysis

This section presents the interview results based on the perceptions of the Greek ASC interviewed producers. The collaborative activities that the Greek ASC producers employ with

their buyers are discussed followed by the different environmental turbulence factors as being existent in the specific context.

4.1 Collaborative activities in the Greek ASC

Significant differences in the collaborative activities found to exist among peach producers and their buyers. As expected, producers who collaborate with wholesalers found to engage in a few collaborative activities as they perform only basic transactions with their buyers. Even for producers that collaborate with cooperatives it is observed to have significant differences in the activities that they collaborate with their buyers. The main collaborative activities that producers engage with their buyers were found to be information exchange about the orders and the product requirements, and communication. The cases of producers exchanging knowledge, sharing resources, as well as joint planning and decision-making were rare. Hence, among producers and wholesalers it could be said that there is transactional collaboration, while among producers and cooperatives it varies from transactional to cognitive (Tourte and Faber 2011; EU 2014; Jarrett et al. 2015; Europa 2018).

4.2 Environmental turbulence factors in the Greek ASC

The findings sought to understand the environmental turbulence factors that are existent in the Greek ASC and ascertain how they may impact producers based on the different buyer types. Although uncertainty factors may be expected to be the same for all the Greek ASC producers, the choice of buyer i.e. collaborator may impact the way that they perceive and respond to those uncertainties. Although producers selling their produce to cooperatives are expected to manage environmental turbulence factors, it was found that they are still facing many uncertainties. Hence, the expected benefits for producers when joining a cooperative were not achieved. The different environmental turbulence factors as identified in the literature review

section are used to compare the differences between producers selling to cooperatives and to wholesalers. These turbulence factors namely regulatory, market, competitive, weather, political, and economic were used as themes to guide the analysis. Technological uncertainty was found not to be existent in the Greek ASC context as producers use standard agricultural equipment for their produce. Table 1 presents a summary of the different environmental turbulence factors and their causes in the Greek ASC from the producers' perspective based on the different buyer types i.e. producers selling to cooperatives and producers selling to wholesalers.

4.2.1 Regulatory turbulence

The main regulations that ASC members in the EU need to comply with and adopt are the following: food safety regulations, food quality regulations, food labelling and food packaging regulations, food traceability regulations, food transport and handling regulations, and organic food regulations. From the interview data it was clear that not all the Greek ASC producers adopted and implemented all the different food regulations suggested for implementation by the EU. The Greek ASC producers were found to mainly implement only the required food regulations which are related to food safety and food quality regulations. Some of the interviewed producers were not aware of the different food regulations they need to adopt and comply with. The variety and continuous changes of food regulations were found to confuse the Greek ASC producers. Buyers were found to advise producers about which food regulations they should comply with. One of the interviewees selling to wholesaler highlighted that:

“... there are so many different food regulations and we are not sure which ones we should implement. Every year there is a change in the regulations that we need to comply with and we are instructed by our buyers about which regulations we need to adopt.” [producer selling to wholesaler]

Although cases of non-compliance to food regulations are rare in the internal market, when the produce is to be exported compliance to food regulations and audits of the produce are much stricter and there are significant food losses¹. Some of the interviewed producers, who export their produce, said that due to the constant changes in food regulations they adopted integrated management of the produce to control every single point in the growing, harvesting, handling and transportation process. However, when the producers sell their produce to wholesalers uncertainty regarding compliance to food regulations is higher. This is because some wholesalers request from the producers to use specific fertilisers and pesticides on their produce and in cases where there are last minute cancellations the producers need to find another buyer to sell their produce or else it will be wasted. A producer selling to wholesaler highlighted:

“...the wholesaler that we use to sell our produce 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 minute the wholesaler cancelled the order. All the producers that were going to sell their produce to him have not sprayed their produce for a specific insect protection pesticide and we tried to spray it last minute, but it was too late, as the produce was full of insects and we had to throw it away” [producer selling to wholesaler]

Additionally, it was found that in many cases food regulations may not have the expected benefits, and they impact the Greek ASC producers negatively. Related to the new environmentally friendly pesticides and fertilisers introduced by the EU, the producers thought that they cause them to have higher food losses as their produce is more sensitive to insect infestations. A producer selling to cooperative stated:

¹ Food losses refer to agricultural food products that are not sold and due to their perishable nature are wasted (Despoudi 2018).

“the new pesticides and fertilisers do not protect our produce as in the past. Because they are not as strong as the others that we use to spray on our produce, our produce is infected by diseases and insects and it goes off faster.” [producer selling to cooperative]

Most of the interviewed producers stated that one of the main reasons of non-compliance to food safety and quality regulations is the cost of implementing them. Producers who collaborated with cooperatives, were found to comply with food quality and food safety regulations as being a part of the cooperative requires compliance with all the regulations that the cooperative has adopted. Cooperatives provide guidance and financial support in order for producers to comply with the food regulations. Financial support is coming from EU, as there are funding schemes for cooperatives only. Being part of the cooperative means that they get advice from their agriculturist regarding the use of pesticides and fertilizers. On the other hand, in cases where producers collaborated with wholesalers, they either have the freedom to choose the fertilizers and pesticides they are using, or they act based on their final buyer's requirements. Also, producers selling to wholesalers find it expensive to comply with the food regulations and they feel that they should get support from their buyers. A producer selling to wholesaler mentioned:

“the price of fertilisers and pesticides is high. We cannot afford to buy everything by ourselves. In most cases, we buy only the essential materials for compliance to food regulations. If we want to comply to food quality regulations, it is very expensive to do it at individual producer level. Only through your buyer it will be possible to comply with the food quality regulations.” [producer selling to wholesaler]

In summary, the Greek peach producers were found not be aware of the different food regulations that they need to comply with. Compliance to food regulations was found to be a requirement coming from the buyers. Also, they perceive that there is significant variation and

frequent changes in food regulations for which they are not informed about. The new pesticides and fertilizers seem not to bring the expected benefits to their produce, and they are expensive too. The type of buyer was found to impact the level of adoption and implementation of food regulations. Specifically, when producers collaborate with wholesalers' regulatory turbulence was inherent due to the following factors: variety of food regulations, changes in food regulations, non-compliance due to buyer requirements, negative impact of food regulations, and the cost of implementing them. Cooperatives seemed to be more proactive and more supportive in ensuring compliance to EU food regulations, compared to wholesalers. However, even in the cases of producers selling to cooperatives regulatory turbulence is still high due to the negative impact of food regulations on their produce and the constant changes in food regulations.

4.2.2 Market turbulence

The interviews with Greek ASC producers showed that the majority of the producers were not aware of their final customer preferences and in most cases who the final recipients of their products are, as they receive the order specifications from their buyers. In the cases of producers selling to wholesalers, there is uncertainty about the buyer related to order cancellation and to new buyer identification on a yearly basis. A producer selling to wholesaler stated:

“... I only deal with the immediate buyer of my produce. The buyer explains the order specification and I hand it over to him as soon as it is ready. I have no idea who is the final recipient of my produce after I sell it to the wholesaler. Every time I make a deal with a wholesaler, I hope that the order will not change the last minute, as my produce will be wasted. Every year I may sell my produce to a different buyer and thus to new customers.” [producer selling to wholesaler]

Interestingly, the interviews showed producers selling to cooperatives found to be more knowledgeable about the order specifications of their customers whereas producers who sell their produce to wholesalers were not aware of their final customers and they had limited visibility in terms of what happens to their produce. Also, in cases of producers selling to cooperatives labels are included on the products as an assurance of traceability. Thus, there are some efforts in increasing the transparency of the ASC and linking the producer to the final customer. A producer selling to cooperative mentioned:

“... the cooperative informs us about the buyers of our produce. We have meetings and they inform us about the new product specifications and our final buyers requests but not in detail. We only focus on the order specification and that is all. We include labels with our names in the packaging of our produce, so the final recipient will be able to identify the producer if needed.” [producer selling to cooperative]

Between producers and wholesalers, it was found that there is a significant lack of information exchange regarding the final customer, low transparency, and high uncertainty in terms of order cancellation. In cases of order cancellations producers selling to cooperatives may find an alternative buyer; however, this does not happen to producers selling to wholesalers. Producers selling to wholesalers were found to have limited knowledge about the market related to alternative markets/new buyer identification in cases of order cancellations. A producer selling to wholesaler stated:

“... when the wholesaler cancelled my order, I did not know where to sell my produce. I tried to find an alternative buyer, but it was impossible to find one immediately. I needed to move fast as peaches are very sensitive and perishable. I tried to sell it for processing, but the price offered to me was very low and the picking and transportation costs were high. So, I decided not to sell it and all my produce was wasted.” [producer selling to wholesaler]

Thus, market turbulence was found to significantly affect the producers who collaborate with wholesalers. In particular, the following factors were found to cause market turbulence: lack of final customer knowledge, lack of traceability and transparency, lack of knowledge about customers' needs and wants, untrustworthy buyer, and lack of market knowledge. Producers collaborating with cooperatives were also found to be significantly affected by market turbulence due to the lack of final customer knowledge, lack of customers' needs and wants, and lack of market knowledge.

4.2.3 Competitive turbulence

The interviews with the Greek ASC producers showed that competitive turbulence is existent for both producers collaborating with wholesalers and cooperatives. Competitive turbulence can be seen in terms of lack of knowledge about competition among producers, and lack of knowledge about competition in the EU market.

Interestingly, producers who sell their produce to wholesalers perceived that there is no competition among producers. A producer selling to wholesaler stated:

“There is no competition among producers. I have the same peaches with any other peach producer; we are on the same level. Maybe there is a little competition in terms of the size of the peaches others produce bigger peaches; it depends on how they are treating the tree.”
[producer selling to wholesaler]

Also, in cases where producers sell to wholesalers it is perceived that there is no competition in the EU market. A producer selling to wholesaler mentioned:

“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 or within the EU market.” [producer selling to wholesaler]

The Greek ASC producers who sell to cooperatives 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). This could be named as healthy competition, although it may lead to some producers getting lower prices for their produce as other producers have better quality products. Producers were found to be aware of competition in EU, however, regarding the internal market, their perception is that there is no competition among producers.

A producer selling to cooperative mentioned:

“There is competition between the producers in terms of whom will get the best produce. Also, there is competition between the cooperatives and however there is no competition with other EU countries. In Greece peach production is like a monopoly so every producer can sell what he produces.” [producer selling to cooperative]

Competitive turbulence exists in the Greek ASC due to the lack of knowledge about competition among producers and in the EU market from the producers selling to wholesalers’ perspective. Producers selling to cooperatives found to have healthy competition among them as they compete in product quality. However, they were not aware of competition in the EU market.

4.2.4 Weather turbulence

The most common uncertainty factor for producers selling to cooperatives and wholesalers in the Greek ASC found to be the changes in weather patterns and their impact on the quality of their produce. All the interviewees stated that due to the high perishability of the peaches, weather conditions affect them significantly. Adverse weather conditions may lead to a full production being wasted. A producer selling to cooperative stated:

“... when the weather conditions are bad we might have even 80% of waste. There are significant changes in the weather and when we are not prepared everything is wasted.”

[producer selling to cooperative]

Weather variability can cause such damages to the produce and it may not be even possible to sell it for juice production. This might have significant financial implications for the Greek ASC producers as they get a very low price. A producer selling to wholesaler highlighted:

“... weather variability impacts us a lot. When there is hail for example the loss is significant and we cannot sell our produce usually not even for juice production and our produce is wasted.” [producer selling to wholesaler]

Also, a producer selling to cooperative stated:

“When our produce is hit by hail the cooperative will not buy it. We could only sell it for processing for an extremely low price.” [producer selling to cooperative]

However, producers who sell to cooperative were found to manage weather variability at a certain level. This is because they were informed by the cooperatives about changes in weather patterns and prepared for it. However, even in these cases food losses are unavoidable. A producer selling to cooperative stated:

“In most of the cases the cooperative informs us about changes in weather patterns, but even when we are prepared loss is unavoidable.” [producer selling to cooperative]

Hence, weather turbulence is existent in the Greek ASC and it is affecting both producers collaborating with cooperatives and wholesalers. However, there are efforts from the cooperatives to reduce this type of environmental turbulence.

4.2.5 Economic and political turbulence

According to the Greek peach producers, political instability due to changes in political system and sector specific policies is existent in their operating environment for both producers selling

to cooperatives and wholesalers. The interviewed producers were found to be significantly affected by the political instability in their country. A producer collaborating with wholesaler stated:

“The political situation is very unstable. Every day there are changes in the political system and structural changes in the agricultural sector. We hear from the news that there will be more and more changes in the political system.” *[producer selling to wholesaler]*

Economic instability was also found to be high in the Greek ASC for both producers selling to cooperatives and wholesalers. The Greek ASC are highly affected by the economic recession that the country faces, and they are struggling to survive. A producer selling to cooperative mentioned:

“We are struggling to survive. It is getting more and more expensive to be a producer. We hardly make any profit. The prices of the products change all the time and the input costs are increasing.” *[producer selling to cooperative]*

Table 1. Summary of the findings of environmental turbulence factors per buyer type.

Environmental Turbulence Factors	Producers selling to Cooperatives	Producers selling to Wholesalers
Regulatory Turbulence		
Variety of Food Regulations	X	
Changes in Food Regulations	X	X
Non-compliance due to Buyers Requirements	X	
Negative Impact of Food Regulations	X	X
Cost of Implementing Food Regulations	X	
Market Turbulence		

Lack of Final Customer Knowledge	X	X
Lack of Transparency and Traceability	X	
Lack of Knowledge about Customer Needs and Wants	X	X
Untrustworthy Buyer	X	
Lack of Market Knowledge	X	X
Competitive Turbulence		
Lack of Knowledge about Competition among Producers	X	
Lack of Knowledge about Competition in the EU Market	X	X
Weather Turbulence		
Unpredictable Climatic Variability	X	X
Economic Turbulence		
Unstable Economic	X	X
Political Turbulence		
Political Conditions	X	X

5. Discussion and conclusions

This study identified the environmental turbulence factors in the Greek ASC context from the producers' perspective based on their buyer type, therefore, contributing new knowledge to the existing literature (Kaditi et al. 2010). Also, the findings of this paper indicated that there is significant variation in the collaboration activities between producers and their buyers with producers selling to cooperatives engaging in more collaborative activities than producers selling to wholesalers; this complements existing research (Valentinov 2005; EU 2014; Jarrett et al. 2015; Europa 2018).

The findings suggested the existence of six environmental turbulence factors which are namely: regulatory, market, competitive, weather, economic, and political turbulence. These environmental turbulence factors are in line with other research conducted about the existence of endogenous and exogenous environmental turbulence factors (Cadogan and Paul 1999). Also, the results of this research are in line with Sivestre's (2015) finding that high level of business turbulence can contribute to a higher degree of uncertainty for supply chains. However, the current research is the first study to consider the environmental turbulence factors in the ASC from the producer's perspective.

The comparison of the different environmental turbulence factors among ASC producers and their buyers indicated that indeed producers who sell their produce to cooperatives manage environmental turbulence better than producers who sell to wholesalers. However, it was also confirmed that producers who collaborate with cooperatives still face significant environmental turbulence. This is in line with previous research that criticised the effectiveness of the cooperatives in supporting producers (Valentinov 2005; Nilsson et al. 2012; Chinaki and Sergaki 2018; Michalopoulos 2020). This study is adding into the existing literature that examines the relationship between environmental turbulence and collaboration (Ziggers and Trienekens 1999; Fisher et al. 2010). According to the findings, the type of buyer will impact how ASC producers perceive the environmental turbulence factors. ASC producers should reassess their current types of collaboration and identify the ones that are more beneficial for them in terms of managing environmental uncertainties. Also, governments and policy makers should make efforts to reduce the current environmental turbulence levels in the Greek ASC.

The Greek ASC producers indicated that regulatory turbulence is existent in their operating environment. Food regulations turbulence was found to impact both producers selling to cooperatives and wholesalers. This research adds on the existing literature about impact of regulatory turbulence on collaboration (Hobbs and Young 2000), by identifying that supply

chain entities perceptions of environmental turbulence may be different according to their buyer type. Specifically, producers collaborating with cooperatives were found to be impacted less by regulatory turbulence compared to the ones that sell to wholesalers.

Market turbulence was also found to exist in the Greek ASC. Producers selling to wholesalers were found to be impacted more by market turbulence than producers selling to cooperatives. This is in line with previous research indicating that market characteristics may impact collaboration (Matopoulos et al. 2007; Fischer et al. 2008), and also adds to existing research as it is from the producers' perspective.

Competitive turbulence was found to be significant in the Greek ASC and it may affect how business partners collaborate. This is in line with previous research stating that 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). The findings indicated that it is not only producers who sell to wholesalers that are not informed about competition in the EU market, but also producers that sell to cooperatives. It is worth noting, that competition among producers was found to be relevant only for producers who sell to wholesalers. This might be due to the fact that producers selling to wholesalers are not aware of the existing competition in the internal market.

Weather turbulence was found to significantly impact both producers selling to cooperatives and wholesalers. The relevance of this environmental turbulence factor is also confirmed by other studies saying that due to ongoing climatic change the frequency and severity of extreme weather events, both in Europe and globally, are predicted to increase annually (IPCC 2019; Eckstein et al. 2019). This will have severe socioeconomic impacts (Diaz and Murnane 2011) as well as implications on the production and distribution of food and it is evident that the ASC

is significantly affected by extreme weather incidents (FAO 2017). Severe weather conditions can severely impact the amount and quality of the produce (Benton et al. 2012). Indeed, this research found that adverse weather conditions impact the Greek ASC producers irrespectively of their buyer type. Finally, the economic and political turbulence, as it was expected, is affecting all the Greek ASC producers (Williams 2015).

5.1 Managerial and policy implications

Firstly, having identified the different environmental turbulence factors in the Greek ASC considering two different buyer types, this research could be used by the Greek ASC entities in order to assess their operating environment and select the most appropriate buyer for them. Secondly, this paper creates awareness about the different collaboration activities that are existent in the Greek ASC hence producers and other ASC entities could consider collaborating with different buyer types in order to manage more efficiently and effectively environmental turbulence. ASC entities need to improve their supply chains transparency and increase market visibility at the producers point as well. Policy makers may enable that by increasing the traceability requirements in the supply chain. Also, there is a need for Greek ASC producers to better be informed about competition amongst them and at EU level. Healthy competition can be encouraged among producers to make them perform better with appropriate policies in place supporting this.

The findings have implications for policy makers who can encourage the formation of more collaborative activities as it was found to help in managing uncertainties. Supply chain entities operating in Greece can assess the impact of these environmental turbulence factors and make informed decisions about their buyers. There is a need for improving ASC competitiveness (EU 2010). This study suggests that there is a pressing need to reassess the impact of the EU ASC regulations on producers. Policy makers can rethink the impact and the effectiveness of

the existing EU ASC policies and regulations and reform them appropriately. They can also consider the establishment of demand-side and supply-side policies in order to promote economic growth as the findings suggest that economic conditions have negative effect on the majority of the Greek ASC producers (Minford and Meenagh 2019). Regarding the demand-side policies, policies that could increase the aggregate demand can be used (Pike et al. 2016). 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 (EC 2015). 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 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 ASC producers as currently they are not able to export their produce by themselves, but only through the cooperatives (Vincent 2019). The research also provides important perspectives into the fresh food supply chain from the aspect of the environmental turbulence factors affecting food producers. This provides managerial insights into supply chain risk and disruption caused due to the environmental turbulence factors and it is useful for supply chain planning (You et al. 2009).

5.2 Limitations and future research

This study offered insights into the environmental turbulence factors from the producers' unit of analysis and under a specific context i.e. Greek ASC. The study utilised a qualitative approach to explore the challenges affecting fresh fruit and vegetable agriculture supply chains. The analysis highlighted six turbulence factors affecting agriculture supply chains based on the

peach farming sector and associated downstream relationship. The relationship between the six factors and their influence on supply chain performance can be explored. Further empirical examination of the environmental turbulence factors is needed to generalise them across Greece and possibly across other EU ASCs. Future research could deploy a nation-wide empirical analysis that will provide generalisable results across Greece and other EU countries. This study focused on the ASC of peach as it is a highly perishable product and it is a major produce of Greece; however future research may examine environmental turbulence factors for other perishable agricultural products.

References

APO., 2006, Postharvest management of fruit and vegetables in the Asia-Pacific region, http://www.apo-tokyo.org/00e-books/AG-18_PostHarvest/AG-18_PostHarvest.pdf.

Askew K., 2019, The climate crisis is already hitting food production An urgent system wide response is needed, <https://www.foodnavigator.com/Article/2019/06/06/The-climate-crisis-is-already-hitting-food-production-An-urgent-system-wide-response-is-needed>

Atanda S.A., Pessu P.O., Agoda S., Isong I.U., & Ikotun I.I., 2011, The concepts and problems of post-harvest losses in perishable crops, *African Journal of Food Science*, Vol. 5, Issue 11, pp.603-613.

Beulens A.J.M., Broens D., Folstar P., & Hofstede G.J., 2005, Food safety and transparency in food chains and networks Relationships and challenges, *Food Control*, Vol. 16, Issue 6, pp. 481-486.

Boshkoska B. M., Liu S, Zhao G., Fernandez A., Gamboa S, del Pino M., Zarate P., Hernandez J., & Chen H., 2019, A decision support system for evaluation of the knowledge sharing crossing boundaries in agri-food value chains, *Computers In Industry*, 110. 64 - 80.

Bourne M.C., 1977, Postharvest Food Losses: the neglected dimension in increasing the world food supply, Ithaca, NY, Cornell International Agriculture Mimeograph 53.

Brecht J., Chau K., Fonseca S, Oliviera F., Silva F., Nunes M., & Bender R., 2003, Maintaining optimal atmosphere conditions for fruits and vegetables throughout the postharvest handling chain, *Postharvest Biology and Technology*, Vol. 27. Issue 1, pp. 87-101.

Caixeta-Filho J. V., 1999, Losses in the Transportation of Fruits and Vegetables: A Brazilian Case Study, *International Journal of Logistics: Research & Applications*, Vol. 2, Issue 3, pp. 325-341.

Chapman, P., 2010, *Reducing product losses across the food supply chain*. In: Mena, Carlos and Stevens, Graham, (eds.) *Delivering performance in food supply chains*. Woodhead Publishing, Cambridge, pp. 225-242. ISBN 978-1845694715.

Chinaki C., & Sergaki P. 2018, Potentials and Pitfalls Of Contract Farming Through Agricultural Cooperatives In Greece, *Revista Galega de Economic*, <https://pdfs.semanticscholar.org/ad41/295b62bc8a8ebf16e86bab6eba7faf9ebed2.pdf>

Choudhury M.L., 2006, Recent development in reducing postharvest losses in the Asia-Pacific region, in *Postharvest management of fruit and vegetables in the Asia-Pacific region*, APO.

Creswell J. W., 2003. *Research design Qualitative quantitative and mixed methods approaches*, Research design Qualitative quantitative and mixed methods approaches. doi: 10.3109/08941939.2012.723954.

Crouch, M., & McKenzie, H. 2006. The logic of small samples in interview-based qualitative research. *Social Science Information*, 45(4), 18. doi: 10.1177/0539018406069584

Dani S., & Kanwar B., 2012, *Sustainability and Risk Challenges in food supply chains: an Indian perspective*, Cambridge- IIML UKIERI, UK.

Defra., 2020, Farming is Changing. <https://www.gov.uk/government/publications/future-farming-changes-to-farming-in-england/farming-is-changing-heres-what-you-need-to-know-august-2019-web-version>.

Denise L., 1999, Collaboration vs. C-Three (cooperation, coordination, and communication), *Innovating*, Vol.7, Issue.3, pp.30-36.

Derrouiche, R. Neubert, G., Bouras, A., & Savino, M. 2010, B2B relationship management: a framework to explore the impact of collaboration, *Production Planning & Control*, Vol. 21, No. 6, pp. 528-546.

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*, 2(1), pp.1-6.

Despoudi, S., 2016. An Investigation of the Collaboration – Postharvest Food Loss Relationship and the Effect of the Environmental Turbulence Factors. Loughborough University. <https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/21785/1/Thesis-2016-Despoudi.pdf>

Despoudi, S., Papaioannou, G., Saridakis, G. & Dani, S., 2018, Does collaboration pay in agricultural supply chain? An empirical approach, *International Journal of Production Research*, DOI: 10.1080/00207543.2018.1440654.

Despoudi, S., 2019, Optimised Food Supply Chains to Reduce Food Losses, Chapter 13 in the book ‘Saving Food: Production, Supply Chain, Food Waste And Food Consumption’, edited by Charis Galanakis, published by Elsevier.

Despoudi, S., 2020, Green Food Supply Chain, Chapter 6 in the book ‘The Interaction of Food Industry and Environment’, edited by Charis Galanakis, published by Elsevier.

Driscoll M., 2012, How can we build a sustainable farming system for all?, <http://www.theguardian.com/sustainable-business/blog/farming-system-principles-based-sustainable>.

EC., 2015, The Interaction of Resource and Labour Productivity, https://ec.europa.eu/environment/enveco/growth_jobs_social/pdf/studies/Study%20Resource%20labour%20productivity%20.pdf.

Eickstein D., Kunzel V., & Schafer M., 2019, Global Climatic Change Risk Index, https://germanwatch.org/sites/germanwatch.org/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020_10.pdf.

EEFP., 2014, Conditions, Attitudes and Structures of Successful POs and Cooperatives. Accessed 1 June 2017. https://ec.europa.eu/agriculture/sites/agriculture/files/agri-markets-task-force/contributions/2016-05-24/ukdefracoop_en.pdf

Elstat., 2017, Areas of production, 05b trees crops and areas of tree production, <https://www.statistics.gr/en/statistics/-/publication/SPG06/->

Eurostat. 2012, Agricultural census in Greece, http://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Greece#Main_statistical_findings.

Eurostat, 2019a, Statistical Factsheet Greece, https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-el_en.pdf

Eurostat, 2019b, The fruit and vegetable sector in UK – a statistical overview, https://ec.europa.eu/eurostat/statistics-explained/index.php/The_fruit_and_vegetable_sector_in_the_EU_-_a_statistical_overview

Eurostat, 2019c, Agricultural production – crops, https://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_production_-_crops#Fruit

EY., 2019, How can Europe change the game? [https://www.ey.com/Publication/vwLUAssets/ey-europe-attractiveness-survey-2019/\\$File/ey-europe-attractiveness-survey-2019.pdf](https://www.ey.com/Publication/vwLUAssets/ey-europe-attractiveness-survey-2019/$File/ey-europe-attractiveness-survey-2019.pdf).

EU., 2010, EU Rural Review, <https://enrd.ec.europa.eu/enrd-static/fms/pdf/796E8491-F491-EF46-04EC-905DC3E2889F.pdf>.

EU., 2017, The food chain, https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/factsheet-food-supply-chain_march2017_en.pdf.

EU., 2014, Assessing efficiencies generated by agricultural Producer Organisations http://ec.europa.eu/competition/publications/agricultural_producers_organisations_en.pdf

Europa., 2018, Background on the EU food supply chain: an important economic sector, http://ec.europa.eu/competition/sectors/agriculture/overview_en.html

FAO., 2011, Global Food Losses and Waste. http://www.fao.org/fileadmin/user_upload/ags/publications/GFL_web.pdf.

FAO., 2012. Top production - Peaches and nectarines - 2012. <http://faostat.fao.org/DesktopDefault.aspx?PageID=339&lang=en&country=84>

FAO., 2017, The future of food and agriculture: trends and challenges, <http://www.fao.org/3/a-i6583e.pdf>.

Folinas D., Manikas I., & Manos B., 2006, Traceability data management for food chains, *British Food Journal*, Vol. 108, Issue 8, pp.622 -633.

Foresight., 2011, Foresight Project on Global Food and Farming Futures. Synthesis Report C7: Reducing Waste, The Government Office for Science: London.

Fritz M., & Schiefer G., 2009, Tracking, tracing, and business process interests in food commodities: A multi-level decision complexity, *International Journal of Production Economics*, Vol. 117, Issue 2, pp. 317-329.

Fusions., 2015, Review of current EU Member States legislation and policies addressing food waste <http://www.eu-fusions.org/phocadownload/Reports/GREECE%20FULL%20pdf.pdf>.

Fusions., 2016, Estimates of European food waste levels <http://www.ivl.se/download/18.7e136029152c7d48c20b15/1462876593644/C186.pdf>.

Galanopoulos A., & Tudwell P. 2019, Greek Peach Farmers' Desperation Growing Over Extreme Weather, <https://www.bloomberg.com/news/articles/2019-11-23/greek-peach-farmers-desperation-growing-over-extreme-weather>.

GIZ., 2012, Food losses concern us all- new challenges for international cooperation- documentation of an expert discussion held on 28 June 2012, <http://www.giz.de/Themen/de/dokumente/giz2012-en-food-losses.pdf>.

Gidney M., 2012, Why a fair supply chain is key to achieving a sustainable food system, <http://www.theguardian.com/sustainable-business/fairtrade-partner-zone/fair-supply-chain-sustainable-food-system>.

Govindan K., 2018, Sustainable consumption and production in the food supply chain: A conceptual framework, *International Journal of Production Economics*, 195, 419–431.

Gustavsson J., Cederberg C., Sonesson U., Otterdijk R., & Meyberg A., 2011, Global Food Losses and Waste. http://www.fao.org/fileadmin/user_upload/ags/publications/GFL_web.pdf.

Halder P., & Pati S., 2011, A need for paradigm shift to improve supply chain management of fruits and vegetables in India, *Asian Journal of Agriculture*, Vol.1, Issue 1, pp. 1-20.

Hernandez J., E., Kacprzyk J., Panetto H., Fernandez A., Liu S., Ortiz A., & De-Angelis M., (2017). Challenges and solutions for enhancing agriculture value chain decision-making. A short review. In IFIP Advances in Information and Communication Technology, Vol. 506 (pp. 761-774). Springer. doi:10.1007/978-3-319-65151-4_68.

Hernandez Hormazabal, J. E., Sauvage C., Rushton, J., Lyons A., Drake, P., & Manish S., 2018., Understanding and Gathering Decision-Making Challenges in EU Agri-Food Systems with Uncertain Regulations. A MCDM-AHP analysis. In N8 AgriFood Conference. Liverpool.

Hodges R., Buzby J.C., & Benett B., 2010, Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use, *Journal of Agricultural Science*, Cambridge University.

Hovelaque, V., Duvaléix-Tréguer, S., & Cordier. J., 2009, Effects of Constrained Supply and Price Contracts on Agricultural Cooperatives, *European Journal of Operational Research*, Vol. 199, Issue. 3, pp. 769-780.

Jarrett, J., Morris, C., Wheeler, R. and Winter, M. 2015, Literature Review on Farming Collaboration. Report for Defra project LM0302 Sustainable Intensification Research Platform Project 2: Opportunities and Risks for Farming and the Environment at Landscape Scales.

IPCC., 2019, Climatic Change and Land, https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf

Kader A.A., 2010, Handling of Horticultural Perishables in Developing vs. Developed Countries, Proceedings 6th International Postharvest Symposium. <http://ucce.ucdavis.edu/files/datastore/234-1875.pdf>.

Kantor L.S., Lipton K., Manchester A., & Oliveira V., 1997, Estimating America's food losses, *Food Review*, Vol. 20, Issue. 1, pp. 2-12.

Ketokivi M., & Choi T., 2014, Renaissance of case research as a scientific method, *Journal of Operations Management*, Vol. 32, pp. 232-240.

Kitinoja L., Saran S., Roy K.S., & Kader A.A., 2011, Postharvest technology for developing countries: challenges and opportunities in research, outreach and advocacy, *Journal Science Food Agriculture*, Vol. 91, Issue.4, p. 597-603.

Kyrkillis D., & Simeon S., 2015, Greek producer Agriculture's Failure. The Other Face of a Failed Industrialization. From Accession to EU to the Debt Crisis, 7th International Conference, The Economies of Balkan and Eastern Europe Countries in the changed world, EBEEC 2015, May 8-10, 2015.

Lehoux N., D'Amours S., and Langevin A., 2014, Inter-firm collaborations and supply chain coordination: review of key elements and case study, *Production Planning & Control*, Vol. 25, Issue. 10, pp. 858-872.

Lozano R., 2007, Collaboration as a Pathway for Sustainability, *Sustainable Development*, Vol. 15, Issue 6, pp. 370-381.

Lundqvist J., De Fraiture C., & Molden D., 2008, Saving Water: From Field to Fork - Curbing Losses and Wastage in the Food Chain, SIWI Policy Brief. SIWI.

Lupien J. R., 2008, Small and Medium-size food producers and processors: potential in national development, international trade, and role in solving nutrition problems, <http://www.iufost.org/publications/books/documents/Lupien.pdf>. [Accessed 10.01.12].

Macfarlane Smith, J. 1972, *Interviewing in Market and Social Research*, Routledge and Kegan Paul, London.

Matopoulos A., Vlachopoulou M., Manthou, V., & Manos B. 2007, A Conceptual Framework for Supply Chain Collaboration: Empirical Evidence from the Agri-food Industry, *Supply Chain Management: An International Journal*, Vol. 12, Issue 3, pp. 177-186.

Manifava D. 2019, US tariffs to hurt peach and can producers, <http://www.ekathimerini.com/245167/article/ekathimerini/business/us-tariffs-to-hurt-peach-and-can-producers>.

Manos C., & Manikas I., 2010, Traceability in the Greek fresh produce sector: drivers and constraints, *British food journal*, Vol. 112, Issue.6, pp. 640-652.

Marshall B., Cardon O., Poddar A., & Fontenot R., 2013, Does sample size matter in qualitative research? A review of qualitative interviews in IS research, *Journal of Computer Information Systems*, Vol. 54, Issue 1, pp. 11-22.

Mena C., Adenso-Diaz B., & Yurt O., 2011, The causes of food waste in the supplier-retailer interface: Evidences from UK and Spain, *Resources, Conservation and Recycling*, Vol.55, pp.648-658.

Mercantila Publishers., 1989, Guide to Food Transport Fruit and vegetables, Mercantila Publishers, Copenhagen.

Michalopoulos S., 2019, Greek Minister: CAP budget should be maintained to ensure agriculture sustainability, <https://www.euractiv.com/section/agriculture-food/interview/greek-minister-cap-budget-should-be-maintained-to-ensure-agriculture-sustainability/>

Michalopoulos S., 2020, Greece vows to build healthy cooperatives, https://www.euractiv.com/section/agriculture-food/short_news/greece-vows-to-build-healthy-cooperatives/

Miles, MB. & Huberman, AM. 1994. *Qualitative Data Analysis* . Thousand Oaks, CA: Sage Publications.

Minagri., 2017, Farmers Cooperation Regulations,

http://www.minagric.gr/images/stories/docs/agrotis/synergatismos/nomos4492_2017.pdf

Minford L., Meenagh D., 2019, Supply-Side Policy and Economic Growth: A Case Study of the UK. *Open Economics Review*, <https://doi.org/10.1007/s11079-019-09536-8>.

Nilsson J., Svendsen G.L.H., Svendsen D., 2012, Are Large and Complex Agricultural Cooperatives Losing Their Social Capital?, *Agribusiness an International Journal*, 28 (2) 187–204.

Nunes M., Emond J., Rauth M., Dea S., & Chau K., 2009, Environmental conditions encountered during typical consumers retailer distribution affect fruit and vegetable quality and waste, *Postharvest Biology and Technology*, Vol. 51, Issue 2, pp. 232-241.

Oderanti F., Chen H., & Liu S., 2017. A Knowledge Network and Mobilisation Framework for Lean Supply Chain Decisions in Agri-Food Industry. *International Journal of Decision Support System Technology*, 9,(4), pp 37-48.

Otles, S, Despoudi, S, Bucatariu, C & Kartal, C., 2014, Food Waste Production and Sustainability in the Food Industry, Chapter 1, in the book 'Food Waste Recovery: Processing Technologies and Techniques' edited by Charis Galanakis, published by Elsevier.

Papadimas L., & Triantafylloy V., 2019, Not a peachy outlook: Greek producers despair over Trump's new tariffs, <https://www.reuters.com/article/us-wto-trade-greece-peaches-idUSKBN1X70M5>

Paul R. E., Nishijima W., Reyes M., & Cavaletto C., 1997, Postharvest handling of losses during marketing of papaya, *Postharvest Biology and Technology*, Vol.11, pp.165-179.

Parfitt J., Bartherl M., & Macnaughton S., 2010, Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050, *Philosophical Transactions of the Royal Society B*, Vol.365, pp.3065-3081.

Pike A., Lee N., MacKinnon D., Kempton L., & Iddawela Y, 2016, Cities and demand-side policies for inclusive growth,
<https://www.ncl.ac.uk/media/wwwnclacuk/curds/files/RSA%20IGC%20Submission%20-%20Cities%20and%20Demand-side%20Policies%20for%20Inclusive%20Growth.pdf>.

Prusky D., 2011, Reduction of the incidence of postharvest quality losses, and future prospects, *Journal Science Food Agriculture*, Vol. 91, Issue 3, pp. 463-474.

Sharma G., & Singh S.P., 2011. Economic analysis of post-harvest losses in marketing of vegetables in Uttarakhand, *Agricultural Economics Research Review*, Vol.24, pp.309-315.

Shepherd, A.W. 1991. A market-oriented approach to post-harvest management,
http://www.fao.org/fileadmin/user_upload/ags/publications/moph.pdf.

Silvestre Bruno., 2015. Sustainable Supply Chain Management in Emerging Economies: Environmental Turbulence, Institutional Voids and Sustainability Trajectories. *International Journal of Production Economics*. 167. 10.1016/j.ijpe.2015.05.025.

Srinivasan M., Mukherjee D., &Gaur A.S., 2011, Buyer-supplier partnership quality and supply chain performance: Moderating role of risks, and environmental uncertainty, *European Management Journal*, Vol. 29, pp. 260-271.

Smith, M. 1975. *When I say No, I feel Guilty*. New York. Dial Press.

Tefera, T., 2012, Post-harvest losses in African maize in the face of increasing food shortage, *Food Security*, Vol.4, pp. 267-277.

Tourte L., & Faber B.A., 2011, *Small Farm Handbook*, The Regents University of California, Agriculture and Natural Resources Communication Services.

TNH 2019., Bad Weather Events Cost Greek Farmers 1.1 Billion Euros Losses

<https://www.thenationalherald.com/270722/bad-weather-events-cost-greek-farmers-1-1-billion-euros-losses/>.

Valentinov V., 2005, The Organizational Nature of Agricultural Cooperatives: A Perspective from the Farm Problem Theory, *Journal of Rural Cooperation*, Vol. 33, Issue 2, pp.139-151.

Vlajic, J.V., Van der Vorst, J.G.A.J. & Haijema, R. 2012, A framework for designing robust food supply chains, *International Journal of Production Economics*, Vol. 137, Issue 1, pp. 176-189.

Voss C., Johnson M. & Godsell J. 2016, Case research, in Karlsson, C. (Ed.), *Research Methods for Operations Management*, 2nd ed., Routledge, New York, NY, pp. 165-197.

Vincent E., 2019, Despite tariff exemption Greek producers struggle to export their oil, <https://www.oliveoiltimes.com/business/despite-tariff-exemption-greek-producers-struggle-to-export-their-oil/70869>.

World Bank., 2006, Enhancing agricultural innovation: how to go beyond the strengthening of research systems. http://siteresources.worldbank.org/INTARD/Resources/Enhancing_Ag_Innovation.pdf.

World Bank., 2011, Missing Food: the case of postharvest grain losses in Sub-Saharan Africa. http://siteresources.worldbank.org/INTARD/Resources/MissingFoods10_web.pdf.

WRAP., 2009, Household Food and Drink Waste in the UK, [http://www.wrap.org.uk/sites/files/wrap/Household food and drink waste in the UK -_report.pdf](http://www.wrap.org.uk/sites/files/wrap/Household_food_and_drink_waste_in_the_UK_-_report.pdf).

WRAP., 2011, Reducing Food Waste through Retail Supply Chain Collaboration. http://www.wrap.org.uk/sites/files/wrap/WRAP_IGD_supply_chain_report.pdf.

You F., Wassick J.M., & Grossmann I., 2009, Risk management for a global supply chain planning under uncertainty: Models and algorithms, *Process Systems Engineering*, <https://doi.org/10.1002/aic.11721>.

Zanoni S., & Zavanella L., 2012, Chilled or frozen? Decision strategies for sustainable food supply chains, *International Journal of Production Economics*, Vol. 140, Issue 2, pp. 731-736.

Zuurbier P.J.P., 1999, Supply chain management in the fresh produce industry: a mile to go? , *Journal of Food Distribution Research*, Vol. 30, Issue 1.