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RESEARCH ARTICLE

The effect of supply chain orientation on supply chain risk and uncertainty: An application on members of dairy products supply chain in erzurum city in Turkey*

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**This study was derived from the master thesis entitled "The effect of supply chain orientation on risk and uncertainty: An exercise on members of dairy products supply chain in Erzurum" and the study was improved and updated. It is not published in any other journal nor is it before another journal for consideration.*

ABSTRACT

Identifying risk and uncertainty is paramount and there are methods and tools deployed to alleviate risk and uncertainty for a supply network to be resilient (Kumar, Mangla, Kumar and Song, 2021). And supply chain orientation (SCO) is one of tools to mitigate supply chain risk and uncertainty (SCRU). The goal of the study is to identify the impact of SCO on SCRU in the dairy supply chain. And the other purpose of the study is to investigate perception differences among supply chain members (dairy farmers, dairy plants and dairy retailers) of SCO and SCRU. And scope of the study is dairy farmers, dairy plants and dairy retailers that are doing business in Erzurum dairy supply chain. And Erzurum city is chosen for the study because economic events taking place in Erzurum has wider consequences for the whole region. According to the study it is determined that there is a perception difference among dairy supply network partners of SCO and SCRU. And finally, it is determined that SCO affects dairy SCRU negatively. This means as SCO among members increases SCRU decreases in the dairy products supply network. So, SCO can be an effective tool for mitigating SCRU in the dairy products supply chain.

Keywords: Agricultural Supply Chain Orientation; Agricultural Supply Chain Risk; Dairy Products Supply Chain Orientation; Dairy Products Supply Chain Risk

INTRODUCTION

Efficient supply network stewardship is paramount to be successful in modern competitive global market. That is why, researchers in academy and industry developed new approaches to manage and devise supply chains. Compared to past, there is a higher chance for unexpected conditions and events to occur in any part of a supply network because; modern supply chains have become more complicated and global by their nature (Chu, et al.,2020).

Unexpected events could undermine integrity and health of a supply chain. Natural disasters, floating exchange rates, seasonal customer orders can exemplify the unexpected events (Fattahi and Govindan, 2018).

Recent outbreak of Covid-19 has added extra motivation for researchers to study on supply chain resilience against SCRU (Majumdar, Sinha, & Govindan, 2021).

Both practitioners and academicians developed methods and tools such as safety stock, doing business with multiple suppliers, flexibility in response to risks, information sharing, collaboration among partners in a supply network or vertical integration to eliminate or at least alleviate risks and uncertainty in supply chains (Kouvelis et al., 2011).

Uncertainty, risks and tools to alleviate them are prominent issues to emphasize on because; risks and uncertainty affect supply chains very dramatically. And SCO can be utilized to alleviate SCRU in dairy products supply network.

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Given the importance of agricultural products, food security, milk supply chains, SCRU and tools for mitigating SCRU; there are several studies tackling the topic. For instance; In their study Ali et al. (2019) constructed sustainable framework by associating food network risks with food wastage to decrease food wastage. They constructed a Pareto analysis to identify risks according to opinions from specialists working for food firms in Bangladesh. They deployed DAMATEL model to determine interactions among the detected significant risks in food supply chains. They identified shortage of talented personnel, bad stewardship, poor information technology system, insufficient capacity and insufficient consumer relationship as the five most important risks to prioritize. They also provided risk alleviation tools to reduce these five risks in their study.

Moragues-Faus, Sonnino, and Marsden (2017) conducted a Delphi method on specialists from Europe related to food safety in order to detect the main reasons of shifts, menaces and vulnerabilities of the food setup in Europe and to disclose their underlying reasons. According to the authors, insufficiency to handle cross-scale dynamics, incapability to cope with problems associated with perpetual imparities in food rights, intensifying geopolitical and industrial interdependences, power inequalities and insufficient intuitional capabilities, clashing values and implementations of food safety were identified as five insufficiencies in food system stewardship that impact European food safety. The authors in the study concluded that these five insufficiencies had to be handled in an integrated manner to progress the present polarized politic views and start to construct a more democratic, sustained and safe food environment in Europe.

Gołębiewski (2018) provided a view on supply networks dealing with agricultural products in EU. The author's aim was to examine multiplicity of economic outcomes and sifts in the trends experienced in productivity of work in various segments of the supply network in the European countries. According to the study, discrete segments in the food supply network vary strongly both throughout the supply chain and among the discrete European countries.

Li, Zhao, and Han (2022) built the agricultural food supply networks and the weak link networks and then, they introduced weak link networks in spread of disruption of the agricultural food supply networks. They analyzed the effect of two methods (i.e. boosting existent business relationship and forming new business relations) on the spread of disruption of agricultural supply networks under extra ordinary conditions such as natural evets, act of god or unpredicted wholesale market shutdowns. Consequently, the authors examined the effect of disruption reformation on supply- demand interactions in agricultural food supply networks. As to the result of the study, the authors suggested that if the number of bad affected companies was slight, administrators might boost the resilience by deploying both of two methods in question. But if a large number of firms was affected by the disruption only strengthening the existent business relationship would be the better choice.

In his study, Liu (2018) constructed a conceptual structure comprising supply chain interaction and quality collaboration for food security. And the author tested suggested structure by gathering data from China. The study asserted that supply network relation stewardship for food security could be termed as a framework incorporating dependability and dialog. And successful supply chain relations positively affected the quality collaboration for food security.

Schmitt, Barjolle, Cravero, and Tanquerey-Cado (2014) drew a comparison of a local and a global milk supply chain in their study. The authors realized the evaluation of their sustainability with a group of attributes and indicators around five sustainability dimensions. Performance scores were measured for a local and a global milk supply chain in each of the indicators. And according to the results of the study, the local chain performed better in 40 % of the indicators and it performed equivalently to the global chain in 40 % of the indicators. And also, the authors considered the higher performance of the local chain in the health and social dimensions worth mentioning. And finally, the authors suggested that inputs procurement and capability of chain's players to form and share added value were two main performance factors and paramount regarding policy interventions targeting value chains sustainability.

As seen in the studies above and in the existent literature -as far as we know- just a few of the studies addressing supply chain risks and risk mitigation tools touch upon the terms of "relationship", "trust", "communication", "collaboration", "cooperation", "integration" as a way of mitigating risks, uncertainties and unexpected events in supply chains. And they only take upstream (agri-food farmers or producers) or downstream members (agri-food consumers or retailers) into consideration when dealing with SCRU. This study also considers these methods as tools for mitigating SCRU. However, the study evaluates both upstream and downstream members (i.e. dairy farmers, dairy plants and dairy retailers) as a whole when examining the effect of SCO on SCRU. Thanks to this more comprehensive approach, the whole dairy products supply chain is considered in a holistic view in the study. Consequently, collective views of these members on SCO and SCRU in dairy products supply chain can be evaluated as a whole in the study.

THE RESEARCH MODEL: DEFINITION OF KEY CONCEPTS AND HYPOTHESES

There are some studies which reached conclusions in relation with SCO risk and SCRU. And this study has similar aspects with the studies of Wang, Jie, and Abareshi (2014) and Schulze-Ehlers et al. (2014).

Wang et al. (2014) applied their study on 279 German farmers who were engaged in the dairy business and the researchers concluded that SCO positively affected the intention of the farmers to implement supply network measures to mitigate the SCRU.

Schulze-Ehlers et al. (2014) applied their study on 98 Australian courier firms and determined that there was a negative relation and interaction between logistics capability of firms and SCRU.

And finally, according to this study, it is concluded that SCO among dairy supply chain members has a negative effect on dairy products SCRU.

As shown in Fig. 1 The effect of dairy SCO among members of supply network on dairy products SCRU in Erzurum is investigated in the study. The model of the study is built by drawing on models of two different papers to determine the impact of dairy SCO on SCRU in the dairy products supply network. The design of the paper is adapted from the paper of Wang, Jie, and Abareshi (2014) to measure orientation among the members of dairy products supply network. In the study, dimension of dairy products SCO has two different sub-dimensions that are vertical cooperation orientation and common goal orientation.

The other section of the design in the study is adapted from Schulze-Ehlers et al. (2014) to detect dairy SCRU. And dimension of dairy products SCRU has three different sub-dimensions that are firm-related uncertainty and risk, customer-related uncertainty and risk and environment- related uncertainty and risk.

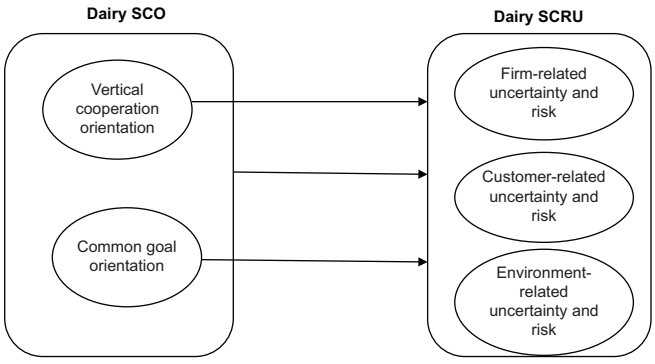

Fig 1. Model of the Study.

Managers or the owner of dairy farms, dairy plants and dairy retailers were requested to rate the level of dairy SCO among supply chain members and dairy SCRU in a 5-likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Risk and risk management in food and dairy supply chains

Risks in food supply networks may stem from volatility in balancing supply and demand. They may also stem from supply chain disruptions (Dani, 2015). There are several risk types in a food supply chain (Gokarn and Kuthambalayan, 2019). And these types are food pollution, energy loss, product recalls, disruptions in logistics activities, economic difficulties, water shortage, raw material shortages, natural disasters, increase in oil prices, outbreaks, union actions, wage increases in man power, terrorism, etc. These risks mentioned above might stem form firms, environment or customers. And these types of risks provide a base for the study. And the risk and uncertainty might be perceived differently with regard to their severity and magnitude among the members in a supply chain.

From this point of view, first group of hypotheses can be drawn:

H_1: Supply chain members' perceptions of SCRU differ significantly.

H_{1a}: Perceptions of dairy retailers and dairy farmers of SCRU differ significantly.

H_{1b}: Perceptions of dairy retailers and dairy plants of SCRU differ significantly.

H_{1c}: Perceptions of dairy farmers and dairy plants of SCRU differ significantly.

Environmental uncertainty and risk

These kinds of risks are mostly out of the control of a firm operating in a supply network. That is why Firms in a supply network may not root out environmental risks totally but they might mitigate them. These are prone to affect the whole supply chain.

These risks are caused by act of god such as earthquakes, floods, outbreaks or caused by humans like terrorist attacks (Noyan, 2012). Economic downturns and political instability can also exemplify environmental risks (Chopra and Sodhi, 2004). Closed roads due to bad weather, lack of derivers to collect or deliver products, seasonal changes in Agri-products, uncertain fuel prices and governmental regulations are also sources of environmental risks (Wang et al., 2014).

Customer related uncertainty and risk

Customer associated risk and uncertainty occur between logistics service providers and their customers. This sort

of risk steams from customers rather than companies and it may lead to distributions in routine logistics operations of logistics service providers (Wang et al., 2014).

According to Sodhi and Tang (2012) several customer related uncertainties and risks exist. And these are unexpected customer, respectability, estimation error, inability to meet customer needs in due time.

Customer related uncertainty and risk might steam from lack of ability to meet changing customer preference and lack of communication among supply chain members with regard to transport capacity to transport products among the partners in the supply network.

It is very paramount to address customer related risk and uncertainty in a holistic view by all supply network members in the dairy products supply network because milk which is a raw material of dairy products is subject to decaying and needs immediate attention.

Firm Related Uncertainty and Risk

Firm related uncertainty and risk is generally a foreseeable risk such as having a difficulty attaining proper credit, backlogs and delays in delivery of ordered materials, increase in energy costs, lack of transportation capacity, inefficiencies in warehousing, insufficient communication and information sharing among supply chain members (Millar, 2015).

Firm related uncertainty and risk is somewhat easy to detect and manage compared to other types of risk because of the nature of its foreseeability.

Agricultural and diary SCO as a way of mitigating uncertainty and risk in the dairy supply chain

Food in general satisfies hunger and also offers necessary nutrients for mankind and sustains the physical and mental well-being of consumers (Knezevic, Grbavac, Palfi, Sabolović, & Brnčić, 2021). Food is indispensable part of peoples' daily life. It's predominant in people's way of life, culture and welfare (Pilař et al., 2018). And as a type of food, milk and dairy goods are vital elements in human meal. Milk has a large and special portion in people's daily meal. And milk is the only food that nature offers for the nutrition of animals and humans in particular (Kaskous, 2021). Milk production is also important and essential part of agricultural production which is the production of food and essential for ensuring the basic physical needs of mankind (Pilař et al., 2018).

Production and trade of dairy products in Erzurum occupy very important place in people's livelihoods. That is why it is important to alleviate risk and uncertainty in the dairy products supply network in Erzurum. And Erzurum city is a commercial capital of Eastern Anatolian Region in Turkey. And economic events taking place in Erzurum has wider consequences for the whole region.

As mentioned in proceeding pages of the study there are tools to eliminate or at least reduce or mitigate the risk and uncertainty in food and dairy supply chains (Mason-Jones and Towill, 1997). And these tools are visibility and information sharing, control and collaboration, risk detection, risk evaluation, risk mitigation and finally risk improvement (Khalilabadi et al., 2020). And also, SCO is one of tools to cope with SCRU.

Basically, SCO is a system of common values and believes which helps clarify how supply chain related principles and behavioral principles should be managed strategically (Deshpande and Webster Jr, 1989). And it can be used as a tool for measuring and alleviating risks in the dairy supply network.

Prakash et al. (2017) developed tools for examining existing risks and identifying the strongest risk mitigation methods in dairy industry. They drew upon interpretive structural model (ISM) to obtain the mentioned methodology. The researchers examined a milk process facility which was situated in India and had a high capacity of processing daily milk. The researchers determined that supplier related risks were more prominent than others. And supplier related risks were followed by trade-related risks and process related risks.

Yu and Huatuco (2016) sought to examine risk management in a dairy supply network. They structured a paper by interviewing experts who were employed in a dairy firm. According to their study they discovered that the dairy firm already had had an awareness against supply network risks. But the researchers also ascertained that the firm didn't have a supply chain risk management program at a functional level.

Axon and Darton (2021) sought to assess risks in fuel supply chains in an objective and quantitative way. In order to reach this objective, the authors separated the global energy system into segments of 27 generic fuel supply chains. They also utilized 7 different types of risks and estimated of probability and effect for each reason of risk for each gasoline. The authors deployed triple bottom line methodology to evaluate effects of risk events taking place in the fuel supply chains. They obtained published data to assess the risks. They conducted the study in the UK. And according to the paper, 19 of the gasoline types were valid. And fossil fuels and nuclear fuels had the highest overall risk livelihood. And the least risky fuels were found to be renewables.

Daud et. al. (2015) reported the results of their study which was an explorative study on risks encountered in dairy products supply network in Indonesia. The researchers sought to explore possible risks in dairy products supply network and determine effects of the risks on production behavior of the supply network. In their study, the researchers conducted a focus group discussion with dairy producers, farmer unions and farmers in West Java. The study revealed some findings about sources of supply chain risks and some other results for actors who were situated in downstream and upstream of the dairy supply network. The researchers also highlighted the significance of risk management practices for the whole dairy supply network.

Septiani, Herdiyeni, and Haditjaroko (2014) sought to construct a sustainable supply network design for a diary product supply chain based upon data base in their study. Structural supply chain risk approach was divided into stages such as risk determination, measurement, evaluation and reduction of risk. Interdependency between possibility of danger occurrence and risk severity was measured via linguistic variables and fuzzy logic in their study. The proposed system in the study was created by intelligent decision support system (IDSS). Design of the model enhanced effectiveness in organizing, sharing and storing information in dairy supply chain risk management.

Li, Zhang, and Jiang (2008) offered a decision support system to meet dairy demand, reduce the disparity between dairy supply and demand and reduce incurred costs by programing charts for milk collection vehicles.

Xu et al. (2019) developed a structure to assess supply network sustainability risk by evaluating operational risk occurring in the whole supply network, society-related risk and environment-related risk to construct a holistic measurement. The authors took two different types of supply chains (i.e. the textile industry and the automotive industry) into consideration. According to the results of the study, the textile industry has distinctive characteristics compared to the automotive industry. The textile industry comprises of generic products while the car industry has characteristics of incorporating much more complicated and sophisticated goods.

Behzadi et al. (2018) determined that robustness and resilience were two prominent and efficient risk management models for managing risks in agricultural supply chains.

Gokarn and Kuthambalayan (2019) suggested that fresh goods supply chains performance was positively correlated with the performance of a firm and fresh produce supply chains uncertainty negatively moderated positive relationships between fresh produce supply chains performance and capabilities of the firms.

Qingbin et al. (2020) assessed the effects of the recent COVID-19 outbreak on the dairy products sectors both in China and U.S. and they offered policy advice for strengthening resilience of the dairy products sectors against the outbreak. In their study, findings showed that the outbreak had a dramatic impact on the dairy sectors both in U.S. and China through similar circumstances such as disruption of distributing milk in the supply chains, scarcity of workforce, higher operating costs. And the study also suggested that pandemic also affected both countries in a different way including transportation distributions because of prevalent road shootdowns and a substantial decrease in holiday sales of dairy products in China and closures of dairy factories in the U.S. due to closed schools, hotels etc.

Fearne, Hornibrook, and Dedman (2001) studied quality assurance schemes initiated by retailers for meat. They focused on reducing risks for quality assurance schemes led by retailers with regard to beef picked up by consumers. And according to the survey, quality assurance schemes initiated by retailers had a likelihood to reduce sensed risk and boost consumer trust in several meat products.

Kumar et al. (2021) sought to determine risk alleviation strategies in food supply network during the pandemic era. First of all, they explained the uncertainties and risks with regard to outbreak issues and then determined risk aliivaiton methods to handle perishable food supply chains in distributions like pandemics and outbreaks. In their study, they suggested that stewardship based on collaboration, business perpetuality and economic stability were the most potent risk mitigation methods.

In their study, Susanty et al. (2017) aimed to assess the interaction between communication driven by collaboration, dependency on power, dependability, supplier adherence and economic performance. According to findings of the study communication driven by collaboration had a positive effect on dependability. And also, Supplier adherence had a significant positive impact on economic performance.

Kach (2012) conducted his study on 110 manufacturing companies that were located south western part of U.S. and reached the conclusion that strategic SCO persuaded by manufacturing companies had a positive effect on new product development and financial performance.

Scott (2012) applied his study on 587 buying agent employees and found that influence of perceived relational capital on risk reducing implementations decreased if the supplier wasn't the preferred supplier.

Mu, van Asselt, and Van der Fels-Klerx (2021) suggested; time, level of effects driven by the safety stocks and level of improvement as the dimensions of stamina in food supply chains. the study was conducted on the pork supply chain. And according to the study proposed framework in the study was suitable to select the most potent tools (i.e. owning substitute suppliers, boosting animal endurance) for enhancing the strength in the supply chain for food security.

And Bowman Jr (2015) interviewed with 6 supply chain mangers that worked in Florida and succeeded in preventing supply chain interruption. And in the scope of his study, the researcher concluded that reliable suppliers had vital roles to reduce interruptions in supply networks.

SCO and agricultural SCO

SCO is a situation where two or more members work to gather through information sharing, joint decision to gain competitive advantage (Blessley et al., 2014). A supply chain member can accomplish an undertaking which it normally wouldn't be able to succeed by itself without a partner (Zuba-Ciszewska et al., 2019). Thanks to this, the supply chain member won't have to incur fixed costs which are necessary to accomplish an activity (Spekman, 1988).

There have been some changes experienced in agricultural supply chain. Especially entrance of global retailers to new markets, integration of sub-sectors to form a new sector, changing consumer needs, rigid and tight regulations for food sector have changed food sector and caused firms in agricultural supply chain to pay more attention to cooperation (Zuba-Ciszewska et al., 2019). Especially most of retailers in food business cooperate with their suppliers and support partnership to improve their performance in most business areas (Kaufman, 1999).

Information sharing comes into play when close cooperation is the case. Information sharing is a dimension of accurate, well timing, relevant, significant and functional information which is conveyed by a firm to its partners in a supply chain (Hong and Kim, 2012). Typical information sharing in a supply chain contains inventory levels, production changes, activity instructions, transportation frequency, modes of transportation and information related to quality (Mehrjerdi and Shafiee, 2021).

Consumers' concern about food security is increasing on a daily basis. And this encourages consumers to be more aware of agricultural food (Hughes, 1994). This reality puts pressure on firms in agricultural supply chain to be more transparent and to have more traceable goods (Kataike et al., 2019). Hence, firms increasingly need more cooperation in food and agricultural supply chain (Simatupang and Sridharan, 2002).

And the SCO can be perceived differently with regard to its strength among the members in a supply chain.

From this point of view, second group of hypotheses can be drawn:

H_2: Supply chain members' perceptions of SCO differ significantly.

H_{2a}: Perceptions of dairy retailers and dairy farmers of SCO differ significantly.

H_{2b}: Perceptions of dairy retailers and dairy plants of SCO differ significantly.

H_{2c}: Perceptions of dairy farmers and dairy plants of SCO differ significantly.

SCO has two main components. And those components are vertical cooperation orientation and common goal orientation. And these components can be deployed to alleviate SCRU.

From this point of view, third group of hypotheses can be drawn:

H_3: SCO has a negative effect on SCRU.

H_{3a}: SCO has a negative impact on SCRU from the view point of dairy retailers.

H_{3b}: SCO has a negative effect on SCRU from the view point of dairy farmers.

H_{3c}: SCO has a negative impact on SCRU from the view point of dairy plants.

Vertical cooperation orientation

Vertical cooperation orientation is one of the elements of SCO and can be defined as a holistic and common positive demeanor towards cooperation with a downstream or upstream member (Schulze-Ehlers et al., 2014).

Trust is very vital for vertical cooperation orientation to work. And it is one of preconditions in establishing good cooperation practices among members of a supply network (Baah et al., 2021).

Trust can be defined as complying with delivery due dates, respect for each other, taking into consideration common interests of all partner firms, maintaining quality and decency (Boyce, 2014).

From this point of view, fourth hypothesis can be drawn:

H_4: Vertical cooperation orientation has a negative impact on SCRU.

Common goal orientation

Common goal orientation signifies the situation that partners should have goals complying with the whole supply chain goals or knowing that it is necessary to realize the whole supply network goals first to be successful at realizing goals of the individual firm (Lejeune and Yakova, 2005).

Common goal orientation can also be defined as common benign demeanor towards presence of reciprocal goals with downstream supply network members (Schulze-Ehlers et al., 2014).

From this point of view, fifth hypothesis can be drawn:
H_5: Common goal orientation has a negative impact on SCRU.

THE STUDY

Importance and goal of the study

Purpose of the paper is twofold;

First goal of the study is to determine the effect of SCO on dairy SCRU

And second goal of the study is to is to detect perception differences among supply network partners of SCO and dairy products SCRU.

As to importance of the study, the study differentiates itself from other existent studies in the literature associated with supply chain risk and orientation because only one party or member isn't taken into consideration three parties or members are evaluated instead. So, almost all members of the whole upper and lower streams of the supply chain are taken into the consideration (i.e. Dairy farmers, dairy plants and dairy retailers). This approach in the study offers a wholesome insight into the risk and orientation in a supply network. And participants namely members of the dairy supply chain were asked about opinions of other members in the supply chain which could offer a multilateral way of thinking. This kind of mindset is consistent with contemporary supply chain relation among the members. Because in a contemporary supply chain relationship a member should be aware of expectations and opinions of other members in order to do business with them accordingly. And there must be information sharing.

The other distinguished feature of the study is that it investigates risk and orientation in the dairy products supply chain.

Scope and limitations of the study

Orientation among dairy supply chain members (i.e. dairy retailers, dairy farmers and dairy plants) doing dairy business in Erzurum Province and its effect in reducing risk and uncertainty are investigated in scope of the study.

As for constraints of the study, SCRU and SCO among the supply chain members only in Erzurum Province are investigated due to time and monetary constraints. So, the study doesn't cover a regional area but only Erzurum Province which can be deemed as a commercial capital in Eastern Anatolian Region in Turkey.

Sample design

A face to face questionnaire was applied on milk producers (dairy farmers who have dairy cows), dairy plants and dairy retailers in the scope of the study.

The dairy farmers who obtain milk from their cows and sell milk by themselves therefore don't deliver their milk to dairy plant but directly deliver their milk to final customer aren't included in the study.

The dairy plants that operate and has an approval from authorities to produce dairy in Erzurum are incorporated in the study.

The other members of dairy supply chain are diary retailers who sell only local brands of dairy products or other products along with local brands of dairy products to final consumer are included in the study.

The dairy retailers who don't sell local brands of dairy products to final consumer consequently don't obtain dairy products from dairy plants or sell only national brands of dairy products to final consumers aren't included in the study. But the dairy retailers who sell only local brands of dairy products or local brands of dairy products and as well as national brands of dairy products are incorporated in the study. Consequently, according to Table 1, the number of dairy products supply chain members is presented.

Methods of data collection

Three different types of questionnaires were applied on dairy farmers, dairy plants and dairy retailers in order to obtain necessary information for the study. The First type of questionnaire was conducted on dairy farmers. And the second type of questionnaire was conducted on dairy plants. Finally, the third type of questionnaire was conducted on dairy retailers.

RESULTS

Collected data were analyzed by SPSS 22.0 and results are summarized below.

Table 1: Summarized demographic characteristics of the respondents

Member of Dairy Supply Chain	Frequency	Percentage
Diary Retailers	168	51,1
Diary Framers	140	42,6
Diary Plants	21	6,4
Total	329	100

Identifying the levels of uncertainty, risk and orientation in the dairy supply chain

The answers obtained from the dairy supply network members in the questionnaires are presented in two different titles below.

Identifying uncertainty and risk in the dairy supply network

There was a need for reliability analysis to determine whether or not the questionnaire was reliable enough to obtain significant results. To this end, Cronbach's alpha coefficient was deployed. The analysis showed that figure of Cronbach's alpha of dairy supply chain uncertainty and risk dimension was found 0.719 surpassing 0.6, which shows substantial reliability figure (Hair Jr et al., 2016). The facts of SCRU acquired from members of dairy supply network are presented in Table 2.

As seen in Table 2, the lowest mean of dairy SCRU (2.32) belongs to the dairy retailers. And the highest mean of dairy SCRU (2.86) belongs to dairy farmers. Total mean of dairy SCRU which belongs to all three members is 2.55.

Identifying SCO in the dairy supply chain

Figure of Cronbach's alpha of dairy supply chain orientation dimension was found 0.745 exceeding 0.6 which shows substantial reliability level (Hair Jr et al., 2016). The facts of SCO acquired from members of dairy supply network are shown in Table 3.

As seen in Table 3, the lowest mean of dairy SCO (3.55) belongs to the dairy farmers. And the highest mean of the dairy SCO (4.85) belongs to the dairy retailers in dairy supply network. And finally, total mean of dairy SCO is 3.73.

Differences in dairy supply chain members' perceptions of SCRU

ANOVA analysis was applied to determine whether or not there was a difference in dairy supply chain partners 'perceptions of SCRU. And the outcomes are shown in Table 4.

Table 2: Views of dairy supply chain partners about dairy SCRU

Items	Dairy Retailers		Dairy Framers		Dairy Plants		All dairy Supply Chain Members[(b)]	
	Mean[(a)]	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Capacity of transportation and delivery of goods is insufficient in dairy supply chain	2,23	0,68	2,57	0,95	2,50	1,04	2,40	0,86
There are problems with warehousing/storing in the dairy supply chain.	2,05	0,46	2,26	0,74	2,43	1,01	2,16	0,68
Delays of acceptance and deliveries of goods are experienced in the dairy supply chain.	2,11	0,74	2,16	0,65	2,02	0,68	2,12	0,70
There is insufficient communication among drivers, their firms and supply network partners in the dairy products supply network.	2,10	0,70	2,24	0,86	1,90	0,48	2,13	0,76
Information sharing among dairy firms and supply chain members is insufficient.	2,21	0,71	3,76	0,78	2,07	0,64	2,81	1,07
FIRM-RELATED UNCERTAINTY and RISK	2,13	0,47	2,60	0,45	2,19	0,51	2,32	0,52
Changing customer preferences are not met enough in the dairy supply chain.	2,07	0,88	3,00	1,13	1,95	0,62	2,43	1,07
There is a lack of communication among dairy firms related to transportation capacity of dairy products. In the dairy supply chain.	2,83	1,08	3,91	0,63	2,36	1,08	3,21	1,10
CUSTOMER-RELATED UNCERTAINTY and RISK	2,45	0,71	3,46	0,66	2,15	0,69	2,82	0,87
There is a lack of drivers to collect and deliver dairy products in the dairy supply chain.	2,44	0,73	2,52	0,85	2,02	1,41	2,33	0,77
Dairy products delivery and collection are affected by closed roads due to bad weather in the dairy supply chain.	2,23	0,85	2,59	0,99	3,17	1,19	2,49	1,00
Production, procurement, delivery and acceptance of dairy products are affected by seasonal changes in the dairy supply chain.	2,69	1,03	3,84	0,66	3,48	1,11	3,24	1,06
Buying and selling prices of dairy products are affected by uncertain fuel prices.	2,98	1,06	2,74	1,03	2,50	0,99	2,83	1,05
Some problems occur in buying and selling of dairy products because of regulations in the dairy supply chain	2,13	0,66	2,78	1,01	2,43	1,13	2,43	0,93
ENVIRONMENT UNCERTAINTY and RISK	2,46	0,52	2,89	0,48	2,72	0,65	2,67	0,56
GENERAL AVALUATION OF SUPPLY CHAIN UNCERTAINITY AND RİSK	2,32	0,38	2,86	0,36	2,40	0,46	2,55	0,46

[(a)]1: Strongly disagree, 5: Strongly agree, All Supply Chain Members [(b)]: Total mean of dairy supply chain uncertainty and risk which belongs to all three members (dairy retailers, dairy farmers and dairy plants).

Table 3: Views of dairy supply chain partners about dairy SCO

Items	Dairy Retailers		Dairy Framers		Dairy Plants		All dairy Supply Chain Members	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
There must be close cooperation among dairy supply chain members.	3,95	0,85	4,56	0,85	4,02	0,87	4,20	0,90
There is strong cooperation among dairy supply network partners.	3,71	0,88	2,59	0,95	3,88	0,77	3,28	1,06
Having close cooperation with the other partners of dairy supply network is important for delivery of dairy products.	4,02	0,89	4,44	0,78	3,93	0,89	4,18	0,87
I trust in the other members of dairy supply chain	3,80	0,81	3,23	1,01	3,83	0,88	3,58	0,94
I am loyal to the other members of dairy supply chain.	3,68	0,93	3,15	1,07	4,07	0,71	3,51	1,02
VERTICAL COOPERATION ORIENTATION	3,83	0,60	3,60	0,46	3,95	0,60	3,75	0,56
I am concerned with the other members of dairy supply chain.	3,65	0,96	4,00	1,13	4,10	0,73	3,84	1,02
If I want to stay competitive, I have to consider other members of dairy supply chain.	3,73	1,04	4,12	1,06	4,26	0,59	3,95	1,03
When firms deal with their own businesses they should also care about the other members of dairy supply chain.	3,90	0,92	4,07	1,08	4,17	0,66	4,00	0,97
I have same goals with the other members of dairy supply chain.	3,33	1,08	2,47	0,89	3,24	1,14	2,97	1,09
My firm is more powerful than the other members of dairy supply chain, but my firm doesn't misuse this against them.	3,91	0,72	2,37	0,81	4,33	0,48	3,35	1,09
I avoid behaving the other members of dairy supply chain arbitrarily.	4,01	0,70	3,81	0,74	4,12	0,67	3,94	0,72
I and the other members of dairy supply chain complete each other.	3,78	0,76	2,85	1,05	3,88	0,74	3,42	1,00
Business relationship with the other members of dairy supply chain is important for me.	4,12	0,70	4,54	0,83	4,29	0,46	4,32	0,76
COMMON GOAL ORIENTATION	3,81	0,54	3,53	0,53	4,05	0,36	3,72	0,54
GENERAL AVALUATION OF SUPPLY CHAIN ORIENTATION	4,85	0,82	3,55	0,42	4,01	0,40	3,73	0,48

Table 4: Perception differences of dairy supply chain members of SCRU

	Sum of Squares	df	Mean Square	F	sig.
Between Groups	23,743	2	11,871	55,851	,000
Within Groups	50,453	326	0,145		
Total	74,195	328			

According to Table 4 perceptions of supply chain members of SCRU differ significantly. Hence, H_1 is supported at the 0.01 significance level.

Because the number of dairy supply chain members differs (168 dairy retailers, 140 dairy farmers and 21 dairy plants) Scheffe which is one of Post Hoc tests was applied to determine where the difference stemmed from. And findings are presented in Table 5.

Table 5 shows that perceptions of dairy retailers and dairy farmers of SCRU differ significantly. Therefore, H_{1a} is supported at the 0.05 significance level. But according to the Table 5, there isn't a significant difference between dairy retailers and dairy plants with regard to their perceptions of SCRU. Consequently, H_{1b} is not supported at the 0.05 significance level. And finally, perceptions of dairy farmers and dairy plants of SCRU differ significantly. So, H_{1c} is supported at the 0.05 significance level.

Differences in dairy supply network partners 'Perceptions of SCO

ANOVA analysis was applied to determine whether or not there was a difference in dairy supply chain partners 'perceptions of SCO. And the outcomes are shown in Table 6.

Table 6 indicates that supply chain members' perceptions of SCO differ significantly.

Therefore, H_2 is supported at the 0.01 significance level.

Again, Scheffe was applied to determine where the difference stemmed from. And findings are presented in Table 7.

Table 7 suggests that perceptions of dairy retailers and dairy farmers of SCO differ significantly. Therefore, H_{2a} is supported at the 0.05 significance level. And also, Perceptions of dairy retailers and dairy plants of SCO differ significantly.

Consequently, H_{2b} is supported at the 0.05 significance level. And finally, perceptions of dairy farmers and dairy plants of SCO differ significantly. So, H_{2c} is supported at the 0.05 significance level.

Investigation on the effect of SCO on SCRU

Simple linear regression was deployed to assess whether SCO has an impact on SCRU or not. For this aim SCO was treated as the independent variable while SCRU was treated as the dependent variable. The results presented in Table 8.

According to Table 8, SCO has a significant and negative effect on SCRU. This means that, as SCO increases, SCRU decrease and in the table coefficient B is -0.426 meaning that 1 unit increase in SCO causes 0,426-unit decrease in SCRU. Moreover, the model is significant in general explaining 19.6% of the variance in SCRU. Therefore, H_3 is supported at the 0.01 significance level.

If dairy retailers in the dairy supply chain are considered, SCO has a significant and negative effect on SCRU. This means that, as dairy retailers' perceptions of SCO increase, their perceptions of SCRU decrease. And, B is -0.322. This signifies that 1 unit increase in SCO causes 0,322-unit decrease in SCRU. Furthermore, the model is significant in general explaining 17.5 % of the variance in SCRU. Therefore, H_{3a} is supported at the 0.01 significance level.

If dairy farmers in the dairy supply chain are considered, SCO has a significant and negative effect on SCRU. This means that, as dairy farmers' perception of SCO increase, their perceptions of SCRU decrease. And, B is -0.211 explaining that 1 unit increase in SCO results in 0,211 unit decrease in SCRU. And the model is significant in general explaining 0.62 % of the variance in SCRU. Therefore, H_{3b} is supported at the 0.01 significance level.

If dairy plants in the dairy supply chain are considered, SCO has a significant and negative effect on SCRU. This means that, as dairy plants' perception of SCO increases, their perceptions of SCRU decreases. And, B is -0.497 meaning that 1 unit increase in SCO results in 0,497 unit decrease in SCRU. Furthermore, the model is significant in general and explaining 18.2 % of the variance in SCRU. Therefore, H_{3c} is supported at the 0.01 significance level.

Simple linear regression analysis was deployed to determine if or not two sub-dimensions of SCO which are vertical cooperation orientation and common goal orientation have effects on SCRU. For this aim sub-dimensions of SCO which are vertical cooperation orientation and common goal orientation were treated as the independent variables and SCRU was treated as the dependent variable. The results are presented in Table 9.

Table 9 explains that vertical cooperation orientation has a significant and negative effect on SCRU. This means that, as vertical cooperation orientation increases, SCRU decreases. And B is -0.341. This shows that 1 unit increase in vertical cooperation orientation results in 0,341 unit decrease in SCRU. Moreover, the model is significant in general explaining 17.4% of the variance in SCRU. Therefore, H_4 is supported at the 0.01 significance level.

Common goal orientation has a significant and negative effect on SCRU. This means, as common goal orientation increases, SCRU decreases. B is -0.309. This explains that 1 unit increase in common goal orientation causes 0,309-

Table 5: Determining the source of perception difference of SCRU among dairy supply network members

The types of supply chain members	Mean Difference[(c)]	Standard Error	Sig.
Dairy retailers Dairy farmers	-,54583	,0436	,000
Dairy retailers Dairy plants	-,08433	,0658	,441
Dairy farmers Dairy plants	,46151	,0671	,000

[(c)]Mean difference is significant at 0.05.

Table 6: Perception differences of dairy supply chain partners of SCO

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8,839	2	4,419	15,065	,000
Within Groups	71,356	326	0,206		
Total	80,194	328			

Table 7: Determining the source of perception difference of SCO among dairy supply network partners

The types of supply chain members	Mean Difference	Standard Error	Sig.
Dairy retailers Dairy farmers	,26163	,0519	,000
Dairy retailers Dairy plants	-,19368	,0782	,048
Dairy farmers Dairy plants	-,45531	,0798	,000

Table 8: The effect of SCO on SCRU

Dependent variable: SCRU	Unstandardized Coefficients		Standardized Coefficients	t	p	F	R^2	Adjusted R^2
Independent variable	B	Std. Error[(j)]	B[(e)]					
SCO[(f)]	-,426	,046	-,443	-9,220	,000	85,017	,196	,194
SCO[(g)]	-,322	,054	-,418	-5,929	,000	35,152	,175	,170
SCO[(h)]	-,211	,070	-,249	-3,017	,003	9,100	,062	,055
SCO[(i)]	-,497	,166	-,427	-2,985	,005	8,913	,182	,162

[(e)]P<0.01, SCO[(e)]: SCO according to all dairy supply chain members, SCO[(g)]: SCO according to dairy retailers, SCO[(h)]: SCO according to dairy farmers, SCO[(i)]: SCO according to dairy plants, Std. error: Standard error.

Table 9: The effects sub-dimensions of SCO on SCRU

Dependent variable: SCRU	Unstandardized Coefficients		Standardized Coefficients	t	p	F	R^2	Adjusted R^2
Independent variables	B	Std. Error	β					
SCO	-,426	,046	-,443	-9,220	,000	85,017	,196	,194
Vertical Cooperation Orientation	-,341	,040	-,417	-8,569	,000	73,420	,174	,172
Common Goal Orientation	-,309	,042	-,364	-7,294	,000	53,201	,133	,130

unit decrease in SCRU. And finally, the model is significant as in general explaining 13.3% of the variance in SCRU Therefore, H_5 is supported at the 0.01 significance level.

CONCLUSION

According the study, dairy products supply network members' perceptions of SCO differ significantly. Consequently, there is a significant difference between dairy farmers and daily retailers, dairy retailers and dairy plants, dairy plants and dairy farmers with regard to their perceptions of SCO. Dairy supply chain members' perceptions of SCRU differ significantly. This stems from the perception difference of SCRU between dairy farmers and dairy retailers, dairy farmers and dairy plants. And there is no significant difference between dairy plants and dairy retailers in regard with their perceptions of SCRU. And SCO has a negative effect on SCRU, that is the more SCO among dairy products supply network members exists the less SCRU will exist. This potentially means SCO can be an effective tool for mitigating risk and uncertainty in the dairy products supply chain. This result is valid for all supply chain members participated in the study.

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Authors' Contributions

Abdullah Tüzemen: Topic selection, literature review, sample design, data collection and analyses, writing, communication with the editor and the reviewers, Tevfik Şükrü Yapraklı: Topic selection, sample design, review and editing.

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