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# COLD CHAIN LOGISTICS FOR FROZEN FOOD AT TOURISM DESTINATIONS

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## ABSTRACT

**Purpose-** The purpose of *this paper is to explore possible distribution system models of cold chain logistics for frozen food producers serving to tourism enterprises.*

**Methodology-** The data were collected through multiple case study method. The firms interviewed were chosen from the most visited touristic destination in Turkey, Antalya. These firms differed in size and the types of products.

**Findings-** We have observed significant differences in cold chains for tourism and 3PL-oriented retail sectors. The firms serving to tourism sector generally choose not to use 3PLs due to issues on food safety/quality despite the advantages in investment costs.

**Conclusion-** We conclude that the reasons for the reluctance of the producers to work with 3PL providers was the very hot weather and frequent stops made at hospitality facilities which leave the cold chain prone to temperature changes and product damage as well as the high demand during peak seasons which lead to urgent order requests nonconforming to 3PL service schedules.

**Keywords:** Frozen foods, cold chain, logistics management, tourism destinations, 3PL.
**JEL Codes:** R41, R42, C89

## 1. INTRODUCTION

The term “cold chain” is used for the special logistics chain required to transport frozen food sensitive to temperature changes during transportation. The cold chain can be described as "cold storage, cold transport and similar operations carried out in order to ensure food quality and compliance with safety criteria during transportation from the producer to the consumer” (Tanyaş, 2013). Cold chain logistics has been used for many years, to preserve the nutritional value of food until reaching the consumers without the need for chemical additives; and the use of cold chain logistics have also become widespread due to the increase in energy efficiency provided by technological improvements. As an indicator of this trend, the number of countries that have signed the ATP Convention, which was signed in Geneva by only 7 countries in 1970 and known as the Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage, today reached 52 (Tarhan, 2013). In an effort to control the cold supply chain and prevent chain breakage, it attempts to define international standards for the improvement of all processes (storage, packaging, loading, transportation, etc.) that must be completed from the production of perishable food until delivery to the customer.

In regions with high demand for food and delicacies, the need for cold chains is also increasing. For example, in regions where tourism has developed, tasty food is also of great importance for customer satisfaction. Moreover, some facilities provide food from different cuisines to appeal to their customers’ traditional tastes. In order to meet these requirements, hospitality firms outsource most of the food they will present to their customers as frozen food, and often they do only

cooking or heating in their own facilities. With these practices, tourism enterprises can also reduce personnel employment, which is one of the important cost items.

Failure to keep the temperature of the food during the logistics process, or breakage of the cold chain, is a huge risk for both the supplier and the buyer. It will reduce the economic value of the products or make the products completely unusable. Loss of economic value or making products unusable is a huge financial burden for producers. For the tourism business, which is the buyer side, this means that the orders can not be met on time or that the products received are not of sufficient quality, which will put the businesses in trouble during serving their customers. This will reduce customer satisfaction, which is very important for the tourism sector. For these reasons, the potential problems in the cold chain logistics should be thoroughly explored, and the determination of the distribution models which can solve these problems is necessary for both the frozen food producers and one of their important buyers, the tourism industry.

In this paper, problems encountered in the management of cold chain logistics by frozen food producers serving tourism enterprises will be examined and possible distribution models for frozen food will be determined; moreover, the efficiency of these models in different situations will be discussed. To our knowledge, there are not any studies analyzing cold chain logistics specifically at tourism destinations. While delivering frozen products to tourism enterprises; serious problems in ensuring food safety may be encountered such as failure to meet the transportation conditions of the products because of the breakage of the cold chain due to the intermittent weather conditions and proximity of the delivery points (hotels and other tourism facilities located next to each other). Our research questions can be summarized as below:

First, in order to determine the situation in practice; through multiple case studies, we will determine how the logistics processes are carried out while the frozen food producers deliver their products to their customers in the tourism sector. In other words, the process steps and potential problems will be classified in the current situation by determining which logistics processes are executed and financed by which chain partners (logistics service providers, producer firms, customers, etc.).

Then, distribution models that can be used during the transportation of frozen food products to tourism customers will be determined and examined.

The selected distribution models will be compared based on different criteria (efficiency, flexibility, product responsiveness, product quality, process quality (Aramyan et al., 2007)) and a framework will be set out as to which distribution model is more advantageous in terms of each criteria for the producers.

In addition, the factors that lead frozen food producers to or away from outsourcing in logistics will be identified and the benefits / losses that can be encountered by outsourcing in this line of business will be determined.

## 2. LITERATURE REVIEW

Based on our research questions we will summarize the previous literature on: design and analysis of cold chain logistics, performance evaluation of logistics systems, and outsourcing decisions in logistics. To our knowledge, we have not observed a research study focusing on cold chain logistics of frozen foods in tourism sector; however, especially in regions with dense populations and high demand on pre-prepared food, we see that cold chain logistics has gained attention from the researchers.

The research efforts on cold chain logistics concentrate on designing either the overall supply chain or different aspects of it to minimize costs. Zhang et al. (2003) used the tabu search algorithm to minimize costs of placement and plant-warehouse allocation for a retail frozen food supply chain operating in central and local warehouses. Montanari (2008), Sun et al. (2009), Golnar et al. (2013), and references in the review by Chen et al. (2011) focus on designing a tracking/safety controlling system with the lowest cost. The food safety/quality factor was also emphasized in other researches on performance criteria in the frozen food supply chain. Chaowarut et al. (2009) has identified the ability to respond to food safety and customer demands in the frozen food supply chain as the most important Key Performance Indicator with Analytical Hierarchy Process (AHP) and Balanced Score Card methods. Retail-focused cold food logistics chains may subject their suppliers to detailed inspections based on the HACCP (Hazard Analysis and Critical Control Points) principles (Losito et al., 2011). Accordingly, based on expert opinions by Analytical Hierarchy Process (AHP) by Wang (2010), one of the most neglected criteria by the producers in determining the quality index in the frozen dumpling supply chain is the "transportation and pre-meal food preservation" criterion. There are also studies reporting for effects of different factors on food safety in cold chain logistics, ranging from temperature changes during transportation (Rediers et al., 2009) to the practices of sales agents (Shabani et al., 2012).

As can be seen from the above discussion, one of the most important criteria in the frozen food supply chain problem is that the product quality should be meeting customer needs. In the literature, other criteria frequently examined in this context are; costs, timing, and speed (Akyüz and Erkan, 2010, Gunasekaran et al., 2004). Criteria to be used for comparative

analysis in this paper can be grouped into five main categories: productivity, flexibility, responsiveness, product quality, and process quality. The said criteria are adjusted for the purposes of our study from criteria used by Aramyan et al. (2007) to measure the performance of agricultural food supply chains. The criteria considered in each group and their definitions are presented in Table 1.

Outsourcing in logistics activities means that the operator obtains all or part of the required logistics activities from a third party logistics service provider (3PL). The logistics alliance is "a medium or long-term agreement between two or more companies. With this agreement, the parties connect their expertise with each other and provide competitive advantage in areas outside of their core competency "(Yıldız et al., 2013 pp. 133-134, from Aydın, 2005, p. 96). Investments in logistics activities mean that the company will meet its logistic needs with its own capital (e.g. buying and managing a truck fleet). The choices made by firms among these three strategies differ. For example, the firm in the case study of Yıldız et al. (2013) preferred to do its own investment in logistics activities due to the increase in transaction frequency, ability to focus on core competencies, and the problems experienced in the 3PL operator's logistics environment and service quality. On the other hand, in a study conducted by Özyörük (2008), it was understood that the decrease in product sales of a cement company producing cement in Ankara and distributing to Central Anatolia region was found to be due to the inadequacy of the number of trucks owned by franchisees, and this firm had chosen outsourcing strategy in its logistics activities. Durak and Ünverdi (2014) compared the costs of outsourcing vs. investment for a frozen food company that supplies the grocery stores in İstanbul, and they demonstrated that "a medium-sized business can both outsource its logistics and provide more flexible, more cost-effective and higher customer satisfaction" (Durak and Ünverdi, 2014, p. 19).

In our literature reviews, we did not find any studies related to companies providing a service which is oriented to tourism. On the other hand, there are very few studies on frozen food-related logistics activities, all of which are retail sector-focused. A retail-focused frozen food supply chain is significantly different from the cold chains that serve the tourism regions in this paper because of the demand and inventory structure as well as the infrastructure of the region in which the firm operates. Therefore, the results presented below are believed to help close the important gap in the literature.

**Table 1: Comparison Criteria For Frozen Food Cold Chain Logistics Systems**

| | **Comparison Criteria** | | **Definition** |
|---|---|---|---|
| **Efficiency** | 1 | Variable Distribution Costs | Unit distribution cost for each product |
| | 2 | Investment Costs for Distribution | Total cost for setting-up the whole distribution system |
| | 3 | Profitability | Profitability of the whole distribution process |
| **Flexibility** | 4 | Volume flexibility | Flebility in the amount to be distributed |
| | 5 | Distribution flexibility | Flexibility at the scheduled deployment time |
| | 6 | Customer Satisfaction | The level of customer satisfaction with the delivered product and delivery service |
| | 7 | Backorder level | The amount of order that can be met later if the customer agrees to wait |
| | 8 | Lost sales amount | The case where if the customer refuses to wait for the missing part of the order, the order can not be met at all |
| **Responsiveness** | 9 | Delays in distribution | The order can not be delivered to the customer at the time of promise |
| | 10 | Leadtime | The time from the moment the customer places the order to the time the order arrives to the customer |
| | 11 | Defective Shipments | Problems in the amount of the order delivered to the customer, product type, etc. |
| | 12 | Food Safety | Delivery of the product without deterioration and without any risk for human health |
| | 13 | Physical condition of the delivered product | Deformation of the product at its physical condition |
| | 14 | Traceability | Ability to track position, temperature, shipping point etc. of the products subject to order during the distribution |

| | | | |
|---|---|---|---|
| | 15 | Proper Handling and Storage Conditions | Ensuring optimum transport and storage conditions for the product in the framework of critical factors such as temperature and shelf life |
| | 16 | Manageability | The ease of management of the distribution process from the producer's point of view |

## 3. METHODOLOGY

Research questions in this paper require an exploratory study. As explained in detail in the literature review, this area has not been adequately researched; for this reason there are no established theories. Therefore, this research is planned as a descriptive study to assist in the formation of the theory in this area. The most appropriate method for such studies is the exploratory analysis (Flynn et al., 1990).

In this paper, it will first be determined how the logistics processes are carried out while the products of frozen food producers reach the customers in the tourism sector. In other words, the problems experienced in each process step will be categorized in the current situation by determining which partner (logistics service providers, producer firm, agents, etc.) executes and finances which process steps. Distribution models that can be used during the transportation of frozen food products to tourism customers will then be identified and reviewed.

In order to reach these goals, our research was conducted as a multi-case study. To select the case studies, we first interviewed the directors of the organized industrial region in the tourism destination subject to our study. From the directors we were able to detect 45 potential active frozen food producers, and then we called these firms to ensure that they were producing frozen food and supplying the tourism sector. Among the 13 firms satisfying these criteria, 3 of them were chosen due to differences in types of products produced, size, and willingness to participate. We believe the experiences of these firms reflect the frozen food industry serving the tourism sector since we were able to analyze most perspectives regarding cold chain logistics for different-sized firms and most types of frozen food products. We have also approached and interviewed one of the biggest national 3PL providers serving the same region to compare the views of producers and 3PL providers.

Data collection was completed within a year, including a single tourism season. In order to be able to answer the research questions and reach the project targets, it was necessary to collect detailed data from the producer enterprises and the 3PL provider. For this reason, semi-structured interviews were used as the data collection method. Interviews were conducted face-to-face and at least two researchers participated in the interviews to ensure that the data to be collected were accurate and reliable. While one of the researchers directed the questions, the other took note of the answers given by the participant and recorded the voice if the participant allowed it. At some interviews three researchers were present and researchers compared their notes with each other. Interviews lasted between 1.5-2 hours.

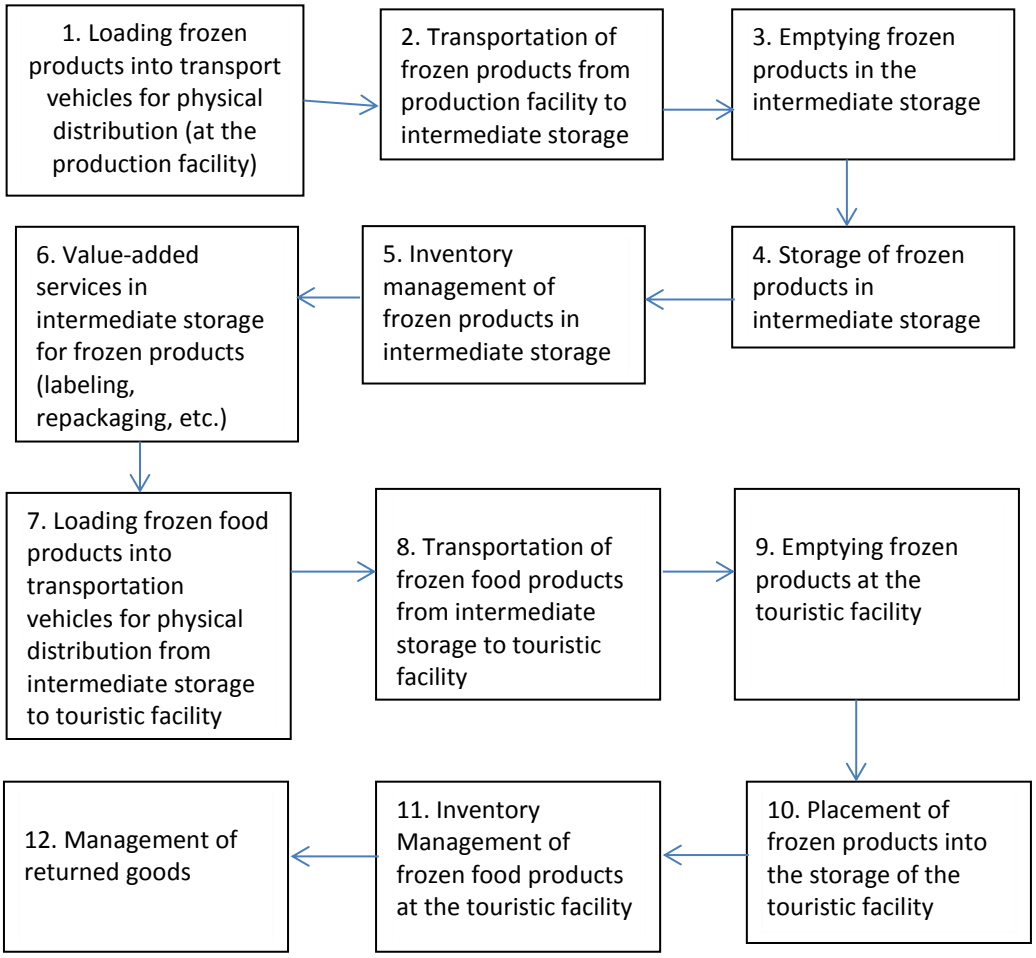
## 4. CASE ANALYSIS

Antalya, located on the mediterranean cost of Turkey, is one of the most visited cities in the world. There are hundreds of hotels, holiday villages, and other hospitality facilities in this city. At the tourism season (spring, summer, and autumn months), the population of the city increases greatly due to tourist arrivals, and especially at the peak time of the season it becomes impossible to prepare all the food from raw ingredients at the hotels. The frozen food producers serving this city during tourism season experience all the pressures described above to ensure cold chain logistics activities are carried out properly; othewise, the customers (hotels) do not accept the deliveries and the producers face risk of great losses. Our empirical research focuses on the experiences of the frozen food producers and 3PL providers serving this region at the tourism season.

All producers in the case studies produce and deliver prepackaged frozen food products that only requires to defrost and heat/cook to prepare at the hospitality facility. They differ with respect to the type of food produced, which lets us consider a wide aspect of logistics activities to serve customers from the tourism sector.

On the full scale, the cold chain logistics activities can be described as below (Figure 1). However, every frozen food supply chain may have been designed such that some facilities may not be present, and the activities could be executed and/or financed by different supply chain partners (producer, 3PL, customer). This can affect the whole performance of the supply chain. We aim to understand how frozen food logistics chains at touristic destinations are currently designed, how different responsibilities are allocated on chain partners, and then to analyze these decisions to gain insights.

**Figure 1: Process Steps İn Frozen Food Cold Chain Serving Touristic Destionations**




As stated in the methodology, we selected three frozen food producers serving hospitality firms: a dairy products producer, a meat products producer, and a vegetable, pastry, and potato products producer. Finally, we have interviewed a 3PL provider capable to serve all types of frozen food producers in each process step above.

### 4.1 First Case-Study

#### 4.1.1. Description of the Firm

In this case study, we analyzed a dairy products firm producing cheese and butter for hospitality facilities. The company has been operating for 50 years, total annual sales are 200-250 million TL (53-67 million USD), 10-15% of the sales are made to the tourism sector, approximately 30 million TL (8 million USD). The company has 495 employees.

#### 4.1.2.Frozen Food Supply Chain Used for Serving the Tourism Sector

The firm sells most of its products to the distributors; thus, it only assumes steps 1 and 2 above physically and financially, steps 3-9 are assumed by the distributors, and steps 10 and 11 are assumed by the customers (hospitality firms). For step 12, depending on the reason for the return, the responsibility could be assumed either by the distributor or the firm itself. For instance, the firm accepts the unsold products after the tourism season if their expiration date has not come yet.

For the choice of the cold chain logistics model, the firm may employ different options depending on the circumstances. While the firm chooses to deliver its products and the financial responsibility to its distributors, if the order request comes from a distant location (outside of the Antalya region), they choose to use 3PL providers for transportation. On the other hand, if the order is a very big batch, the customer comes and picks the delivery himself/herself; at the event of a very short leadtime for the order, the firm delivers the order itself, rather than transferring the order to the distributor. Some

customers require more traceability, such that they require the temperature records for all supply chain processes, and if their vehicles do not have enough technical qualifications the firm does not use 3PL providers. The evaluation of different cold chain logistics systems for this firm was summarized in Table 2.

For their 3PL choices, the firm requires 3PL to make a contract to assume insurance responsibility, to have a national distribution network, and to allow traceability. As potential problems in their existing network, the firm reported that sometimes deliveries were made to incorrect distributors; however, they had been able to uncover the reason and solve the issue. The firm always confirms that the distributors abide by their standards on distribution routes, personnel, cold storage, frigorific vehicles, etc.

### 4.2.Second Case-Study

#### 4.2.1.Description of the Firm

In this case study, we analyzed a frozen meat products firm producing red and white meat for hospitality facilities. The company has been operating for 18 years, total annual sales are 50-100 million TL (13-26 million USD), 25-50% of the sales are made to the tourism sector. The company has 175 employees.

#### 4.2.2.Frozen Food Supply Chain Used for Serving the Tourism Sector

The firm employs two different types of cold chain logistics system designs; through distributors, and by transporting by itself. For the case of distributors, the process is described as the following. Step 1 in Figure 1 is executed and financially assumed by the firm. Step 2 could either be totally assumed by the firm itself or the distributor. Step 3 is executed by either the firm itself or the distributor while it is financially assumed by the distributor; steps 4, 5, 7-9 completely belong to the distributor, steps 6, 10-12 are not applicable for this firm. For the case of transporting by itself, the firm assumes steps 1 and 9, and the other steps are not applicable for this choice.

The firm chooses to work with distributors if they have strong networks and customer relations at their own districts and they comply with the firm's standards. If the firm cannot find an appropriate distributor for a particular district, then it delivers the orders itself. This firm does not work with 3PL providers. The evaluation of different cold chain logistics systems for this firm was summarized in Table 2.

As potential problems for the logistics processes, the temperature requirements are a very sensitive issue for the firm. Especially at direct deliveries by the firm itself to several delivery points closely located to each other, frequent stops cause the vehicle doors to open often, and the cold chain could be broken. This firm also audits its distributors and requires them to be trained in applying the First-Expired-First-Out priority principle.

### 4.3.Third Case-Study

#### 4.3.1.Description of the Firm

In this case study, we analyzed frozen fruit, vegetables, pastry, and potatoe products firm serving the hospitality facilities. The company has been operating for more than 50 years, and they have been producing vegetables for 25 years. Total annual sales are 300-400 million TL (80-107 million USD), 10% of the sales are made to the tourism sector. The company has 1400 employees.

#### 4.3.2.Frozen Food Supply Chain Used for Serving the Tourism Sector

Similar to the second case study, this firm also employs two different chain designs, either delivery by itself or through distributors. This firm operates nationally and it has eight regional centers, 50 distributors nationwide. With this scale, they assume steps 1-5, 7-9, and 12 by themselves, steps 6, 10, and 11 are not applicable. The firm sometimes employs 3PL providers to transfer goods from the production to interim storage facility; however, the firm itself assumes financial responsibility in these cases.

The evaluation of different cold chain logistics systems for this firm was summarized in Table 2 (some criteria required too detailed analysis to decide on due to the large scale of the firm, so no comments were made for such criteria).

Due to the national scale and economical strength, this firm has vehicles with higher qualifications, such that defrosting risk during frequent stops is lower for this firm's deliveries. As potential problems, they report that if 3PL is employed, the drivers may sometimes forget to leave the vehicle in working condition at the time of delivery, and the temperature requirements may not be met. This happens especially when the hotel is receiving more than one delivery at the time and the truck has to wait until the other deliveries are accepted.

### 4.4.Fourth Case-Study

#### 4.4.1.Description of the Firm

In this case study, we analyzed how a nationwide 3PL provider experiences the current cold chain logistics operations during the tourism season and the reasons that producers may or may not prefer to use 3PL providers for their supply chain activities. The 3PL firm has been operating for 10 years, the total sales reach 1.3 billion TL (350 million USD), the firm has 7000 employees, and it has storage facilities nationwide and overseas (50 in Turkey, 25 overseas).

#### 4.4.2.3PL Provider Serving the Tourism Sector

The firm assumes most logistics activities for its customers; transportation, storage, handling, packaging, inventory management, inspection/control, and insurance. According to the 3PL provider, frozen food producers serving the tourism sector choose to work with them to minimize costs. This is because 3PL providers benefit from economies of scale, and for the same reason they own equipment with higher technical qualifications (e. g. high capacity generators at the storage facility protects the frozen food against temperature changes due to powerouts). On the other hand, there are producers choosing not to work with 3PL providers. Either that they may not be aware of the cooperation opportunities, or they may feel uncomfortable with delegating responsibility to other parties and lose trace of the product before delivery. It is also possible that they may be requesting nonstandard service (such as deliveries with very short leadtimes), or they may not be capable of using analytical techniques to minimize costs and hence could be making nonoptimal decisions in supply chain design. The 3PL provider firm has also observed that especially small-scale producers may be reluctant to discontinue previous work agreements with their old distributors for sentimental reasons

**Table 2: Comparison of Different Frozen Food Cold Chain Logistics Systems from the Perspectives of the Producers**

| Comparison Criteria | | | Cold Chain Logistics System Design (Evaluation Criteria: 1-Very Unpreferable, 2- Unpreferable, 3-Indifferent, 4-Preferable, 5-Very preferable, Left Empty if no comments were received) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direct delivery to the customer | | | Delivery to Distributors | | | Both (Direct Delivery & Distributor) | | | Outsourcing to 3PL Provider | | | | | | |
| | | | | | | | | | | | | Yes | | | No | | | |
| Evaluations of Criteria by the Firm in Case Study # | | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| Efficiency | 1 | Variable Distribution Costs | 4 | 3 | | 3 | 4 | | 3 | 5 | | 4 | 2 | | 1 | 4 | | |
| | 2 | Investment Costs for Distribution | 2 | 2 | | 3 | 5 | | 4 | 4 | | 4 | 4 | | 2 | 2 | | |
| | 3 | Profitability | 3 | 5 | | 3 | 4 | | 3 | 5 | | 4 | 4 | | 2 | 3 | | |
| Flexibility | 4 | Volume flexibility | 3 | 5 | | 3 | 4 | | 4 | 5 | | 5 | 5 | | 1 | 3 | | |
| | 5 | Distribution flexibility | 3 | 2 | | 3 | 5 | | 3 | 4 | | 5 | 3 | | 1 | 3 | | |
| | 6 | Customer Satisfaction | 4 | 5 | | 3 | 5 | | 3 | 5 | | 4 | 3 | | 2 | 3 | | |
| | 7 | Backorder level | 4 | 1 | | 2 | 3 | | 3 | 4 | | 4 | 3 | | 2 | 3 | | |
| | 8 | Lost sales amount | 4 | 1 | 5 | 2 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | | 2 | 2 | | |
| Responsiveness | 9 | Delays in distribution | 4 | 5 | 5 | 3 | 4 | 4 | 3 | 5 | 4 | 4 | 2 | | 2 | 3 | | |
| | 10 | Leadtime | 2 | 4 | 5 | 3 | 4 | 4 | 3 | 4 | 4 | 5 | 4 | | 1 | 2 | | |
| | 11 | Defective Shipments | 5 | 5 | 5 | 3 | 4 | 4 | 3 | 4 | | 4 | 3 | | 2 | 3 | | |
| | 12 | Food Safety | 4 | 5 | 5 | 3 | 4 | 5 | 4 | 4 | | 4 | 2 | | 2 | 4 | | |
| | 13 | Physical condition of the delivered product | 4 | 5 | 4 | 3 | 4 | 3 | 3 | 4 | | 4 | 3 | | 2 | 4 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Process Quality** | 14 | Traceability | 4 | 5 | 1 | 2 | 5 | 1 | 3 | 5 | | 4 | 4 | | 2 | 3 | |
| | 15 | Proper Handling and Storage Conditions | 4 | 5 | 5 | 2 | 4 | 4 | 3 | 4 | | 4 | 3 | | 2 | 4 | |
| | 16 | Manageability | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 4 | | 4 | 4 | | 2 | 3 | |

## 5. FINDINGS AND DISCUSSIONS

For frozen food producers serving the tourism sector, firm-specific and also sector-specific factors were observed to be dominant in choosing the cold chain logistics system design. For instance, we see that the meat producer in the second case study is of smaller scale compared to the other two firms of national scale. This firm is the only one expressing marketing opportunities and customer relationship as an important factor in prefering to work with distributors. This firm also has the most sensitive meat type of products that could be affected by any infinitesimal temperature changes, and they are again the only firm that do not work with 3PL providers at all.

Thus, we have observed that smaller scale frozen food producers choose to work with distributors if they have strong customer relations at their tourism districts. The product's sensitivity level to temperature changes influences the producer towards not using the 3PL provider. This also coincides with the fourth case study observations (3PL case), such that the firms with highly temperature-sensitive products may not feel comfortable in delegating the transportation to the 3PL while having the financial responsibility of the load. They will be assuming customer dissatisfaction risk in case of damage due to temperature-oriented problems.

The other two firms in the first and third case studies are of larger scale, and they include 3PL provider in their supply chain designs, albeit on a nondominant scale. The main situations that lead these firms to prefer cold chain designs without a 3PL provider are urgent orders with short leadtimes and lack of sensitivity towards temperature requirements by the employees/drivers of the 3PL.

In the fourth case study the 3PL firm describes the urgent order circumstances as nonstandard service. Even if these firms work with 3PL providers they request that 3PL provides traceability and assumes insurance responsibility. When we look at the producers' evaluation results on 3PL providers we observe that, as expressed in the fourth case study by the 3PL provider, using 3PL is advatageous to decrease the investment costs. However, the quality and food safety requirements are so pressuring that although the vehicles and facility infrastructre of 3PLs are of higher level, the firms still may not choose to outsource logistics processes. If the 3PL providers are not willing to assume insurance responsibilities and train their personnel, the producer will not be willing to work with 3PL providers, and it will apply cold chain logistics designs including only distributors or direct delivery by themselves. This difference compared with the retail sector is mainly caused by factors specific to tourism destinations. Closely located delivery stops cause the drivers to stop the frigorific vehicles frequently, and when they open the storage doors to retrieve the products, the hot weather enters inside the vehicle. Moreover, the tourism sector has peak times and this causes lots of urgent orders to be made that would not let firms to outsource logistics.

## 5. CONCLUSIONS AND FUTURE RESEARCH

In this paper we have analyzed, through multiple case studies, the principles with which cold chain logistics systems for frozen food producers in touristic destinations are designed. We have observed that there are significant differences in cold chains of this type compared to the traditional 3PL-oriented cold chains serving the retail sector. We have observed that even if the firm has large enough scale to not have any marketing and customer relationship related concerns, they generally choose not to use 3PLs due to issues on food safety/quality despite the advantages in investment costs.

The very hot weather and frequent stops made at hospitality facilities lead to increased risk of temperature changes, and this leaves the cold chain prone to product damage. As the product's sensitivity to temperature changes increases, the producers become more reluctant to work with 3PL providers. This was the case with the frozen meat producer observed at the second case study. This not only risks health hazards, but also customer (hospitalty firm) dissatisfaction and financial losses could also be very harmful in the long term. Therefore, if the producers choose to work with 3PLs on some occasions, they make 3PLs sign contracts for financial responsibility and have their emploees trained and audited on temperature sensitivity.

From the 3PL's perspective, it was observed that the high-tech infrastructre and vehicles were made available to customers. However, due to economies of scale to be employed, 3PLs may not be flexible and responsive enough to accept urgent order requests, and this is also a difference from the retail sector where the demand is more regular and more correctly

estimated. In the tourism sector, however, not all customer arrivals are scheduled in an organized manner, and during peak times, such as the holiday seasons, the hospitality firms may encounter higher demand for food than planned, and this would lead to urgent order requests nonconforming to 3PL service schedules.

For future research, there could be more case studies conducted at different touristic destinations to observe whether there are differences between the practices of 3PL firms serving to frozen food producers. More studies could also be conducted to measure any potential differences in cold chain designs with respect to differences in firms sizes/scales and types of food produced.

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