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Supply Chain Management, 3rd Party Logistics & Food Quality & Safety: Evidence from Greece

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Abstract

The aim of this study was to examine whether or not the efficiency of the supply chain management affect the food quality & safety. We focused upon transportation, warehousing, and inventory management. We also examined why food companies choose to outsource logistics functions such as transportation and warehousing and to what extent outsourcing affected food quality & safety.

We conducted a large scale quantitative survey during January to March 2005. We faxed 400 questionnaires to Greek food companies with more than 5 personnel. We got 79 usable questionnaires (response rate 19.8%).

The data analysis showed that food companies have no doubt that improving food quality means increased market share and profits. Transportation & warehousing are the main cost drivers. The most significant problems of the logistics function are: (1) re-occurring failures to quality control (2) overdue expiration date (3) inefficiencies in product sorting and handling. 44% of the companies have a logistics department.

35% of companies reported that prefer to get 3rd party logistics; most of them are SMEs. 50% of Greek food companies have acquired ISO certification in production, transportation and warehousing. ISO 14001 is rarely used. Almost all companies reported that training of personnel is a factor of improving food quality.

Conclusions, recommendations, and directions for further research are provided in the closing section.

Keywords: Food Quality & Safety, Supply Chain Management, Greece.

1. Introduction and goal

The competitiveness of EU food and beverages industry is largely dependant on the ability of food companies to remain competitive in the global market. Food and beverage enterprises have turned their attention to logistics management as the last frontier of gaining and sustaining a competitive advantage (Fearne and Hughes, 2000; Hayenga, 2000; Lambert and Stock, 1993). Moreover, recent food crises have demonstrated the critical role of safety and quality in the competitiveness of today's' food companies. EU now obliges food companies to apply quality certificates. Food quality and safety also adds costs and complexity in internal processes. For example, companies have to implement sophisticated systems for tracking and tracing their products, seek trustworthy partners and at the same time operate at the maximum efficiency to increase productivity and reduce costs. Food quality & safety can be guaranteed with a proliferation of certificates (i.e. ISO 22000, EN ISO 9001:2000, HACCP, BRC, GMP, GHP, International Food Standard – IFS, etc). However, more and more food companies outsource logistics operation to third parties. Outsourcing may have an impact on food safety and quality.

The aim of this study is to examine whether or not the efficiency of the supply chain management affect the food quality & safety. We focused upon transportation, warehousing, and inventory management. We also examined whether food companies outsourced logistics functions such as transportation and warehousing and to what extent outsourcing affected food quality & safety. Firstly, we reviewed the literature on food chain management, 3rd party logistics, and how they relate to food quality & safety. Next, we describe a quantitative survey we conducted with Greek food companies. We present the results of the data analysis. Conclusions and directions for further research are provided in the last section.

2. Research framework

2.1 Food Chain Management

Food industry in European Union is characterized by a large percentage of small and medium enterprises conducting agribusiness activities with little or no cooperation or coordination. Food & beverage networks are typically non-integrated and agribusiness activities are conducted in isolation mainly by SMEs.). Fernie et al. (2000) reported that large retailers in the U.K applied collaborative efforts, and managed to "save millions of dollars in the late 1990s" by increasing efficiency and decreasing supply chain disruptions. Furthermore, fragmented food networks are harder or fail to meet increasing consumer demands. For example, food traceability which is the necessary information to describe the production history of a food crop, and any subsequent transformations or processes that the crop might be subject to on its journey from farm to fork, requires the efficient collection, storage, real-time transmission, and management of information. Modern information technologies can manage effectively traceability data yet a proactive collaboration among food supply partners is required.

It is evident that companies in the agribusiness and food sector have to co-operate to achieve mutual benefits (Iijima et al., 1996; Myoung et al., 2001; Vlachos, 2003). One increasingly common method of collaborating is outsourcing.

In this respect, a food supply chain is defined as a set of interdependent companies that work closely together to manage the flow of goods and services along the value-added chain of agricultural and food products, in order to realize superior customer value at the lowest possible costs (Folkerts and Koehorst, 1998). Myoung et al. (2001) argued that the successful implementation of SCM in agriculture means that all participants in production, distribution, and consuming could trust each other and get benefit by sharing information. Thus, Win-Win relations are realised satisfying agricultural producer, distributor, and consumer together by faster and rapid reaction in production and consumption.

Figure 1 depicts the primary and support activities occurring in the food supply chain. Core activities include: supply, production, logistics, services, and marketing & sales. Due to market conditions and consumer demands, there emerge new critical areas now being targeted for improvement, which include packaging processes, the control of quality in Hazard Analysis and Control Critical Points (HACCP), the quality of the product, and reverse logistics.

INFRASTRUCTURE ACTIVITY				
HUMAN RESOURCE MANAGEMENT				
RECRUITING AND TRAINING				
TECHNOLOGICAL DEVELOPMENT				
Automation and optimisation of incoming flows		Just in time distribution Quality control in HACCP Food safety		Retail assistance and more consumer information
VARIOUS FUNCTIONS				
Raw Material Flow Management	Material Handling and Packaging	Shipping Order Management	Customer Relationships. Sales.	After-sales customer service
Management and pick up of raw materials	Selection of raw materials	Ad hoc palletising per customer	Advertising Promotion	Return policies
Control of incoming raw materials	Production and packaging	Deliveries	Sales force management	Collection of out-of-date merchandise
Quality control on outgoing merchandise	Finished product warehousing inventory Management	Vehicle routing and Scheduling Shipment and consignment Tracking	Price and discount policy Trade marketing activities Agreements with large scale retail & organised distribution Assortment and product policies	



Figure 1: Primary and Support Activities of Food and Beverages Supply Chain

Source: e-Business W@tch (2003)

2.2. Third Party Logistics

Third Party Logistics (3PL) is the outsourcing of logistics functions between a Third Party Logistics Provider and one company (user) aiming to increasing customer service with the minimum cost. In contrast to transportation services, 3PL offer a wide spectrum of services that include: packaging, warehousing, stock keeping, information management, Picking and Labeling, invoicing, ordering, etc.

The development of logistics outsourcing has been largely based on the needs that companies have to obtain cost savings and to concentrate on their core competencies. One of the key advantages of using 3PL results from economies of scale and economies of scope (Nemoto and Tezuka, 2002). Using 3PL, companies can save on capital investments, which reduces financial risk and, spread the logistics risk to sub-contractors, and at the same time free up capital to invest it more productively in core competences.

Food companies are likely to use 3rd party logistics to some extent in order to improve their performance (Engeler et al., 1998; Ryder and Fearn, 2003). For example, Crum and Arango (1996) investigated the impact of interfirm relationships among selected supply chain members using a survey of firms in the food production industry. Results gave some support for the hypothesis that a partnering relationship with customers and motor carriers results in better logistics performance

Market characteristics may influence the decision to contract third-party logistics services (Van Damme and Ploos Van Amstel, 1996; Rabinovich et. al.,1999). The aim of this study was to investigate the extent to which, if any, food quality and safety influence decisions to contract or not 3rd party logistics. We hypothesise that food companies will tend to integrate food quality and safety with other logistics functions (such as transportation, warehousing, information management, etc.) they outsource in order to improve their logistics performance.

2.3. Third Party Logistics in Greece

Third Party Logistics show a significant development in Greece. 3PL that offer quality of service at competitive prices are an important alternative for small and medium enterprises that proliferate in Greek food sector and don't have the resources to acquire expensive warehouses or transportation means. 3PL offer handling, picking, transportation, warehousing and distribution as well as export-import services. There are three types of 3PL companies in Greece: Those that do 3PL exclusively, with an estimated market size of 80 million Euros (in 1999), (b) transportation and carriage companies which offer 3PL services worth of 30 million Euros market, and (c) other companies that work as 3PL sub-contractors with 3 million Euro sales. During the period 1999-2005, there is a booming of 3PL services, with an average growth of 26.3% (ICAP, 2005). This extreme growth is attributed to new entrants entering the 3PL market, the widening of services.

3. Method

3.1 The Greek food sector

The food sector's structure is bipolar; on the one hand, a few large companies dominate the market such as the multinationals (e.g. Nestlé, Carrefour) and on the other hand, there is a significant group of small and medium-sized firms that operate mostly in regional markets.

In the Greek food retail market, there are about 294 retail chains and the leading food retail multiples in terms of sales are the multinational firms, i.e. Carrefour and A/B Vasilopoulos

(Delhaize Le Lion). The total food retail market was approximately 7.9 billion euros in 2001. In food manufacturing, there are 1,036 companies with 4.2 employees on average. Over 80% of the enterprises operating in this sector are small companies (with less than 50 employees). The total sales of the sector were approximately 8.9 billion euros in 2001. Table 1 presents the structure of Greek food sector.

It is noteworthy that the Greek food sector has undergone a major transformation over the past decade. For example, new retail warehouses - regional distribution centres have been built whilst there has been an increasing use of information technology applications. That transformation led to an increased bargaining power for the retailers in the local supply chain vis-à-vis the manufacturers that is a phenomenon taking place in most European retail environments (Dawson, 2004). That power is also the outcome of the heightened food retail market concentration level. It is estimated that the top 10 food multiples enjoy 86% of the total food retail market in terms of sales. Based on the above, it can be reasonably concluded that the food sector in Greece presents strong structural and operational similarities with the food sectors in the rest European Union member states, mainly with those in the Southern Europe.

Table 1 Structure of Greek food-beverage industry in 2004 (N=3000).

<i>Characteristic</i>	<i>Percentage</i>
Number of full time employees	
0-10	38%
11-50	43%
51-250	16%
251-1000	3%
>1000	1%
Sales	
0-500.000 €	6%
500.000-1.000.000 €	15%
1.000.000-2.000.000 €	22%
2.000.000-5.000.000 €	28%
5.000.000-10.000.000 €	14%
>10.000.000 €	15%

3.2 Sample

We drew our sample from food companies operating in Greece for a minimum of five years. In-depth interviews were conducted with key decision makers prior to designing a pretest. The questionnaire was pretested with randomly selected firms. Based on the results of the pretest instrument, the final questionnaire was refined. The respondents were logistics managers or managing directors of Greek food firms.

In terms of the empirical research, we posted 400 questionnaires. We got 78 questionnaires. The total response rate was 19.5%. To ensure that the respondents were comparable to non-respondents, analyses of variances were conducted between these groups. The non-response bias was assessed by comparing early respondents with late respondents (Armstrong and Overton, 1977).

4. Analysis and results

4.1 Logistics

Food companies reported 41% had a logistics department. 80.6% had a traceability system. One of the main reasons of outsourcing is to reduce logistics cost. Food companies reported that main logistics cost drivers are: transportation (22.1%), warehousing (21%), materials handling (16.5%), procurement (13.2%), information management (12.9%) and packaging (9.4%). Regarding logistics inefficiency, problematic areas include: poor demand forecasting (87%), inventory management in central warehouse for all products (82%) but most importantly for fresh produce (77%), customer service (43.2%), food quality and safety (51.3%), and reverse logistics (43.2%),

4.2. 3LP

Outsourcing logistics functions to sub contractors has an immediate effect on logistics costs.

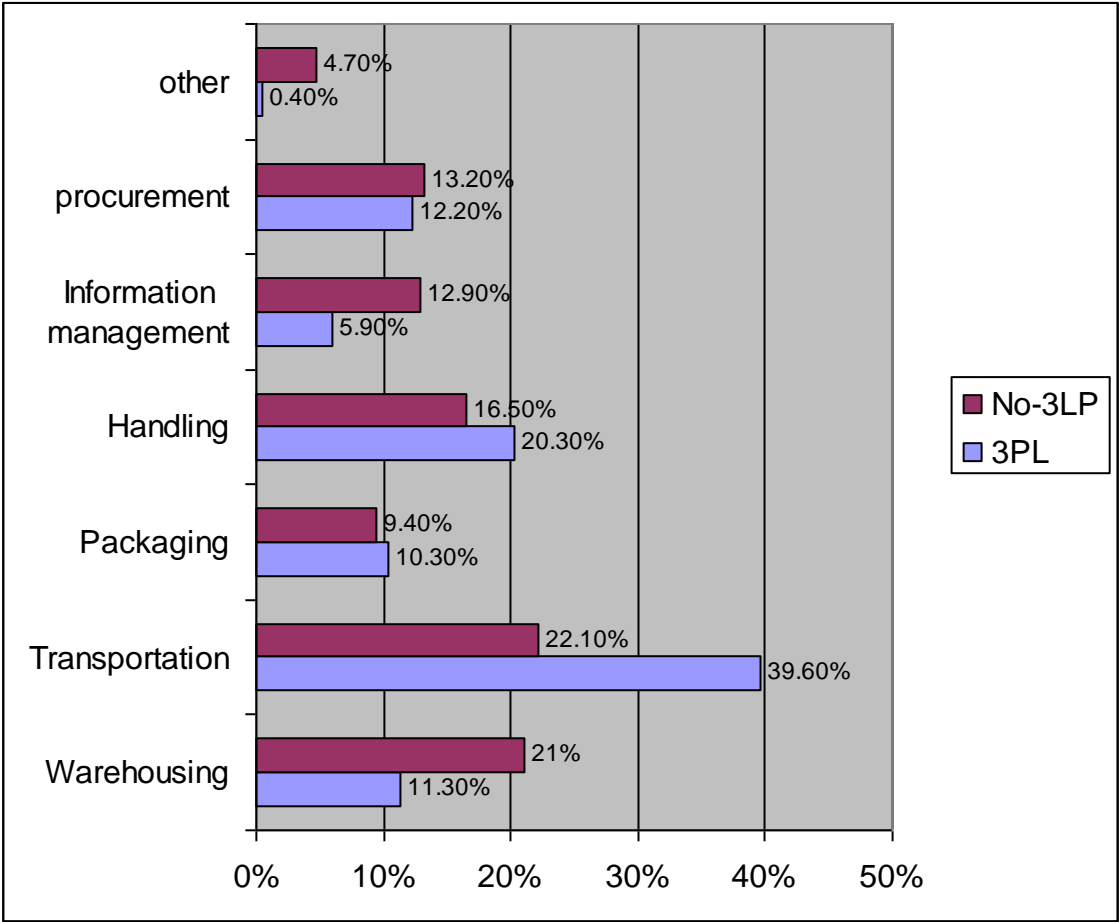


Figure 2 Logistics Cost Structure with and without 3PL

35% of food companies reported that had 3PL contractors for their logistics functions. Most of them were SMEs. Most companies used 3PL for all of their food products, especially for exporting. About 30% of companies with 3PL subcontractors have the same contractor for more than 10 years. However, another 50% have switched 2-3 subcontractors in the same

period. One of the most important factors for a company to turn to 3PL was to minimize and control logistics cost. Without 3PL, the most important cost driver is warehousing which contributes 21% to total logistics cost. Logistics outsourcing reduces this figure to 11.3%, freeing up capital to use in other areas. With 3PL, transportation becomes the main factor of logistics cost (39.6%) which is attributed to the increased customer service (more destinations – areas covered, frequency of deliveries, etc.) Table 2 shows that food companies with 3PL deal with logistics problems better than without them. This is particularly true with their major issue, demand forecasting: 3PL contractors reduce the severity of the problem from 80% to 50%. However, problems with Food Quality and Safety slightly increase with 3PL than food companies (42.9% from 34.6% respectively).

Table 2 Comparison of Logistics functions between 3PL and food companies

	3PL	Food Companies	3PL	Food Companies
Problem with	<i>Never</i>		<i>Few</i>	
<i>Deliveries</i>	21,4%	32,0%	57,1%	60,0%
<i>Inventory Management</i>	21,4%	15,4%	64,3%	69,2%
<i>Expiration Day</i>	76,9%	69,2%	15,4%	26,9%
<i>Demand Forecasting</i>	50,0%	20,0%	42,9%	52,0%
<i>Food Quality and Safety</i>	50,0%	61,5%	42,9%	34,6%

4.3 Food quality and safety

Food companies reported that problems with food quality and safety can come from any logistics activity. Transportation is the most possible cause of food quality problems due to the complexity and uncertainty of activities (35.1%). Warehousing can be also a problem especially when temperature and humidity are not adequately controlled (26%), and packaging (13.5%).

According to the data in Table 3, logistics functions play a significant role in food quality and safety. Warehouse technology (68%), transportation equipment (82%), days to sell inventory (74%) were reported to have high impact on food quality and safety.

Table 3 Association of Logistics with food quality & safety

Logistics Functions	Impact on Food Quality & Safety			
	None	Low	Moderate	High
Warehousing				
Number of distribution centers	26%	29%	11%	34%
Size of central warehouse	19%	14%	14%	54%
Technology	3%	3%	26%	68%
Warehouse Cost	32%	19%	19%	30%
Transportation				
Inbound logistics	5%	29%	24%	42%
Destination from marketplace	16%	16%	32%	37%
Size of distribution	11%	16%	16%	57%
Lead Time	3%	19%	24%	55%
Number of distribution centers	19%	19%	19%	43%
Equipment Transportation	0%	8%	11%	82%
Number of products	19%	24%	35%	22%
Number of pickup times	0%	13%	18%	68%

Delivery Frequency	18%	8%	16%	58%
Delivery Timeliness	16%	8%	18%	58%
Inventory				
Raw material quality	0%	3%	5%	92%
Inventory Quantity	18%	8%	34%	40%
Days to sell inventory	3%	8%	16%	74%
Number of suppliers	18%	24%	21%	37%
Quality Control	0%	3%	0%	97%
Other Factors				
Marketing	3%	8%	8%	81%
IT applications	11%	24%	22%	43%
Expiration Day	3%	8%	11%	79%
Retail Price	22%	11%	30%	38%

5. Conclusions and discussion

Recent food crises have demonstrated the critical role of safety and quality in the competitiveness of today's food companies. The competitiveness of food companies is dependant on their ability to build trust relationships with their partners and customers. Those relationships are increasingly exposed to food quality and safety issues. A company which is inefficiently equipped to safeguard food quality and safety damages its customers and partner relationships. Logistics and supply chain management are critical areas where food quality and safety requires special attention. Moreover, working with 3PL contractors can have a direct impact on the food quality and safety.

The survey we conducted with Greek food companies revealed that logistics managers are more often than not preoccupied with demand forecasting, warehousing and delivery times. However, in order of significance, the most important problems are associated with food quality and safety, expiration day, and meeting quality standards. 35% of Greek food companies are working with 3PL whereas the same figure is 58% in EE. However, the majority of SMEs prefer to work with 3PL contractors, especially in exporting goods. 67% of companies reported that safeguarding food quality and safety is an extra cost. Transportation is most likely to cause food quality problems followed by warehousing and packaging.

Although results showed that logistics functions have a direct impact on food quality and safety, there is inconclusive evidence whether 3PL do better with food quality and safety. IT seems that the most important factors for a company to turn to 3PL is still to minimize and control logistics cost. More research is required to investigate the effect of which, if any, 3PL affect the quality and safety of food products.

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