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**THE DEVELOPMENT OF SUPPLY CHAINS
IN THE REFRIGERATED CARGO FREIGHT
FROM SPAIN TO POLAND**

Abstract

The transport of refrigerated cargo (fruit and vegetable) imported from Spain to Poland is realized mainly by road. At the moment, there are no specialized short-sea shipping services of citrus fruit from Spain. In the previous years, only an insignificant amounts of fruit was transported from Spain to the Polish seaports.

The aim of this article is to identify and characterize supply chains and logistics-transport infrastructure used in the freight of refrigerated cargo between Poland and Spain. The particular emphasis is put on the characteristics of supply chains of citrus fruit and vegetables.

Keywords: refrigerated cargo, supply chain, citrus fruits, vegetables freight, maritime transport

Introduction

The aim of this article is to identify and characterize supply chains and logistics-transport infrastructure used in the freight of refrigerated cargo between

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Poland and Spain. The particular emphasis is put on the characteristics of supply chains of citrus fruit and vegetables.

In order to identify the existing transport chains, this analysis includes roads and details of cargo flows as well as elements of the infrastructure and means of transport used in the citrus fruit and vegetables freight to Poland. The analysis has been based on the existing literature, direct contacts and interviews with major companies of the citrus fruit market (importers, port terminals, wholesalers, carriers).

In the part of the article regarding the characteristics of supply chains, a comparative analysis of road transport and maritime transport has been made; the latter is meant as an alternative for road transport. For obvious reasons, at this stage of the research, only approximate transport costs can be determined. In order to pursue full comparative analysis, some more criteria, of great importance for the importers when choosing means of transport, are considered. Next, an attempt to quantify the significance of each criteria has been made by attributing them a number of points. When determining the significance of the criteria, opinions and experience of citrus fruit importers to Poland has been taken into consideration.

The conclusions of this research study will help to elaborate a strategy for the establishment of future transport chains in the freight of citrus fruit as well as organizational concept and functioning of the planned short-sea shipping line service between Spain and Poland.

1. Analysis of transport and logistics chains of citrus fruit and vegetables

Existing transport chains

The transport of fruit and vegetables is realized in the Polish export and import as refrigerated cargo within land and land-sea transport-logistics chains. The realization and organization of the transport process in supply chains requires the participation of importers, forwarders, carriers, port terminal operators, warehouse owners, customs offices veterinarian and sanitary services as well as wholesale and retail consumers.

Currently in the domestic transport market there are many companies importing citrus fruit and vegetables from different countries. However, the main

supplier of these goods is Spain. The importers buy directly from producers or foreign agents, or else, foreign importers. Therefore, many players are involved in the delivery process of fruit and vegetables to Poland. The network of transport infrastructure and freight routes is extensive.

The transport of goods from consignor to consignee is mostly organized by importers themselves as well as specialized forwarding and transport-forwarding companies. In rare cases, supermarkets deal with forwarding and transport on their own. The freight of citrus fruit and vegetables imported from Spain is in major part realized by Polish road carriers.

Moreover, many of domestic importers also provide transport-logistics services since they own their means of transport and storage facilities (refrigerated warehouses). The storage of fruit and vegetables also takes place at the importers' warehouses or other storage facilities offered by ports or wholesale companies.



Figure 1. Refrigerated warehouse ANECCOOP POLSKA, Swarzędz (2011)

Source: Kalinowski 2011.

The final receivers in the fruit and vegetable supply chain are super- and hypermarkets and retailer chains located in the whole country. They buy in the wholesale market or directly from the producer. Another dominating feature of these transactions is that they take form of exchange or a fair where prices are directly influenced by supply and demand.

The wholesale market in Poland is represented by *Stowarzyszenie Polskie Rynki Hurtowe* (The Association of Polish Wholesale Markets). The main aim of the Association is to coordinate actions of local markets and to solve current and future problems occurring during their development.

The biggest market for citrus fruit in Poland is in Warsaw, Poznań, Kraków and Katowice. In Warsaw there is the biggest wholesale market for fruit and vegetables in Poland *Warszawski Rolno-Spożywczy Rynek Hurtowy SA Bronisze* (The Bronisze Wholesale Market). Rynek Hurtowy Bronisze is not only a part of Warsaw infrastructure but it is also the principle place of supply with vegetables, fruits and flowers stores in the Mazovia Province. The Rynek's impact area also covers the provinces of Warmia and Mazovia, Podlesie, Lublin and Podkarpacie, with the estimated annual trading operators of 1.2 million tonnes and 14 million affected consumers. The Rynek Bronisze also redistributes to foreign markets – Russia, Belarus, Ukraine, Lithuania (Ministerstwo Skarbu Państwa 2015).

The sale of fruit and vegetables takes place in two covered market buildings, under the fruit and vegetable shelter and in the open market area for sale directly from lorries. In the market area there has also been established the “Bronisze” Logistics and Warehousing Centre which can store goods up to 10,000 pallets. There, the main activities are realized by producers, wholesalers and importers of fruit and vegetables. In the market, approximately 2500 sellers a day offer full range of different kinds of fruit and vegetables, both domestic and imported. Many of the sellers import citrus fruit as well.

In the carriage of refrigerated and frozen cargo there are established high legal requirements as to the conditions of transported cargo. The international standards have to be kept regarding health safety of foodstuff, namely HACCP (Hazard Analysis Critical Control Points). Strict veterinarian and sanitary control apply to transported foodstuff especially to the countries of EU.

The frequency of fruit and vegetable supplies and their availability in the domestic market is closely related to the seasonality of cultivation. The season for the supply of oranges, mandarins and other citrus fruit from Spain lasts from October to April, while peaches, nectarines and apricots are available only from July to August. However, the supplies of these fruit from Brazil, Argentina and other countries located in the southern hemisphere intensify in summer months, e.g. the supplies of fruit from Argentina take place from May to August.

One part of fruit imported to Poland is also sent as a reexport to east European countries. Receivers of these deliveries are in major part Poland's

neighbouring countries: Ukraine, Belarus and Lithuania. Therefore, transport and logistics supply chains of citrus fruit include road carriage from warehouses of Polish importers to the receivers in eastern markets.

Characteristics of land connections

In the European land transport chain relations there exist realized carriages of refrigerated cargo. Land transport takes place via different elements of land infrastructure (Fig. 2), whereas the cargo freight is realized using road as a transport means (refrigerated trucks). The elements of land infrastructure of this transport chain includes: European road network, refrigerated warehouses owned by producers, importer's warehouses, wholesale and retail markets.

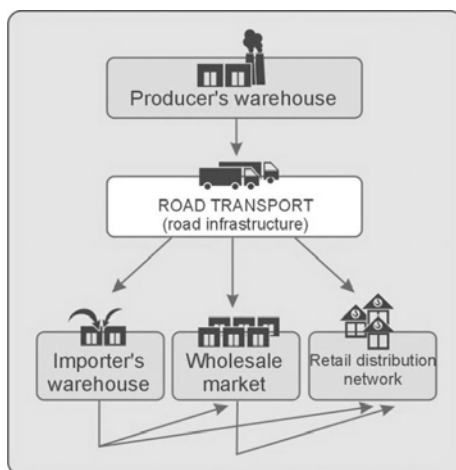


Figure 2. Model of land transport chain for citrus fruit carriage to Poland

Source: Kowalczyk, Burchacz 2009.

Transport services of citrus fruit import from Spain is in general based on road chain supplies. Fruit is most commonly delivered directly from the warehouses of the producer to importer's warehouses or wholesale warehouses located in different parts of Poland. From these storage facilities the fruit is delivered to retail chains or fruit and vegetables fairs/markets. Only in some part, citrus fruit deliveries are provided directly from producer to hypermarkets.

In the transport of citrus fruit, mostly refrigerated trucks with controlled temperature are used or canvas covered trucks without the refrigerating unit.

The later are used mainly in lemon carriages, which are less subjected to higher temperatures, in colder weather conditions, which is done in order to lower the transport costs. An average shipment size of fruit carried by road transport is 22,0 tonnes (Kowalczyk *et al.* 2009: 8–9).

Characteristics of sea-land connections

In the sea-land transport chain of citrus fruit and vegetables, there are used the above mentioned elements of the land infrastructure as well as the seaport infrastructure (Fig. 2). Long-distance freight in these chains is realised via sea. Maritime transport of fruit and vegetables is realised on reefer vessels (refrigerated vessels) or container vessels. On reefer ships these goods are transported in cardboard boxes on pallets. It is often the case, that these vessels also offer possibility to carry a fixed number of refrigerated containers.

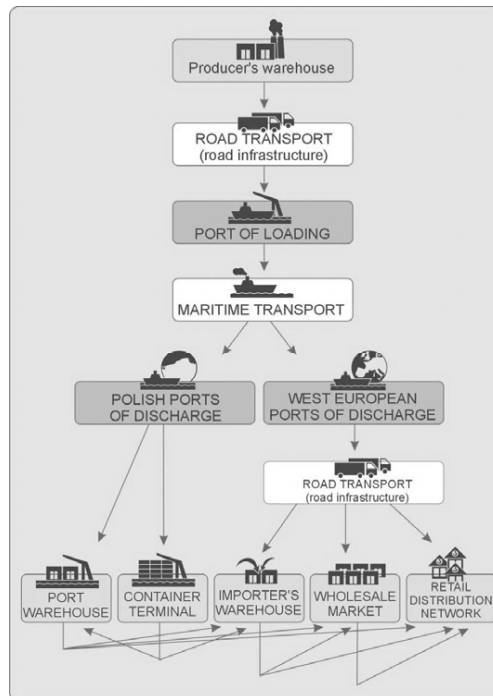


Figure 3. Model of sea-land transport chain for citrus fruit and vegetables carriages to Poland

Source: Kowalczyk, Burchacz 2009.

Transport chains of this type that include Polish ports are used currently only in overseas journeys. At the moment, there are no specialized short-sea shipping services of citrus fruit from Spain. In the previous years, from Spain to Polish seaports only insignificant amounts of fruit were transported. In this case, transport and logistics chain includes: carriage of cargo from the producer to Spanish ports, maritime freight, unloading and storage in Polish ports, delivery via road transport to receivers.

In the shipping market there are shipowners which possess a numerous fleet of reefer vessels of various size, e.g. „Seatrade”, or „Green Reefers”. It is estimated that there are no limitations as to the charter possibilities of reefer vessels as well as small containers.

The port infrastructure used in sea-land chains is constituted by specialized terminals for handling refrigerated cargo, such as: fish, citrus fruit, as well as container terminals, general cargo terminals and port refrigerated warehouses.

In the realization and organization of transport processes in sea-land supply chains, the following players take part: importers, forwarders, land and sea carriers, port handling terminal operators, storage space owners, customs, as well as wholesale and retail receivers.

Sea-land transport chains of citrus fruit deliveries are handled by:

- Polish ports,
- West European ports.

Deliveries of citrus fruit imported from Argentina, USA, South Africa, Morocco etc. are handled by the Gdańsk and Gdynia ports. These ports are considered places to be able to provide new services especially those referring to the import of citrus fruit and vegetables from the Valencia Region.

In the case of citrus fruit deliveries to the West-European ports like Antwerp, Rotterdam or Hamburg, the road transport is used in their further transport to recipient. Polish importers collect cargo in these ports from port warehouses or directly from ships and transport it by truck to Poland.

According to importers, direct callings with low-volume cargo at the Polish ports are not profitable due to the scarce use of ship capacity, high transport costs (large freight rates) and longer transport time to Polish ports which takes 3 days longer.

Part of the fruit imported from the South America by e.g. the “Top Fruit” company is transported to Gdańsk from Antwerp and Hamburg. An approximate transport time for the South America–West European ports route is 2–3 weeks.

In the recent years the largest Polish importer – the *Przedsiębiorstwo Produkcyjno-Uslugowo-Handlowe „Polmex”* in Nowy Sącz imported citrus fruit in the refrigerator containers via the port of Gdańsk. Forwarding services were handled by the TERRAMAR company. However, currently, the “Polmex” uses suppliers from the Netherlands and delivers cargo to Poland via trucks. An approximate cost of the transport from Rotterdam to Warsaw is 1300–1500 EUR per refrigerated truck (ca. 22 t).

The sea-land delivery chains also include citrus fruit delivered by sea by the “*Consortruit Polska*” *Sp. z o.o.* Citrus fruit is imported from Chile and Argentina to Hamburg or Rotterdam and later on transported by trucks to Poland. There goods are delivered in 2–4 containers per every shipping and the time of transport takes ca. 3 weeks.

The goods imported by the „*Prominex*” *Sp. z o.o.* in Cracow are partly carried through the Polish ports (Gdańsk) or West European ports. Their further transport from the Polish ports to customers in the whole country takes place with the use of refrigerated trucks.

Fruit and vegetables imported by the “*Fresh World International*” in Bronisze are also carried via sea transport. The company imports these goods from the South America and further transport is carried from Rotterdam or Gdańsk/Gdynia ports with the use of containers or pallets. According to the company’s representatives, the transport of fruit to Poland via West European ports is cheaper, because the Polish ports have much higher freight rates and they also additionally charge for the empty container return.

An important factor weakening the competitive position of sea transport when compared to road transport is the lack of door-to-door delivery to be realized by one means of transport. Door-to-door requires a change in the means of transport, which in turn prolongs and increases the transportation process cost, and requires close coordination between the shippers, ports and land carriers (Kotowska 2014: 22).

2. Comparative analysis of road and sea transport chains

Time and unit cost of transport are considered the basic criteria as regards the comparative analysis concerning individual supply chains of citrus fruit trans-

ported from Spain to Poland. These parameters are the most frequently used criteria determining the type of transport mode to be chosen.

In the full comparative analysis of road and sea transport, apart from the main criteria (time and costs of transport), other factors also play a significant role in the creation of transport chains. These factors comprise such elements as: the promptness and reliability of delivery conditions, frequency of transport services or supply of transport to the market.

Opinions of companies importing citrus fruit from Spain to Poland have been used to assess the importance of separate criteria decisive in selecting the transport mode and road and sea transport and port services quality assessment.

The surveys that have been conducted on 4 companies [(CONSORFRUT POLSKA Sp. z o.o. Cracow, VEGDIS Sp. z o.o. Warsaw (Hispa Groups Sp. z o.o.), FRUCO Sp. z o.o. Pruszcz Gdański, HISPOL Sp. z o.o. Gdańsk)] importing citrus fruit from Spain to Poland have demonstrated the promptness of deliveries, cost and time of transport and frequency of deliveries to be the most significant aspects (Table 1).

Table 1. Importance of criteria for taking decisions concerning transport of citrus fruit imported from Spain to Poland

Criteria	Number of points	Very low	Low	Medium	High	Very high
		1	2	3	4	5
		Number of companies				
1	2	3	4	5	6	7
Door-to-door transport cost Price (total cost) of door-to door transport service for one cargo	17			1	1	2
Total door-to-door transport time Total time of door-to-door transport including waiting time, transport, loading and discharge	17		1			3
Promptness of deliveries Is the cargo delivered on time	19				1	3
Credibility of deliveries conditions (risk of loss/damage of cargo) Probability of loss/damage of cargo	14			2	2	
Level of complications in the documentation and administrative procedures	9		2			1
Flexibility Minimal time needed to place the transport order (number of weeks/days/hours before departure/delivery of cargo)	11	1		2	1	

1	2	3	4	5	6	7
Appearance of indirect handling places in the door-to-door deliveries chain (ports/logistic or distribution centers/trans-shipment terminals)	8	2	1		1	
Frequency of particular transport service	15		1		2	1
Environmental impact CO2 emission	11	1	1		2	
Sufficient supply of particular means of transport Does the transport capacity of particular mean of transport meet needs of placed order?	12	1	1		1	1

Source: Maritime Institute in Gdańsk 2015.

The three interviewed companies have highlighted the greatest importance of total transport time, while one has described it as a low importance element. However, in the case of transport costs opinions vary. For 2 companies these criteria are very important, for one – high and for one – medium.

Importers stressed that such criteria as the appearance of indirect handling places in the deliveries chain and the level of complications in the documentation and administrative procedures are of minor importance. It has to be stressed that in their opinions importers do not pay enough attention to such important element as the environmental impact of transport.

Summary

Land and sea-land transport chains are used in the import transport of citrus fruit and vegetables to Poland. The former chain is preferred in the European transport, the latter in the import of cargo from overseas.

The transport of fruit and vegetables imported from Spain is realized mainly by road. These products are delivered from producers to importers/wholesalers magazines who transport it successively to recipients (wholesale/retailing chains) all over the country. Deliveries of citrus fruits are partly dispatched directly for sale on goods market, or to supermarkets.

Many companies operate within the Polish market of fruit and vegetable importers, but only a few of them cherish having a dominant position. The biggest concentration of importers with own warehouses is in the middle and south-

hern regions of Poland where the biggest wholesalers of fruit and vegetables are also located.

Some companies importing citrus fruit and vegetables, for example, from Spain, is located in the Pomeranian Region as the direct base for the Gdańsk/Gdynia ports. These ports are considered a potential destination for the planned short-sea shipping services transporting citrus fruit from Valencia. It does not mean that only deliveries from Spain are directed to this regional market. The Pomeranian Region deliveries chain also consists of importers from other regions where fruit is e.g. transported from an importer's warehouse in Poznań to the retail chain in Gdańsk.

The transport and freight forwarding is mainly operated by importers themselves. They not only have their own refrigerated magazines, but often also own transport resources. Sometimes freight forwarding and transport/freight-forwarding companies are hired by importers, trucks owned by hypermarkets are also in use.

The big involvement of road transport in citrus fruit and vegetable transport from Spain to Poland is caused mainly both by the large flexibility of this transport and possibility of direct deliveries from producers' magazines to recipients warehouses. On the other hand, it is also supported by the strong development of private road transport delivery companies which are highly competitive towards the short-sea shipping.

Within land-sea transport chains, the transport of citrus fruit by sea is operated by the Polish and West European ports. It mainly involves citrus fruit imports from other countries (Argentina, USA, South Africa, Morocco etc.). Cargo is transported to the Polish ports by refrigerated ships and later handled to port magazines. In the case of smaller quantities, citrus fruit is transported in containers and delivered to container terminals where they are mostly directed to port magazines for handling. Products are successively transported from magazines to recipients (fruit and vegetable markets, retail shops) all over the country.

According to citrus fruit importers' opinions, the most important criteria deciding about the choice of deliveries transport chains are: the promptness of deliveries and time and costs of transport, followed by the frequency of deliveries. From the point of view of these criteria, the companies have assessed road transport as very good or good.

The preliminary results of the survey highlight the promptness of deliveries, cost and time of transport and frequency of deliveries to have the largest importance for citrus fruit importers.

The relatively small importance has been assigned to such criteria as: the appearance of indirect places of handling in deliveries chain, complicated documentation/administrative procedure and transport influence on environment. It has to be pointed out that environmental protection plays marginal role in importers opinions.

In the comparative assessment of land and land-sea (intermodal) transport quality based on the accepted criteria, importers have assessed road transport as the best. In 1 (very bad) to 5 (very good) ranks scale, road transport received the best ranks within the most of criteria. However, importers show their interest in the use of sea transport in citrus fruit import from Spain to Poland. The necessary condition is competitive, from the point of transport view, deliveries offer in whole transport-logistics chain.

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ROZWÓJ ŁAŃCUCHÓW DOSTAW W TRANSPORCIE ŁADUNKÓW CHŁODZONYCH Z HISZPANII DO POLSKI

Streszczenie

Transport ładunków chłodzonych (owoców i warzyw) importowanych z Hiszpanii do Polski realizowany jest głównie samochodami. Obecnie nie istnieje specjalny serwis żeglugi bliskiego zasięgu z Hiszpanii do Polski tylko dla transportu owoców cytrusowych. W ostatnich latach tylko nieznaczne ilości owoców transportowano drogą morską między Hiszpanią a Polską.

Celem artykułu jest identyfikacja i charakterystyka łańcuchów dostaw oraz infrastruktury transportowo-logistycznej wykorzystywanych w obsłudze ładunków chłodzonych pomiędzy Polską a Hiszpanią. Szczególna uwaga została poświęcona charakterystyce łańcuchów dostaw owoców oraz warzyw.

Słowa kluczowe: ładunki chłodzone, łańcuch dostaw, owoce cytrusowe, transport warzyw, transport morski

