



**Agri-Food Logistics**

**2<sup>nd</sup> International Forum on Agri-Food Logistics**

**3<sup>rd</sup> National Scientific Conference  
AGROLOGISTYKA**

***Logistics Facing Challenges of Food Security  
and Environmental Protection***

**Scientific editorial board by  
Karol Wajszczuk**

**Poznań, Poland  
June 22-23, 2017**



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**2<sup>nd</sup> International Forum on Agri-Food Logistics**

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AGROLOGISTYKA 2014**

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## Contents

<i>Preface</i> .....	10
<i>Chapter 1: Food Losses and Waste in the Agri-Food Sector</i> .....	11
<b>1.1. Regional diversity of food losses and food waste in the food supply chain</b> .....	12
<b>1.2. Sustainable consumption and food waste as perceived by household managers</b> .....	14
<b>1.3. Analysis of Logistics Practices of Warqe Foods in Relation to Food Losses along Supply Chain in Ethiopia</b> .....	16
<b>1.4. Food Losses and Waste in Cereals Agri-food Chain in Turkey</b> .....	19
<b>1.5. The role of dairy cooperatives in reducing waste of milk products on local market</b>	22
<i>Chapter 2: Sustainable Agri-Food Supply Chains</i> .....	27
<b>2.1. Towards the sustainable pork supply chain in Poland</b> .....	28
<b>2.2. Typical Products Sustainability in Southern Italy: Exploring Apulian Consumer Perception</b> .....	32
<b>2.3. Evaluation of logistics sustainability in family farms in terms of the LSR concept</b> ..	37
<i>Chapter 3: Agri-Food Supply Chains – World Case Studies</i> .....	41
<b>3.1. Supply chain performance indicators: case study of Costa Rican coffee production</b>	42
<b>3.2. Fish Supply Chain in the Sultanate of Oman</b> .....	46
<b>3.3. Impact of Milk Cooling Plant Adoption on Small Holder Farmer Incomes in Nandi County, Kenya</b> .....	50
<b>3.4. Characterization of an agricultural area of Cundinamarca, its problems and possible solutions</b> .....	54
<b>3.5. Supply chain analysis of exotic carps in Jammu &amp; Kashmir, India</b> .....	57
<b>3.6. Analysis of the ‘Panela’ value chain in Utica-Colombia</b> .....	61
<i>Chapter 4: The role of analytical research in ensuring the production of safe food</i> .....	65
<b>4.1. Applicability of neutron activation analysis for food characterization</b> .....	66
<b>4.2. Removal of cd(ii) ions from aqueous solutions using elderberry waste</b> .....	69
<b>4.3. Microbial contamination of homogenized sausages containing BAADER meat, stored in atmospheric air</b> .....	72
<b>4.4. Microbial contamination of homogenized vacuum packaged sausages containing BAADER meat</b> .....	76
<b>4.5. The effect of edible protective casings on selected quality characteristics of culinary meat obtained from pork carcasses</b> .....	80
<b>4.6. Management of food allergens in the food industry</b> .....	82
<i>Chapter 5: Importance of IT in optimizing flows in food chains</i> .....	85
<b>5.1. Internet and Mobile Phone Revolution in Developing Regions: Implications for Food Security in Africa</b> .....	86
<b>5.2. E-commerce distribution channel of food – the chance or the problem</b> .....	89



5.3.	The role of information in optimization of logistics processes on the example of supplies of sugar beet.....	93
5.4.	Agricultural press as balanced development knowledge broker .....	97
<b>Chapter 6: Food Transportation: economic and environment perspective .....</b>		<b>101</b>
6.1.	Food transportation in the EU-the characteristics of some selected items.....	102
6.2.	The influence of transportation processes on the environment in the fuel and energy industry in the light of surveys. ....	104
6.3.	Transportation systems optimization to enhance agricultural logistics in Central Java .....	108
6.4.	Economic and technical conditions of air transport of food products.....	113
6.5.	Development of distribution and sales of low alcohol beverages in Poland .....	116
<b>Chapter 7: Management Strategies in Agri-Food Supply Chains .....</b>		<b>120</b>
7.1.	Management of the supply chain of pork in the meat enterprises .....	121
7.2.	Lean Management Strategies for Source wise wastes in Indian Paddy Processing Industry .....	124
7.3.	Suppliers' partnership building on the organic market .....	129
7.4.	Determinants of the supply chain in brewing industry .....	131
<b>Chapter 8: Problems, challenges and trends in food supply chains: global and regional perspective.....</b>		<b>134</b>
8.1.	A ten year Outlook for Agriculture .....	135
8.2.	Challenges and trends in virtual food supply chains in Poland .....	137
8.3.	Trends in the international position of Polish logistics .....	141
8.4.	Effects of global supply chains on the safety of agrifood .....	145
8.5.	External costs of open-cast lignite mining (as illustrated by the case of Oczkowice reserve).....	147
8.6.	Food quality marks as part of the Polish consumers food security .....	152

## Preface

Dear Forum Participants,

On behalf of the Department of Management and Law, Faculty Economics and Social Sciences at Poznań University of Life Sciences I have the honor to welcome you to the **2<sup>nd</sup> International Forum on Agri-Food Logistics** and **3<sup>rd</sup> National Scientific Conference AGROLOGISTYKA**

FAO reports that feeding of the growing population will be soon one of the major problems of humanity in the coming decades. However, this is does not only concern the quantity.

The increasing environmental, social and ethical problems, as well as public awareness of the impact of food production and consumption on the environment, leads to increase pressure of consumer organizations, environmental advocacy groups, policy-makers, and several consumer groups on agri-food companies to introduce systemic solutions throughout the food supply chain ("from farm to fork"). They aim to be safe for the society and be environment friendly. Hence, such supply chains become a particular challenge for logistics.

Taking this into account, nowadays the issues of food safety should not only be limited to the sphere of the production at the farm level.

Thus the safety food flow throughout the supply chain should be ensure for the consumer.

Therefore we need the appropriate means of transportation, storage, both safe and ecological packaging, efficient information systems in terms of flow and processing to ensure ongoing monitoring, as well as legal solutions in these aspects. In addition, the functioning of all these elements must meet the requirements for maintaining a safe environment.

Therefore, nowadays the creation of efficient and environmentally friendly logistics systems which guarantee the delivery of safe food products for consumers become the objective of logistics management. The realization of these objectives allow the effective implementation of LSR and CSR concepts into enterprises.

Such solutions are becoming key factors of success for manufacturers, logistics companies and retailers operating in the food supply chain.

This book presents an exchange of views and proposals for solutions in the above mentioned issues presented in Poznań on June 22-23, 2017 at the **2<sup>nd</sup> International Forum on Agri-Food Logistics**, and **3<sup>rd</sup> National Scientific Conference AGROLOGISTYKA**, titled: *Logistics Facing Challenges of Food Security and Environmental Protection*.

Karol Wajszczuk, PhD  
Chair of Organising Committee  
2<sup>nd</sup> International Forum on Agri - Food Logistics  
and the 3<sup>rd</sup> National Scientific Conference AGROLOGISTYKA  
Poznan, June 2017

## **Chapter 1: Food Losses and Waste in the Agri-Food Sector**

1.1. Regional diversity of food losses and food waste in the food supply chain  
(Karolina Pawlak)

1.2. Sustainable consumption and food waste as perceived by household managers  
(Agnieszka Siedlecka, Michał Kuszneruk)

1.3. Analysis of Logistics Practices of *Warqe* Foods in Relation to Food Losses  
along Supply Chain in Ethiopia  
(Ashenafi Chaka Tuffa, Tadesse Kenea Amentae, Girma Gebresenbet)

1.4. Food Losses and Waste in Cereals Agri-food Chain in Turkey  
(F.Füsün Erden, Ilkay Dellal, Zeki Bayramoğlu)

1.5. The role of dairy cooperatives in reducing waste of milk products on local  
market  
(Maria Zuba-Ciszewska)

## **1.1. Regional diversity of food losses and food waste in the food supply chain**

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**Key words:** food losses, food waste, food supply chain, regional diversity

### **Introduction**

Ensuring food security is one of the key priorities of the economic policy in many countries with different degrees of economic development. Since the early 1990s both the number of undernourished people and their percentage in the total population have been systematically decreasing worldwide. Despite this fact in 2014-2016 there have been nearly 795 million undernourished people, with nearly 15 million living in developed countries and about 780 million living in developing countries (FAO, 2015b). Food losses and food waste, which are observed in all segments of the food supply chains, are one of the most important determinants of food security in the world. Food loss is defined as the decrease in quantity or quality of food available for human consumption throughout the different segments of the supply chain (FAO, 2015a). Quantitative food loss, which is analysed in this paper, can also be referred to as physical food loss. An important part of food loss is called food waste, which refers to the removal from the food supply chain of food which is fit for consumption, or which has spoiled or expired (FAO, 2014). Food waste occurs at the end of food chain rather, and relates to retailers' and final consumers' behaviour (Parfitt, et al., 2010).

According to the FAO data, one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year (<http://www.fao.org/food-loss-and-food-waste/en/>, 24.03.2017). World Resources Institute indicates that globally, food worth \$750 billion is lost or wasted each year throughout the entire supply chain (<http://www.wri.org/blog/2015/09/what%E2%80%99s-food-loss-and-waste-got-do-sustainable-development-lot-actually>, 24.03.2017). Reducing food losses and food waste might be of high importance not only in the efforts to combat hunger but also to improve ecological safety. Less food losses and food waste mean less use of limited natural resources (Kwasek, ed., 2016).

The exact causes of food losses vary throughout the world and are very much dependent on the specific conditions and local situation in a given country, region or production area (FAO, 2016). Five system boundaries are distinguished in the food supply chains. There are: agricultural production, post-harvest handling and storage, processing, distribution and consumption. The aim of the paper is to identify regional diversity of the scale of food losses and food waste in the food supply chain.

### **Data and methods**

The research is based on the data from the United Nations Food and Agriculture Organization (FAO), the Statistical Office of the European Union (Eurostat), World Resources Institute, and the Economist Intelligence Unit (EIU). The analysis covered seven regions of the world, i.e.: Europe; North America and Oceania; Industrialized Asia (Japan, China, South Korea); Sub-Saharan Africa; North Africa, West and Central Asia; South and Southeast Asia; Latin America. The methods of meta-analysis, as well as the method of descriptive analysis, the

method of analogies and comparisons, and the deductive approach were employed in the research.

### **Findings and conclusions**

The highest food losses and food waste throughout the food supply chain occur in North Africa, West and Central Asia (36,0% of the initial production available for human consumption), and Sub-Saharan Africa (35,6%), while the lowest ones are observed in South and Southeast Asia (28,2%). It was proved that in developing countries food is lost mainly during the early stages of the food supply chain (agricultural production, post-harvest handling and storage). In general, this is related to the low level of technical advancement in agricultural production, inappropriate storage conditions (no refrigeration equipment), and lack of transport infrastructure. Food losses in highly developed countries occur at retail and consumer levels rather. Among others, this is due to overproduction of food and bad consumers' habits. In view of the abovementioned facts, it should be stressed that only a combined effort by farmers, the food industry, retailers and consumers through resource-efficient production techniques, sustainable food choices and reduced food waste can contribute to improving food security at a global level (EC, 2011).

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## **1.2. Sustainable consumption and food waste as perceived by household managers**

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**Key words:** household, sustainable consumption, food waste

The rational use of food, both in the context of sustainable consumption, as well as environmental awareness is an incredibly important issue. The problem of food waste refers not only to the households but it also can be analyzed from the point of view of producers. Changes in the production processes and globalization in certain regions of the world contributed to the occurrence of overproduction of food.

The issue of food waste, both in micro and macroeconomic terms constitutes an essential problem, therefore it has become an area of interest to the EU. European Union assumes development of specific measures towards halving food waste by 2025. These measures will be targeted at food waste as well as they will prevent the generation of bio-waste (Dąbrowska and Janoś-Kresło, 2013). The scale of the food waste can be illustrated by the statistics, according to which in 2012 in the European Union, the food waste amounted to 89 million tonnes i.e. 180 kg per one inhabitant. The largest 'producers' of wasted food are households (42%). In Poland, the amount of wasted food per inhabitant per year corresponds to 235 kg of food, while in Austria it amounts to 207 kg, and to 227 kg in Sweden (Kwasek).

The objective of the study is to identify differences in the approach towards sustainable consumption and food waste according to the declared consumption attitude. For its realization, the following research questions were formulated: Do households that are managed by respondents who understand the relationship between sustainable consumption and the state of the natural environment throw away food products significantly less often? Are purchasing decisions in these types of households made rationally?

To achieve the objective, a survey questionnaire on a group of 100 household managers was conducted. Selection of the research sample was carried out with the use of a non-probability sampling technique (non-probabilistic) – snowball sampling. The main premise behind the selection of the respondents was the fact of them being responsible for the purchases in a household. The studies were conducted in the time period of April - June 2016. The results of the studies were analyzed using the SPSS statistical program. The analysis of data was carried out on the basis of descriptive statistics: the mean and standard deviation.

Among the examined household managers, only 32% of respondents indicated that the surplus of food products, which cannot be rationally used, is donated by them to the family, acquaintances or to others in need. More than 60% household managers participating in the survey stated that the surplus of food products is thrown to the garbage. Analyzing the reasons for the disposal of the surplus of food products, it can be indicated that most often it is expiration of the use-by date (86%) and preparation of excessive portions (32%). Low-quality food products (22%) and improper storage conditions are factors that contribute to food waste as well.

While analyzing the food products that are most commonly thrown away in the households, the respondents enumerated: yoghurts (55%), bread (46%), milk (36%), sliced meats (34%) and fruit (31%).

Food waste is not only an economic problem, which is among others connected with unused financial resources in a household, but also a social and environmental problem. Household managers that see the link between sustainable development and care for the natural environment were less prone to throw away the surplus of food products, and more eager to donate it to others (acquaintances, family). It can be assumed that one of the factors contributing to such an approach is a higher level of environmental awareness.

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### 1.3. Analysis of Logistics Practices of Warqe Foods in Relation to Food Losses along Supply Chain in Ethiopia

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**Key words:** *Bulla*, Ethiopia, Food loss, *Kocho*, Logistics Practices

#### Introduction

*Warqe* (Enset) is a banana like plant domesticated and grown as a food crop only in Ethiopia and used also as non-food applications (Brandt et al., 1997; Gebremariam, 1996). Unlike to banana, the edible parts of this plant are the pseudo-stem and the underground corm. The plant largely cultivated in southern and south-western parts of Ethiopia and *warqe*-based farming plays a significant role in food security of Ethiopia (Brandt et al., 1997; Tsegaye and Struik, 2002). *Warqe* food products are used as a staple and co-staple foods for about 35 millions of Ethiopians (Tuffa et al., 2017). *Kocho* and *bulla* are the two main food products of *warqe*. As described by Tuffa et al., (2017), *kocho* is the dough like product which is the bulk of the fermented starch obtained from the mixture of the decorticated leaf sheaths and pulverized corm. *Kocho* processing involved a two-stage fermentation process and fermentation takes place in earth pit. After two or three months, fully fermented *kocho* can be produced. *Bulla* is white dry powder or semi-liquid which is produced by squeezing the decorticated leaf sheaths and pulverized corm and decanting the liquid. The two main supply routes for *kocho* and *bulla* to the central market in Addis Ababa are the Woliso and Guder-Ambo routes. According to the report by the Ethiopian Central Statistical Agency (CSA, 2014), in the two zones of Oromia region of Ethiopia, a total of 1,169,348 *warqe* plants were harvested in west Shoa zone and 1,929,028 in south-west Shoa zone. Some of these products were supplied to local and central markets. Therefore, the main objective of this paper was to analysed logistics practise of *warqe* foods associated with food losses along the supply chain and also to identified hotspots for losses.

#### Methods

Two survey studies were conducted in Ethiopia during 2014 and 2015 in order to analyse the logistics practise *warqe* food products and to assess the food losses of *kocho* and *bulla*. The first survey was conducted in the major *warqe*-growing areas of the country. The second study was conducted along two main supply routes of *warqe* foods started from two major *warqe* producing areas namely Haro Wanchi and Maruf areas. Supply chain management concept was used to analyse the *warqe*-based food chain. In this analysis, the stages-wise methodology was developed; describing and defining supply chain actors; mapping supply chain; analysing activities and relationships of the actors; describing logistics practices and identified its constraints and pointing out upgrading strategies. Food loss was assessed by adopting LaGra (1990) Commodity System Assessment Methodology (CSAM).



### Findings

*Kocho* and *bulla* reached final consumers through various channels. Farmers, collectors, processors, wholesalers, retailers, transporters, open market dealer, and consumers were identified as the main actors in the supply chain and logistics system. These actors grouped in three streams (Table 1). Upstream involves producers and collectors as the producers and initial suppliers of the products. Midstream includes traders, transporters and processors are engaged in trading, processors are involved in the processing of *bulla* and transporters are engaged in transport services. In downstream, only consumers are found. It was observed that a lot of logistics activities takes place in the midstream groups, implying that there a number of parties are involved in trading, transporting and processing *warqe* food products.

Table 1. Logistics and supply chain actors of *warqe* food supply and their activities.

	Upstream	Midstream	Downstream
<b>Actors</b>	<ul style="list-style-type: none"> <li>• <i>Warqe</i> producers and collectors</li> </ul>	<ul style="list-style-type: none"> <li>• Wholesaler, retailer, transporters, processor and open market dealers</li> </ul>	<ul style="list-style-type: none"> <li>• Consumers: households and restaurants</li> </ul>
<b>Major activities</b>	<ul style="list-style-type: none"> <li>• Growing <i>warqe</i> plant, producing <i>warqe</i> foods (<i>kocho</i> and <i>bulla</i>), packaging, transporting and selling the products</li> <li>• Collectors: buying and transporting the products, and sharing and picking up market and production information</li> </ul>	<ul style="list-style-type: none"> <li>• Buying, storing, repacking, transporting and selling</li> <li>• Food processors: buying, processing, drying, packaging, storing and selling</li> </ul>	<ul style="list-style-type: none"> <li>• Buying, storing, preparing various forms of food and selling</li> </ul>
<b>Relationship</b>	<ul style="list-style-type: none"> <li>• Exchanging information market</li> </ul>	<ul style="list-style-type: none"> <li>• Exchanging information, products and finances and collaboration in the transport of their products</li> </ul>	<ul style="list-style-type: none"> <li>• Providing feedback about product quality</li> </ul>

Source: Chaka et al., 2016

It was perceived that significant amount of food losses were observed in both *kocho* and *bulla* supply chains and losses occurred in the whole stages of the chains. It was calculated that about 45% of *kocho* and 46% of *bulla* were lost from the total marketed product along the supply chain. The highest *kocho* (24%) and *bulla* (29%) losses were observed at retailer and processor levels respectively. Practicing poor processing methods, using perishable packaging material, poor transportation and inappropriate storage and market conditions were the main reasons for the losses. The major constraints identified in the chain were poor information flow, lack of cooperation between actors, a poor infrastructure such as road and warehouse services, and poor policies concerning the *warqe* market.

### Conclusions and implications

It is, therefore, a need for cooperation and coordination between the chain actors to create an effective information sharing system. Shared warehouses need to be built near

producers and market places. Transportation, packaging, and handling need to be improved to reduce food losses of *warqe* food products. Research is required to develop an integrated, efficient and effective logistics for *warqe* supply and marketing chain.

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## **1.4. Food Losses and Waste in Cereals Agri-food Chain in Turkey**

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**Keywords:** Food losses, food waste, food security, cereals, Turkey

### **Abstract**

Agriculture has always been one of the leading sectors in the Turkish economy, largely because the land has rich soil sources and because there is a lot of biological diversity, a good climate and geographical conditions. There is also a tradition of farmers and, more recently, private entrepreneurs interested in investing in Turkish agriculture. Agriculture has an important impact on Turkey's social and economic development as it meets the majority of the population's food requirements domestically and also supplies the raw materials for other sectors dependent on agriculture.

Global food losses and waste has much attention recently in the world. According to FAO, almost one third of food produced for human consumption approximately 1.3 billion tonnes per year is either lost or wasted globally. In order to reduction of food losses and waste is now presented as essential to improve food security and to reduce the environmental footprint of food systems.

The objective of the study is to assess food losses and waste at critical points in the agri-food chain for cereals in Turkey, which has the greatest impact on food security and supply in the country. For this purpose, food losses and waste were assessed in general together with their effects on food security and supply in Turkey. Critical loss points in the agri-food chain for cereals was also identified and analyzed.

### **Introduction**

Global food losses and waste has much attention recently in the world. According to FAO, almost one third of food produced for human consumption approximately 1.3 billion tonnes per year is either lost or wasted globally. In order to reduction of food losses and waste is now presented as essential to improve food security and to reduce the environmental footprint of food systems.

This study has been carried out to validate food losses and waste in cereals agri-food chain in Turkey and a part of the The Turkish Country Report which was prepared at the request of the Food and Agriculture Organization of the United Nations (FAO) in 2013. The Turkish Country Report is a part of overall FAO work on identifying food losses and waste in the framework of the Save Food Project.

### **Data and method**

In this study, the methodology developed by FAO and the Swedish Institute for Food and Biotechnology was used. Cereals that has the largest influence on food security and supply in Turkey To this end, among the cereals wheat, barley and corn in terms of production area, production output, production value and the contribution of exportation are determined based on its properties. In addition to this one agricultural food industry product that is considered to be lost and wasted were chosen. This product is flour and flour products.

The most vital constraint here is that the studies are limited. In order to determine food losses and waste as well as critical loss points along supply chains, focus group meetings were organized with the participation of stakeholders from the flour and flour products sector. In these meetings, semi-structured questionnaires were used. These questionnaires set five stages for losses emerging in agri-food chain; namely:

1. Agricultural production.
2. Postharvest handling and storage
3. Processing and packaging.
4. Distribution.
5. Consumption.

### **Main results and conclusions**

Taking the agri-food supply chain as a whole, the highest rate of loss is observed in the first link of the chain; namely, agricultural production. The structural problems that Turkish agriculture is facing, such as small and fragmented farms and poor levels of cooperation are the main causes of losses at this stage.

Losses at the agricultural production stage are mainly associated with farmers' traditional methods, habits and practices. Losses often result from the unwillingness of farmers to seek information related to agricultural production. Furthermore, agricultural production is generally undertaken by elderly people since young people from rural areas are willing to migrate to urban areas and prefer to work in sectors other than agriculture. Older farmers tend not to stay up to date but rather engage in production methods that they learned from past generations, meaning they are too slow to adopt and practice new technologies. The shortage of intermediate personnel in agricultural production can be listed as another reason for food losses at this stage. Another main factor is low precipitation, and dry farming on vast agricultural lands. The expansion of irrigated farming and investments for ensuring more efficient and effective use of irrigation water will reduce losses, especially in cereals.

Food safety and quality standards are important elements in achieving low levels of losses in agriculture. Although there are various regulations on these subjects, there are some restrictions in achieving safer and better quality agricultural products. One of these restrictions is the lack of pricing systems based on nutritional content for all products.

Losses that occur in the other stages are relatively smaller than those that occur in the agricultural production stage. Recent advances in transportation, processing and storage technologies and preference of firms in the supply chain for new technologies are helping to reduce losses.

The Ministry of Food, Agriculture and Animal Husbandry and other related ministries have some regulations that cover all those problems not only solving long lasting structural problems of Turkish agriculture but also adapting its agricultural policy to EU. However, proper application, control and governance at the all stages of agri-food supply chain are needed.

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## **1.5. The role of dairy cooperatives in reducing waste of milk products on local market**

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**Key words:** dairy cooperatives, the waste of milk products

### **Introduction**

The Polish dairy cooperative movement has a long-standing history, over 100 years (Inglot, 1971), which has resulted in its gaining vast experience and expertise, and the building of the sector's credibility and trust from the cooperatives' members and customers (Zuba-Ciszewska, 2016). In 2015, there were 241 milk processing plants, including 177 plants employing over 10 people. There are at least several dairy plants in each region. Their concentration is clearly visible in the following voivodeships: Mazowieckie, Wielkopolskie, Kujawsko-Pomorskie, Łódzkie, Małopolskie, Lubelskie, Podlaskie, Śląskie and Warmińsko-Mazurskie. The dairy plants in these voivodeships account for 83% of all such facilities in Poland. Domestic dairy cooperatives are still the most important type of enterprise in the dairy sector. As a result of changes in the milk processing sector taking place since mid-1990s (Seremak-Bulge, 2005), their share in the purchasing and processing of milk has been reduced from 100% to approximately 66%. Nearly 61% of dairy plants operate as cooperatives. The concentration of dairy cooperatives occurs in regions characterised by a large number of dairy plants in general, which confirms the crucial role of cooperatives in the Polish dairy industry, strengthened by experience and a long-standing tradition. The Podlaskie Voivodeship, where the two largest dairy-cooperative groups are based, has gained considerable significance in this field. There are 17 branches of the groups in ten other regions of the country (12 branches of Mlekovita and 5 branches of Mlekpól), bolstering the dairy market in these areas. In response to the changing market conditions, e.g. consumers' preferences, dairies, including cooperatives, have been expanding their product range. Apart from basic products, they are trying to introduce products requiring more processing. Consumers can benefit from a wider choice of products, perceiving them as a strong Polish brand, which is possible due to the concentration of the dairy sector (Brodziński, 2014) by dairies groups, mainly cooperatives.

Global food waste is currently a serious problem, the resolution of which requires a sector-based analysis. Waste in the dairy-production chain occur at each of its individual stages, i.e. milk production (on farms), processing (in dairy plants), distribution (retail stores) and consumption (households). Therefore, the causes and results of the waste also vary. (Grochowska, 2015). Dairy products are classified as perishable goods. For that reason, the continuity and promptness of deliveries is of great importance in their sales which local dairies can provide (Kapusta, 2012). The aim of this paper is to determine the role of dairy cooperatives, which still remain a crucial link in the dairy-production chain as far as the reduction of losses of dairy products at the distribution stage, on local market. The term "local" refers to location of dairies in a given region, not the scope of their operation. A lot of them

sell their products both in Poland and abroad, which is reflected in the growing exports of Polish dairy products.

### **Research methodology**

The research includes data on two consecutive years (2014, 2015) provided by one of the largest Polish supermarket chains<sup>1</sup>. The chain consists of a few hundred stores located in all voivodeships, and sells food products from local suppliers. The researched area was narrowed down to one voivodeship - Lubelskie. This is due to the fact that the chosen retail chain had a large number of shops in this region (over 50), where customers can buy dairy products from local manufacturers. Also, there are a lot of dairies in the area of this Voivodeship. Dairy products are manufactured in 18 plants, out of which 14 belong to dairy cooperatives. There are 9 dairy cooperatives operating in the area, out of which three have two plants. Furthermore, two dairy cooperatives belonging to the Mlekovita group based in the Podlaskie Voivodeship are located here. The study covers two aspects: the share in the sales of products from various dairies groups (dairy cooperatives in the Lubelskie Voivodeship, Lublin-based branches of the Mlekovita cooperative, other dairies in the Lubelskie Voivodeship, and entities from outside the Voivodeship) and the issue of food waste. It has been assumed that the food losses by shops selling food products from local dairies are smaller. The role of one of the main reasons for food losses, expiry date, has also been determined. The losses not only exclude food products from consumption, but are also the cause of costs which the retail chains, not the producers, are forced to bear (Wrzosek, et al., 2014).

### **Research results**

The correlation between the type of the sold dairy product and their origin is clearly visible in the researched supermarket chain in the Lubelskie Voivodeship. Basic dairy products are mainly supplied by local dairies, while processed dairy products are supplied mostly by dairies from outside the Voivodeship. In 2015, Lublin-based dairy cooperatives (including the two belonging to Mlekovita) supplied 59% of pasteurised liquid milk (8% less than in 2014), nearly 78% of basic fermented beverages such as kephir, buttermilk and sour milk (an increase of over 4% as compared to 2014), 64% of cream and sweet cream (5% more than in the previous year), and 50% of butter and milk fat (7% more than in 2014). Only cheese and cottage cheese, accounting for nearly two-thirds of the sales volume, is supplied by dairy plants from outside the region. Nearly all the dairy cooperatives in Lublin include most basic dairy products in their product range (from 3 to 5 types of products). Only a couple of them manufacture yoghurt or processed cheese. Thus, the share of Lublin's dairies making processed dairy products is low. In addition, no entity in Lublin manufactures desserts, so they have no share in the sales volume of this kind of product. The low share in the sales of maturing cheese is also striking (8.5% in 2015). Apart from the access to the product (manufactured by 10 dairies, including brands recognised outside of Poland, such as SM Spomlek, SM Ryki and SM Michowianka), this might result from other factors such as, for example, the price or form of packaging. To sum up, processed dairy products are delivered by entities from outside the Voivodeship.

The research showed considerable differences in the waste of dairy products in the researched retail chain. The largest food losses reached a couple of dozen tonnes a year (nearly

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<sup>1</sup> At the request of the chain, its trade name has not been given in the study.

79 tonnes of yoghurt, and 49 tonnes of cottage cheese in 2015) while the lowest losses do not exceed a few tonnes (2 tonnes of lost cream and sweet cream, 5 tonnes of maturing cheese). In the case of the majority of the assortment, the largest losses are characteristic of dairy products delivered by dairies from outside the region. This concerns products for which this type of entity is the main supplier, i.e. processed products (yoghurt and milk beverages, maturing cheese, processed cheese, milk desserts) as well as cottage cheese. Waste of products from these dairies is also larger in the case of butter and milk fat, despite the fact that their advantage in its supply is gradually decreasing. In the case of pasteurised liquid milk, kephir, butter milk, sour milk, cream and sweet cream, the chain incurred the most considerable losses on products delivered by dairy cooperatives from the Lubelskie Voivodeship. The volume of losses on products delivered by entities from outside the region is from 1.4 to 50 times larger than the volume of losses on products delivered by local entities, and where the losses are larger in the case of the latter (for milk, basic fermented beverages, cream and sweet cream), their magnitude is considerably smaller (from 1.1 to 3 times).

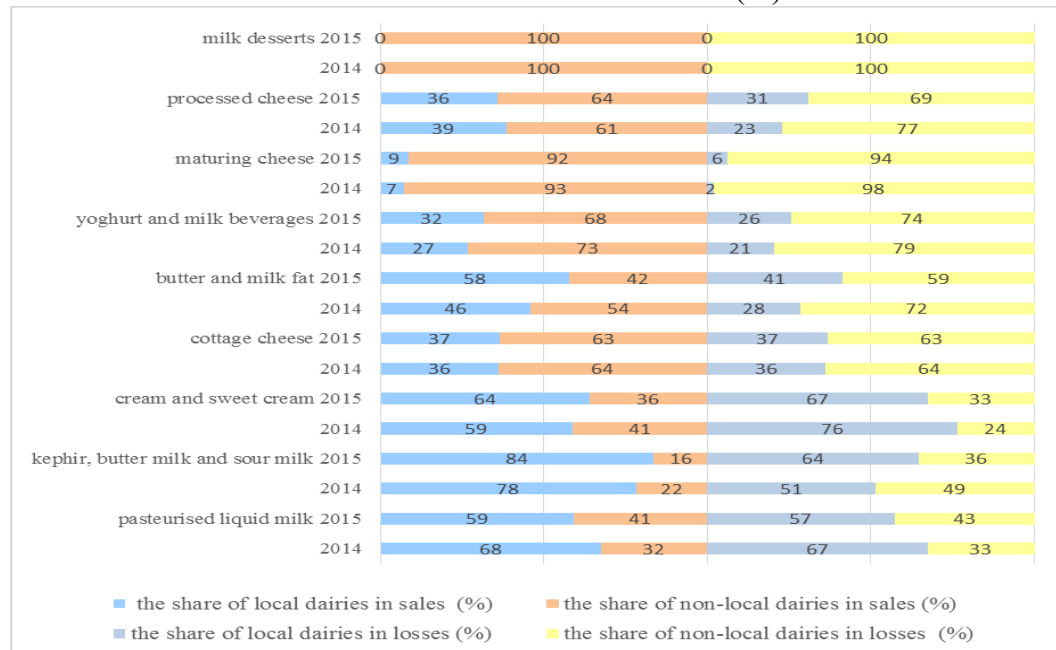
In 2015, the losses of products delivered by local dairies amounted to 9 thousand litres of pasteurised liquid milk and 62 tonnes of other products. In the case of dairies from outside the region, the volume is much higher, at 127 tonnes (though this is lower than in 2014) and 7 thousand litres of milk. In conclusion, the losses of products from local dairies, including dairy cooperatives, are considerably lower than for dairies from outside the region.

The main reason for the occurrence of losses of dairy products is their expiry date. The share of products past their expiry date in the total volume of losses ranged from 42% (cream and sweet cream) to 73% (basic fermented beverages) in 2015. In most cases, products delivered by local dairy cooperatives had a smaller share in the losses on account of expiry dates than products delivered by cooperatives from outside the region (in 2015, except milk and processed cheese). For that reason, the largest share of products past their expiry date (except desserts) concerned the assortment delivered by dairy plants from outside the Voivodeship (61% in 2015), whereas the share of the three types of Lublin's dairies amounted to 50%. The lowest share was observed in the case of local dairy cooperatives (45%).

The magnitude of product loss by a given dairies group is connected with their supply volume (Fig. 1). In the case of pasteurised liquid milk, basic fermented products, cream and sweet cream, the chain incurred the greatest losses on products supplied by the Lublin dairies which are its main suppliers. In the case of butter and milk fat, supplied by mostly by local entities, the greatest generated losses included products from outside the Voivodeship. Greater supplies of processed products from dairies from outside the Voivodeship involve a greater scale of loss.



Fig. 1. The share of dairy product losses incurred by various dairies in their total losses, and their share in the studied chain's sales in 2014 and 2015 (%)



Source: own study

Comparing the share in losses with the sales contribution of dairies, it can be observed that the proportion of product losses of non-local dairies is greater than their contribution to sales for most products (from a few to a few dozen percent). Only in the case of cottage cheese is the contribution in sales the same as the losses (63% in 2015), and in the case of cream and sweet cream it is higher (by 3% in 2015).

### Summary and conclusions

Basic dairy products are mainly supplied by local dairies, and especially by dairy cooperatives. Nearly all of them offer the majority of basic dairy products, and only a small percentage of them offers processed products (apart from maturing cheese). The entities based outside the Voivodeship supply the majority of processed milk products (yoghurt and milk beverages, maturing cheese, processed cheese, milk desserts), as well as cottage cheese. The greatest product losses involve the products supplied by dairies based outside the Voivodeship. This refers to products supplied by the aforementioned entities, as well as butter and milk fat. The total losses in products supplied by local dairy plants are significantly lower compared to non-local suppliers. The main cause of dairy-product loss in the studied chain was the passing of the expiry date. On average the greatest share of expired products (excluding desserts) included the goods supplied by the dairies based outside the Voivodeship. The magnitude of product loss of a given dairies group is connected with their supply volume. Greater supplies of processed products from dairies from outside the Voivodeship involve a greater scale of loss. Additionally, the share in losses of products supplied from outside the Voivodeship is greater than their share in sales for most of the products (from a few to a few dozen percent).

The studied retail chain utilises the vast product choice of local basic dairy products offered by Lublin dairies, and especially the dairy cooperatives. Those entities continue to be an important link in the dairy chain of the region. By selling their products, shops suffer smaller

food losses, as the nature of dairy products requires swiftness and continuity of delivery, which is guaranteed by local dairies.

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## **Chapter 2: Sustainable Agri-Food Supply Chains**

2.1. Towards the sustainable pork supply chain in Poland  
(Magdalena Kozera-Kowalska)

2.2. Typical Products Sustainability in Southern Italy: Exploring Apulian Consumer Perception  
(Roberto Capone, Francesco Bottalico, Nouredin Driouech, Hamid El Bilali, Gianluigi Cardone, Philipp Debs)

2.3. Determinants of sustainable development of logistics in agricultural enterprises  
(Karol Wajszczuk)

## **2.1. Towards the sustainable pork supply chain in Poland**

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**Key words:** sustainable food chain, agribusiness, pork production, sustainability in the pork chain, concentration in pork supply chain

### **Introduction**

In the studies on the management of production processes in the agri-food economy a new trend appears which focuses on involving food processing companies into the food supply chain. They do not want to get engaged into the process of the meat production directly, but are willing to participate in monitoring the food supply chain as a whole. It may seem disinterested or aiming at implementation of social responsibility slogans but in practice it is caused by an economically justified objective to gain the additional growth of the value added. Nevertheless, such an attitude significantly influences different areas of the food supply chain.

The study aims at showing changes in the pork supply chain affecting mutual relations between its participants, including consumers, despite the long term crisis in the sector.

### **Research methodology**

To carry out the research the case study method and some selected parts of Porter's Five Forces Analysis were used. Both methods have been for years successfully applied to diagnose the situations of sectors. The first one allowed to analyze sector only with the possibility of reference to the processes taking place in the other parts of agri-business. The use of the other method was determined by the availability of sources.

### **Results**

According to the supply chain concept entities being aware of mutual dependence on the market try to use them on the synergy effect basis. In practice this means that previously competitive to each other institutions undertake cooperation encompassing not only their own typical work (for example processing and delivery of product to a final purchaser), but also support and monitoring related to the other stages of production. The network of relations arising this way contributes to creating new values, and results in socio-economic benefits for all its participants. Nowadays the term "supply chain" is expanded by an adjective "balanced". It emphasises the implementation of the idea of balanced development based on three interdependent areas- social, environmental and economic (Rokicka, Woźniak 2016, s. 6).

The supply chain of pork is very complex and - also remains under the pressure of not only socio-economic conditions, but also political ones, often in the macroeconomic scale, influencing economic decisions. According to the classical approach it consists of farmers producing pigs, buyers and intermediary companies, slaughter entities of different scale of activity and finally processing and packaging companies. In this process wholesalers and distributors responsible for the delivery of, meat and its preserves to consumers are the recipients (Fig.1). The group of clients is divided into traditional consumers purchasing meat in butchery shops, megastores or outlets and organizational recipients, with the growing role of

HoReCa<sup>2</sup> sector. In the analyses of the last two decades of economy development in Poland the impact of meat import streams should be also considered, basically resulting from foreign capital investments into the meat sector in Poland. The export of pigs and pork to the UE and other markets has also influenced the pig supply chain.

The complex nature of the broad network, and the impact of the institutional environment in particular, generates an increasing flow of information mainly related to the balance issues, significantly hindering communication, especially feedback, and monitoring of the process as a whole. Indisputably, it is related to the disproportionate numbers of entities in particular groups of the chain. The most numerous of them is still the pig producer link. Despite the decline of the number of farms declaring pig production (by almost 80%) observed during the last two decades. It should be noted, however, the shift is not reflected in the productivity and efficiency (a number of pigs per farm), which could be a positive effect of changes taking place in the structure of the sector (tab.1).

Tab. 1. Changes of number of farms producing pigs and scale of production in selected years

Year	Number of farms (in 1000)	Scale of production (pig number per 1 farm)					
		1-9	10-19	20-49	50-99	100-199	200 and more
2002	760,6	402,2	146,4	133,5	48,0	20,9	9,5
2010	397,7	193,7	74,0	73,7	31,0	15,3	10,1
2014	219,6	91,7	43,5	44,9	20,8	10,5	8,2
2015	172,2	61,3	35,6	38,4	17,7	10,0	9,0

Source: based on: Program Rozwoju Głównych Rynków Rolnych na lata 2016-2020

The issue of production consolidation also concerns butchery and meat processing companies, which impose their conditions on individual, dispersed farmers, but have little power to compete with foreign companies. According to the data published by Main Veterinary Inspectorate in 2013 on slaughterhouses operating in the country there were 1453 slaughterhouses approved and overseen by this institution, 785 of them carrying out slaughter of farm animals, 1110 carrying out cutting and boning and 883 facilities dealing with meat processing (<https://www.wetgiw.gov.pl/>). More comprehensive information is provided by REGON register data, according to which on 31st December 2016 in Poland there were altogether 5458 entities of different size and location<sup>3</sup> performing slaughter and meat processing (including poultry meat)<sup>3</sup>.

Tab. 2. Changes in links of supply chain of pork in Poland

Specification	Years	
	2006	2016
Number of farms producing pigs (thousands of units)	761	172
Number of slaughter and meat processing companies	4271	5548

<sup>2</sup> Hotels- Restaurants- Catering

<sup>3</sup> BIP GUS Kwartalna informacja o podmiotach gospodarki narodowej w rejestrze REGON deklarujących prowadzenie działalności dostęp on-line: <http://bip.stat.gov.pl/dzialalnosc-statystyki-publicznej/rejestr-regon/liczba-podmiotow-w-rejestrze-regon-tablice/kwartalna-informacja-o-podmiotach-gospodarki-narodowej-w-rejestrze-regon-deklarujacych-prowadzenie-dzialalnosci/>

(thousands of units)		
Number of retail supply entities (thousands of units)	7191	3610
Number of citizens (thousands of units)	38,14	38,43
Number of farms / processing companies	178,18	31,00
Number of farms / retail supply entities	105,83	23,92
Number of citizens / Number of farms producing pigs	50,11	223,43

Source: own calculations based on: RS GUS oraz Raport rynek handlu detalicznego w Polsce - potencjalne skutki wprowadzenia węgierskich rozwiązań regulacyjnych dla polskich sieci handlowych, 2015. Wyd. PWC.

Assuming, that consolidation of the particular stages within the pork production chain is a priority, it may be concluded that the observed changes follow the required direction in every aspect. However, a few negative phenomena should be noted, too. The pace of the changes seems to be worrying, especially given the changes in the size of production and volume of herd per farm. The second significant observation concerns still too low a number of slaughter and meat processing companies, as well as retailers, responsible for transfer of information about balanced development to the producers. In the area of the retail, the number of entities noticeably decreases and if the analysis encompassed only entities of trade in food products (about 115 thousands) - the proportions would become worse. Although it finds reflection in the general trend of retail concentrating around large supermarkets and increasingly popular in Poland outlets, the observed disadvantageous phenomenon becomes another barrier to achieve sustainability of the pork supply chain.

### Summary

The article analyzed the situation of Polish pork production sector in the context of all stages of the food distribution. On the basis of the available information it turned out that particular elements of the pork supply chain changed significantly. It concerns both real (producer-processor-client) and instrumental areas (among others: information transfer between sectors). The analysis also showed two worrying phenomena. One is related to the pig production structure (the decreasing number of farms does not cause the meaningful increase in the concentration of production calculated per farm). The other is related to the competitiveness: the seemingly strong concentration rate of slaughter and meat processing stages in Poland is still insufficient regarding the power of foreign competition on the liberalizing agri-food market, both inside and outside the EU.

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## 2.2. Typical Products Sustainability in Southern Italy: Exploring Apulian Consumer Perception

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**Keywords:** Apulian consumer attitude, traditional agri-foods , food sustainability, Mediterranean.

### Introduction

In a highly globalized economy, consumers are increasingly paying attention to food quality, typicality and ethical values of agri-food products.

Nowadays, consumers are more sensitive to the food origins, preferring local ones those with quality certifications schemes (e.g.. PGI, PDO, Organic) and/or with a low environmental impact. Local and typical agro-foods offer an important opportunity for farmers to add and retain value to produce (**Ilbery and Maye, 2005**). There is a need to promote a broader assessment of the links between health, nutrition, local food products and sustainability, with traditional and typical foods at their epicentre (Trichopoulou, 2015). Moreover, to maintain and preserve local products it is of paramount importance for policy makers and private sector to invest in their sustainability and to highlight the strong link with the territory of production. In Apulia region (south-eastern Italy) agri-food products play an important socio-economic role (**Istat, 2010**). The region is well known by a strong agricultural potential supported by a unique culture, tradition and biodiversity. The region peculiarities are essential determinants of the typicality of its agri-products. These peculiarities are related to different endogenous factors including micro-climate, biodiversity, ecosystems, production and marketing techniques, farmers knowledge, traditions, uses and customs.

In this context, the programme *Agriculture & Quality* (2013-2015) of *Regione Puglia* (Regional Government of Apulia), technically and scientifically supported by the CIHEAM-Bari (*Centre International de Hautes Etudes Agronomiques Méditerranéennes* - Bari), was established aiming to the qualification and enhancement of the regional typical food products through the setting up of the quality scheme “*Prodotti di Qualità Puglia*” (Quality products of Apulia, PdQP) (**Capone, et al. 2016**). Moreover, a pilot project was carried out to ensure that any products adhering to the quality voluntary scheme (PdQP) should/must comply not only with the quality requirements defined by the technical specifications, but also with sustainability requirements.

In this framework, an exploratory survey was conducted among Apulian consumers to collect useful information/feedback on their attitude towards the typical products of the region. The present paper will focus on the consumers’ perception of the sustainability of typical products in Apulia region. The survey aimed to contribute to the identification of the main criteria that drive the food purchasing and consumption decisions, deepening in this context the issue of consumer perception towards the typical/traditional Apulian products (e.g. those included in the Atlas of Traditional Agri-food Products of Apulia region) (**Regione Puglia, 2010**).



## Methods

The survey was conducted through a questionnaire structured in 35 questions. It was built around the four pillars of sustainability: (1) environmental pillar, questions were focused on consumers' attention towards seasonal and low-impact products; (2) socio-cultural: questions aimed to explore how the consumption of typical products favour mutual exchange and social conviviality as well as the role of women in passing on the traditions related to the typical/traditional products in Apulia. (3) The economic approach focused on the consumer's willingness to pay higher prices for typical/traditional with respect to conventional products. (4) Lastly, nutritional-health concern: different questions were formulated with the aim to have a better understanding about the attention paid by Apulian consumers to the health and nutritional aspects in the choice of a food product.

The questionnaire<sup>4</sup> was designed through "Survio" platform and was made available online from 18 June until 22 July 2014. Responses were gathered/collected online as well as face-to-face. Since the entire regional area was concerned, the survey was performed in all five provinces of Apulia region in order to have a representative sample of the region. In fact, Apulia is a region that encompasses a large typical cultural diversity. The total number of collected questionnaires including - both online and face-to-face - was 168 (50 from Bari province, 25 from BAT - Barletta-Andria-Trani - province, 22 from Lecce province, 17 from Brindisi, 25 from Taranto and 29 from Foggia province). This survey was addressed exclusively to consumers who make their own food purchases to be able, therefore, to assess and analyse their behaviour and the key criteria that drive their products choice. The survey fact-finding shows that today's consumers are watchful of what they eat and attribute great value to food.

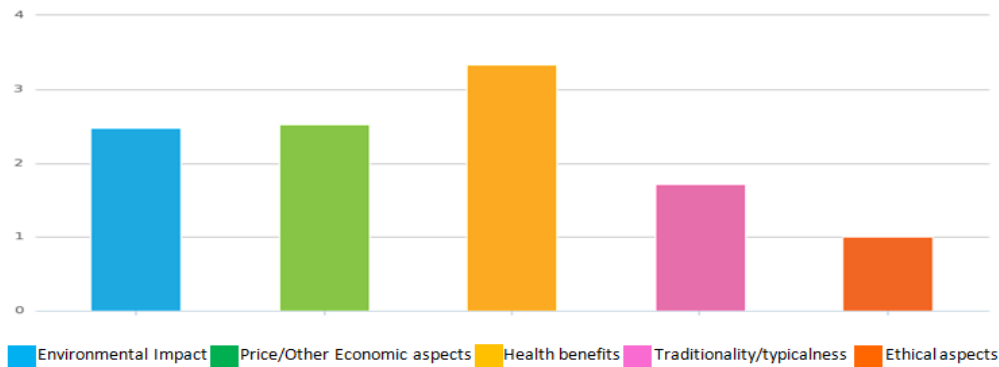
## Findings

The survey has highlighted that the consumer perceives local products as being more respectful of the environment compared to conventional products, because they have greater traceability. For this reason, the Apulian consumer is more confident in these products also from a health point of view. This often justifies a greater willingness to pay for a typical, traditional, local and seasonal product. According to the survey, the consumer is currently more informed, more sensitive to and watchful of what he/she buys, and takes into account factors such as the origin, the nutritional values of products, etc., relying on what is shown on the label. The label as well as logos and certifications are the source of information that the consumer takes as the most reliable. From the survey conducted on the consumption of typical/traditional Apulian food products emerge important data to assess both the socio-economic situation of the region, and the impact that these products have in terms of sustainability for each one of the four pillars (environment, economy, society and culture, nutrition and health). One of the first questions addressed to consumers was to assess the weight of some variables in their food products choice. The elaboration of the answers (**Fig. 1**) shows a focus on health, followed immediately by the price and the environmental impacts.

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<sup>4</sup> <http://www.survio.com/survey/d/Q5A9W7T7N7C8B3W3W>

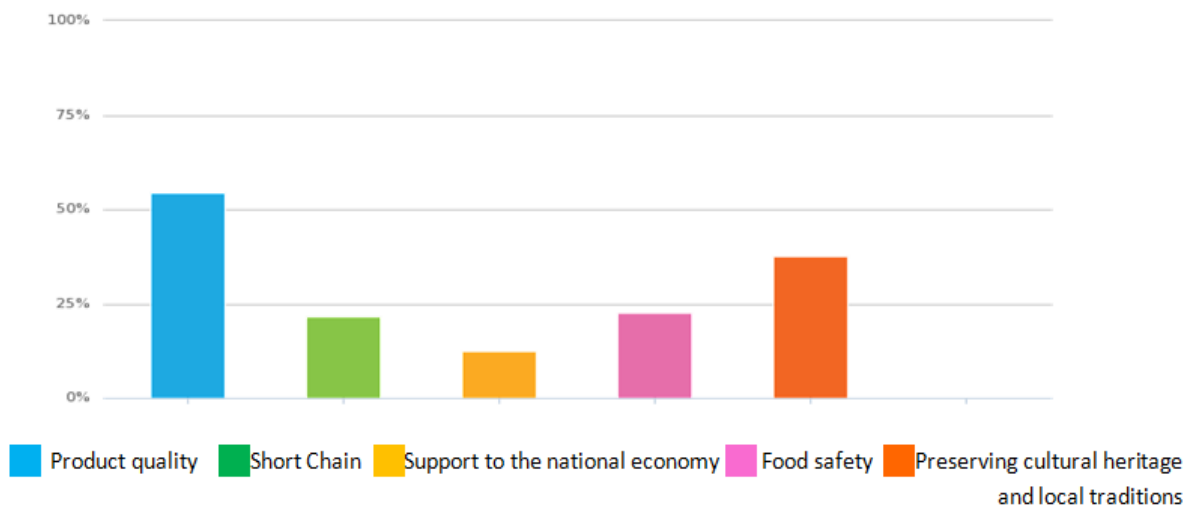
**Figure 1.** Most relevant variables in determining agro-food products choice by Apulian consumers (n=168). N.B. For each variable was associated by the respondents a weight from 1 to 5.



*Source:* Authors' elaboration based on the survey data.

Considering the consumer's attention to the environment, the survey results showed that approximately 60% of the sample know and buy environmentally friendly products. Meanwhile, 26.8% know these products, but do not buy them mainly because consumers have not guarantees that the product is truly environmentally friendly. Probably a certification system would give more confidence to consumers encouraging them to purchase typical products. Surprisingly, 97% of respondents prefer to buy seasonal products. This is a very important datum since it reflects the high consumer's attention to the seasonality of the products, but this piece of information could hide consumer confusion about the real product seasonality. A further important data that emerges from the elaboration of the answers/responses is that the traditional feature and the typicality of a product are connected to a high quality. The perception of the consumer, therefore, is to consider a typical/traditional product not only a genuine product, but also a product that reflects local identity (**Fig. 2**).

**Figure 2.** Aspects and issues associated with typical/traditional products by Apulian consumers (n=168). N.B. Respondents had the possibility to provide multiple answers.



*Source:* Authors' elaboration based on the survey data.

Moreover, 85% of respondents believe that the consumption of these products encourage social sharing and conviviality. This underlines that typical/traditional products have a very strong link with the production territory and its dynamics.

It is interesting to put in evidence or emphasize that 91% of the sample believe that woman plays a key role in passing on the tradition of the typical/traditional products. This derives both from the knowledge and the know-how passed down from mothers to daughters in preparing food, and from the figure that the woman still holds in the household.

Furthermore, the survey shows that Apulian typical/traditional products are purchased mainly because they are perceived as genuine products, with better organoleptic characteristics, and because they are marketed through fairly short chains.

Typical/traditional products are primarily purchased at large retailers, small neighbourhood shops or local markets with a frequency of two or more times a week. Moreover, 35% of the sample buy these products at least once per week, and a significant percentage (around 20 %) buys them every day.

The typical/traditional Apulian products are generally perceived by consumers as more expensive than conventional products. Despite this, the majority of respondents would be willing to pay a higher price that goes from 10% to over 20% than market/commercial price of the same product. In fact, the typical/traditional Apulian products are perceived as environmentally friendly and healthier than a conventional “*non-typical*” products which could justifies the greatest willingness to pay.

### **Conclusions and Implications**

The findings of this investigation has shown how today, in a global market, consumers are careful about what they eat and the importance of food and how consumers prefer typical local products reflecting traditions and culture of a specific area. Furthermore, local products are perceived by consumers as environmentally friendly than conventional products.

Another important aspect that emerged from the survey findings consisted on consumer perception of the typical/traditional Apulian products as healthy one. This, often, could justify the high willingness to pay towards a typical/traditional, local and seasonal product, rather than another conventional product.

The consumer takes into account aspects such as the origin, the nutritional value, etc. of the products relying on what is reported on the label. The label, as well as logos and certifications, are the most reliable source of information for customers. In fact, especially in an urban context, most of the purchases are made at large retail outlets that offer a wide range of products. In this context, the label is the only source of information available for the consumer. Even if marks, logos and certifications are a guarantee for the consumer, very often these are not well known as well as many typical/traditional Apulian products, so it would be necessary to strengthen the dissemination of the labels and publicize the typical products in every territorial reality of Apulia region while up-scaling this dissemination process also at national level.

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## 2.3. Evaluation of logistics sustainability in family farms in terms of the LSR concept

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**Key words:** logistics processes, LSR concept, family farms

### Introduction

In the food supply chains, the starting point for the production of products and raw materials for further processing is agricultural enterprises - large and family. At this level, the quality of the products which processed at the next stage is developed. The products is addressed to the end consumers. For the consumers, it becomes increasingly important to know in what conditions the food is produced, whether it is safe, healthy, or the production process is environmentally friendly.

Also, social and ethical issues are becoming so important. In this regard, the evolution of the views included in the various concepts is observed. The range of pro-ecological activities promoted under the concept of *sustainable development* (SD) (World Commission, 1987) has been extended to social aspects in another concept called *corporate social responsibility* (CSR) (Ciliberti, Pontrandolfo, Scozzi, 2008) in which Human rights were addressed (Robinson, 2004).

One of the first processes in which the search for environmentally friendly solutions was carried out were transport processes. Gradually the scope has expanded into forwarding and logistics processes. Further evolution in the direction of pro-ecological activities in logistics has led to the introduction of prosocial sphere, referring to CSR. On this basis a new concept has emerged in relation to logistics processes, defined as the *logistics social responsibility* (LSR) (Carter, Jennings, 2002; Murphy, Poist, 2002; Iakovou et al, 2014).

Taking into account the role and significance of agricultural enterprises in food quality and environmental impact, the purpose of the research was to assess the sustainability of logistics in this link of food chain in terms of the LSR concept.

### Methods

Five family farms (F) from Wielkopolska region of Poland have been selected for the research. Farms operated on the following areas: (F1): 32 ha AL; (F2): 58 ha AL; (F3): 64 ha AL; (F4): 71 ha AL i (F5): 131 ha AL (*agricultural land*). The mixed production (plants and animals) have been main direction at these farms.

The study utilized adopted method of the logistics sustainability estimation for the family farms in terms of the five main areas of the LSR concept. These are: *purchasing social responsibility* (PSR), *sustainable transportation* (ST), *sustainable packaging* (SP), *sustainable warehousing* (SW) and *reverse logistics* (RL) (Wajszczuk, 2016). There has been defined a sustainable sphere for all these processes, like: social, environmental and economics. Within the main processes of LSR, subprocesses were evaluated. Then the points obtained were aggregated within the individual LSR main processes as well as within the sustainable spheres. The

possible maximum scores have been shown in Table 1.

Table 1. Maximum score for sustainability in a given LSR /Sustainable sphere.

Sustainable sphere	Main processes of LSR					Total in Sustainable spheres
	PSR	ST	SP	SW	RL	
Social	26	6	4	2	4	42
Environmental	16	24	14	12	24	90
Economics	32	24	2	4	6	68
Total	74	54	20	18	34	X

Source: Wajszczuk K. (2016). Metodyka pomiaru zrównoważenia logistyki dla przedsiębiorstw sektora gospodarki żywnościowej na bazie koncepcji LSR – ujęcie procesowe.

This scoring aggregation system has made it possible to individually evaluate of LSR main processes (5 indicators) and to identify the level of sustainability in the social, environmental and economics spheres of the LSR concept (3 indicators). The assessment of the degree of sustainability of the sphere/main process in terms of the LSR concept followed a five-level scale, which is as follows:

- > 80% - given sphere/LSR main process - sustainable highly
- 60% - 79,9% - given sphere/LSR main process - sustainable well,
- 40% - 59,9% - given sphere/LSR main process - sustainable middle,
- 20% - 39,9% - given sphere/LSR main process - sustainable low,
- < 20% - lack of sustainability in a given sphere/ LSR main process

## Findings and conclusions

The results of the analysis of the degree sustainability of logistics in the social, ecological and economic dimensions of the examined farms were presented in Table 2. From the presented data it can be noticed that farms performed LSR practices generate weak (F3, F4 and F5) or none (F1 and F2) a degree sustainability in the environmental sphere. However, the complete lack of logistics sustainability was noticed in the social sphere. Only one of the largest area farm has achieved the threshold of low sustainable. In turn, the most sustainable sphere in terms of logistics has been the economics sphere. Two farms (F4 and F5) recorded an average degree of sustainability. In the next two (F3 and F2), a low degree of sustainability was noticed, while in the F1 farm found no economics sustainability in terms of logistics processes.

Table 2. The degree of logistics sustainability in the particular sustainable spheres

Sustainable sphere	Total in sustainable spheres									
	F 1		F 2		F 3		F 4		F 5	
	scores	%	scores	%	scores	%	scores	%	scores	%
Social	5	12,5	6	15,0	6	15,0	7	17,5	8	20,0
Environmental	9	11,3	15	18,8	22	27,5	24	30,0	27	33,8
Economics	13	19,7	21	31,8	26	39,4	31	47,0	33	50,0

Source: Own calculations.

Table 3 presents the results of the analysis of the degree of logistics sustainability in the main LSR processes.

Tabela 3. The degree of logistics sustainability in the main LSR processes

Main LSR processes	Total in the main LSR processes									
	F 1		F 2		F 3			F 4		F 5
	scores	%	scores	%	scores	scores	%	scores	%	%
PSR	10	13,9	15	20,8	15	20,8	19	26,4	21	29,2
ST	12	23,1	18	34,6	27	51,9	31	59,6	31	59,6
SP	3	18,8	3	18,8	3	18,8	3	18,8	6	37,5
SW	0	0,0	2	12,5	4	25,0	4	25,0	5	31,3
RL	2	6,7	4	13,3	5	16,7	5	16,7	5	16,7

Source: Own calculations.

By comparison of LSR main process indicators, according to the adopted assessment scale, sustainability of transport (ST) across all surveyed farms is the best sustainable. Within this process, at the three farms (F3, F4 and F5) have been noticed a degree of middle sustainability. Whereas at farms F1 and F2 – low sustainability were noticed. In turn, the lack of logistics sustainability in RL reported in all tested objects. The remaining main LSR processes are low sustainable, or as is the case of the F1 farm - not sustainable at all.

In general, the paper presents the results of research evaluating the degree of logistics sustainability in selected family farms in the aspect of LSR concept. Case studies conducted in five farms have shown an increasing degree of sustainability of logistics as the area grows - both in terms of individual LSR processes and in social, environmental and economics spheres.

Similarly, given the size of the enterprise, Ciliberti, Pontrandolfo and Scozzi (2008) observed in their studies. They found that the degree of logistics sustainability, in terms of LSR concepts, is increasing as the size of the business grows. According to the authors' own research, only 9.8% of LSR practices were implemented in small enterprises, with an average share of 20.3% in middle companies and 69.9% in large companies.

In light of the increasing public pressure to increase the safety in the food supply chain, agribusiness companies that buy raw materials from small farms, wanting to preserve transparency, will force their adoption of LSR rules to be increasingly enforced. On the basis of this emerging trend, it is appropriate to conclude that even small companies, which are farms, should step up their implementation of LSRs in their development strategies, thus becoming the responsible raw material suppliers for large companies.

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## **Chapter 3: Agri-Food Supply Chains – World Case Studies**

### **3.1. Supply chain performance indicators: case study of Costa Rican coffee production**

(Mercedes Montero, Ann-Christine Schmalenberg, Reiner Doluschitz, Olman Quirós Madrigal)

### **3.2. Fish Supply Chain in the Sultanate of Oman**

(Abdallah Omezzine, Omar al-Jabri, Mohammed Usman, Said Younis)

### **3.3. Impact of Milk Cooling Plant Adoption on Small Holder Farmer Incomes in Nandi County, Kenya.**

(Chumo Chepchumba, Korir Mark)

### **3.4. Characterization of an agricultural area of Cundinamarca, its problems and possible solutions**

(C.P. Pérez, J.E Naranjo, D.M. Ramírez, A. E Jaimes, J. D. Arévalo Arias)

### **3.5. Supply chain analysis of exotic carps in Jammu & Kashmir, India**

(U. Nisar and N.R. Kumar)

### **3.6. Analysis of the ‘Panela’ value chain in Utica-Colombia**

(Natalia Martinez Zárate, Fabio Alberto Pachón, Wolfgang Bokelmann)

### 3.1. Supply chain performance indicators: case study of Costa Rican coffee production

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**Key words:** coffee, supply chain, performance, indicators

#### Introduction

Costa Rica's exporting origins were built on coffee exports (ICAFE 2016a). Nowadays, although food supply chains have become more complex and specialized (Ross 2009), coffee production is one of the pillars of the agricultural exports in the country (Procomer 2015). The large proportion of small scale coffee production makes it a very important source of income for many agriculture-dependent families. For example: in 2016, 97.7 % of the coffee producers delivered less than 300 *fanega* (258 kg coffee cherries /46 kg green coffee beans ) to the processors during one harvest season and 92% of farmers owned less than 5 hectares for coffee production (ICAFE 2016b).

Agri-food supply chains lack standardized supply chain performance indicators, and coffee is not the exception (COSA 2013). Van der Vorst (2000) describes indicators as criteria with which the performance of products, services and production processes can be evaluated. Although coffee certification systems have detailed standards for performance measurement, these are voluntary and do not include all farmers, certifications cannot measure the country's performance

To construct a basis for an analytical framework, performance measurement indicators for food supply chains were chosen regarding the three pillars of sustainability and their feasibility for evaluating the supply chain under consideration. This research intends to provides a holistic perspective on performance base on a case study of a Costa Rican coffee producer association called *Asociación de Productores Agropecuarios de las Comunidades de Acosta y Aserrí* (ASOPROAA).

#### Methods

To attain a framework for analysis, literature review on agri--food supply chain indicators was conducted. Aramyan's (2007) approach was used and 22 expert surveys were conducted from January to March, 2016 via a semi-structured questionnaire that addressed indicators from economic, social and environmental perspectives (Table 1). It is important to note that although numerical information was collected, these are only valid for 2015/2016 harvest since coffee prices may vary widely.

Table 1. Selected indicators for coffee supply chain performance

<b>Economic</b>	<b>Social</b>	<b>Environmental</b>
Production costs	Communication	Quality
Volume	Training-education and personal skills	Pesticide use
Flexibility		Storage and transportation facilities
		Energy and water use

### Findings

The following paragraphs provide a brief description of economic, environmental and social aspects considered for analysis. On these findings, it is important to note ASOPROAA has two production systems: traditional and *micro lote*. The latter is a type of coffee that grows in special microclimates within a coffee plantation and has a higher quality than the rest of the harvest.

#### a. Economic

*Micro lote* (2) and traditional (15) farmers were interviewed, and although there is expected to be a correlation between farm size and expenses, results did not indicate there is such in this case. Other aspects such as disease prevention and handling, relief, and microclimate management should be considered instead of farm-size as a proxy for production costs. In terms of profits, there is also no strong correlation between inputs and yield. Coffee production was profitable for 14 farmers and nonprofitable for 3 farmers, however more data are needed to report concluding remarks. Average income per harvest were estimated in 2.37million *colones*<sup>5</sup>. Further research is needed to address how profitable the business is since information such as hours of work and labour's efficiency, inputs and other associated costs, as well as family's dependency on coffee should be considered. Flexibility, although an important indicator for performance was not really in question in coffee production. Once coffee cherries are ripe, these are picked up and must be processed the same day; since there is high demand, there is no evidence of bullwhip effect affecting the association.

#### b. Social

As there are no records about every communication behaviour between farmers, suppliers and the association, coffee farmers were asked of about the type and frequency of their interactions. Most frequent Responses were: constant exchange of information (68%) done either by person (52%) or by phone (48%). Farmers 'collaboration with their suppliers was also obtained, 63% mentioned a constant exchange of information and this mostly done in person (63%).

In regards of education level, agriculture in Costa Rica is often linked to low education, which was also the case for most farmers in ASOPROAA in which 68% have a 6 year stay at school, because of the urgency to work on the family business. Most farmers (56%) mentioned how they learned how to produce coffee either from their families or from other farmers. Formal education is not common for farmers; however, a generation change lies ahead since many of

<sup>5</sup> Costa Rican currency. Exchange rate 542 colones/1\$ (average from January-March, 2016). Banco Central de Costa Rica. Available:

<http://indicadoreseconomicos.bccr.fi.cr/indicadoreseconomicos/cuadros/frmvercatcuadro.aspx?CodCuadro=400>

the farmers' younger generations strive for higher education and therefore different types of jobs.

**c. Environment:**

Farmers are mostly concerned about in-farm diseases management, especially *La Roya*, because of its influence on product quality. According to their perception, coffee processing (*beneficio*) does not affect quality as much as the in-farm management does. *La Roya*'s importance can be observed on fungicide use: 91% of financial expenses on agrochemicals used are for fungicide. Nonetheless, estimated of agrochemical use are under national average and governmental recommendation.

Regarding energy and water use: farmers mentioned they do not use energy for production, however there is an associated transportation cost. Only 4 farmers mentioned water use for production.

**Conclusions and Implications**

The results of the research study provide a selected overview of the current situation in the harvest of 2015/2016 in the supply chain of ASOPROAAA. The relationship between production costs and farm-size as well as the expected result of higher input costs would lead to higher yields could not be confirmed by the collected data. The pictured situation about the diseases, which has high influence on the product quality, mirrors the relevance of this topic for the coffee sector.

A long-time investigation should be considered in order to be able to analyse the influences of the changing harvest results and the changing coffee prices over the time. It would also be interesting to keep an eye at the structure of the sector. As broached in this chapter, the demographic change will play an important role for the future development of the sector and the Republic of Costa Rica.

What would happen if international markets bring prices down? How can farmers and the association handle these types of situations? They are now used to selling to all production because of high demand of coffee but what would happen if the association experiences a reduction of prices and/or demand? Addressing warning and resiliency mechanisms is a challenge for ASOPROAA and the coffee sector, which is also a interesting topic for further research in which benchmarking with other coffee producing regions or countries could give a broader perspective of performance.

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### **3.2. Fish Supply Chain in the Sultanate of Oman**

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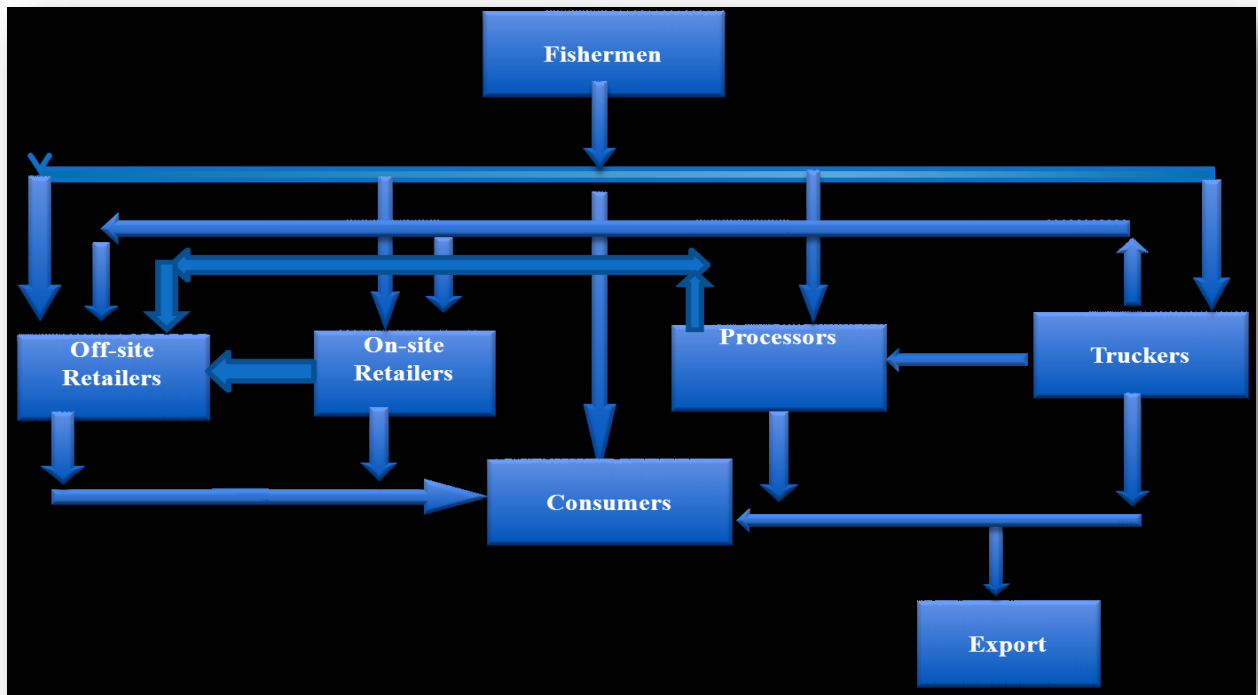
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**Keywords:** fish supply chain, Oman, transportation means

Fisheries play an important role in the contribution of Oman's economy by providing employment and satisfying an important source of diet for over 4 million people in Oman. The sector contributes to the national income, employment and foreign exchange. It affects the livelihood of more than 200,000 people directly and indirectly. The available marketing network for fish does not promote these objectives (Omezzine, 1998). Therefore, it is very important to develop an efficient distribution system capable to meet different needs of different actors involved in the local fish marketing chain such as fishermen, processors, traders, consumers and international markets. The total value of the GDP of the fisheries sector has increased from RO 162 million in 2013 to RO 182 million in 2014, which is an annual growth rate of 12%. According to the 2015 fishery statistics, the total fish production increased from 211,000 tons in 2014 to about 248,000 tons in 2015, an annual growth rate of 18%. In 2015, traditional and coastal fishing has made the highest proportion of production reaching 99% of total production (MAF, 2015).

Fish exports are the most important source of foreign currency. Policies therefore encourage the trade and a high percentage of the local catch is exported to the neighboring countries (regional consumers) with the highest quality going to the international consumers. Most of the catch produced by the traditional fisher sector is landed on the beach where fish buyers congregate to compete for the purchase of the catch. The buyers come with trucks carrying fiberglass insulated fish boxes to facilitate moving fish to their processing plants or markets.

The export processing companies have installed processing, freezing, and cold storage facilities; these located in the Muscat area, Duqm, Mashirah and Salalah



Source: Al Qatan (2010) Operating a wholesale fish market in the sultanate of Oman Analyses of external factors.

The current system of distribution is mainly handled by truckers who take the catch from the fishermen at the landing sites or primary markets to the secondary markets inside the country and to the neighboring countries.

The traditional fish marketing system in Oman is characterized by fishermen, landing their catches on scattered jetties in fish baskets along the coast often known as landing sites these catches are bought by small boats or larger vessels called “Dhows” often with poor storage facilities. There is a relationship between the fish traders and fishermen that is often long-lasting, providing an assured market outlet to the small-scale artisanal fishermen and a source of steady supply to the trader with an informal credit system in place.

One common issue noticed was the poor quality of trucks used in transportation of catch to the various markets inside the country. It is observed more than 40% of small traders without automatic cooling capacity usually load the fish in containers along with ice and transport them. These traders collect fish at the landing sites with the cooperation of the fishermen. This practice results in quicker deterioration of the catch, since it is highly perishable commodity, often resulting in lower prices and few takers. Various studies and reports indicated inadequacy in cold chain management particularly for freshly landed fish that can be exposed to elevated temperatures (40-45 C<sup>o</sup>) for up to 5-7 hours thus accelerating deterioration of the fish quality (Al-Jufaili M. Saud and Opara Linus U. , 2006; Al-Jufaili, 2006; Opara Linus U. and Al-Jufaili Saud M., 2006). Furthermore, loses in both quality and quantity limit the profitability and competitiveness of local fishery produce.

Larger trucks with automatic refrigeration trucks carry the catch to neighboring countries, cold stores and processing facilities. Constraints for proper supply in Oman are driven by lack of proper on board and handling post-harvest. Evidence of lack of suitable shore-based fish handling, collection, storage, marketing and distribution facilities. It was observed that produce in small trucks with improper refrigeration facilities travelling to neighboring countries was refused by the local authorities due to deterioration of fish. Another factor for the delay border and customs checks.

Maintaining a properly modern cold chain with all the amenities is essential to minimize product deterioration and achieve maximum shelf life for the catch. Many potential problems in the supply chain can be avoided or effectively managed by understanding the critical handling issues and carefully planning each load.

With most of the trade occurring at landing sites, lacking basic infrastructure is a major cause for concern. However, the government is facilitating as a part of its moves to bring the entire seafood supply chain under control and improve procedures throughout the chain. In order to improve supply, safety and quality of fish for the domestic and export supply chain, a large scale wholesale fish market has been constructed by the Ministry of Agriculture and Fisheries with full modern services such as electronic auctioning, fish quality checking, ice machines, potable water, hygienic containers, display areas, facilities for monitoring temperature, sanitary inspections and etc.

Further it has been decided by the government that all small wholesale markets be established and connected all electronically to assist buyers and sellers. As well as facilitating trade of local fish, these central markets will in future be used for imported and farmed fish. Enhanced legislation for the organization of fish markets is also one major step in improving the supply chain of the Omani catch. These legislations should include monitoring quality throughout the supply chain, where labeling and traceability considered to be the poorest, if not absent.

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### 3.3. Impact of Milk Cooling Plant Adoption on Small Holder Farmer Incomes in Nandi County, Kenya.

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**Keywords:** Milk Cooling Plant (MCP), Adoption, Small Holder Farmer (SHF), Incomes, Propensity Score Matching (PSM).

#### Introduction

In Kenya, it is widely cited that about 70-80% of milk production comes from smallholders, with the remainder from larger producers, estimated at about 5,000 (FAO, 2007). The estimates of the number of smallholders vary. The number of 600,000 (Omoro *et al.*, 1999) has been widely cited for many years. According to SDP, the Kenyan population has grown significantly over this period and the number is no longer valid. According to their revised estimate the number of smallholder dairy farms is much greater at about 1.8 million (ILRI, 2007).

One point eight million farms represent about 35% of rural households and 26% of total households in Kenya. Most of them combine dairy production with maize, or other cash crops. ILRI estimates that about 40% of their income comes from dairy. In addition to being an important source of recurrent revenue cattle is also an important asset investment providing non-recurrent income (from selling cattle or meat) (GOK, 2007). Income from dairy is also the only year-long recurrent revenue from agriculture, though revenue flows do fluctuate with seasons

Milk is perhaps, the “only liquid that flows upwards”; its production is carried out in widely dispersed production units in rural areas but its market is largely, in urban areas (Sirohi *et al.*, 2009). For dairying to be an assured source of income for the rural households and cater for the milk demand of urban consumers, these two groups of stakeholders have to be brought together. The logistical challenge of linking rural producers with urban markets is compounded by the highly perishable nature of milk. Thus, processing is an important component in milk chain, linking the producers to the consumers. However, the bulk of raw milk produced in Nandi County is marketed in the unprocessed form.

Heifer International and its partners has assisted farmers organize into dairy farmer business associations (DFBA), such as Kabiyet dairy plants. They support farmers increase their incomes through multiple interventions in the dairy value chain. Its aim is to remedy inherent issues trapping dairy farmers in extreme poverty. Farmers are largely fragmented and unorganized, with weak bargaining power, and are vulnerable to exploitation by informal milk traders. Moreover, because farmers lack information and inputs the quality of the milk produced is generally poor. Heifer International and its partners are remedying these pitfalls through an innovative approach leading to farmer-owned, cooperative-like business models centered on milk chilling plants (MCP) (KDB, 2012). With this backdrop, this study examined the impact of adoption and intensity of use of milk cooling plants (MCP) and its impact on rural household

incomes in Nandi County. The main issue this study sought to find out is if the efforts of encouraging the proposed model uptake by farmers by the development partners and the Government of Kenya had yielded its ultimate result of increasing farm household incomes.

## Methods

A multi-stage sampling procedure involving a combination of purposeful and random sampling procedures was used to draw a representative sample of adopter and non-adopter dairy farmers. Both descriptive and inferential statistics were combined to give a comprehensive explanation of the study results. For descriptive statistics mean, median, and variances were used. For inferential statistics Z - and P-Values were used to describe some of the differences observed between adopters and non-adopters. Propensity score matching model was used to measure the impacts of adoption & intensity of use of milk cooling plants.

Propensity score matching method was used to address the self-selection bias. This method took into account the counterfactual situation: “how much did the adopters benefit from milk cooling plants compared to the situation if they had not adopted”. PSM balanced the distribution of observed covariates between a treatment group and a control group based on similarity of their predicted probabilities of having a given “propensity score”. The PSM does not require a parametric model linking facility placement to outcomes, and thus allows estimation of mean impacts without arbitrary assumptions about functional forms and error distributions (Jalan and Ravallion, 2003).

## Findings

The finding on the impact of adoption of milk cooling plants on farm household income showed that adoption and intensity of using milk cooling plants had significantly and positively impacted on farm household incomes for the adopters. The results further showed that institutional factors, economic factors and individual farmer characteristics’ such as age, level of education and gender significantly affected adoption and intensity of using MCP.

Propensity Score Matching Results for Adoption of Milk Cooling Plants.

The results were estimated by matching estimator, average matching effect with weighting matrix inverse variance. The results showed that population average matching effect had significant effect on household’s income.

The results also showed that population average matching effect was significant (p – value  $0.000 < 0.001$ ). The hypothesis of this study stated that there was no significant impact of adoption of milk cooling plants on households’ income. The results from propensity score matching reported in table 3.1 showed that there was significant impact of adoption of milk cooling plants on household’s income. Therefore based on this finding this hypothesis was rejected.

**Table 3.1: Results of Propensity Score Matching of Adoption of Milk Cooling Plants**

INCOME	Coefficient	Std. Error	Z – Value	P >  Z
SAME	0.6769	0.0176	38.55	0.000
PAME	0.6808	0.0172	39.55	0.000

Source: Authors Data Analysis Results 2015 using R

**Table 3.2: Results for Covariate Balancing Test for Propensity Score Matching on Adoption**

Deviance Residuals:

	Min	1Q	Median	3Q	Max
	-2.5285	-0.8262	-0.3502	0.9237	2.2025
Coefficients	Estimate	Std. Error	z value	Pr(> z )	
Intercept	46.748736	16.876862	2.770	0.00561	**
Age of the farmer	-0.004716	0.007537	-0.626	0.53153	
Education level of the farmer	0.615518	0.050208	12.259	< 2e-16	***
Extension visits	0.014804	0.007163	2.067	0.03876	*
Access to credit	1.501017	0.247033	6.076	1.23e-09	***
Membership to cooperatives	0.621798	0.248004	2.507	0.01217	*
Membership to cooling plant	-0.418106	0.171792	-2.434	0.01494	*
Land ownership	0.793363	0.185493	4.277	1.89e-05	***
Gender of the household head	0.370644	0.134249	2.761	0.00576	**
Transport cost	-0.044226	0.018662	-2.370	0.01779	*
Land size in acres	0.069314	0.021510	3.222	0.00127	**
Other occupations	-0.429959	0.054486	-7.891	2.99e-15	***
Ratio of milk consumed	-1.471996	0.466067	-3.158	0.00159	**
Off- farm income	-0.077538	0.010886	-7.123	1.06e-12	***
Income from milk sales	0.157345	0.065671	2.396	0.01658	*
Distance to MCP	-26.614608	11.611013	-2.292	0.02189	*

Significant codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1 (Dispersion parameter for binomial family taken to be 1) Null deviance: 2292.5 on 1661 degrees of freedom, Residual deviance: 1759.9 on 1646 degrees of freedom AIC: 1791.9

Source: Data Analysis Results 2014 using R (S-PLUS)

The results above were estimated by matching estimator, average matching effect with weighting matrix inverse variance. The result showed that population average matching effect had significant effect on household’s income. The results also showed that population average matching effect was significant (p – value 0.000 < 0.001). The hypothesis that there was no significant impact of milk cooling plants on households’ income was rejected based on results from propensity score matching reported in table 3.2 that showed that there was significant impact of milk cooling plants on household’s income. The results showed that age, education level and gender of household head were significant balancing factors for propensity score matching with p values < 0.005. The results further showed that extension visits, access to credit, membership to both cooperatives and cooling plants were significant with p values <0.005. Land ownership, transport cost, land size in acres, ratio of milk consumed, off farm income and income from milk sales were also significant with the expected appriori signs.

### Conclusions and Implications

The level of Milk Cooling Plant technology adoption by small holder dairy farmers in Nandi County is highly dependent on farmer’s education level, farmer’s characteristics, their economic status and institutional factors.

The study confirmed that the farmer education levels, land tenure, distance and access to the nearest cooling plant, access to credit, extension visits and other occupations were the main determinants that affected the adoption and use of Milk Cooling Plant’s. This showed that training programs should be conducted to improve knowledge of the farmers about the merits of

adopting and using MCP's so that they can improve their productivity hence high milk sales that in turn lead to increased farm incomes.

Given the critical role of proximity and access to MCP centers, the existing efforts by the central and county government to invest in improved rural road infrastructure should be continued.

More farmer organizations should also be developed, especially in areas where the existing MCP's are not easily accessible so as to increase adoption and use. The County government through the various SACCO'S and financial institutions in the divisions should channel loans and other financial facilities to allow farmers improve their dairy production because the new dairy system is very capital intensive.

Dairy farmers should be educated on the benefits of belonging to member groups and societies. The government through the ministry of cooperatives should try to revamp the milk cooperatives and introduce cooling plants in those cooperatives so that the farmers can have better bargaining power hence better prices for their milk.

The more developed milk cooling plants should move to the next level of processing their own milk so that they can offer farmers better prices for their produce by keeping what the processors and middlemen would have had.

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### **3.4. Characterization of an agricultural area of Cundinamarca, its problems and possible solutions**

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**Key words:** Logistics, food supply chain, postharvest, Cundinamarca, Colombia

#### **Introduction**

In the framework of the project "Technologies and design or redesign of products that support the system of logistics operation and distribution and development of a model in Bogota and Cundinamarca", a characterization of the technological state of the production of twenty-four products associated to the following Categories: fruits, vegetables, legumes, tubers and livestock products, in order to identify their problems and possible solutions to the losses that are generated during the supply chain in Cundinamarca, Colombia

Despite the lack of studies on product losses in Colombia, it is estimated that about 50% of annual production is lost during the supply chain (FAO, 2012a), whether in transport, lack of cold chain, poor post-harvest handling among others that also affect the chain.

Given these circumstances, which lead to a deterioration in food security in the Bogotá-Cundinamarca region we identified the social and technical factors affecting the work around production, these being concern by the lack of technical assistance and the poor adaptation of low-cost technologies to farmers without taking account the conditions of the area as the study from the National Statistical Department from Colombia showed in (GOBERNACION DE CUNDINAMARCA, 2015). In this sequence of ideas a diagnostic model is then proposed, in order to gather information for the products studied, in terms of harvesting and postharvest technologies, aimed at improving the supply chain.

Possible solutions are aimed at improving the distribution of resources in the harvesting, distribution, marketing and consumption processes as (FAO, 2012b) also established in its study, by developing technological models adaptable to the agricultural economies present in the region like, in order to meet quality and traceability standards, challenges in improving the supply chain in Colombia as (World Economic Forum, 2013) advice.

The combination of problems and solutions was evaluated with the field word with farmers in eleventh different towns, which belong to the Cundinamarca agricultural area.

## Methods

The procedures that the group did in order to complete the diagnostic is showed in the Figure 1

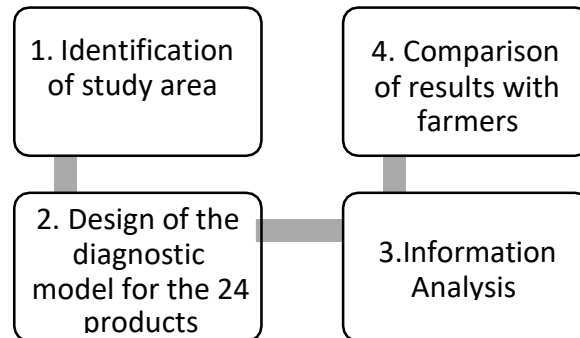


Figure 1. Research Metodology. Source: (Grupo Poscosecha, 2016).

### 1. Identification of study area

Was carried an identification of the towns which belong to Cundinamarca region and produced the one of the twenty-four products and them production rates, those ones positioned the region as one of the more important regions in the production of agricultural products in Colombia.

### 2. Design of the diagnostic model for the twenty-four products

A form created for the research group of “Postharvest of Agricultural Products” was used for design an strategy that allows compare the bibliographical information and field one, to find the problems and challenges presents for the production of the twenty-four products.

### 3. Information analysis to recognize the global problems in the supply chain.

Based in the form filled by the research, the information was analysed, for a global supply chain and compare with the information recollected in field with the farmers; for all the products were identified what were the most important processes that they shares, in that way, it would be possible to compare the same procedures in the postharvest operations and find the most important interventions that the project had to formulate.

## Findings

It was found that the supply chain in the Cundinamarca region has to be intervene from the harvesting, improving the technologies and tools, in this way, the farmers will keep the quality of their products and could commercialise the in a fair trade chain.

Also the supply chain was divided in: farm, logistics operations and markets, in these cases the problems where studied for each one, therefore there are many different situations that can be fix, the most important found ones were the post harvesting manipulation of products, that involves the transport and the operations like washing, classification and storage. In the other hand for the markets similar problems were find but with an exhibition issue marked.

### **Conclusions and Implications**

The characterization of Cundinamarca region, in Colombia, is remarkable, instead the information that exist in the country is not enough for the proper study of the problematics and how to solve them. This research could recognize some of the concerns given but the structure of the supply chain in the country and the view from farmers, who are the population that needs a real change on the way of the supply chain is managed.

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### 3.5. Supply chain analysis of exotic carps in Jammu & Kashmir, India

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**Keywords:** Disposable pattern, fish supply chain, marketing efficiency, price spread and producer's share in consumer's rupee.

#### Introduction

The domestic fish marketing system in India is neither efficient nor modern and is usually carried out by traders with a large number of intermediaries' between producer and consumer (FAO, 2001). The domestic fish market is of high potential but highly unorganized and unregulated (Ganeshkumar *et al.*, 2008). In India, supply chain of fresh fish involves certain intermediaries with different functions such as auctioneer, commission agent, wholesaler, retailer and fish vendor. Fish marketing in India has received little attention from public agencies and is mainly handled by the private sector. Compared to the achievements in fish production, the fish marketing system is very poor and highly inefficient in India (Ganeshkumar *et al.*, 2008). The number of intermediaries and channel of distribution vary from region to region, state to state and district to district within a state. The supply chain can be defined as a pipeline through which product flows from the point of production to the ultimate consumption. The study was designed to have a clear understanding of prevailing fish supply chains in the state of Jammu and Kashmir. The study has analyzed information on the efficiency of different marketing channels, producers share in consumer's rupee and role of intermediaries in supply chain of exotic carps which is of great help in analyzing present marketing practice to suggest suitable measures for improving fish marketing in the state.

#### Data and Methodology

Primary data for the study was collected from sample farmers, pre- harvest contractor, wholesaler, retailers and consumers using personal interview method with the help of pre-tested specially designed schedule for the study. The respondents were selected using multistage stratified simple random sampling. A total of 80 farmers 40 each from Jammu region and Kashmir valley were selected in addition 3 pre- harvest contractors, 3 wholesalers and 10 retailers from Kashmir region and 5 wholesalers and 10 retailers from Jammu region were selected randomly which makes the total sample size of 113. Information on production, disposal pattern, prices, quantities traded, marketing functions and others were collected and price spread, and marketing costs were estimated using average and percentage analyses. The share of fishermen/producers in the consumer's price was obtained from price spread analysis. Marketing efficiency was estimated as the ratio of consumer's price to total marketing costs and margins (Acharya and Agarwal, 2002).

**Results and discussion**

*Disposable pattern of exotic carp on sample farms*

It was estimated that on an average 638.15 kg of exotic carp was produced per sample farm. Out of which 3.79 per cent was consumed at household and 2.3 percent was distributed as gift to friends & relatives, 66.87 per cent was sold at farms and remaining 27.04 per cent was sold in the nearby market at consumers door step. The average marketable surplus for sample farmers was 599.27 kilograms (93.91%). Consumption of carp at household was small owing to the fact that fish was consumed only on special occasions since fish being source of income they sells more of it for earning income rather than consuming at home.

Table 1: Disposable pattern of carp at sample farms

Farm size category	Total production	Consumption at household	Family & friends	Sold		
				At farm	At market	Marketable surplus / Marketed surplus
Marginal	602.35 (100.00)	21.26 (3.53)	9.92 (1.65)	421.73 (70.01)	149.45 (24.81)	571.18 (94.83)
Small	659.63 (100.00)	25.99 (3.94)	17.51 (2.65)	431.31 (65.39)	184.90 (28.03)	616.21 (93.42)
Overall	638.15 (100.00)	24.21 (3.79)	14.67 (2.30)	426.70 (66.87)	172.57 (27.04)	599.27 (93.91)

**Note:** The figures in parenthesis indicate their percentages

*Exotic carps supply chains*

Fish farmers in the study area were scattered in remote villages while consumers were everywhere starting from rural areas to semi-urban and urban areas. There are different agencies and functionaries through which fish reach to consumers from farm. Supply chains prevalent for marketing of exotic carp in the state of Jammu Kashmir are depicted in Table2.

Table2: Supply chains for exotic carp in the state	
Supply chain (SC)-I	Farmer → Pre-harvest contractor → Wholesaler → Retailer → Consumer
Supply chain (SC) -II	Farmer → Wholesaler → Retailer → Consumer
Supply chain (SC) –III	Farmer → Consumer

It is vivid that there were 3 supply chains operating for marketing of exotic carp in the state. Two supply chains (SC-I and SC-III) were operating for marketing of exotic carp produced by farmers in Kashmir valley. In the first chain farmers were selling their produce to the pre-harvest contractors and then it passes through wholesalers and retailers to the consumers. Also, in the third channel farmers themselves take the fish in the nearby market or provide fish at door level of consumer. In Jammu region, also two supply chains (SC-II and SC-III) were operating for marketing of exotic carp. In first chain, the farmers were selling their produce to wholesalers at their farms. Wholesalers arrange harvest of produce on their own and sell it in the local markets to retailers who finally sell to consumers. In the second chain, farmers directly sell their produce to consumers in the local market or at farm depending on the availability of consumer

*Price spread and marketing efficiency*

It can be viewed from the table 3 that supply chain-III was the most efficient supply chain as estimated marketing efficiency (17.82) and producers share in consumer's rupee (94.69) was maximum for the chain. Similar result was reported by (Taliat 1991) who studied domestic marketing of fish products and found that fishermen share in consumer's rupee was maximum (95%) in one member chain and lowest (27.9%) in the chain where more middlemen were involved. The marketing efficiency was 2.72 and 3.17 for supply chain-I and supply Chain-II, respectively and producer share in consumer's rupee was 73.13 percent and 76.05 percent in supply chain I and Supply Chain II, respectively. Zynudheen *et al.* (2003) studied marketing of fish in Gujarat and concluded that retailers and wholesalers bagged largest share in the consumer's rupee

Upon further analysis, it was revealed that per kilogram total marketing cost and total marketing margin in fish supply chain-I was INR 12.18 and INR 56.67 where as in case of Supply chain-II it was INR 6.06 and INR38.72, respectively. The similar result was obtained by Kashyap *et al.* (2012) where total marketing margin for dry fish was about INR77.25. The reason for high marketing margins was existence of more intermediaries between producer and consumer. Also, it is clear from the table that the highest margin among the market players was kept by the retailers (INR 29 for supply chain-I and INR 26.28 for supply chain-II). The similar pattern was observed in the marketing of tilapia by Omar (2014) where retailers earned the highest net marketing margin. The total price spread and producers share in consumer's rupee was estimated to be INR 68.85 per kg and 73.13 percent, respectively in Supply chain I and INR 44.78 per kg and 76.05 percent, respectively in supply chain- II. This indicates that supply chain-II was more efficient than supply chain-I. It is mainly due to existence of additional intermediaries (pre-harvest contractor) in supply chain-I which has reduced the producers share in consumer's rupee and also reduced the efficiency of supply chain. The supply chain-III was beneficial for both the producer as well as consumer because producers were getting the better price for their produce and at the same time the consumers were paying less for quality produce.

Table 3: Price spread and marketing efficiency in exotic carp marketing

Particulars	Supply Chain-I	Supply Chain-II	Supply Chain-III
Price received by fish farmer (INR kg)	187.46	142.24	206.48
Marketing cost of fish farmer (INR./kg)	0	0	10.97
Net price received by farmer (INR./kg)	187.46	142.24	195.52
Price paid by Pre- harvest contractor (INR kg)	187.46		
Price paid by Wholesalers (INR kg)		142.24	
Pre -harvest contractor			
Marketing cost(INR kg)	4.28	0	
Marketing margin(INR kg)	17.07	0	
Price received by wholesaler(INR./kg)	208.81	0	
Wholesaler			
Marketing costs(INR kg)	4.98	3.85	
Marketing margin(INR kg)	10.60	12.44	
Price paid by retailer(INR kg)	224.39	158.53	
Retailer			
Marketing cost(INR kg)	2.92	2.21	
Marketing margin(INR kg)	29.00	26.28	

Price paid by consumer(INR./kg)	256.31	187.02	206.48
Producers share in consumer's rupee (%)	73.13	76.05	94.69
Total price spread(INR./kg)	68.85	44.78	10.96
Marketing efficiency	2.72	3.17	17.82

### Conclusion and policy suggestions

The supply chain-III was the most efficient supply chain as the estimated marketing efficiency (17.82), and the producers share in consumer's rupee (94.69) was maximum and there was no exploitation. Thus direct marketing should be promoted to improve the marketing efficiency and better profit to fish farmers. At present there is no proper fish market in the state where exclusively fish can be sold and purchased. Fish is sold either in local market or on Amira Kadal Bridge in Srinagar which is not only unhygienic but illegal also. The department of fisheries, Government of Jammu and Kashmir is planning to construct a fish market in Srinagar and another in Jammu which will help the farmers in direct marketing of their produce to the consumers which will increase the producers share in consumer's rupee and also the efficiency of marketing.

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### 3.6. Analysis of the 'Panela' value chain in Utica-Colombia

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**Keywords:** Food Supply Chain, Non-Centrifugal Cane Sugar, Smallholders

#### Introduction

Non-Centrifugal Cane Sugar (NCS) is a sub product of sugar cane. It is a brown sugar without a refining process. NCS looks like a hard mass with different shapes and a brown colour that varies from light to dark according to its processing. It also has a characteristic smell and flavour, sweet taste, and it is soluble in water. NCS is known under different names around the world, and the most common are '*panela*' in Latin America, Jaggery and Gur in South Asia, Muscovado in the Philippines, Rapadura and Azucar Mascavo in Brazil, and Kokuto in Japan.

According to JAFFÉ (2015), the most important component of '*panela*' is a disaccharide, the sucrose, whose content varies between 76.55 and 89.48%. Further components are monosaccharides such as half glucose and half fructose, with contents between 3.69 to 10.5%, and water between 1.5 - 15.8%. The protein level is between 0.37-1.7%, and it has less than 0.1% fat. Additionally, '*panela*' contains different minerals like Calcium, Magnesium, Potassium, Phosphorus, Sodium, Iron, Magnesia, Zinc, Copper, and Chloride. In general, the content of minerals can vary between 0.3 - 3.6%. The vitamins present are thiamine, riboflavin, niacin, vitamin B5, B6 and C. Finally, '*panela*' contains diverse mineral salts.

According to the Food and Agriculture Organisation of the United Nations (FAO) '*panela*' production is concentrated in 25 countries, and it is distributed in 11 in America, most of them in Latin America, 9 in Asia and 4 in Africa. Between 2005 and 2009 the contribution of the most important countries that produce '*panela*' were: India 59.6%, Colombia 14.6%, Pakistan 5.17%, China 4.05% Brazil 3.92%, Bangladesh 3.68%, Myanmar 4.65%, Philippines 1.13%, and other countries 3.08% (JAFFÉ, 2012).

In Colombia the production of '*panela*' dates from the time of the colony when the Spanish colonisers brought and distributed it throughout the territory near the extensive sugarcane crops. However, sugar and honey production was a craft process until the beginning of the 20th century (CENICAÑA, 2016). Currently, sugar cane is cultivated in 27 States and 511 municipalities distributed throughout the territory. Most of these cities are located in warm weather areas. Sugar cane is equivalent to 9% of the permanent crops in Colombia. Taking into account that the total sugar cane produced in the country is around 226.000 Ha (MADR, 2010), about 61% of such production is used to manufacture '*panela*', 32% to make refined sugar, and

7% for the production of honey, guarapo<sup>6</sup> and fodder (OSORIO, 2007). In 2014, the '*panela*' production increased 15% compared to the previous year, reaching 1.330.000 Tonnes, of which 3.441 were exported to different parts of the world (MADR, 2015).

As well as in other '*panela*' producer countries in the world such as India and Brazil, '*panela*' in Colombia is a common product, and its production is carried out in small and medium farms in a traditional way, through artisanal or in some cases semi-industrialized processes. The main characteristic of '*panela*' is that its production is a major source of jobs in all producer countries (MARTINEZ, 2013).

'*Panela*' production is the second largest sector that demands agricultural hand labour, with more than 2.5 million people around Colombia. For this reason, it is considered the second agroindustry of the country after coffee. This sector generates more than 855,365 direct and indirect jobs in 511 municipalities, and around 350,000 families obtain their livelihoods from this activity (MADR, 2015).

According to CASTELLANOS et al., (2010), the total number of '*panela*' farmers was 39961, distributed in 27 States, and concentrated mainly in the South of Colombia. The States of Cauca (18,3%), Huila (7,35%), Caquetá (3,24%), and Nariño (13,1%) have more than 40% of the '*panela*' farmers. The Centre of the Country concentrates 37% of producers, in the States of Boyacá (5,96%), Santander (5,77%), Tolima (4,76%), and Cundinamarca (20,3%), being the last one the state with more '*panela*' farmers in the country. The central region leads the market because its location is close to Bogotá, the main Colombian commercialisation place. Other regions maintain a significant number of '*panela*' producers such as Antioquia, Risaralda and Valle del Cauca.

Given the '*panela*' production data in Colombia, just 5% of '*panela*' is produced in farms over 50 Ha. According to the characteristics of the land distribution in Colombia, these farms are pondered as a large-scale production. These farms are located mainly in two States, Valle del Cauca and Risaralda. The medium-scale production is carried out in farms of between 20 and 50 Ha and is located mainly in the area known as '*Hoya del Rio Suarez*' in the states of Boyacá and Santander. However, some of these farms are placed in Nariño and some municipalities of Antioquia. Finally, the most frequent farms, which constitute the small-scale production, are farms with less than 20 Ha. They are located mainly in the provinces of Gualiva, Rionegro, and Tequendama in the west of the state of Cundinamarca, and in some municipalities in the states of Antioquia, Tolima, Huila, and Norte de Santander (CASTELLANOS et al., 2010; MADR, 2005).

Colombia is considered the first consumer of '*panela*' in the world. The per capita consumption per year is around 32kg per person. It is a perfect alternative to low-income households because of its low cost and high nutritional quality. However, the national consumption has been decreasing in the last years, and other artificial sweeteners and beverages whose nutritional value is not comparable have replaced '*panela*'. It means that the guild that gathers '*panela*' producers in the country known as FEDEPANELA -*Federación Nacional de Productores de Panela de Colombia*- must construct a strong marketing strategy in order to stimulate '*panela*' consumption among Colombian people, regardless of their income level.

In the recent years, this agroindustry has focused its efforts on improving the production through innovative techniques given the likelihood to reach the international market. For example, new steam boilers to make the process of manufacture more efficient and to use energy better have been implemented. On the other hand, new business trends are opening the

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<sup>6</sup> It is a fermented sugar cane juice consumed as an alcoholic beverage, especially in rural areas.

panorama of the industry. For instance, sugar cane by-products are currently being used not only as sweeteners but also in the pharmaceutical industry and in the production of biofuels, beverages, cosmetics and the like. Certainly, such alternatives to reach new markets are a huge possibility to the Colombian '*panela*' agroindustry (CASTELLANOS et al., 2010).

The main challenge in the value chain analysis is to identify and propose alternatives to achieve a sustainable growth in the economic, environmental, and social aspects for all the actors involved, especially the most vulnerable and generally more isolated areas, as is the case of many small farmers in developing countries. The particular case of Utica-Colombia, involving the producers of '*panela*', is an attractive example of analysis. In this town, sugar cane is more than simple agricultural activity; it is the main cash crop for farmers, and the principal source of incomes to almost all the population. That is why '*panela*' production plays a significant role in the livelihoods of more than 4500 inhabitants of the town (MADR, 2005). It is crucial for the purpose of improving the quality of life of farmers and other stakeholders of the region of Utica, to find advantageous alternatives to gain better inclusion in the markets through the value chain analysis of the '*panela*' production in the municipality.

Given this context and knowing the conditions of production of '*panela*' in the municipality of Utica, the following is the question that motivates the current research: what are the alternatives of farmers in Utica to improve the agricultural practices of the sugarcane crop, and the method to manufacture '*panela*' for the purpose of gaining a better access to markets, making the process economically, environmentally, and socially sustainable?

This work seeks to identify key points within the value chain of '*panela*' production in the municipality of Utica (Colombia), which allow to access to markets, improve prices paid to the producer and continue the production of '*panela*' in a sustainable way for producers and other participants in the chain. Through the analysis of qualitative data, this research will analyse the '*panela*' value chain in Utica, taking into account social and environmental aspects, to identify strengths and opportunities to make it more inclusive.

## Methods

For the purpose of reaching the objective, 72 surveys were carried out to '*panela*' farmers in Utica in order to identify the most relevant aspects of the value chain, as well as to recognise the actors involved in it, their roles and the likelihood of solving the problems of the chain. Based on such characterization of the value chain, 20 face to face interviews to political, technical and market stakeholders involved were carried out for the purpose of find out the alternatives to improve the process to integrate in a better way the farmers to the market.

## Main finding and Implications

The particular case of Utica shows that integration of the '*panela*' farmers in the value chain is scarce. It is represented in the low level of affiliation to the *Federación Nacional de Productores de Panela* FEDEPANELA, even though this organisation offers alternatives to commercialise in a better way the product. A possible explanation of this fact is because of the actions of illegal armed groups in the area. The guerrilla group *Fuerzas Armadas Revolucionarias de Colombia*-FARC was located during decades in the surroundings of the Town. Obviously, this group has an anti-governmental political discourse. That is why the farmers of the town have a strong distrust of the government and its policies. In addition to the above, since 2003, other illegal armed group, *paramilitaries*, fighting against FARC colonised a significant portion of the territory, deepening, even more, the violence and becoming more involved '*panela*' production.

## **Conclusion**

Given this context, the institutions, both public and private, that currently are working in Utica must construct a confidence ties between all the actors. Beyond technical, productive, and manufacture process improvements, the reconstruction of the trust and farmers organisations would be the base to integrate a better way the farmers to the market.

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## **Chapter 4: The role of analytical research in ensuring the production of safe food**

**4.1. Applicability of neutron activation analysis for food characterization**  
(Camila Elias, Elisabete A. N. Fernandes, Márcio A. Bacchi)

**4.2. Removal of Cd(II) ions from aqueous solutions using elderberry waste**  
(Joanna Dudczak, Tomasz Kalak, Ryszard Cierpiszewski)

**4.3. Microbial contamination of homogenized sausages containing BAADER meat, stored in atmospheric air**  
(Bożena Danyluk, Agnieszka Bilaska, Ryszard Kowalski, Monika Niedzielska, Krzysztof Kubera)

**4.4. Microbial contamination of homogenized vacuum packaged sausages containing BAADER meat**  
(Bożena Danyluk, Agnieszka Bilaska, Ryszard Kowalski, Anna Jeżewska, Agnieszka Świtała)

**4.5. The effect of edible protective casings on selected quality characteristics of culinary meat obtained from pork carcasses**  
(Ryszard Kowalski, Agnieszka Bilaska, Bożena Danyluk, Mirosława Krzywdzińska-Bartkowiak, Michał Piątek)

**4.6. Management of food allergens in the food industry**  
(Bogdan Pachołek, Sylwia Sady)

## **4.1. Applicability of neutron activation analysis for food characterization**

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**Keywords:** minerals; trace elements; traceability; reference material; organic food

### **Introduction**

International food trade requires trustful and comparable analytical results for quality control and for ensuring safety of foodstuff throughout the entire production network. Metrological traceability of analytical results is therefore a key issue when considering the commerce between countries. Reliable and traceable methods for the analysis of food are demanded worldwide, especially for measuring chemical elements, since some are essential minerals for humans while others can have toxic effects if ingested above certain levels.

Neutron activation analysis (NAA) is a multi-element, non-destructive technique, capable of producing results from the whole sample (Tian et al., 2001). Depending on the sample composition, NAA has the potential to measure up to two-thirds of the periodic table, including transition metals, halogens, lanthanides and platinum-group metals (Bart, 2005). Basically describing, the physical processes involved initiate with the production of radionuclides by nuclear reactions, generated from the irradiation of the samples with neutrons in a nuclear research reactor. Afterwards, gamma-rays emitted in the radioactive decay of such radionuclides, according to the characteristic half-lives, are measured with high resolution detectors, providing the determination of elemental contents in the samples.

Among the NAA modalities, the most widespread is the instrumental neutron activation analysis (INAA), which practically dispenses sample preparation, while most other methods used to analyze solid samples depends on the dissolution of the elements to be determined. For INAA, the preparation is usually restricted to obtaining a dry, fine and homogeneous sample for analysis. The absence of chemical steps makes the analytical procedure easier, reduces the possibility of contamination and avoids the occurrence of fractioning or partial recovery of elements.

NAA has been consistently used for the determination of essential and non-essential elements in different types of food, as grains, fruits, meat, vegetables, sugar and honey. In fact, its excellent metrological properties described elsewhere (Greenberg et al., 2011) make this technique especially suited for applications where the quality and reliability of results are more relevant than the cost and turnover time of analysis, as is the case of technical and scientific research. For about three decades, INAA has been applied at Nuclear Energy Center for Agriculture (CENA) for the analysis of food, amongst other types of samples, in several studies. Here, some of such studies are presented for illustrating the applicability of NAA for food analysis.

### **Methods**

Following the general procedure adopted at CENA, food samples are oven and freeze-dried, being afterwards processed in a mill for reducing particle size. Analytical portions of 200-

300 mg of the powdered samples are inserted into high purity polyethylene vials for irradiation with neutrons in the nuclear research reactor IEA-R1 at IPEN/CNEN (Nuclear and Energy Research Institute, National Nuclear Energy Commission). The induced radioactivity is measured by high resolution gamma-ray spectrometry at four decay times of about 4, 7, 15 and 30 days, allowing the detection of radionuclides with half-lives from 12 hours to several years. The quantification is performed by the  $k_0$ -method, which can provide results for many elements from the use of standards (comparators) for one single element (De Corte, 2001). Small pieces (10 mg) of Ni-Cr wires with well-known composition are placed between vials before irradiation and Cr is used as comparator. Suitable reference materials were added to each series of samples for quality control, while empty vials were irradiated for blank measurement. An in-house software package (Bacchi and Fernandes, 2003) takes care of all calculations, providing mass fractions of the elements and the respective analytical uncertainties.

### **Findings**

With focus on nutritional elements, INAA has been applied at CENA for analyzing several types of food, including honey, milk, and byproducts of fruit and vegetable processing. Besides the measurement of essential elements, the analysis provided information on trace elements, some of them potentially toxic to humans. On the other hand, the technique has been used for the analysis of rice samples from different regions of Brazil, with emphasis on the measurement of As, which is a toxic element usually present in rice at levels close to or higher than the international accepted limits (Kato, et al, 2013). In fact, the potential of INAA for measuring both nutritional and toxic elements in food samples were clearly evidenced when investigating the quality of Brazilian dog food. Since 2010 potentially toxic elements have been determined, i.e. Al, As, Sb and U, besides all essential minerals with recommended values, i.e., Ca, Cl, Cu, Fe, I, K, Mg, Mn, Na, P, Se and Zn (Elias, 2015).

The multi-element capacity of INAA have been useful for investigating the traceability of food, regarding both its geographic origin and the production system. Bovine meat from Brazilian biomes were discriminated with the use of multi-element analysis and chemometrics. Among the elements determined, Br, Cs and Rb showed the wider variability between samples and thereby being significant tracers for identifying the meat from the different regions (Fernandes et al., 2016). Other studies compared the chemical composition of organically and conventionally grown food using INAA, comprising five products, i.e. beans, coffee, potato, orange and tomato. Significant differences were observed for all five crops and chemometrics provided discrimination between products from organic and conventional systems, with Br and Rb showing the largest contribution.

For fulfilling national demands and following the priorities established by the Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA/Brazil), reference materials of tomato pulp, rice, rice flour and soybean flour were developed at CENA, with emphasis on nutritional and toxic elements. INAA was the main analytical tool for the characterization of such reference materials, including both the homogeneity and the stability studies. Besides the direct sample analysis, without chemical steps in the preparation, some of the metrological characteristics of INAA, i.e. multi-element capacity, metrological traceability, good precision and well-known sources of uncertainty are fundamental for those applications.

### **Conclusions and implications**

The results compiled here corroborate the idea that NAA has a special place in the food sector with a wide scope of applications, despite depending on a neutron source and producing radioactivity, which limit its routine and widespread utilization. The technique showed to be

efficient and sensitive for the determination of chemical elements in several food matrices, providing accurate and traceable results. Due to the multi-element capacity, NAA is especially useful when necessary to have a broader knowledge of chemical composition, i.e. for characterization of reference materials, determination of food origin, investigation of potentially toxic elements, among other applications.

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## **4.2. Removal of cd(ii) ions from aqueous solutions using elderberry waste**

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**Keywords:** adsorption, elderberry waste, Cd(II) ions

### **Introduction**

Heavy metals are one of the factors contributing to environmental degradation. Copper, cadmium, lead, zinc, chromium and others penetrate to an ecosystem. The most common sources of these pollutants are industrial and household waste, leachate from landfills and rainwater [Uluzlu et al. 2008]. The presence of metal ions in surface waters can lead to disruption of the biological balance and to slow down the process of self-purification and water treatment. Furthermore, their excess in living organisms can lead to irreversible lesions. Metal ions can easily overcome the barrier of the cell membrane due to the affinity for connecting to nucleic acids, lipids and proteins. As a result, they lead to cells damage and disturbance of their functioning [Seńczuk 1999]. Consequently, there is a growing interest in the purification of water from metal ions. Control, concentration monitoring and effective elimination are a huge challenge [Gala et al. 2010]. Waste from the agro-food industry is estimated about 20% of raw materials entering production processes. Elderberry pomace is the remain of fruit processing into several products, such as jams, preserves, juice or wine, and in addition it is sometimes consumed in dried form. Fruits have numerous antioxidant properties and others that have a positive effect on human health due to the presence of pectins, anthocyanins, flavonoids, vitamins (C, B1, PP, A) and iron. Environmental and economic considerations are the reason for the creation of new methods of management of this waste. It was shown that the pomace even after industrial processing is still rich in fiber and therefore it is characterized by sorption properties in relation to metal ions [Bartnikowska 1997, Król et al. 2003].

The aim of the study was to demonstrate the possibility of removal of cadmium(II) from aqueous solutions using elderberry pomace. The influence of the mass of adsorbent, contact time and pH of the solution on adsorption of cadmium(II) ions has been examined.

### **Materials and Methods**

Biomass in the form of elderberry pomace obtained from food industry was used in the study. The pomace was crushed in a blender and sieved by hand through a sieve in order to select particles with a 0.212 mm diameter. The obtained biomass was dried in a drying oven at 60±2°C to constant weight and then placed in a polyethylene container and stored in a desiccator. The samples prepared in this way were used for analysis. All chemicals were pure for analysis and deionized water was used in the experiments.

Adsorption tests were performed in Erlenmeyer flasks of 10 cm<sup>3</sup>. The solutions (10 cm<sup>3</sup>) of Cd(II) at a concentration of 10 mg/L, initial pH 3, 4 and 5 were introduced into flasks. Samples of dried elderberry pomace with the mass of 0.025 g to 1 g were placed in flasks. The mixture was shaken for 60 minutes, and then the solutions were centrifuged to separate the phases. Next,

the supernatants after adsorption were measured by atomic absorption spectrophotometry (F-AAS) using SpectrAA 800 (Varian, Palo Alto, USA) apparatus at a wavelength  $\lambda = 228.8$  nm for cadmium. Adsorption measurements was repeated in triplicate.

## Results and Discussion

Adsorption of biomass is dependent on many factors, such as the mass of adsorbent, degree of fragmentation, temperature, pH and time of the process. Based on literature, an increase in sorption capacity with a greater degree of fraction fragmentation is observed [Sag and Kutsal 2001, Rao and Prabhakar 2010]. Accordingly, the smallest fraction equal to 0.212 mm was used to the research. In the first stage, experiments related to the determination of contact time of the phases to reach equilibrium were conducted (Fig. 1).

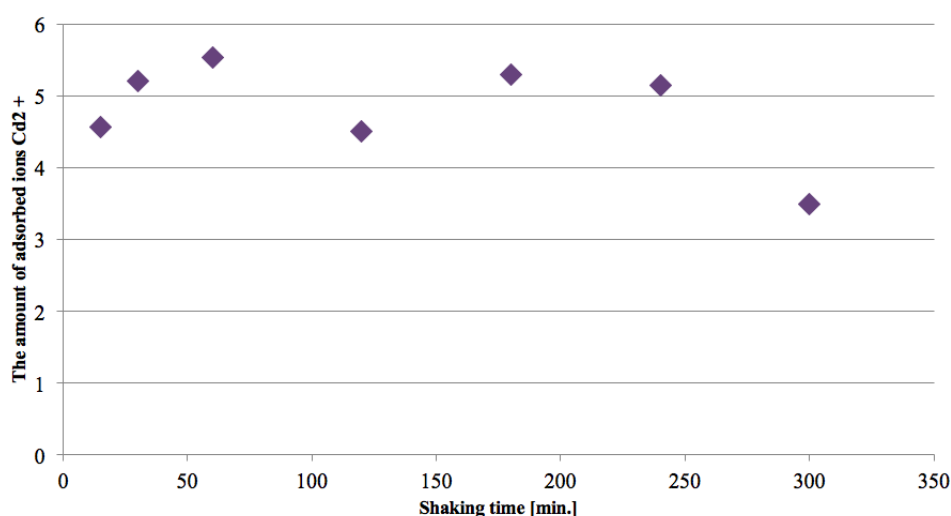


Fig. 1. Effect of agitation on adsorption of Cd(II) ions.

Source: own research

The obtained results show that the amount of adsorbed metal ions depends on the contact time of the phases. In the initial stage, it grows quickly to reach values close to equilibrium after several minutes. The adsorption process reaches an equilibrium after 30 minutes. After this time, significant changes in the adsorption are not observed. A similar result was obtained in case of different masses of the pomace samples. Therefore, further experiments were carried out for 60 minutes, because the obtained values constitute equilibrium ones. Effect of the mass of the sample and pH of the solution on adsorption of Cd(II) ions was also examined. In Figure 2 the influence of the mass of the sample and pH of the solution on adsorption was presented. There is shown that the amount of adsorbed cadmium(II) increases with the growth of the mass of the biosorbent. Similar upward trend was observed in our previous studies when different masses of elderberry pomace samples were used to adsorb copper(II) ions [Kalak, Cierpiszewski and Dudczak 2015]. However, changes are also observed in samples with low masses. Further increasing the mass of the adsorbent did not contribute to enhance adsorption of Cd(II) ions. In the solution contained 0.025 g of the biomass at pH 4 the highest sorption capacity equal to 0.63 mg/g was noticed. It was observed that the highest level of cadmium removal (about 60%) occurred at pH 5 and pH 4.

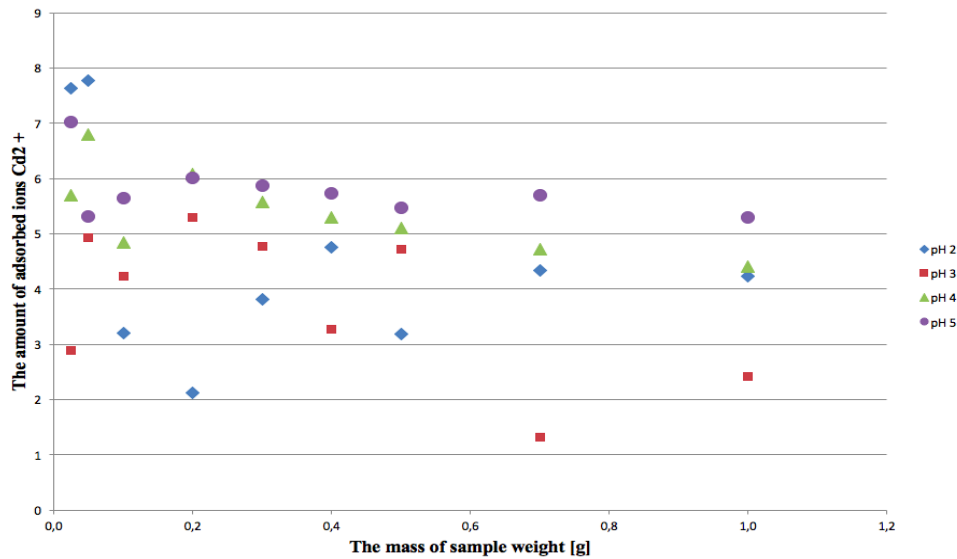


Fig. 2. The influence of the mass of elderberry pomace samples on Cd(II) ions adsorption, depending on pH ( $C_{Cu(II)} = 10 \text{ mg/L}$ )

Source: own research

## Conclusions

As a result of the conducted experiments, it was demonstrated that the equilibrium of the biosorption process was achieved after about 30 minutes. There was shown that the greatest ability to remove the cadmium(II) from aqueous solutions by elderberry biomass was noticed at pH 5. Under these conditions, approximately 58% of the metal ions present in the solution was removed. In spite of that, only about 32% of the ions were adsorbed at pH 3. The highest sorption capacity equal to 0.63 mg/g was obtained at pH 4 in the presence of 0.025 g of the biomass. The research results clearly showed that elderberry pomace may be a promising biosorbent material for removing heavy metal ions from waste water.

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### **4.3. Microbial contamination of homogenized sausages containing BAADER meat, stored in atmospheric air**

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**Key words:** wiener sausages, poultry deboned meat, microbiological quality

#### **Introduction**

Mechanically separated poultry meat (MSM), is muscle tissue recovered from poultry skeletons and bones remaining e.g. after cutting fillets. As a result of more and more poultry being used for boneless meat production year after year in Poland and other European Union countries, the utilisation of MSM becomes particularly important. MSM has a limited technological usefulness, lower nutritional value and is more microbiologically contaminated and prone to decay than hand-separated meat (Anonim, 2011, Henckel et al., 2004, Pereira 2011, Żych, 2009). Depending on the method of obtaining this raw material, the quality of the resulting homogenate varies. Employing the low pressure process using a Baader separator does not result in damaging the bone structure – the raw material is of better quality and more expensive (0,6 ÷ 1,5 euro/kg) compared to MSM obtained through the high pressure method (0,3 ÷ 0,6 euro/kg) (Cegiełka et al., 2014, Makala, 2012). MSM can be used mainly for the production of homogenised sausages, which also include the cheaper raw material. Its use is primarily justified by economic factors.

#### **Research methodology**

The research material was constituted by frankfurter type sausage. The contents of the filling used for the control sausage (K variant) production were the following: class III pork (shoulder) – 54%, fine fat – 25%, water/ice – 21%. Then the "buttery sausages" spice, a pickling mix, polyphosphates and soy concentrate were added to the filling. In the remaining variants, some of the class III pork was replaced by MSM obtained from poultry neck (N25 and N50) and carcasses (C25 and C50).

Variants N25 and C25 had 25% of pork meat replaced by MSM from poultry necks/carcasses in the contents. Variants N50 and C50 had 50% of pork replaced by MSM from poultry necks/carcasses.

Pork meat and fine fat were initially minced in a grinder and then cut. While cutting, frozen mechanically separated poultry meat, additives and spices were added. Filling produced in this way was used to fill casings. The obtained batons were smoked, boiled ( $T_c=72^\circ\text{C}$ ), cooled and put in a cold store at  $4^\circ\text{C}$  and changes in microbial status were determined after consecutive storage periods, i. e. after 0, 1, 3 and 6 days. The performed microbiological evaluation included determinations of: total aerobic bacteria count, enterococci count and presence in 0,01



*g coli* form bacteria and spore forming anaerobic bacteria. Individual cultures were obtained using the following media by BTL Company:

- nutrient agar – determination of the total number of microorganisms (incubation for 48h, at 30°C)
- Slanetz and Bartley - determination of the number of enterococci (incubation for 48h, at 37°C)
- brilliant green agar - determination of the presence of *coli* form bacteria (incubation for 24h, at 37°C)
- Wrzosek medium - determination of the presence of spore forming anaerobic bacteria (incubation for 48h, at 37°C)

Measurements of pH were carried out using a HANDYLAB 2 pH-meter of the Schoot Company equipped in a combined electrode type Blue Line 21.

The results obtained during the course of the tests were subject to a statistical analysis. A significance level of  $p \leq 0,05$  was assumed to verify the research hypotheses. A two-way analysis of variance ANOVA and the Fisher multiple comparison test were used. The calculations were performed using Excel and Statistica 6.0 computer applications.

## Results

The results of microbiological tests are shown in tables 1 and 2. It can be concluded, based on those results, that replacing 25% of meat raw material with Baader meat does not have a significant effect on the overall number of aerobic bacteria in 1g of the finished product during the evaluated storage period (1-6 days). A 50% replacement, however, resulted in a statistically significant growth of the number of those bacteria as early as in the first test period, i.e. after 3 days of storage. Those correlations were observed in sausages containing Baader meat obtained from poultry carcasses as well as poultry neck. Replacing meat in the contents of wiener type sausages with Baader meat did not increase the number of enterococci during cold storage between 1-6 days, regardless of the share of Baader meat (25 or 50%). When marking the presence of coli group bacteria and anaerobic resting bacteria in 0.01 g, only in the case of 50% meat replacement with Baader meat (from necks and carcasses) a decrease in quality was observed after 6 days of storage (the presence of resting stems in 0.01 g). The pH value of the sample sausages was between 6.19 and 6.59 (tab. 3), no statistically significant differences were observed.

Table 1. The influence of the storage period on the microbial contamination of the experimental sausages, containing BAADER meat from poultry carcasses ( $x_{sr} \pm s$ ).

Product variant	Storage period (days)	Total aerobic bacteria count	Enterococci count	<i>coli</i> form bacteria	Spore forming anaerobic bacteria
		Log cfu/g		Presence in 0,01 g	
K	0 (batter)	5,84 <sup>cd</sup> ± 0,04	2,83 <sup>be</sup> ± 0,41	+	-
	1	3,91 <sup>a</sup> ± 0,03	1,00 <sup>a</sup> ± 0,00	+	-
	3	4,93 <sup>b</sup> ± 0,02	2,61 <sup>b</sup> ± 0,06	+	-
	6	7,47 <sup>e</sup> ± 0,13	2,62 <sup>b</sup> ± 0,05	+	-
C25	0 (batter)	5,76 <sup>c</sup> ± 0,04	3,18 <sup>c</sup> ± 0,07	+	-
	1	3,97 <sup>a</sup> ± 0,05	1,00 <sup>a</sup> ± 0,00	+	-
	3	5,26 <sup>b</sup> ± 0,05	1,76 <sup>d</sup> ± 0,19	+	-
	6	5,29 <sup>b</sup> ± 0,05	2,98 <sup>ce</sup> ± 0,07	+	-
C50	0 (batter)	5,96 <sup>cd</sup> ± 0,01	3,07 <sup>c</sup> ± 0,03	+	-

	1	4,15 <sup>a</sup> ± 0,3	1,00 <sup>a</sup> ± 0,00	+	-
	3	6,23 <sup>d</sup> ± 0,37	1,57 <sup>d</sup> ± 0,08	+	-
	6	9,57 <sup>f</sup> ± 0,08	2,06 <sup>f</sup> ± 0,01	+	+

Explanatory notes:  $x_{sr}$  – mean value, s – standard deviation, K - control sausage, C25 - 25% of pork meat replaced by Baader meat from poultry carcasses, C50 - 50% of pork meat replaced by Baader meat from poultry carcasses, „+” – presence, „-” – not presence, different letters (a, b, c ...) in the same column indicate statistically significant differences ( $p < 0,05$ )

Table 2. The influence of the storage period on the microbial contamination of the experimental sausages, containing BAADER meat from poultry neck ( $x_{sr} \pm s$ ).

Product variant	Storage period (days)	Total aerobic bacteria count	Enterococci count	coli form bacteria	Spore forming anaerobic bacteria
		Log cfu/g	Presence in 0,01 g		
K	0 (batter)	5,84 <sup>ef</sup> ± 0,33	2,83 <sup>b</sup> ± 0,05	+	-
	1	3,91 <sup>a</sup> ± 0,32	0,00 <sup>a</sup>	-	-
	3	4,93 <sup>bcd</sup> ± 0,09	2,61 <sup>b</sup> ± 0,15	+	-
	6	7,47 <sup>h</sup> ± 0,12	2,62 <sup>b</sup> ± 0,15	+	-
N25	0 (batter)	5,44 <sup>cde</sup> ± 0,21	3,32 <sup>e</sup> ± 0,09	+	-
	1	3,79 <sup>a</sup> ± 0,10	0,00 <sup>a</sup>	-	-
	3	4,74 <sup>bc</sup> ± 0,11	0,00 <sup>a</sup>	+	-
	6	6,34 <sup>fg</sup> ± 0,15	1,52 <sup>c</sup> ± 0,04	+	-
N50	0 (batter)	5,65 <sup>def</sup> ± 0,01	4,00 <sup>f</sup> ± 0,08	+	-
	1	4,26 <sup>ab</sup> ± 0,03	0,00 <sup>a</sup>	+	-
	3	6,95 <sup>gh</sup> ± 0,70	0,00 <sup>a</sup>	+	-
	6	8,37 <sup>i</sup> ± 0,17	1,82 <sup>d</sup> ± 0,16	+	+

Explanatory notes:  $x_{sr}$  – mean value, s – standard deviation, K - control sausage, N25 - 25% of pork meat replaced by Baader meat from poultry neck, N50 - 50% of pork meat replaced by Baader meat from poultry neck, „+” – presence, „-” – not presence, different letters (a, b, c ...) in the same column indicate statistically significant differences ( $p < 0,05$ )

Table 3. pH value of the experimental sausages, stored in atmospheric air, chilling conditions ( $x_{sr} \pm s$ )

Product variant	Storage period (days)	The sausage with BAADER meat from carcasses	The sausage with BAADER meat from neck
K	0 (batter)	6,45 ± 0,24	6,45 ± 0,24
	1	6,47 ± 0,15	6,47 ± 0,15
	3	6,40 ± 0,34	6,40 ± 0,34
	6	6,21 ± 0,09	6,21 ± 0,09
25	0 (batter)	6,59 ± 0,08	6,19 ± 0,53
	1	6,40 ± 0,13	6,42 ± 0,06
	3	6,37 ± 0,23	6,37 ± 0,14
	6	6,40 ± 0,21	6,44 ± 0,20
50	0 (batter)	6,52 ± 0,05	6,50 ± 0,16
	1	6,44 ± 0,07	6,44 ± 0,19
	3	6,37 ± 0,19	6,38 ± 0,30
	6	6,45 ± 0,26	6,44 ± 0,32

Explanatory notes:  $x_{sr}$  – mean value, s – standard deviation, K - control sausage, 25 - 25% of pork meat replaced by MSM from poultry necks/carcasses, 50 - 50% of pork meat replaced by MSM from poultry necks/carcasses

## **Conclusions**

Utilising the cheaper raw materials has a significant economical impact because it lowers manufacturing costs and undoubtedly increases sales as well as prevents animal protein waste. The study has shown that a 25% substitution of pork by MSM did not cause a significant deterioration of the microbiological status of the examined sausages, regardless of the type of MSM (poultry neck/carcass) after low-pressure separation.

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#### 4.4. Microbial contamination of homogenized vacuum packaged sausages containing BAADER meat

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**Key words:** wiener sausages, poultry deboned meat, microbiological quality, vacuum packaging

##### Introduction

One of the most popular homogenised sausages is the wiener type sausage. Because of the degree to which it is ground, lower quality raw material can be utilised in its production, including mechanically separated poultry meat (MSM). The quality of meat recovered from bones is lower than that of manually separated meat, but also varies depending on the method it is obtained with (Tolik, et al., 2015). According to literature data (Makała, 2012), only 23% of mechanically separated meat is constituted by meat obtained using the low pressure method (e.g. in a Baader conveyor belt separator), which does not destroy the bone structure and disintegrates myofibers to a lesser extent. Baader meet is also characterised by a better microbiological state than meat obtained using the high pressure method. The shelf life of the finished product can be prolonged by using the right packaging method, e.g. vacuum packaging. The resulting limitation of oxygen access restrains the growth of aerobic microorganisms primarily responsible for the decay of meat and meat products (Sakowska, et al., 2014, Węsierska 2007).

##### Research methodology

The research material was constituted by frankfurter type sausage. The contents of the filling used for the control sausage (K variant) production were the following: class III pork (shoulder) – 54%, fine fat – 25%, water/ice – 21%. Then the "buttery sausages" spice, a pickling mix, polyphosphates and soy concentrate were added to the filling. In the remaining variants, some of the class III pork was replaced by MSM obtained from poultry neck (N25 and N50) and carcasses (C25 and C50).

Variants N25 and C25 had 25% of pork meat replaced by MSM from poultry necks/carcasses in the contents. Variants N50 and C50 had 50% of pork replaced by MSM from poultry necks/carcasses.

Pork meat and fine fat were initially minced in a grinder and then cut. While cutting, frozen mechanically separated poultry meat, additives and spices were added. Filling produced in this way was used to fill casings. The obtained batons were smoked, boiled ( $T_c=72^\circ\text{C}$ ), cooled and vacuum packaged, using vacuum packaging machine MULTIVAC, type A300/16 (98-99% vacuum). The sausages were stored at 4°C. The concentration of examined microorganisms (total aerobic bacteria and enterococci count) and presence in 0,01 g (*coli* form bacteria and

spore forming anaerobic bacteria) was marked after 0, 1, 3 and 6 days. Individual cultures were obtained using the following media by BTL Company:

- nutrient agar – determination of the total number of microorganisms (incubation for 48h, at 30°C)
- Slanetz and Bartley - determination of the number of enterococci (incubation for 48h, at 37°C)
- brilliant green agar - determination of the presence of *coli* form bacteria (incubation for 24h, at 37°C)
- Wrzosek medium - determination of the presence of spore forming anaerobic bacteria (incubation for 48h, at 37°C)

Measurements of pH were carried out using a HANDYLAB 2 pH-meter of the Schoot Company equipped in a combined electrode type Blue Line 21.

The results obtained during the course of the tests were subject to a statistical analysis. A significance level of  $p \leq 0,05$  was assumed to verify the research hypotheses. A two-way analysis of variance ANOVA and the Fisher multiple comparison test were used. The calculations were performed using Excel and Statistica 6.0 computer applications.\

## Result

The addition of Baader meat obtained from poultry carcasses caused a decrease in the microbiological quality of the sample sausage which was vacuum packed and cold stored (tab. 1). Compared to the control sample (K) the overall number of aerobic microorganisms increased statistically significantly after 3 (C25) or even 1 day of storage (C50). The number of enterococci was low, it did not exceed  $10^2$  jtk/g in the finished product. Significant differences were only observed in samples containing 50% replacement of pork meat with Baader meat. The presence of anaerobic spore forming bacteria in 0.01 g was not observed in any of the tested samples. *Coli* group bacteria were present in 0.01 g as early as after 1 day in the C50 sample, after 3 in the C25 sample and after 6 in the control sample.

Table 1. The influence of the storage period on the microbial contamination of the experimental, vacuum packaged sausages, containig BAADER meat from poultry carcasses ( $x_{\bar{s}} \pm s$ )

Product variant	Storage period (days)	Total aerobic bacteria count	Enterococci count	<i>coli</i> form bacteria	Spore forming anaerobic bacteria
		Log cfu/g		Presence in 0,01 g	
K	0 (batter)	$5,84^b \pm 0,02$	$2,83^f \pm 0,05$	-	-
	1	$3,91^a \pm 0,02$	$1,00^b \pm 0,00$	-	-
	3	$5,51^d \pm 0,04$	$1,65^c \pm 0,04$	-	-
	6	$6,66^f \pm 0,03$	$1,76^{ac} \pm 0,04$	+	-
C25	0 (batter)	$5,76^b \pm 0,07$	$3,18^e \pm 0,04$	-	-
	1	$3,97^a \pm 0,02$	$1,00^b \pm 0,00$	-	-
	3	$7,07^g \pm 0,04$	$1,74^{ac} \pm 0,04$	+	-
	6	$9,45^i \pm 0,03$	$1,76^{ad} \pm 0,04$	+	-
C50	0 (batter)	$5,96^e \pm 0,04$	$3,07^e \pm 0,07$	-	-
	1	$4,15^c \pm 0,06$	$1,00^b \pm 0,00$	+	-
	3	$7,44^h \pm 0,015$	$1,80^{ad} \pm 0,03$	+	-
	6	$9,66^j \pm 0,04$	$1,88^d \pm 0,05$	+	-

Explanatory notes:  $x_{\bar{s}}$  – mean value, s – standard deviatin, K - control sausage, C25 - 25% of pork meat replaced by Baader meat from poultry carcasses, C50 - 50% of pork meat replaced by Baader meat from poultry carcasses,

„+” – presence, „-” – not presence, different letters (a, b, c ...) in the same column indicate statistically significant differences ( $p < 0,05$ )

The results shown in tab. 2 indicate that the overall number of aerobic microorganisms in the sample sausage, made with the addition of Baader meat obtained from poultry neck, differs statistically significantly from the number of those bacteria marked in the control sample only after 6 days of cold storage. For enterococci, significant differences occur after the 3<sup>rd</sup> day, although the number of those microorganisms is low and does not exceed  $10^2$  jtk/g. The presence of coli group bacteria in 0.01 g in the control sample was observed after 6 days of storage. The addition of Baader meat resulted in coli group bacteria being present in 0.01 g as early as after 3 (N25) or 1 day (N50) of cold storage.

Table 2. The influence of the storage period on the microbial contamination of the experimental, vacuum packaged sausages, containing BAADER meat from poultry neck ( $x_{sr} \pm s$ )

Product variant	Storage period (days)	Total aerobic bacteria count	Enterococci count	coli form bacteria	Spore forming anaerobic bacteria
		Log cfu/g		Presence in 0,01 g	
K	0 (batter)	$5,84^a \pm 0,13$	$2,83^{bc} \pm 0,76$	+	-
	1	$3,91^b \pm 1,23$	$1,00^a \pm 0,00$	-	-
	3	$5,51^{ac} \pm 0,11$	$1,00^a \pm 0,00$	-	-
	6	$6,66^c \pm 0,71$	$1,76^{de} \pm 0,01$	+	+
N25	0 (batter)	$5,44^{ac} \pm 0,15$	$3,32^{bc} \pm 0,11$	+	-
	1	$3,79^b \pm 1,32$	$1,00^a \pm 0,00$	-	-
	3	$4,74^{cd} \pm 0,64$	$1,32^d \pm 0,30$	+	-
	6	$7,63^f \pm 1,39$	$2,93^{bc} \pm 0,84$	+	+
N50	0 (batter)	$5,65^a \pm 0,01$	$4,00^c \pm 1,59$	+	-
	1	$4,26^{bd} \pm 0,99$	$1,00^a \pm 0,00$	+	-
	3	$6,66^c \pm 0,71$	$1,62^d \pm 0,09$	+	-
	6	$7,81^f \pm 1,52$	$3,20^{bc} \pm 1,03$	+	+

Explanatory notes:  $x_{sr}$  – mean value, s – standard deviation, K - control sausage, N25 - 25% of pork meat replaced by Baader meat from poultry neck, N50 - 50% of pork meat replaced by Baader meat from poultry neck, „+” – presence, „-” – not presence, different letters (a, b, c ...) in the same column indicate statistically significant differences ( $p < 0,05$ )

The pH value of the sample sausages was between 6.19 and 6.52 (tab. 3), no statistically significant differences were observed.

Table 3. pH value of the experimental, vacuum packaged sausages, stored in chilling conditions ( $x_{sr} \pm s$ )

Product variant	Storage period (days)	The sausage with BAADER meat from carcasses	The sausage with BAADER meat from neck
K	0 (batter)	$6,45 \pm 0,24$	$6,45 \pm 0,01$
	1	$6,47 \pm 0,15$	$6,47 \pm 0,03$
	3	$6,48 \pm 0,18$	$6,48 \pm 0,04$
	6	$6,48 \pm 0,25$	$6,47 \pm 0,03$
25	0 (batter)	$6,19 \pm 0,07$	$6,19 \pm 0,17$
	1	$6,40 \pm 0,13$	$6,42 \pm 0,01$
	3	$6,36 \pm 0,21$	$6,41 \pm 0,01$

	6	6,47 ± 0,23	6,44 ± 0,01
	0 (batter)	6,52 ± 0,05	6,50 ± 0,05
50	1	6,44 ± 0,07	6,44 ± 0,01
	3	6,38 ± 0,18	6,48 ± 0,04
	6	6,49 ± 0,24	6,41 ± 0,01

Explanatory notes:  $\bar{x}_{sr}$  – mean value, s – standard deviation, K - control sausage, 25 - 25% of pork meat replaced by MSM from poultry necks/carcasses, 50 - 50% of pork meat replaced by MSM from poultry necks/carcasses

## Conclusions

The regulations of orders WE 853/2004 and 2073/2005, 1441/2007 allow using mechanically separated meat as a food product ingredient, however the range of its use is limited. MSM can be used only in meat products which undergo heat treatment. Replacing pork meat with mechanically separated meat facilitates utilising the lower quality raw material and lowering the finished product price, but the amount of MSM introduced into the stuffing should be limited due to the possibility of a significant decrease in quality. Research conducted as part of the present study indicates that the microbiological state of the finished product depends on which parts the Baader meat was obtained from. The sample sausage including poultry neck meat in its ingredients was characterised by a lower overall number of aerobic microorganisms than sausage containing Baader meat from poultry carcasses. Vacuum packaging did not result in a significant improvement of the finished product's microbiological quality.

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## **4.5. The effect of edible protective casings on selected quality characteristics of culinary meat obtained from pork carcasses**

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### **Introduction**

The modern consumer pays more and more attention not only to the culinary product, but also to its packaging as its inseparable, integral part. Besides the aesthetic value, the packaging needs to fulfil a range of specified roles and functions among which protecting the packaged product is undoubtedly the most important. A good package is characterised by aesthetics, it protects the product, has a positive effect on its properties, quality and shelf life, informs the consumer as well as is, ever more importantly, environmentally-friendly – ecological.

The growing consumer awareness as well as the more and more strict regulations in the food market result in new, unconventional methods of packaging and storing food. In many countries, the regulations regarding the use of artificial packaging are particularly rigorous. According to them, its use must be limited in favour of environmentally-friendly packaging. This includes edible casings and edible packaging.

Edible casings (edible films) are thin layers, most often made of biopolymers, which cover the food. They can be eaten along with the packaged product. Using edible casings improves product quality, gives it new mechanical properties, constitutes a protective barrier against negative environmental impact and prolongs its shelf life.

Various factors have an effect on the characteristics of edible casings. The type of material is important as well as its manufacturing process and the way it is used on the product. The properties of edible casings change depending on the kind of plasticizer, the presence of micro organism inhibitors or the use of other functional substances. An edible casing should constitute an ingredient of a food product, its integral part, thus it should be tasteless or its taste should be compatible with the taste or smell of the product.

### **The aim of the study**

The aim of this study was to evaluate the effect of edible protective casings made out of natural biopolymers on selected quality characteristics of steaks obtained from the longissimus thoracis muscle of 'zlotnicka pstra' breed pigs.

### **The study material and methodology**

The scope of this study encompassed carrying out a laboratory-scale experiment using study material constituted by longissimus thoracis steaks from 'zlotnicka pstra' breed pigs. The study was split into two stages. The aim of the first stage – preliminary study – was to develop the technology to produce protective casings obtained from sodium alginate and konjac gum, whose quality was modified by adding plasticizer as well as natural antibacterial substances – rosemary extract and acetic acid.



The task that was to be carried out at the second stage of the study (the main study) was to determine the effect of varied contents on selected quality characteristics of the examined steaks.

The quality of the examined steaks was evaluated based on the changes in physical parameters characterising the colour ( $L^*$ ,  $a^*$ ,  $b^*$ ) and the mass loss during cold storage (+4°C). An evaluation of the colour sensory desirability of the sample products during storage was also carried out. The studied quality characteristics of the examined steaks were analysed immediately after obtaining the muscles and after 2, 4 and 7 days of storage. The results are the arithmetical average of three independent production runs.

The instrumental colour evaluation of the sample raw sausages was carried out using a Spectro-Pen type LMG 161 (Dr Lange, Germany) spectrophotometer, which allows for colour composition measurement using the reflection method. The standard observer settings used for this study were typical for food industry analytics, i.e.: light source angle 10°, light  $D_{65}$ . Each time before carrying out the measurements, the device was calibrated against the dispersed light and the white standard LZM 224 Standard 3125, the parameters being  $X_{cal}=92,1$ ;  $Y_{cal}=97,2$ ;  $Z_{cal}=103,9$ .

The sensory analysis was carried out based on a five-point scale according to the guidelines set out by Barylko-Pikielna. All the evaluations were carried out by a jury whose sensory sensitivity had been confirmed.

Analysis of variance (ANOVA) was used to test the hypotheses about the significance of the influence variance factors have on the effect, meaning the experimental variant, storage time and the interaction of variant x storage time of steaks. Tukey's test was used to create statistically homogeneous groups.  $p \leq 0,05$  was assumed as the significance level. The results of statistical analysis constituted the basis for drawing conclusions.

## **Conclusions**

The use of casings had a significant effect on the values of the physical parameters of the colour  $L$ ,  $a^*$ ,  $b^*$  and on the mass loss of the experimental steaks. Regardless of the casing used, a larger share of the red colour and a significantly higher brightness value of the sample steaks were observed compared to the non-cased samples. The casing which contained sodium alginate and plasticizer in the form of mono- and diglycerides was characterised by the highest efficiency at limiting the mass loss of the sample steaks. The possibility of further improvements to protective casings to limit unfavourable changes occurring during meat and meat products storage seems highly probable.

## 4.6. Management of food allergens in the food industry

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**Key words:** allergens, food allergies, food safety, management of food allergens,

Nowadays, the food safety is becoming extremely important issue because of its significant impact on human health especially regarding people who are hypersensitive to selected food ingredients. The twenty-first century society must deal with more and more health problems of allergic nature even though the issue has been present in people's everyday life for a long time. The term "allergy" was first mentioned in 1906 by Austrian paediatrician Clemens von Pirquet, from the ancient Greek words *allos* meaning different and *ergon* meaning reaction (Compare and Nardone, 2013). Allergy can be defined as a hypersensitivity reaction mediated by immunological mechanisms. In the majority of cases the antibody typically responsible for an allergic reaction belongs to the IgE isotype therefore a person may be referred to be suffering from an IgE-mediated allergic disease (Johansson, et al., 2001). A major threat to human health and life pose the food allergies. Their progressive spread has led to the emergence of distinct food industry sector, which produces food addressed directly to this segment of the market. Almost 90% of all food allergens is Almost 90% of food allergens is classified within 8 groups of food products: cow's milk, eggs, fish, crustaceans, nuts, peanuts, soybeans and wheat (Przybylski, 2016). According to the data from The Epidemiology of Allergic Disease in Poland project food allergies affects 13% of children at 6-7 years of age, 11% of children at 13-14 years of age and 5% of adults (Samoliński, et al., 2008).

Both the scale of the problem and possible consequences of consumption of products containing food allergens by people suffering from hypersensitivity led to introduction of legal regulations concerning information about the presence of allergens in food which were meant to protect and increase the safety of consumers. Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumer requires food manufacturers that for pre-packed foods allergen information must be emphasised in the ingredients list while for non-prepacked foods (including catering) allergen information must be made available to consumers. The main source of information for consumers regarding a presence of allergens in food products is the appropriate labelling. According to prevailing regulations the presence of any of the 14 major allergens in food products should be declared whether for use as an ingredient or a processing aid: cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk, nuts, celery, mustard, sesame, sulphur dioxide or sulphites (at concentrations of more than 10mg/kg or 10mg/L), molluscs, lupin. Such information is mandatory for the allergens that are intentionally in the food product and should be mentioned either on a label or through provided information such as menu. It should be easily accessible, in a conspicuous place, easily visible and clearly legible as well as it should not be hidden, obscured, detracted from or interrupted by other written or

pictorial matter. Food manufacturers have recognised that there is a risk of allergen cross-contamination across the supply chain, from raw materials through to the finished products with allergens which are not deliberately added to food products. In order to avoid an unintentional presence of allergens in food it is necessary to evaluate the likelihood contamination. This risk is often conveyed to customers in advisory warning statements such as “may contain...” or “may contain traces of...” voluntarily used on products’ labels (Dzwolak, 2015). It is important that the application of advisory labelling should only be made after performing a risk assessment which proves there is an actual risk to the food allergic consumer. Otherwise, the use of precautionary allergen labelling could be considered as misleading.

Taking into account the risk that even trace amounts of an allergen may pose a serious threat to consumers’ health, more and more manufacturers are developing their production processes in order to produce foods in which they significantly reduce or even totally eliminate the use of allergens (Rona, 2007). A manufacturer is fully responsible for a statement that a food product is free of allergens and that a cross-contamination during the production process was eliminated. Such food can be determined by manufacturers with special symbols such as Crossed Grain (figure 1) for gluten-free products food or special terms e.g. Lactose-Free for product without lactose. Such information ensures consumers that the product does not contain ingredients causing an allergic reaction.

Figure 1. Crossed Grain symbol used to represent gluten-free products certified by Polish Coeliac Society.



Source: <http://www.celiakia.pl>

One way to ensure food safety is implementing effective monitoring and control of allergens at each stage of food production process: raw materials and additives, employees and their workwear, machines and manufacturing equipment, finished goods, packaging, by-products and waste, transport and air. Monitoring includes the following activities: identification of raw materials and additives used in food, assessment of cross-contamination risk, implementing proper cleaning and disinfection procedures, providing food safety related trainings for employees. Mandatory systems, which must be implemented by a manufacturer to ensure the safety of food products include: Good Manufacturing Practice (GMP), Good Hygiene Practice (GHP) and the system of Hazard Analysis and Critical Control Points (HACCP). The special control should apply to all raw materials and additives, both those supplied and used in the production, as well as production lines, machines and equipment. Food which is destined for people who suffer from allergies should be manufactured on dedicated and separated production lines, in order to minimize the risk of final products contamination

(Stefko, et al., 2013). Moreover, the manufacturer has to provide the procedures which prevent improper packing and labelling of final products. Employees should follow all procedures related to food safety in a very restrictive manner while employer should take care of raising their awareness by regular trainings. Reaching a desired level of food safety is possible through appropriate management of food allergens. The detailed requirements in this area are defined by the following standards: The FSSC 22000 Food Safety System Certification, BRC Global Standards, IFS (International Food Standard) and SQF (Safe Quality Food) (Dzwolak, 2015). Management of allergens in food industry consists in identifying all allergens existing in a plant, determining their place in the production process and areas of their occurrence in a plant, finding which products contain certain food allergens and which remain free of allergens, assessing a risk of unintended presence of the allergen in the product and providing reliable information about products containing allergens to consumers. Only a comprehensive approach in this field can bring noticeable benefits such as increasing consumers' trust concerning the information provided on products labels, reducing the number of alerts and notifications related to an identified hazard in food safety and ultimately reducing the amount of products' recalls or withdrawals from the market.

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## **Chapter 5: Importance of IT in optimizing flows in food chains**

### **5.1. Internet and Mobile Phone Revolution in Developing Regions: Implications for Food Security in Africa**

(Abel Ezeoha, Ajuruchukwu Obi, Chinedum Nwajiuba, Omoke Philip)

### **5.2. E-commerce distribution channel of food – the chance or the problem**

(Grzegorz Chodak)

### **5.3. The role of information in optimization of logistics processes on the example of supplies of sugar beet**

(Marcin Polowczyk, Rafał Baum)

### **5.4. Agricultural press as balanced development knowledge broker**

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## **5.1. Internet and Mobile Phone Revolution in Developing Regions: Implications for Food Security in Africa**

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### **Abstract**

Food insecurity problem is more severe and persistent in Sub-Saharan Africa than in any other part of the world. Among other developing regions, Africa's food security situation had remained typical for a number of reasons. First, according to UNCTAD (2010), agriculture is a single sector that dominates many African economies, providing the largest source of employment and livelihoods for the greatest percentage of the citizens. This implies that instability in and vulnerability of the sector ideally pose much more severe threats for Africa than any other region. Secondly, whereas the global average per capita agricultural production in the last two decades climbed to 40%, in the Sub-Sahara Africa, the level rather fell by 5%. Thirdly, above the level in other regions, a third of the African households still remain highly exposed to the risks of food shortages and hunger (Skoet and Stamoulis, 2006), with the Sub-Saharan Africa for instance recording the highest level of undernourishment, with about 23.2 percent of the population estimated to be undernourished between 2014 and 2016 (FAO/IFAD/WFP, 2015).

Equally to note is that unlike the cases in most other regions of the world, agricultural technology in Africa remains widely crude and informal, which accounts for why the region continues to lag behind others in the five pillars of food security measures – name, for availability, accessibility, affordability, utilization, safety and security. Inefficient production and management system, defective food pricing and supply system, and misuse of technology are all held to be responsible for the rising threat of food security in the region.

The persistent and crude nature of agricultural production and management in Africa sharply contrasts with development in the ICT sector across the region. Before 1990s, telephone services and telephone line ownership were an exclusive preserve of rich individuals and businesses in Africa – with average penetration rate in the Sub-Sahara Africa standing at mere 0.86 per 100 persons in 1985 (Ezeoha, 2015). By the end of 2015, as much as 67 percent of the adult population in the Continent have access to mobile phones. At the same time, the percentage of internet users rose from a near zero percent in 1990 to 22.4 percent in 2015. Studies on how the emerging growth in internet and mobile phone penetration can aid growth in critical sectors like agricultural in developing countries are evolving. Abraham (2007), for instance, used the Indian case to demonstrate how mobile phone improved supply chain and

enhanced the living standard of Indian fishermen. A study by GSM Association and Deloitte revealed that a doubling of mobile data use brought about an “increase of 0.5 percentage points in the GDP per capita growth rate across selected 14 countries, and that countries with higher level of data usage per 3G connections have seen increases in GDP per capita growth exceeding a percentage point” (GSM Association, 2012).

Interestingly, the linkage between ICT revolution and business survival and sustainability is well premised in theoretical literature. The Internet and mobile phone for instance are proved to be of viable aid to businesses through the reduction in information costs and the expansion of the business opportunities and platforms (Comptroller’s Handbook, 1999; Calisir and Gumussoy, 2008; Ezeoha, 2010, 2013; Asongu, 2013; Qureshi et al., 2013; Singh, 2008; Porter et al., 2012; Funk, 2009; Michalakelis et al., 2008). Aker and Mbiti (2010) identify five potential mechanisms through which mobile phone interfaces economic development, namely: the capacity of mobile phone to improve access to and use of information; the capacity to provide opportunity for business efficiency through enhanced supply chain; the capacity to provide income-generating opportunities to rural and urban population; the possibility of facilitating information sharing and reduced households' risk exposures; and the possibility of facilitating essential services delivery, especially in the areas of health, education and agriculture.

In this paper, we collect data on two sets of variables from up to 40 countries in the Sub-Saharan Africa for the periods 2000 to 2015. The variables include: internet and mobile phone penetration rate and food security indicators. We hypothesize that internet and mobile phone growth has no consistent relationship with key food security indicators in Africa; and that internet and mobile phone developments explain less of the performance of African countries in the attainment of food security goals. We formulate some theoretical models to explain the hypothesized relationship and to empirically test for the channels through which internet and mobile phone penetration could impact on food security. Our findings are expected to provide sufficient evidence to guide policies on how government can leverage on the private sector-driven ICT revolution in Africa to sustainably resolve the persistent problem of food insecurity in the region.

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## **5.2. E-commerce distribution channel of food – the chance or the problem**

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**Keywords:** e-commerce, online store, distribution channel, food

### **Introduction**

Electronic commerce became present in the Polish economy with the growing number of Internet buyers, however food online stores still remain the minority of food market. People who shop online encourages entrepreneurs to find new solutions for the distribution of food. This involves, however, significant changes in logistics management. The Internet can be added as an additional distribution channel on every stage of the supply chain. If the e-commerce channel is used by the manufacturer or wholesaler to sell goods to the final customer, it is the disintermediation [Delfmann, 2002]. If the Internet is used by retailer as an additional distribution channel, the length of the channel remains unchanged.

The paper presents the advantages and disadvantages of the use of the Internet as an additional food distribution channel. While a significant part of the discussion concerns retailing sector it may also relate to distributors and manufacturers. The aim of this article is to analyze mutual influence of traditional and online distribution channels. The structure of the article is as follows: the first main part presents advantages and disadvantages of using the Internet as an additional distribution channel. The next section of the article presents brief analysis of the market of Polish online stores selling food. The final section of the article contains conclusions.

### **Traditional and online distribution channels**

There are two types of click and mortar companies [Chodak, 2010]:

- the shops that began selling in the traditional form, and then expanded the sale of a new online distribution channel;
- the shops that began selling via Internet, and then opened traditional distribution channel.

The subsequent analysis will take into consideration first group because it is much more common form among online stores which sell food.

It is important to indicate these features which make traditional and online distribution channels to support with each other but not interfere. In literature the concept of the inter-channel cannibalism arises in the context of the Internet channel [Deleersnyder, 2002]. This indicates that this channel should not be regarded merely as a source of benefits.

In literature there are various classifications of the advantages and disadvantages of using the Internet as an additional distribution channel. For example, Geyskens et al. [2002] divide the advantages and disadvantages of features concerning the demand side and the supply side. On the demand side authors mentioned: increasing demand, which can be achieved by broadening the market by reaching new groups of consumers, taking customers away from competitors and increase sales volume to the current consumers by strengthening relationships with them. The benefits concerning the supply side are divided into cost reduction of distribution and decreasing transaction costs [Geyskens et al. 2002].

The advantages of internet channel can be also divided into real benefits and ambiguous (in some cases apparent) benefits [Chodak, 2010].

The important advantage of using the Internet as an additional distribution channel seems to be the ability to reach a wider group of customers. In Internet, there are no geographical barriers, so there is a possibility of acquiring customers, who would not be able to reach the brick and mortar store (e.g. customers from small towns and rural areas). This feature which in many sectors seems to be real benefit, in food sector is not as unequivocal. If the deliveries of orders are carried out by own car fleet of the store (as it is in case of most hypermarkets and supermarkets with online channel), the geographical area of potential clients is limited by the cost of delivery.

Another advantage of internet channel in many sectors are lower labour costs as the consumer does himself the part of the shopping process - client finds, compares the goods, take the information about the goods in electronic form, then put products into e-shopping basket and completes the checkout process with the electronic payment. In self-service markets which sell food this advantage is ambiguous because pick and pack process (which is carried out by customer in brick and mortar store) takes human resources in internet channel.

It is also worth to mention the reduction of marketing costs in case that both distribution channels inform customers about each other [Steinfeld et al., 2002]. It is, however, ambiguous phenomenon of synergy marketing. The basic question is whether the client, who in brick and mortar store finds information about the possibility of making purchases in the Internet channel, will buy in the long run, more goods in this shop, or just will turn from one distribution channel to another. If the shop offer additional possibility of shopping in online channel it is the advantage to customer, which gives him more choice. From this point of view it is the improvement of quality of service and in this context it can be argued that an additional distribution channel is beneficial for the company, since the total sale is always a function of customer satisfaction.

The ability to quick search of products is one of the main advantages of e-commerce. A well-designed search engine allows to seek through the long tail of products. Brynjolfsson et al. [2011] claim that the Internet channel exhibits a significantly less concentrated sales distribution when compared with traditional channels. The recommendation system in online store facilitates buying process of food [Gaikwad et al., 2017], [Ricci et al., 2011]. Customers of traditional store, aware that this shop is also available in Internet, may choose online store because of the simpler and faster searching of goods. The additional online channel may cause the increase of sale of niche products.

The ability of using social media in online store is very important in food distribution. Traditional stores can not offer customers the ability to read and write product reviews. Such facilities give only online distribution channel. Traditional shop may refer to the reviews and customer feedback contained in the online store or Facebook fanpage. The fanpage posts may refer to the brick and mortar store or online store. Social community connected with some ideas such as healthy food or vegetarian food enables exchange of opinions about products or recipes.

It should be noted, that if there are free resources in the traditional distribution channel, the online channel may be a good mean to exploit them (e.g. free storage space). Similarly, employees who, due to the irregular sale on morning hours do not have work to do, can be referred to the packing of online orders. However, in the case, when resources are fully used, directing shop assistants into online sales packing can create the effect of the inter-cannibalism of resources [Chodak, 2010].

In the traditional retail packaging process orders are usually carried out either by the shop assistant or by customer in self-service stores. Online orders require collecting, packing

and shipping or leaving the possibility of personal receipt of the order by the customer. The process of collecting and packing of online orders requires appropriate organizational arrangements.

It is also worth to mention the problem of adjusting information system to additional online distribution channel. This involves costs and can cause software and hardware problems if the existing IT system is not flexible enough.

### **Polish food online stores**

Polish sector of food online stores is growing rapidly during last few years. According to Sklepy24.pl catalogue there are almost 350 online stores which sell food [www.sklepy24.pl]. Some of them are additional distribution channel of hypermarkets (such as www.leclerc24.pl, ezakupy.tesco.pl). Some of them are specialist shops selling only one kind of products such as tea shops (www.best-tea.pl), coffee shops (www.cafeamor.pl), spices and herbs shops (przyprawowo.pl), shops for vegans (www.vegabutik.pl), shops with ecological food (ekolandia24.pl). The more complex classification and analysis of Polish food e-commerce market will be presented in the full paper.

### **Conclusions**

Businesses expanding the distribution of additional online channel should be aware of the benefits and risks caused by the combination of channels. As it was mentioned, there are a number of ambiguous advantages of additional online distribution channel, as well as some of them may turn out to be illusory benefits. Presented lists of pros and cons should not be regarded as complete, but the most important issues have been pointed out. Summarizing the above considerations it can be stated that before opening an additional online distribution channel, the company should examine whether and how to integrate this channel with the existing one. Managers should consider how channels can support marketing and pricing strategy they use - whether unify or reduce prices in the online channel. The company should also consider the possibility of use owned resources in the new channel, bearing in mind the possibility of the inter-cannibalism phenomenon. Considering to open online channel there is also very important to take into account characteristics of food distribution such as short expiry dates, specific conditions of transport, seasonality of supply etc.

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### **5.3. The role of information in optimization of logistics processes on the example of supplies of sugar beet**

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**Key words:** Information, supply, flow of information, feedback

#### **Introduction**

When it comes to optimization of logistics processes, access to information is of significant importance. Another equally important element is the proper flow of that information within the whole logistics chain. Nowadays, when it is said that business advantage must be built on usage of information, the role of information becomes a dominant element of competitive advantage.

Ubiquitous information and its collection, processing, and analysis/interpretation is related to the need of establishing proper infrastructure. That refers not only to dedicated computer software that aids management of information, but also to specialized integrated systems, such as:

- SCM - Supply Chain Management
- WMS - Warehouse Management System
- ERP – Enterprise Resource Planning

In the case of transporting crops, especially sugar beet shipped for processing directly from fields of growers, it has become important to prepare a relevant infrastructure that will enable seamless flow of information between individual participants. It should be noted that process participants are often entities that cooperate with each other during the sugar season and the infrastructure used in the process must not pose additional costs on those entities.

#### **Material and methodology**

In order to properly analyze the problem and meaning of information in the supply chain of sugar beet for direct processing with the use of professional external transport companies, for the needs of this research, a group of sugar refineries owned by one concern operating in Poland was selected.

The basic source of research information has been original data delivered directly by the raw material department of sugar refineries. The research scope is to cover the last 5 years, during which a management system was introduced for beet, using a centralized supply schedule.

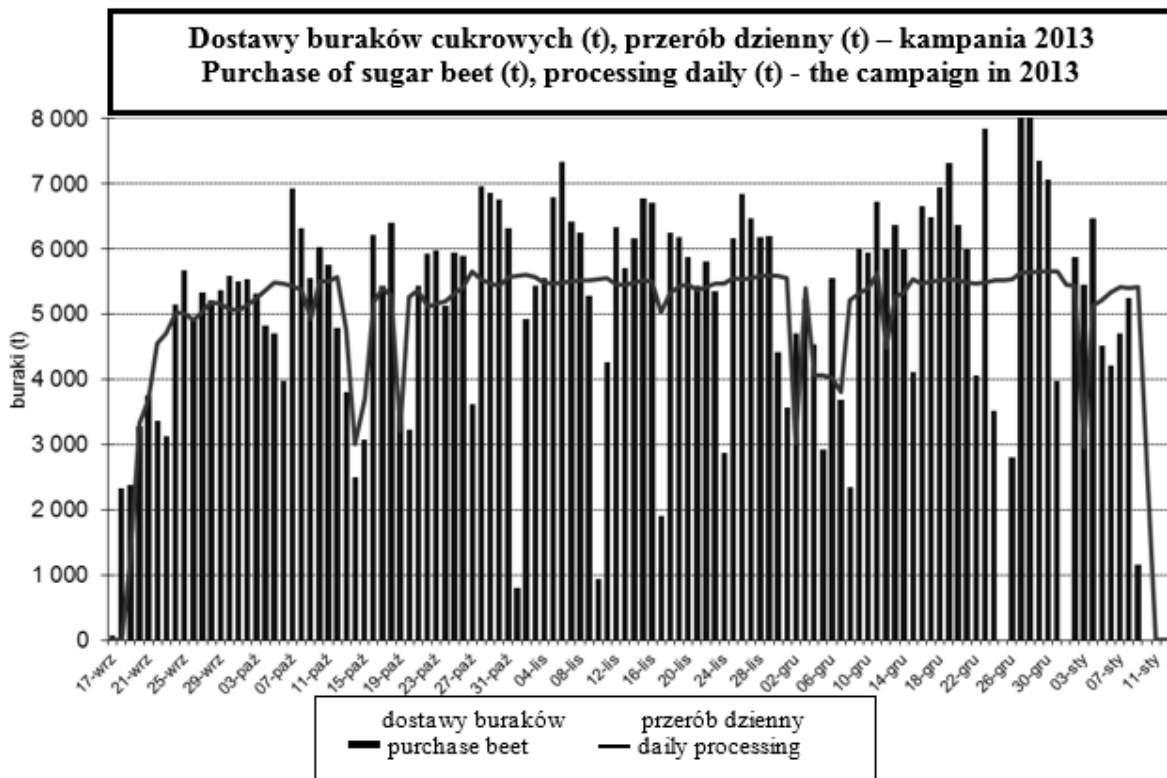
Organization of deliveries of sugar beet in the analyzed sugar refineries has been based on truck transport performed by the sugar producer. Assuming that each truck is, each time, capable of delivering 24 tons of pure beet, to satisfy the processing demands of sugar refineries, 260 deliveries a day will be then sufficient, i.e. about 60% less than in the case of individual deliveries performed by farmers.

The analyzed sugar refineries include the territory of west and central part of Poland (the following voivodeships: wielkopolskie, dolnośląskie, łódzkie, kujawsko-pomorskie, and mazowieckie).

### **Results of research**

Introduction of data analysis and providing direct access to such data for individual participants of the process has contributed to achieving the following benefits:

- elimination of paper documentation for deliveries, including shipping lists. The decrease of amount of required documentation decreases: the time needed for the carrier, grower, owner of transported beet to prepare the required documents. It also has a significant influence on the amount of errors arising from manual preparation of documents. What is more, it enables implementation of automation of individual processes that would become free of irrelevant amount of paperwork.
- limitation of the number of events managed in the process. It has been achieved through using highly-efficient transport that would not be possible for an individual farmer.
- automation of identification concerning individual process participants and places of processing. Implementation of electronic storage media is connected with enabling identification of places at which the process user appears.
- expansion of access to information in the system. Electronic management of information and its flow allows granting access for a wider group of users. The ability to share information easily and immediately between the users of supply chains greatly contributes to, e.g. optimization of stock kept at individual processing plants in case of problems with deliveries of beet. An example of minimizing of the stock level in one of processing plants has been presented below.



1. Porównanie wielkości dostaw buraków do ich dziennego przerobu w Cukrowni nr 1  
 Fig. 1. Comparison of beet deliveries to their daily throughput in the sugar factory No. 1  
 Źródło: opracowanie własne na podstawie danych z kampanii 2013 w Cukrowni nr 1  
 Source: own study based on data from the 2013 campaign in the Sugar No. 1

- connecting users of supply chains also enables feedback. A bidirectional flow allows faster reaction of individual links to unforeseen changes e.g. caused by breakdowns.

## Conclusions

Summing up this elaboration, the following conclusions might be drawn:

- in order to achieve further economic advantages, it is necessary to introduce more stages of information connections of individual users of the supply chain for sugar beet. In particular, it refers to a direct access to information that supports making decisions.
- that information chain must also include other elements related to provide services for growers. It mainly concerns the handing over of products transported to farmers from sugar refineries, e.g. beet pulp or defecation lime. Optimization within that scope should limit costs and, at the same time, increase satisfaction concerning services for growers.
- integration of all, even the smallest elements, participants of the beet supply chain field-sugar refinery will make those participants, being recipients of even small amount of information, aware of the fact that they are an important link of the whole process. In such a situation, it is possible to expect increased involvement and responsibility of individual participants.

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## 5.4. Agricultural press as balanced development knowledge broker

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**Key words:** agriculture, knowledge transfer, knowledge broker, agricultural press, balanced development

### **Introduction**

Agriculture is a field in agribusiness traditionally and quite precipitately viewed as a branch of knowledge with relatively low knowledge absorbtion. This opinion is justified only when base agricultural activity (vegetative and animal raw material production) is compared, for instance, with entities based on biotechnology, genetical advancement or Information Technology development which can be found in the vecinity of agriculture and work to its advantage. Viewing the issue from another perspective, i.e. from the perspective of improving the levels of education and the will to learn through practice, as well as investment activity (e.g. purchase of equipment and technology), the postulate of low knowledge absorbtion in agriculture is not accurate (Kozera, 2013, pp. 170-174, Kozera-Kowalska, Kalinowski, 2016, pp. 80-100).

The following study attempts at analysing the notions of knowledge transfer in agriculture pointing to the necessity of broadening the informative function of entities surrounding agriculture. Especially, in terms of matters connected to practical realisation of balanced development postulates. The increase in knowledge transfer in this field could contribute to further popularisation of its principles. It could also increase the efficiency of their application in Polish agriculture. The aim of the presented study is to point to branch agricultural press which – being the means of knowledge transfer – plays the role of knowledge broker in this sector.

### **Methodology**

The following analysis is based on a review of branch literature using *desk research* method (i.e. papers concerned with knowledge transfer in agriculture and in rural areas and especially plans and concepts of building an optimal network for knowledge transfer for the whole sector). Also, available branch information (i.e. The Ministry of Agriculture and Rural Areas Development, The Institute of Rural and Agricultural Development – Polish Academy of Science in Warsaw and The Press Distribution Control Union) was used. Analysis of cultivators' opinions (i.e. Agrofoto.pl internet forum users' posts) concerned with the preferred periodicals and agricultural magazines served as supplement for secondary materials. Three hundred registrations performed in the period between October 2016 and March 2017 were analysed altogether. It ought to be emphasised, that concluding on the basis of this kind of source might be burdened with considerable cognitive error which, amongst other things, might be the result

of the possibility to moderate discussion on the forum. The conclusions, hence, might possess cognitive value as well as set disinformation for the researcher.

## **Results**

The notion of knowledge transfer to the area of agriculture is one of the major concepts as well as challenges which institutions responsible for the development of agriculture have to face. Traditionally, the Ministry of Agriculture and Rural Areas' Development and broadly understood agricultural consulting is considered to play the primary role in the process. More and more frequently, though, this responsibility is delegated to research units and institutions, non-governmental organisations, and even municipal government units (Chyłek, Mikołajczyk, Niepytalski 2017, pp. 99-113). This points to increasing awareness of the complex character of modern knowledge market as well as ongoing activities aiming at improving the mechanisms of its information transfer. Undoubtedly, they constitute a complex whole which demands not only the use of diverse tools and means of transmission, but also a new manner of formulating information.

Connections between entities existing within agriculture refer to the fundamental scheme (i.e. science – agricultural practice), in which the cultivator becomes the centre of communication network as well as the ultimate addressee of the communication process. The number of network's participants influences the manners in which cultivators are stimulated. This is due to diversification in terms of knowledge, experiences, competencies and interests among cultivators themselves. This, in turn, opens a whole new space for activities conducted by the entities, which can be defined as knowledge brokers. The character of information network is open by nature. Hence, all entities engaged in development of agriculture and rural areas can become part of the network. Amongst such entities, the broadly understood branch press has an especially significant role to play, as it is naturally predisposed to become knowledge broker for agriculture.

The very term 'broker' undergoes various interpretations. It can be a person or an organisation which facilitates and supports the creation, exchange and exploitation of knowledge on its way between the producers and the users. Hence, it is generally a job connected to commissioned search for and sharing of information. In practice it is an entity (i.e. a person or a company), which searches for and shares information for a fee. In the process of making particular information available, the entity takes account of certain specific criteria which allow to satisfy the needs of the ordering party. A knowledge broker should not only gain the necessary information, but also he or she ought to evaluate, analyse and compile it. The broker, thus, becomes the most natural mediator between the demand side of the market and the supply side of the market.

Although the history of agricultural press in Poland has its sources in the 19<sup>th</sup> century, it is rather hard to univocally define the role and the coverage of agricultural press on the Polish market. It could be estimated with the help of information provided by The Ministry of Agriculture and Rural Areas Development, as its webpage (which has not been updated since 2009) contains a list of 66 titles of agricultural periodicals. However, from the perspective of knowledge-based economy such information becomes unreliable due to passing time. Especially in the light of dealing with an entity as prone to change as branch press. The durability of periodicals dedicated to agriculture can differ, which additionally renders such judgements troublesome. Amongst them, we can find periodicals which marked their existence, however, did not manage to survive the test of time as well as the competition and existed on the market for a year or a few years. There are also periodicals which have lasted for 20 and more years (Solon, 2014, p. 277). Most periodicals with a steady position on the market as well

as in the awareness of the cultivators are monthly magazines. There are also weekly magazines, fortnightly magazines, bi-monthly journals, quarterly magazines and journals which are published once or twice a year. All these magazines are different in terms of their circulation and volume, which is usually in strict relation with their characters (e.g. strictly branch magazines usually have lower circulation and smaller volume in contrast to agricultural press with a more general character). In Top-114 (Top-150) six titles dedicated to broadly understood agriculture can be found amongst the leading titles. They are as follows:

- no 43(47) is *Top Agrar Polska* (with average circulation rate of 49 thousand units),
- no 98(125) - *Farmer* (circulation rate of 17 thousand units),
- no 128(102) - *Sad Nowoczesny* (circulation rate of 8 thousand units),
- no 129(103) - *Miesięcznik Praktycznego Sadownictwa Sad* (6 thousand units),
- no 132(106) - *Warzywa i Owoce Miękkie* (8 thousand units),
- no 134(106) - *Hasło ogrodnicze* (8 thousand units).

The ranking, however, does not take into consideration weekly magazines, amongst which we can find a very popular *Tygodnik Poradnik Rolniczy* (created from the merger of two pre-existing magazines, i.e. *Tygodnik* and *Poradnik Rolniczy*). The circulation of this magazine is over 77 thousand units. On the aforementioned internet forum, cultivators interested in branch press point to over 30 titles within their scope of interest. Among the titles *Top Agrar*, *Tygodnik Poradnik Rolniczy*, *Farmer*, *Nowoczesna Uprawa*, *Trzoda chlewna*, *Bydło*, *Agroserwis*, *Raporty rynkowe*, *Sad nowoczesny* etc. are enumerated. The matter of opinion-forming factor of agricultural press (and what follows, the possibility to utilise it as balanced development knowledge broker) remains open. From The Institute of Rural and Agricultural Development – Polish Academy of Science reports, it appears that cultivators are a very specific target group, i.e. such that displays a relatively low level of interest in branch press as a source of knowledge (only 5% of the respondents declare using it). Amongst reliable magazines they, however, point to the titles which are most significant to them: *Top AGRAR* (10% of indications), *Tygodnik Poradnik Rolniczy* (6% of indications) and *Farmer* (4% of indications).

## Conclusions

In the process of transferring knowledge from the field of science to the field of practice, a major institutional gap is still observable. The process lacks entities which would comprehensively monitor the needs of cultivators as well as gather information to deliberately provide the cultivators with the necessary knowledge or at least be a link between the cultivators and the ones who possess this knowledge. As a result, the generated knowledge reaches the ultimate target recipients with a considerable delay. Broadly understood agricultural press which could successfully play the role of knowledge broker could fill this space. This stance is shared by the entities offering knowledge and information to cultivators. From their pragmatic perspective, agriculture is high-potential demand side of know-how market. Additionally, agricultural press has been acknowledged as a reliable source of information for years and could also play educational role. Amongst others, it could promote knowledge about balanced development.

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## **Chapter 6: Food Transportation: economic and environment perspective**

6.1. Food transportation in the EU-the characteristics of some selected items  
(Michael Irobi, Hanna Teszbir, Piotr Uciechowski, Joanna Sarniak)

6.2. The influence of transportation processes on the environment in the fuel and energy industry in the light of surveys.  
(Dariusz Budkiewicz)

6.3. Transportation systems optimization to enhance agricultural logistics in Central Java  
(Ibrahim Adrian Nugroho)

6.4. Economic and technical conditions of air transport of food products  
(Krzysztof Melski)

6.5. Development of distribution and sales of low alcohol beverages in Poland  
(Justyna Majchrzak-Lepczyk, Maciej Szymczak)

## **6.1. Food transportation in the EU-the characteristics of some selected items**

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**Key words:** food supply chain, challenges, transport in EU

### **Introduction**

In recent times, the economic process of organizing and exchanging of products, is based on the free movement of goods and capital [Winiarski 2006, s. 177]. This is also the reason why currently, creating food supply chains has become a major challenge.

The food sector has to meet the highly competitive markets, the ever needs of consumers (both in terms of their quantity and quality) and to adapt to the already existing legal framework. Manufacturers pay much attention to the possibility of the introducing innovative technologies and reconstruction processes and supply chain management strategy in order to achieve a sustainable competitive advantage [Olugu, Wong, 2009, p. 202].

The purpose of the article is an attempt to characterize food transportation in the European Union. We will try to present trade sizes of goods between the countries of the European Union. The authors main attention was particularly turned on the need to comply with recommendations regarding the cargo temperature and precise planning of working time for drivers. More to these, will be facing the contemporary problems of business transportation companies.

### **Methods**

We will review in the work both national and foreign literatures. Observation will be subjected mainly to, amongst all, variation processes regarding the main directions of food transportation within the borders of the European Union, the average transportation distance of selected group of products and also the selection of the type of transport depending on the type of transported products. We shall use statistical inference, especially the average, standard deviation, coefficient of variation and graphical data presentation methods to describe the variation method.

The primary source of data that will be used in the work, will mainly come from the data published by the European Statistics Office.

### **Findings**

The EU attaches great importance to the quality of food supplied to consumers, because this, transportation is regulated by many legal regulations, amongst which, outstandingly noticed is the act of the 25<sup>th</sup> August 2006 on food safety and nutrition, regulation of the European Parliament and of the Council No. 178/2002 of 28 January 2002, laying down general

principles and requirements of food law, established by the European food safety authority and thereby establishing the procedures concerning food safety, regulation of the European Parliament and of the Council No. 852/2004 of 29 April 2004 on the hygiene of foodstuffs and Regulation (EC) 853/2004 of 29 April 2004 laying down specific hygiene rules for food transportation.

The basic manufacturing activities associated with wholesale applies only to fruits and vegetables, which is why these products are most often transported by Polish transport companies, both within the EU and beyond its borders. The main means of transportation of food is still by trucks. Most of the goods, foodstuffs, beverages and tobacco are carried out within the borders of the European Union for a distance of about 150 km. This type of short distance is just because of short expiring dates to consumption and also related to the need for quicker delivery to stores.

### **Conclusions**

Food transportation is one of the biggest logistical challenges of the 21st century. The most important element is first and foremost a properly structured transportation of products, upon which the health of consumers depends. Food transportation has to take place quickly (due to the short expiring date of transported goods) and take into account a variety of legislative requirements.

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## **6.2. The influence of transportation processes on the environment in the fuel and energy industry in the light of surveys.**

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**Keywords:** logistics, transport, environment, power plant, mine.

### **Introduction**

The author presents the development of logistics solution in a specific enterprise, such as the open pit mine. In this type of company is very characteristic to use transport subsystems, especially conveyor belts and factory railways. In the transport sector, there appears clearly the phenomenon of scales, which gives a special dimension to the transport processes.

This article presents the relationship of logistic processes with the environmental activities in the Team Pątnów - Adamów - Konin, and the PAK Konin Lignite Mine. These plants are located far from each other in the Konin Lignite Basin in the Municipality of Kleczew and they are under investigation. The specificity of these two plants is that between them there are different transport processes, mainly using the railway rolling stock and in the mine there is additionally a special transport process, which uses conveyor belts. Currently in the field of the electricity industry in particular there is high pressure from society and various organizations in what concerns environmental impact.

A collection of organization and technological solutions which aim to perform warehouse processes with the highest social standards and with the least possible impact on the environment, taking into account financial effectiveness (Żuchowski, 2015). As it is clearly emphasized in the above definition of a sustainable process of storage, it is important that this process takes into account possible adverse effects in the environment and society.

The idea of distribution logistics is to provide the final buyers with a product, in this case the power demanded by the clients' products, in the place where they want them, at the scheduled time, in predetermined conditions and at an acceptable price. This process focuses its main attention on transport and storage. In the globalizing world market of goods and services, however, this process must be supplemented by the so-called: green logistics. Currently, the concept of green logistics is used for activities in the area of „ecologistics”, that is, the right way to use resources, mainly taking into account the reduction of greenhouse gas emissions.

KWB Konin Mining Railways is an industrial railway network with a length of 120 km used to transport coal from the KWB Konin opencast mine to Pątnów and Konin power stations. It is connected to the railway PKP PLK through a transferring point in the Przesmyk-Gaj KW Station. Up to 15 trains a day are transported through the KWB Konin railway siding. They consist of one electric locomotive and 10 wagons. The annual amount of transportation is about 11 million tons of lignite (Rudziński, 2008).

Despite the seemingly simple process of coal mining, loading and shipping to the place where it has been ordered, the transport of coal from the mine to the power plant is influenced by several factors. In this case, a significant factor in the process of transportation is the good location of the plant to which the coal is to be imported. But the transportation of coal is not



only a question of amount, way of loading and the distance from the target point. The issue here is the important influence on the surrounding environment in which the transport takes place.

## **Methods**

The basic method adopted for the implementation of the aforementioned process will be a critical analysis of domestic and foreign literature in the field of transport logistics and the impact on the environment. For confirmation of the main objectives, a research was carried out, using an indirect measurement survey (a survey measuring method).

The study was conducted based on personal questionnaires tested on 50 residents of the selected commune and town of Kleczew, in whose territory the PAK KWB Konin mine is found. It lies at a short distance from Pałnów - Adamów - Konin. The Kleczew Municipality located in the eastern part of Wielkopolska is one of the 14 communes of Konin.

An important objective aimed at improving the quality of life of the residents of industrial areas is the creation of joint actions of environmental change by the local community, municipalities, NGOs and the same factories.

Poland is the largest EU producer of coal, which is the energy fuel with the highest emission. It is important to mention the Polish energy security, which requires the construction of new power plants and the modernization of the outdated power units. Despite the increase in the allowance prices, Poland will continue to produce energy from coal, because the cost production of coal electricity is currently the cheapest. In the coming years there will be a huge issue in meeting global energy demands without coal, which is burned in outdated power plants.

An important factor in determining the proximity of the power plant from the mine is the composition of the coal: because of the large amount of water in lignite it is not suitable for transportation over long distances. The construction of a new power plant would cost tens of millions of złotych.

## **Findings**

The main objective of the research was to investigate the effect of transport processes on the environment between the mines KWB Konin and Pałnów - Adamów - Konin. The main thesis of the study was to answer the question of whether the residents of the Commune and the City of Kleczew think that transport has any impact on the environment. The study lasted three days and was conducted among residents of the Commune. I think that in the study I managed to achieve the intended purpose, that is, to respond to the primary objective and to obtain the necessary information. The collected data are reliable because the author himself conducted them and queried people who were asked to provide honest and credible answers. I think the value of the collected data is very valuable because it can show what has already been done in terms of processes of transport in the fuel and energy industry, and what needs to be done in the light of current knowledge achieved by the test of the transport in the city and municipality of Kleczew. The selected situation and the way of observation was correct and well carried out.

Due to the dominance of road transport as one of the main objectives of the European Transport Policy (ETP), there was an increase in the alternative forms of transport - the revitalization of rail transport, the promotion of water transport and the development of intermodal transport. It is planned to increase the quantity of rail passenger transport to 10% and

cargo up to 15% a year till the year 2020 (Commission of the European Communities, 2001). To compare, in the United States railway (45%) is the dominant form of freight transport, while passenger transport, in principle, is not counted (less than 0.5% of the total balance of transport) (Energy and Transport in Figures, 2009). A separate issue is the biomass boiler in Pątnów-Adamów-Konin SA, which aims to meet the demands of environmental protection in terms of emissions into the air. The new biomass boiler, equipped with a circulating fluidized bed (CFB) was built in place of the old coal-fired boiler (ZE PAK SA).

When it comes to the pollution of the environment according to data from the European Environment Agency, which depend on the country emissions of NO and NMVOC SA, in Poland it is negligible, no more than 1%, NMVOC 0.24%. According to the report of environmental impact assessment, the project does not affect the environment of the immediate area. Certain negative impact is related to the transport of biomass, but it has been estimated as inconsiderable.

In the Polish conditions, the natural direction for the development of solid biofuels is the production of heat. Since the transport of biomass to EDO is realized by trucks, for a proper assessment of the actual reduction of the amount of CO<sub>2</sub> emissions by power plants, the emissions associated with road transport should be taken into account. In practice, the biomass is rarely transported directly to the plant. Often, after it is cut, it is transported to the company, which is engaged in grinding the biomass in the form of sawdust and there it is also stored and then goes to power plants or other biomass recipients.

The supply is organized in a manner similar to the procedure used by road transport. According to the EIA report, roads and railways in the region of Konin have adequate capacity to ensure the continuity of supply of biomass. For the boiler to operate stably, it is extremely important to maintain a constant fuel quality, avoiding major changes in the characteristics of the fuel. Stability depends primarily on automated collection of biomass from transport vehicles and the storage of several types of biomass (ZE PAK SA).

### **Conclusions and Implications**

The main conclusions of the study are: as a result of the railway between the KWB Konin mine and the power plant, the traffic on the roads was reduced, which had as direct effect the reduction of CO<sub>2</sub> emissions, for which it was unnecessary to rebuild the existing road system. The main disadvantages of rail transport included noise emissions and vibrations, and the use of land. A major issue which was brought into attention by residents are accidents involving cars at level crossings, failure to follow traffic rules and lack of responsibility on the part of drivers and numerous suicide attempts, which were mistakenly confused with accidents, and suicides related to tracks of State Polish railways.

The scale of the impact of rail transport on the environment and on safety is incomparably smaller than in road transport. In the European Union railways carries 6.1% of the total passenger transport and 10.7% of the freight (Badyda, 2010).

In the electric industry, the negative impact on the environment should be reduced. The described nature of the industry in this study may lead to a large extent to the deterioration of the environmental situation in the study area, as well as degradation of the quality of life of residents affected by the operation of these plants. In the literature, there is a lack of studies that show the impact of the transport of coal to power plants on the environment. The phenomenon of continuous transportation of coal from the mine to the power plant indicates the need to deploy solutions that provide with modern methods, with the aim of reducing the impact on the

environment. The activities of large facilities, like power plants, over a large area and on a mass scale, requires intervention in many areas including environmental management landscape.

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### **6.3. Transportation systems optimization to enhance agricultural logistics in Central Java**

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**Keywords:** Mathematical Methods, Operational Research, Transportation, Agricultural Logistics

#### **Abstract**

Central Java is one of the main producers of food commodities in Indonesia. Its role in stabilizing the country's food supply is imperative. Therefore, the price making of food commodities in Central Java is crucial to the country's inflation rate. Previous studies indicate that transportation cost dominates the food prices' cost structure in Central Java, and so does in other provinces in Indonesia. Unlike other countries, the use of rail transport to deliver agricultural goods is very unpopular in Indonesia. Almost all farmers use land transport (especially trucks) to deliver their products, including for long-distance shipping. On the other hand, the use of rail transport to deliver goods, including agricultural goods, is proven to be more efficient in many developed countries. In addition, the use of land transport to deliver agricultural goods is also considered to be unsustainable due to the increasing traffic. This study aims to construct mathematical models in order to find the most efficient modes of transport to deliver food commodities outside from Central Java. The mathematical methods used to construct the model refer to a branch of operational research called the shortest path model. In this study, the term "path" or "distance" in the shortest path model is replaced with "cost". The results indicate that the combination between land and rail transport can reduce the agriculture shipping cost effectively.

#### **Introduction**

Central Java is one of the main producers of strategic food commodities in Indonesia. In 2015, Central Java was the largest producer of shallots in Indonesia, producing 42% of the country's total production (Ministry of Agriculture, 2015, p.61). While at the same time, Central Java was also the third largest producer of rice and beef in Indonesia, producing 14% (Ministry of Agriculture, 2015, p.80) and 12% (Ministry of Agriculture, 2015, p.45) of the country's total production respectively. Therefore, the price making of food commodities in Central Java is crucial to the country's standard food prices.

One of the factors that highly affects the price making of Central Java's food commodities is transportation cost. Previous study from Nugroho (2016) showed that the share of transportation cost of shallots supply chain in Central Java is 30%. While at the same time, the share of transportation cost of rice and beef supply chains in Central Java were 40% and 30% respectively.

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The views expressed in this paper are those of the author and do not necessarily represent the views of Bank Indonesia, its Executive Board, or Bank Indonesia management

This high and inefficient transportation cost has been a central feature in Indonesia's logistics problem. One of the efforts that can be implemented to reduce this high logistics cost is by optimizing the combination of transportation modes that are used to transport goods, including food commodities that drive the country's inflation rate. Based on previous study from ITB Research Center for Logistics & Supply Chain (2011), railway transportation had the lowest cost compared to the other transportation modes in Indonesia. However, the use of rail transport to distribute food commodities was very unpopular among farmers in the country, including Central Java (Nugroho, 2016). Almost all farmers are still using truck as the main transportation mode, including for inter-provincial shipping. In addition, the use of land transport to deliver agricultural goods is also considered to be unsustainable due to the trend of increasing traffic in Indonesia (Ipsos Business Consulting, 2016, p.7).

On the other hand, previous study proposed by Hyoung-Gi Kim (2011) showed that the use of rail transport as a transportation mode of goods could reduce the logistics cost effectively. Lower logistics cost means lower cost of goods sold, and this also applies to the strategic food commodities that drive the country's inflation rate. This study aims to find the optimal combination of transportation modes used to deliver food commodities from the production centers to the markets.

## Methods

Shortest Path Model is a mathematical representation of a network problem that can be used to determine the shortest distance from various routes that are available. In this study, the term "path" or "distance" in the shortest path model is replaced with "cost". In reality, the shortest route doesn't always correspond the least cost. Hence, it is more likely to use "cost" instead of "distance" to represent the real transportation problems in this study.

The Shortest Path Model consists of 2 equations:

### 1. Cost equation

$$\text{Min} \sum_{i=1}^m \sum_{j=1}^n R_{ij} \cdot X_{ij}$$

With,

$X_{ij}$  : route from I to j

$R_{ij}$  : distance, time, or cost from i to j

### Shortest route selection equation

Selection of alternative routes is undertaken by using binary integer programming (0-1) that allows us to choose the paths that connect the starting point with the end point such that the sum of the weights (distance, time, or cost) of its constituent edges is minimized.

Data used to construct the models include land transportation costs, rail transport costs, and handling costs. The data of land transportation costs and handling costs is provided by Organda (Indonesia's Land Transportation Association). While the data of rail transportation costs is provided by PT Kereta Api Indonesia (Indonesia's Railway Company). In this research, the case study used for the simulation involves the top five production center of shallots, beef, & rice at Central Java; and Jakarta as the main market.

## Findings

Although the use of rail transport is very unpopular among farmers in Indonesia, the simulation results show that the use of rail transport can reduce the cost of transportation effectively for some routes. Here are the solutions of the mathematical models that have been constructed:

### a. Shallots Supply Chain

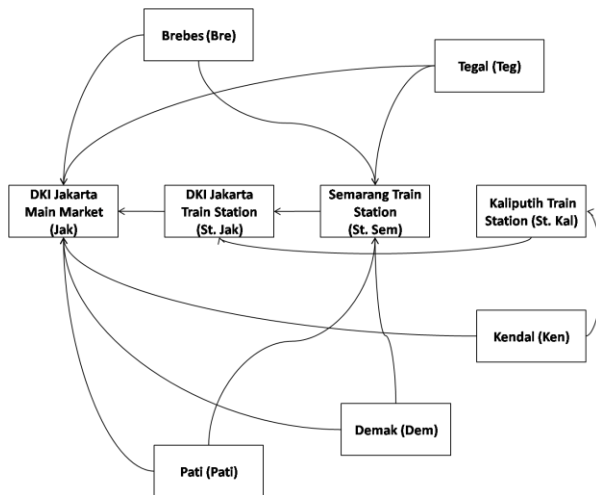


Figure 1. Transportation Network of Shallots Shipping from Central Java to DKI Jakarta

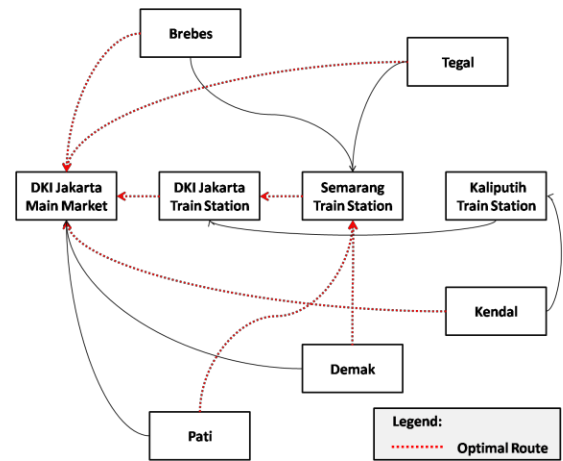


Figure 2. Optimal Solution of Transportation Network of Shallots Shipping from Central Java to DKI Jakarta

### b. Rice Supply Chain

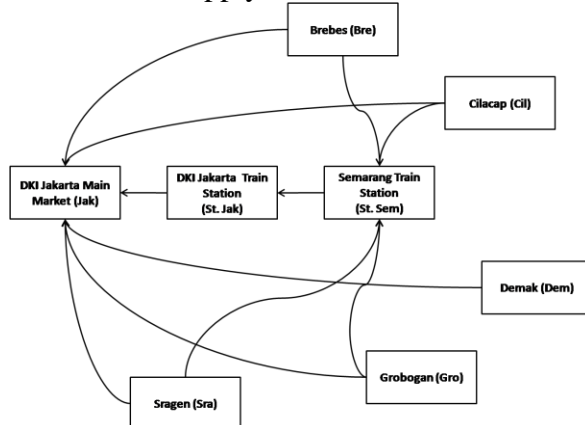


Figure 3. Transportation Network of Rice Shipping from Central Java to DKI Jakarta

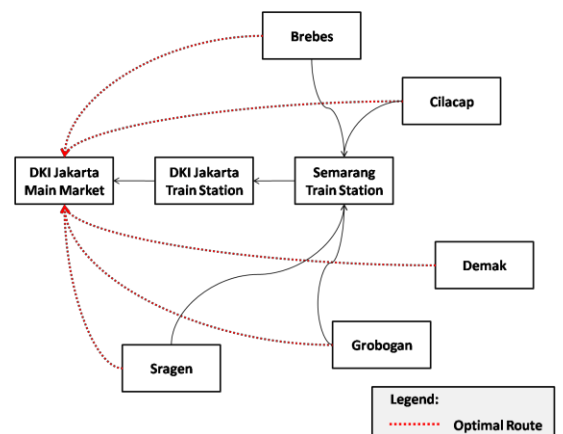


Figure 4. Optimal Solution of Transportation Network of Rice Shipping from Central Java to DKI Jakarta

c. Beef Supply Chain

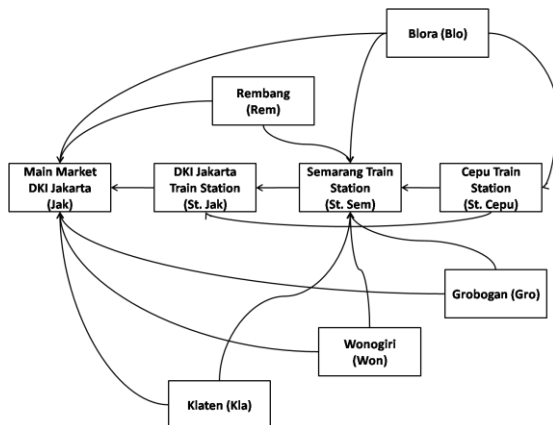


Figure 5. Transportation Network of Beef Shipping from Central Java to DKI Jakarta

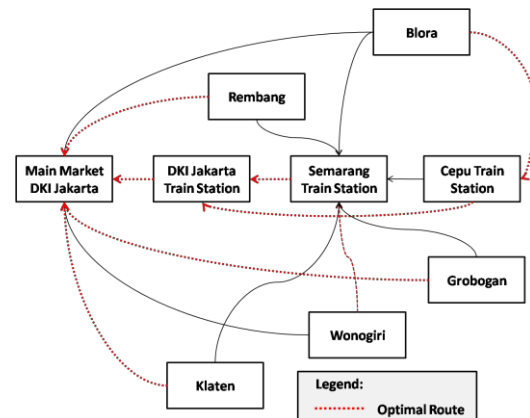


Figure 6. Optimal Solution of Transportation Network of Rice Shipping from Central Java to DKI Jakarta

### Conclusion and implications

Based on the simulation results using mathematical models that have been implemented in the previous section, there are some conclusions obtained:

1. Combinations between rail and land transport can reduce the logistics cost effectively.
  - a. For shallots, the simulation result shows that the use of rail transport in shallots supply chain helps reduce the transportation cost for routes Demak and Pati to Jakarta.
  - b. For rice, the simulation result shows that the use of direct land transport generates lower cost than the combination of land and rail transport.
  - c. For beef, the simulation result shows that the use of rail transport in beef supply chain helps reduce the transportation cost for routes Blora and Wonogiri to Jakarta.
2. Handling cost takes the largest portion of overall rail transport cost, since the handling frequency doubled; from farms to train stations and from the train stations to the trains. Hence, it is relevant to create an integrated agriculture handling systems between PT Kereta Api (Indonesia's Railway Company) and farmers to help reduce the handling cost.
3. The use of rail transport for agricultural commodities should be intensified since it is more sustainable than land transport due to the increasing traffic.

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## 6.4. Economic and technical conditions of air transport of food products

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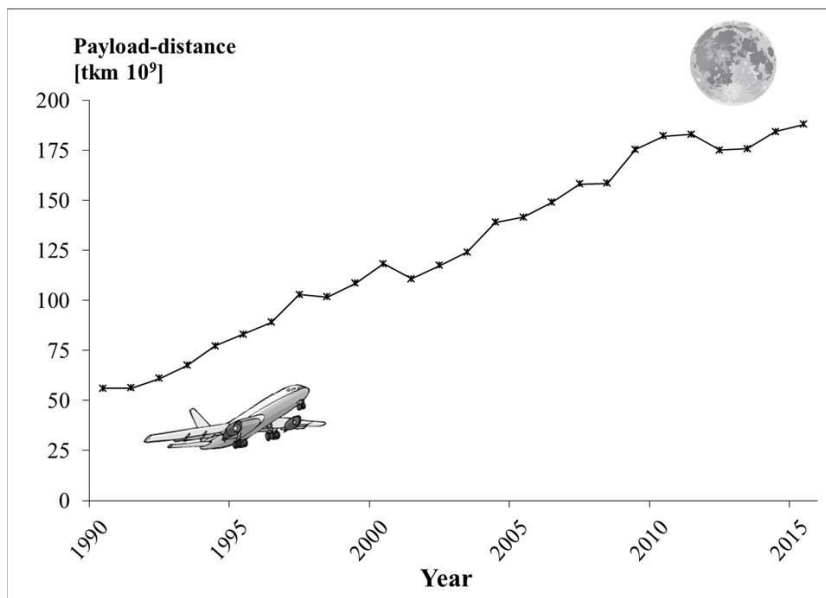
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**Keywords:** air cargo transport, airfreight, perishable food, Temperature-sensitive goods

### Introduction

The observed in recent decades rapid development of air transport takes place not only in the segment of passenger transport, but also freight. The driving force behind this growth is the cooperation, specialization and international trade progressing within the framework of globalization. Another important factor is also the growth of wealth of societies, stimulating demand for luxury goods, often exotic. As part of the cargo transport, airlines in 2015 transported almost 52 million tons of cargo, while doing payload-distance at the level of 188 billion tonne-kilometres, which can be compared with transport of more than half a million tons of cargo from Earth to the Moon (Figure 1). The main advantage of air transport is speed and global reach. An extensive, in highly developed countries, network of airports and a dense network of connections allows for flexible inclusion of air transports into logistic chains (The World Bank Group, 2009, p 1-12).

Figure 1. Payload-distance of world air cargo transport.



Source: IATA, Economic performance of the airline industry, December 2016.

Increasing consumption combined with its progressive personalization stimulates demand for luxury and premium products, also in the scope of commercially available and served in restaurants food products. Very often their constituents or final products are products originating from distant lands, often fragile, perishable, for which air transport is the only available way to quickly deliver them to the final consumer, a factory or restaurant.

### **Methods**

The elaboration analyzed the basic economic and physical parameters having influence on the efficiency of the process and determining the behavior of qualitative parameters of transported food products.

### **Findings**

A critical limiting parameter, which results directly from the specifics of air transport, is the gross weight of freight. Moreover, there are significant limitations in terms of volume and dimensions of the loads, as well as on-board aircraft power source. Even small exceeding of the containers' weight usually result in the necessity to remove the excess freight, which can generate significant losses and delays.

The transport by air creates a series of exposures of a physical character, which may result in a reduction in the quality of the product or even its destruction. Knowledge and understanding of their specificities allows to take measures to minimize losses at the optimum cost-effect relation.

The physical exposures present in air transport are the following:

- temperature,
- mechanical forces: accelerations, shocks, vibrations,
- pressure,
- electromagnetic radiation.

Most perishable products usually have narrow temperature range in which they can be stored/transported. The most common and cheapest way to ensure a low temperature is disposal within the container, in special chambers or directly in containers with dry ice. With the exception of frozen products, it does not provide the required temperature range in a container (Terry, 2014). Containers providing adequate temperature conditions with own air-conditioning system have a much higher mass, thus they increase significantly the gross weight of freight, and thus the unit cost of air transport (lufthansa-cargo.com).

During air transport, the material and its container are subjected to mechanical forces: static load, vibration and acceleration during takeoff, landing and strong turbulence. The basic protection is the appropriate packaging, positioning the container and the elements to prevent movements inside the container - dividers, nets, etc.( HPE, 2014, p. 89-91).

Pressure on board, usually reduced by about 25% of ground level pressure, in case of the hermetically sealed packaging causes a significant differential pressure. In the case of airtight plastic packaging with reduced barrier to gases, gas exchange with the external environment is possible. In case of packing in modified atmosphere, a change of the mutual proportions of the components of the atmosphere inside the package can occur. One also has to take into consideration the tightness of the packaging, especially the seals and welds, and changes in the volume of the hermetic packaging of low stiffness (Singh, et al., 2003).

The quality of many products may be affected by low humidity, usually around 4%, which can cause drying of transported food.

### **Conclusions and Implications**

The dynamic development of trade on a global scale as well as air cargo transport results in the increasing use of air transport in the food logistics chains. The Polish businesses also are or will be increasingly looking for their place in this type of chains. Knowledge of the specifics of air transport and adjusting own products is a prerequisite for success in this sector of the market. The time, spatial and economic conditions predispose air transport for the transport of delicate foods with a short shelf life. Specificity of air transport imposes a number of specific conditions, in particular in the scope of physical parameters such as temperature, humidity, pressure. Knowledge of the existing conditions is a prerequisite for effective protection of the load against damage or loss of essential properties during transport. The key element is the selection of appropriate packaging and container adapted to the specific product. Destination for air transport should be taken into account at all stages of a product from its design and manufacturing to packaging and shipping.

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## **6.5. Development of distribution and sales of low alcohol beverages in Poland**

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**Keywords:** distribution, distribution channels, sales techniques, logistics, innovations.

### **Introduction**

The struggle for the customer is symptomatic of the companies operating on contemporary markets. Developing new distribution channels and sales techniques is manifestation of the struggle. Dynamic market changes determine how vendors operate and induce them to implement innovation concepts in distribution, sales and logistics. These original solutions create new shopping modes and possibilities. The purpose of the paper is to present new solutions in this area, which are implemented and used within the alcohol industry in Poland. Scope of the study relates to beverages of low alcohol excluding beer. The authors focus mainly on solutions for distribution and sales, but they won't pass over complementary solutions for customer communication, including those aimed at education of consumers, which is essential in this industry. The structure of the paper makes it possible to present transformation of alcohol market in Poland, taking into account changes in the processes and the value they create for the consumer.

### **Convenient shopping for low alcohol beverages**

Purchasing food is rather a routine task we repeat automatically. We buy food products on a daily basis. Consumer convenience ranks right next to food safety issues in the organization and management of food supply chains. That's why retailers introduced convenience stores many years ago. A visible manifestation of the continuity of this trend is the emergence of convenience food where final processes of processing were moved from households, catering establishments and eating places to food industry enterprises and retail sector. At present the idea of convenient food shopping has progressed much further towards shopping malls, leisure-oriented supermarkets and personalized shopping experience. These are primarily retailers that want to offer convenience to customers. We observe the emergence of new retail formats, new additional services, new retail arrangements in space and, finally, the search for new retail business models. All these concepts have one guiding principle – to meet consumer needs, to increase the convenience of shopping, and to create added value. One of the most visible trend is omnichannel sales. Food retailers are generally enthusiastic about the potential of omnichannel. They create omnichannel strategies that require a shift in focus from products, their features and prices, to shopper's experience when buying and using the product. Since omnichannel is a cross-channel business model used to increase customer experience, retailers keep on deploying e-commerce solutions, updating websites and mobile apps not only to defend their existing business, but to transform communication patterns and win increased loyalty from customers. This approach has become very visible on the alcohol market. A growing range of alcoholic beverages is available through a variety of sales channels. In Poland especially the selection of alcoholic beverages available on-line and in

discount stores (that systematically increase their share of food products sales) significantly expanded. It was followed by the emergence of professional consulting services to shoppers and a massive education campaign. Polish customers have gained much improved accessibility to high quality wine and other low alcohol beverages and the culture of consumption of these beverages has dramatically improved. Growing popularity of wine consumption is one of the noticeable trends in Poland, particularly among young people. The taste of Polish consumers, previously preferring stronger beverages, the perception of wine and drinking manners are continuously changing in Poland. Therefore particular attention is paid to the distribution and sales of wine in Poland and the changes that were introduced to the system and how they impact market and consumers [Majchrzak-Lepczyk and Szymczak 2011].

### **Innovative packaging for the industry, and what data exchange technology has got to do with it**

Wine and cider need adequate containers. They usually are quite traditional, made of glass with an elegant label. Some producers have introduced an innovation packaging with the main focus being comfort and time. The innovative product is meant to be comfortable and easy to carry even in your pocket and ready to use quickly – you can put it in a pocket or a small bag due to its light weight and portability, and you do not need a corkscrew to open it.. Poles are increasingly interested in luxury alcohols. Premium alcohols are bought not only as presents or means of celebrating special occasions, but they also become investment goods. The trend is reinforced by improvement of material standing experienced by some parts of the society along with their improved awareness. High-quality wine is a luxury product; hence, its container must be adequate. It usually is quite traditional, made of glass with an elegant label. One of the producers has introduced an innovation, comprising changed packaging, with the main focus being comfort and time. It would seem that on such particular drink market, there is little room for new trends due to attention paid to the brand image and consumers' preferences (with the consumers being mostly well-educated, mature people).

The major issue affecting international alcohol distribution is counterfeiting luxury brands. In order to counteract such activity, or at least prevent sales of fake wine at legitimate outlets, manufactures have reached for the most cutting-edge technology available: RFID (Radio Frequency Identification) and NFC (Near Field Communication). The application of RFID tags makes it possible to monitor the flow of specific product batches during the distribution process (track & trace), which is a recognised practice in many supply chains – at least at the level of collective packaging, but this technology may also be used to confirm product authenticity. In this case, the RFID tags must be placed on every product item, which is not feasible in the case of alcohol.

### **Results**

Examples reported in the paper undoubtedly show how to make the existing range of products more attractive, thus increasing the company's competitive position. Observation of current trends in the industry reveals a number of interesting solutions aimed at providing additional value to the customer, especially related to the comfort of purchase.

Customers are the engine of growth and business entities should focus on them designing actions and using tools that extend and enrich the B2C relation as it was pointed out in the paper. Without a doubt, there is a large challenge before the industry of low alcohol beverages in Poland that involves a clear commitment to the needs of customers. As a result,

both giant and small players in the market will increase their chances of being successful in value creation and being leaders of innovation.

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## **Chapter 7: Management Strategies in Agri-Food Supply Chains**

7.1. Management of the supply chain of pork in the meat enterprises  
(Elżbieta Jadwiga Szymańska)

7.2. Lean Management Strategies for Source wise wastes in Indian Paddy Processing Industry  
(V.M. Indumathi and K. Mahendran)

7.3. Suppliers' partnership building on the organic market  
(Marta Raźniewska)

7.4. Determinants of the supply chain in brewing industry  
(Agata Kielesińska)



## **7.1. Management of the supply chain of pork in the meat enterprises**

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**Keywords:** supply chain, pork, meat enterprises

### **Introduction**

Enterprises are constantly looking for ways to create competitive advantages in a market economy, that is, to achieve the primary position in relation to competitors. It allows to offer customers products or services that meet their expectations at a more appropriate offer. It is expressed in higher product quality, lower price and better service or more comprehensive customer satisfaction.

Dynamic changes in a contemporary environment enhanced mutual impact of the enterprises in the economic, market, legal and socio-cultural spheres (Webber, 1982). This effect is manifested mainly through changes in the capital-cash market, work, goods, law rules and existing norms and values in society. The interaction between the environment and the organization creates that the efficiency of the organization is caused by the efficiency of its logistics chain, including mutual partnership between all links in the chain in the first place. The partnership between the links allows to create standards that are the basis of integration. Designed stereotypes affect correct decision-making and the choice of effective solutions, creating the company's competitiveness. The result is a flexible collaboration of partners, which is achieved by a synergistic effect, which occurs in many optimization of logistic processes in supply chain (Walasek, 2012).

The traditional supply food chain are characterized by a low degree of integration, which stems, in part, from economic and organizational imbalances of interacting chains. These differences are most visible when the comparison of initial and final level, i.e. producers of agricultural products and commercial enterprises. Moreover, the process of agricultural products moving from the producer to the consumer includes the stage of processing of agricultural products, storage, transportation and transfer of rights of ownership (Tomczak, 2004).

One of the most important segments of the agricultural market is pork production. In this sector the variety and diversity of relations between actors occur, defining the path of movement of products from producer to final buyer. The aim of the research was the recognition of the sources of supply of raw materials for enterprises engaged in pig slaughter and processing of pork and allocation methods of finished products.

### **Material and methods**

The primary source of data was the research carried out in the group of 60 companies involved in the slaughter and processing of pork in 2015. With respect to the companies the following selection criteria were adopted:

- slaughtering of pigs and/or processing of pork,
- the owner's consent to fill in the questionnaire.

In the first stage, the survey was sent electronically to 110 meat companies. Due to data protection and reluctance of the undertakings to provide information only by 5 entities returned completed questionnaires. In this situation, still using a questionnaire method, the owners of the meat companies were approached directly. Eventually, as many as 60 companies completed the surveys. The surveyed companies were partially different in terms of their business activities, the scale of production and the number of employees. Their diversity, however, reflects in overall the structure of business entities in the pork market. The results of the analyses have been presented in a narrative and graphic forms.

### **The results of the research**

The supply chain is a network of connected suppliers and consumers through various processes and activities that creates value in the form of products and services to end consumers (Christopher 2000). The main links in the supply chain are considered: suppliers, manufacturers, wholesalers, retailers and consumers (Gołemska, 1994).

A significant problem in the supply chain of pork is the lack of integration connections between the individual links. This situation increases the risks and activities costs at all levels of the food chain and limits the international competitiveness of individual farms and enterprises (production and trade), and the sector as a whole. The process of integration, despite their irrefutable benefits are developing very slowly, mainly due to errors and load from the past and financial and organizational support limits at present.

Meat enterprises use several forms of supplies of live pigs in the country, and in an effort to costs reductions are looking for raw materials abroad. As reported by Mroczek (2002) the choice of a particular form of supply depends on: the human factor, the scale of production, the location regarding the potential markets supply of animals for slaughter and transport, organizational and financial opportunities of enterprises.

For sales of manufactured products meat enterprises use the variety of distribution channels. Their choice is determined by a number of factors, in particular, the type of product, their durability term and ensuring appropriate conditions of transportation, storage or display. The organization of the distribution depends also on the situation in the sector, investment opportunities in modern information technology through trade agents, and used marketing, in particular marketing strategies and pricing (Seremak-Bulge, et al 2007)

In accordance with the classification of the Main Inspectorate of Veterinary Medicine, 38% of entitles were engaged in the slaughter of pigs. Over 53% run cutting sides of pig and half of them were producing meat products. About 30% of the tested entitles produced raw meat products, and 21% run production of chopped meat. Only 4% of enterprises carried out production of meat mechanically chopped. In part of the studied enterprises these types of activities were involved.

The studies proves that in the structure of supply of raw materials were dominated by deliveries from farmers which accounted for 25.1% of raw materials. The similar part concerned the purchase of pork from other enterprises in the country (24.6 %). About 14.8% of the raw meat was get by enterprises using own vehicles from farmers. Supplies from trade brokers accounted for only 9.5%, and from producer groups included 7.8%. Some companies also conducted their own point of buying of live pigs (7.6%). A smaller percentage carried out its own production on farms (4,8%). Import comprised only 3.0% for pork and 1.9% of live pigs. The smallest share amounted for buying purchase (1.1%).

In the distribution structure of finished products in the analyzed enterprises dominated the sales through its own stores (41.9%). Considerable part took also selling through small retail shops (19.7 %). Selling to wholesalers included 7.2% and supermarkets is 5.3%. About 6.2%

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of the production fell to other meat enterprises, 3.3% was allocated for export. In turn, the food service sector and hotels sales took only 2.2%.

### **Summary and conclusions**

On the basis of performed research it can be concluded that the number of partners agreements in the supply chain of pork is limited and the extent of this process had not significant impact on the efficiency of technical-economic organization of the Polish meat market yet.

There is a big fragmentation of the producers of live pigs in the pork market and a large number of enterprises engaged in the slaughter of pigs and the processing of pork, which complicates the process of integration in supply chains. In addition, most of the enterprises of the meat is characterized by high differentiation in the field activities, and limited specialization that is driven by a variable situation in the market.

To reduce the weakness of the market of live pigs in Poland and to achieve the competitive benefits in the EU it is advisable to increase cooperation between producers of live pigs and increasing the long-term cooperation between producers and slaughter entities and enterprises engaged in the processing of pork, The shopping network can also reach real value in developing a permanent relationship in the supply chain of pork

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## **7.2. Lean Management Strategies for Source wise wastes in Indian Paddy Processing Industry**

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**Keywords:** Lean, Paddy Processing, Waste , Source

### **Introduction**

In the recent years, with high growth of population in India, more pressure is being made on the arable land and thus higher productivity of crops was felt as the need of the hour solution. At the same time, large quantity of food grain was reported to be lost due to inefficient milling process in the country. About 1.11 million metric tonnes of food grains were lost in government godowns due to wastage or pilferage since 2010 and 30 per cent of food grains supplied through public distribution system was lost every year. Also post processing loss of paddy was quite significant due to the inefficient or poor milling techniques.

Paddy processing units played economically important role in terms of value addition, meeting the customer requirements, providing raw materials to down the line industries creating employment and enhancing the income of its stakeholders. Though many stakeholders were involved in the paddy processing chain, the paddy processing units assumed an important and greater role in terms of reducing the wastages where most of the value addition takes place. Also better internal controls can be implemented in a sustainable manner by the processing units.

The paddy processing units in Southern Tamil Nadu have started focusing towards newer lean technologies and it is visible in the processing of paddy rather in conducting their business. In order to sustain and expand the business, the paddy processors need to be competitive in maintaining the quality standards of the products, which could be possible with implementing lean techniques in their processing systems. The entrepreneurs were not aware of the degree of lean practices they adopted but they did adopt waste minimization activities to improve their efficiency. In order to understand the degree of lean practices adopted the present paper was conceived for identifying the sources of waste generation and to evolve appropriate strategies for improving the efficiency of paddy processing units (PPUs) in Southern Tamil Nadu.

Reduction of wastes by adopting lean practices in such an important agro based industry is vital in protecting and promoting the interests of all the stakeholders especially the farmers resulting in increased value for their output.

## **Methodology**

The major paddy processing clusters were purposively selected for the study based on the geographical concentration of paddy processing units. Three clusters namely Madurai, Dhalavaipuram and Pudukkottai were again purposively selected to provide the sample an even spread of locations representing the Southern region of Tamil Nadu. The PPUs were categorized into conventional and modern units based on the technology adopted, and totally ninety paddy processing units (PPUs) were selected for conduct of the study.

For collection of primary data, a well-structured interview schedule was prepared based on the objectives of the study. The data required for the study was gathered through personal interview method from the owners of selected paddy processing units. The four major categories of wastes identified were;

1. Inventory–Paddy was procured and stored in the processing units before processing and rice was stored after processing and sent to the consumers market.
2. Defects–Head rice was the economic output of paddy processing. Products such as broken, discolored rice, black rice were categorized under defects from PPU.
3. Waiting time–When the product or process was made to wait for a longer time before moving to the next step was treated as waste.
4. Over processing – processing step that does not add value to the final product.

## **Findings**

### **1. Inventory**

Apart from the raw paddy, there are different forms of inventory maintained at the PPUs such as rice, brokens, chaffs, packing materials, firewood for the parboiling operations, and rice husk ash. As the value of the finished good inventory was very high compared to the other forms of inventory, the analysis was confined to rice.

### **Finished Goods (Rice) Inventory**

The level of inventory maintained was not static as all firms purchased the good quality paddy as and when it arrived at the market. The PPUs processed paddy and sold their products (rice) in local state market. All the PPUs bought paddy by cash and carry method and distributed the processed rice to retailers on credit. Quality of paddy improved over period of storage where as the quality of the rice gets deteriorated. Thus proportion of quantity of paddy stored was higher when compared to final product. Majority of conventional PPUs (37.78 per cent) stored their final product for 11 - 15 days. The average shelf life of rice was better with conventional units compared to modern units. Modern PPUs stored rice for longer duration compared to conventional units. 42 per cent of modern PPUs stored their products for a minimum of 30 days, twenty seven per cent stored for about 15 days and 40 per cent stored the final product rice between 31 – 45 days.

### **2. Defects**

The economic output of paddy processing is head rice. Other products such as coarse brokens, fine brokens, discoloured paddy, black rice were categorized as defects. The reason for such defects may be due to poor quality of paddy, prolonged soaking of paddy, mixtures of immature grains during boiling operations, processing technologies, sudden processing breakdowns due to wear and tear of machineries. Quantity of defects varied with the variety of the paddy processed among the batches due to improper processing of grains, forms of rice produced and moisture content of the raw material.

Nearly 50 per cent of conventional units located in Madurai cluster had defective percentage that ranged between 12.00 to 14.00 but in Dhalavaipuram cluster most of the units (46.67 per cent) had more than 14 per cent of defective output during processing. Half of the sample modern PPU's (49 per cent) had defective percentage that ranged between 4.10 and 6.00. Higher per cent of defects was observed in Dhalavipuram cluster because of the technology where more number of polishing the grain is done.

### **3. Waiting time**

The raw material was procured either in local market or outside the state. Procured paddy arriving at the PPU was unloaded and stacked in storage godowns for further processing. There was a labour association contracted for loading and unloading operations of the packed produce in Madurai cluster. Tariff was negotiated for every year. Such procedure was also seen in Dhalavaipuram cluster but units located in Pudukkottai cluster carried out loading and unloading operations on their own.

Waiting time for paddy to be unloaded varied among the PPU's according to the circumstances. In most of the conventional PPU's (36.67 per cent) the average waiting time for paddy to be unloaded ranged between 2.00 – 3.00 hours. Checking the quality of paddy by palm crushing the grains, ensuring weight and counting of bags, insufficient space for goods to be unloaded, non-availability of labour were the reasons for delay in unloading. Delay in unloading caused time wastage, quality loss and reduction in grain weight.

Paddy underwent sequence of processing steps to get converted into rice. The rice was finally collected in bins in case of modern PPU's and it was made to flow in a room in the conventional units. Such rice remained waiting till it was packed and stacked. Packing was done either manually or using automated (semi / full) machines. Most of the PPU's (36.67 per cent) processed rice in both conventional and modern PPU's waited for more than 4.00 hours before process of packing started. Entire batch was processed and packed in a single lot to avoid admixture of other batches. Waiting time for rice to be packed and stored was also similar in both conventional and modern paddy processing units.

### **4. Over processing**

The activities such as reprocessing returns from the market, processing of chaffs along with paddy if not properly removed, increased boiling time of paddy, number of whiteners and polishers used while processing paddy were categorized as wasteful activities. PPU's decided the number of whiteners and polishers to be used while processing paddy. When the market demanded fine polished grains, the processing undergoes maximum of two whiteners and three silky polishers in modern units. Conventional PPU's had lesser number of whiteners and majority of the units does not own silky polishers. The slender / fine rice fetched higher market price but because of the numerous polishing and whitening processes, the nutritional value was reduced. The nutritional layers were removed when the grain underwent various polishing stages. Majority of conventional PPU's (40.00 per cent) had two stage polishing (whitener and silky) and about 46.66 per cent of PPU's used both whiteners and silky polishers while processing paddy. Most of modern PPU's (49 per cent) had two whiteners and three silky polishers. PPU's in Dhalavaipuram had taken up more number of polishing activities i.e., three whiteners and two silky polishing.

### Lean Management Practices

Analysis of the lean practice bundles for this study was adopted from Doolen and Hacker model as it was found to be more appropriate in terms of applications for the current study. PPU in the sample clusters did not strictly follow lean practices but each of them had their own code of business practices that resulted in value identification of either product or process. The PPU pre-considered the cost and returns while incorporating new machineries/technologies or facilities. The production scheduling activity for different processed forms of rice was prepared by all the PPUs in not so scientific manner in anticipation of smooth flow of finished products. Total cost evaluation was the sole criteria on which the suppliers of the raw material were concerned and in few instances there was a long-term association. Information was shared among the suppliers and also the processors regarding the quality of paddy procured, market price of paddy and quantity of paddy. Over all, the PPUs ensured prompt delivery to the customers from their retail units to the customer place. The logistics cost was borne by the PPUs and the returns from the customer were taken care of. PPU in Madurai and Puduvayal clusters sample cooked every batch of rice and ensured the quality and to measure the ideal water requirement, cooking time, aroma and stickiness.

### Conclusion

The conventional PPU of sample clusters maintained *paddy inventory* for about two to four months. Paddy processing units had *rice inventory* for 11 - 15 days. The average *waiting time* for paddy to be unloaded ranged between 2.00 – 3.00 hours. In case of *inappropriate processing*, majority of conventional PPUs had two stage polishing (whitener and silky). Majority of the paddy processing units were inefficient since the percentage of *defective materials* were more than 12.00 per cent.

The processed rice in both conventional and modern PPUs waited for more than four hours before the process of packing started in most of the PPUs. Modern PPUs maintained finished goods *inventory* for longer duration compared to conventional units. Majority of PPUs stored their products for a minimum of 30 days. In case of *inappropriate processing*, majority of modern PPUs had two whiteners and three silky polishers. Nearly half of the sample modern PPUs had *defective percentage* that ranged between 4.00 and 6.00.

### Lean Strategies

The findings of the study have indicated a significant difference in outturn of head rice between the conventional and modern paddy processing units. Therefore modernization of the conventional units must be promoted through policy interventions to reduce the processing waste and improve the outturn ratio. The technology that occupied the least space and layout, which was found to be more efficient in terms of processing efficiency in the study, can be promoted for modernization. As the resources available with the conventional units are limited, such a policy would enable the existing conventional units in reducing the overall capital requirement for modernizing. There is a need to evolve indigenous technology options towards this end. The role of research and development agencies and the government policies in supporting this cause is essential.

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### **7.3. Suppliers' partnership building on the organic market**

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**Key words:** suppliers' relationship management, partnership, organic market, key supplier

#### **Introduction**

The organic market has been developing very rapidly and has required building partnership relationship not just with clients but with suppliers in contemporary supply chains. The aim of this article is to describe the main factors of cooperation with suppliers, as well as the conditions and possibilities of Suppliers' Relationship Management on organic market. In the first part of article, based on literature revue the potential areas of cooperation are described. Afterwards, according to the result of international studies the main suppliers' partnership building effects are presented.

Methodology,

The researches were conducted with professionnels of the organic market in Italy, German and France in 2016. The analyse base also on writer's experience acquired at work as responsible in the cooperation with suppliers in logistics service by a retailer.

The main research questions are as follows:

- Is the suppliers' relationship management an important strategic element?
- How many companies build the partnership relations with suppliers?
- What are the main factors of partnership building with the suppliers?
- What are the main effects of partnership building on the mature organic market?

#### **Conclusions**

Based on the literature, interviews with organic food sector providers and own experience, writer provide the key potential elements of suppliers' partnership management. Moreover, the importance of each factor for the organic manufacturers is presented. The effects of supplier's partnership building include inter alia: increase of supplier's product quality, production creation improvement, product innovation development, fullfilement of social responsible economy requirements.

This analysis is relevant from both a practical and theoretical point of view. The results of researches conducted on three mature organic market give the perspective to polish manufacturers. On the other hand, it pinpoints retailers how important the fair partnership is in todays organic business.

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## 7.4. Determinants of the supply chain in brewing industry

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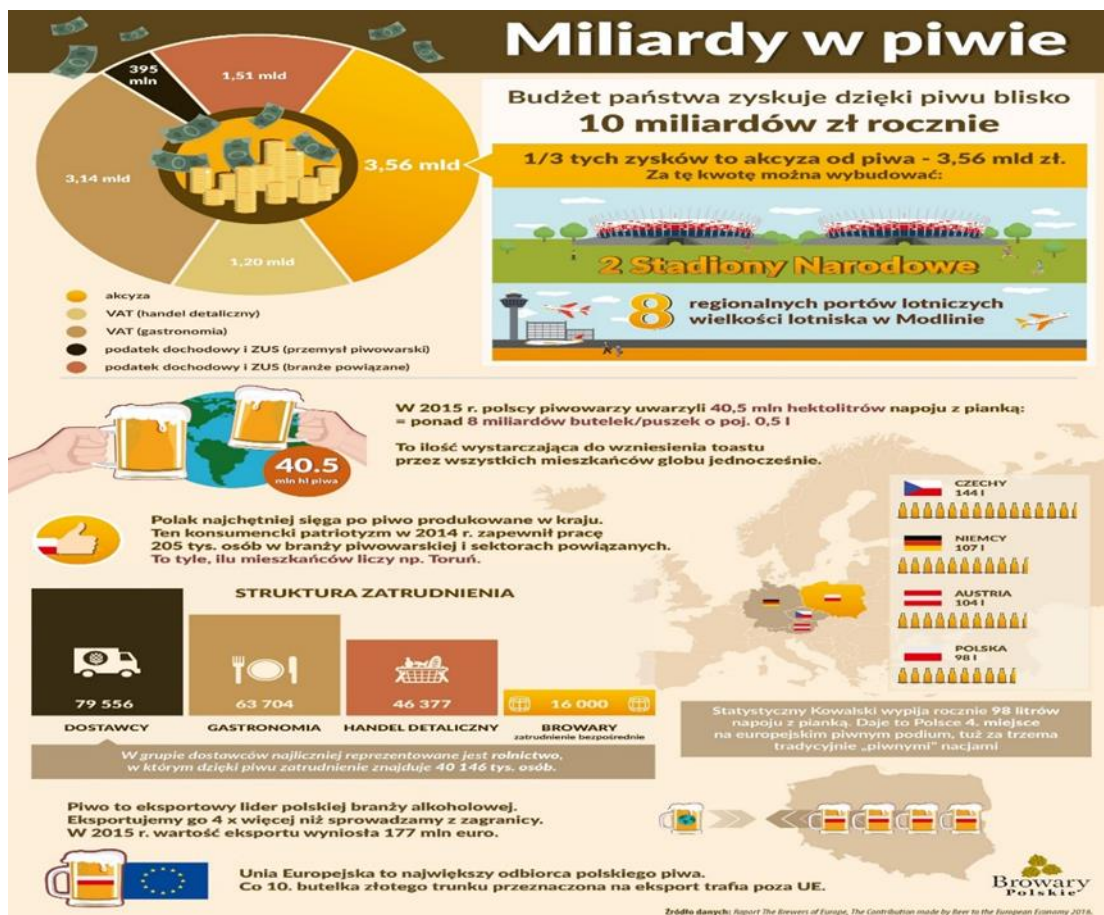
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**keywords:** supply chain, brewing industry, regional development

### Introduction

The article presents the essence, existing tendencies and trends in the supply chain and its role in economic, social and environmental activity of brewing industry, based on the report of the Brewers of Europe 2016 and Pulse HR 2 information (Fig. 2), which presents the synergy aspect in the process of socio-economic development as the brewing industry in Poland consists of over 200 thousand jobs and has a significant impact on the agricultural sector as well as food and retail trade market in Poland by stimulating specific areas of local and regional development.

Fig. 1 Beer market in Poland

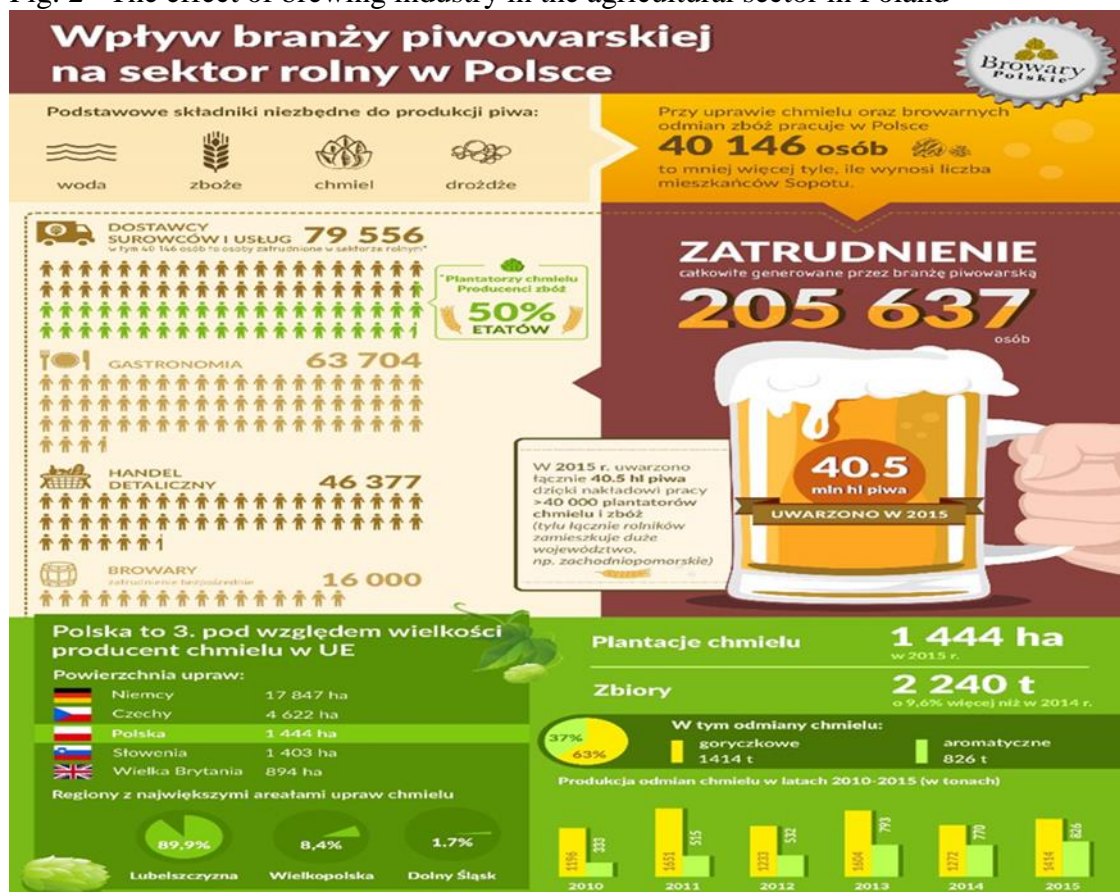


Source: Report the Brewers of Europe, The Contribution made by Beer to the European Economy 2016

## Methodology

Critical analysis is based on the contemporary literature and researches published with regard to the rules on the functioning of the supply chain system in the brewing industry in Poland and the European Union.

Fig. 2 The effect of brewing industry in the agricultural sector in Poland



Source: puls HR.pl, 14.02.2017

## Summary and Conclusions

The modern concept of supply chain management is an alternative to the traditional competitive relationships between suppliers and customers and management of movement of goods is based on the cooperation between the parties involved in the process of supplying the products from the manufacturing sites to places of final consumption and synchronizing information and financial flows, which means reconciliation by market partners with the aim to create added value for all participants in the supply chain. The acceptance and implementation of this concept was motivated mainly by the accession to the European Union and for the adjustment of the food market to EU requirements. Offers and forms of selling food products according to the requirements of consumers are the primary challenges for the development of the supply chains. The requirements of the final recipients are identified not only in the sphere of processing and distribution, but also at the stage of the primary production.

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## **Chapter 8: Problems, challenges and trends in food supply chains: global and regional perspective**

8.1. A ten year Outlook for Agriculture  
(Marcel Adenauer)

8.2. Challenges and trends in virtual food supply chains in Poland  
(Ludosław Drelichowski and Marek Sikora)

8.3. Trends in the international position of Polish logistics  
(Bogdan Klepacki)

8.4. Effects of global supply chains on the safety of agrifood  
(Milena Zupanic, Jorge Numata, Helmut Schafft, Monika Lahrssen-Wiederholt)

8.5. External costs of open-cast lignite mining (as illustrated by the case of Oczkowice reserve)  
(Benedykt Pepliński)

8.6. Food quality marks as part of the Polish consumers food security  
(Julia Krysztofiak, Karolina Pawlak)

## **8.1. A ten year Outlook for Agriculture**

### **Marcel Adenauer**

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One main challenge of the agricultural sector today is to ensure food security in face of a growing population with changing preferences while acknowledging the role the sector can play to mitigate climate change without hindering productivity growth. The OECD-FAO *Agricultural Outlook* is a collaborative effort of the two institutions prepared with input from experts of their member governments and from specialised commodity organisations. It provides a consensus assessment of the medium term (ten year) prospects for agricultural and fish commodity markets at national, regional and global levels. It can be seen as a benchmark for market projections und a now change policy world and is therefore highly valued by many governments and research institutions.

This presentation highlights some of the major drivers and storylines that are expected to be revealed over the coming ten years: Currently many agricultural commodity markets are characterised by record production and abundant stocks, with prices of cereals, meats and dairy products continuing to decline from peaks experienced in the last decade. Over the outlook period, demand growth is projected to slow considerably. The primary sources of growth in the last decade were first the People's Republic of China, where rising meat and fish demand caused the consumption of feed to grow by almost 6% per year, and second the global biofuel sector, where the use of feedstock inputs grew by almost 8% per year. The replenishment of cereal stocks by 230 Mt over the last decade also augmented demand. These recent drivers are not anticipated to support markets in the same way over the medium term, and no other sources to replace them are foreseen. Growth in food demand for virtually all commodities in the *Outlook* is anticipated to be less than in the previous decade. Demand for cereals, on a per capita basis, is anticipated to be largely flat, with food demand growth coming from dairy products, vegetable oil and sugar. The *Outlook* s assessment of meat demand has been revised down on the basis of recent trends in many countries, where dietary preferences and limited access curb consumption. Overall, there appear to be few signs of a 'convergence' towards western diets.

The demand growth for ethanol and biodiesel has weakened due to lower fossil fuel prices and fewer incentives from government policies. Even though energy prices are projected to increase, the derived demand for biofuel feedstocks, especially maize and

sugarcane for ethanol and vegetable oil for biodiesel, will grow slowly, except in key developing countries where demand increases are driven by more pro-active domestic policies. Future growth in crop production will be attained mostly by increasing yields. Yield growth is projected to slow slightly on average, but could be raised by closing large yield gaps that continue to persist, especially in Sub-Saharan Africa. The global cereal area will only increase marginally, while a further expansion of soybean area is needed to satisfy the demand for animal feed and vegetable oil.

Growth in meat and dairy production will be achieved from both larger herds and higher yields, with large differences in the intensity of production continuing to persist. Growth in poultry production continues to exceed total growth for all other meats. Milk production is expected to increase strongly, most notably in India and Pakistan. Aquaculture dominates growth in the fish sector, as capture fish production remains limited by the current level of stocks and policies to limit over-fishing. China will maintain a share in excess of 60% of global fish production. Farmed fish production is the fastest growing source protein among the commodities in the *Outlook*. The growth in agriculture and fish trade is projected to slow to about half the previous decade's growth rate. However, trade will represent a broadly constant share of output and consumption for most commodities. In general, agricultural trade has proven more resilient to weak economic growth than trade in other goods, despite relatively high protection, and the growth in trade could be further facilitated by the opening of markets.

Food imports are becoming increasingly important for food security, particularly in Sub-Saharan Africa, North Africa, and the Middle East. While for some countries this may reflect greater demand but insufficient resources for growing food domestically, in other cases it may indicate agricultural development problems which need attention.

Net exports are projected to increase from the Americas and from Eastern European and Central Asian countries, and net imports to increase across other Asian countries. The continued concentration of exports among a few supplying countries contrasts with the dispersion of imports among many importers and implies a greater susceptibility of world markets to supply shocks than to demand shocks, whether those supply shocks stem from natural factors such as weather and disease or from policy factors. Under the *Outlook's* expected supply and demand conditions, real prices of most agricultural and fish commodities are anticipated to remain below previous peaks, and be flat to declining over the next ten years. While prices appear to have moved closer to their longer term trend, natural yield variability alone is likely to cause prices to diverge from trend in some years and prices can remain off trend for several years at a time.



## **8.2. Challenges and trends in virtual food supply chains in Poland**

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**Keywords:** logistics, food supply chain, import, export

### **Introduction**

The studies concerning the impact of the development of hypermarket chains in Poland in the late nineties of the twentieth century, conducted by the authors of the article and their colleagues, have allowed to identify the challenges of Polish agribusiness logistics posed by the presence of hypermarkets (Drelichowski, 2000, 2001a, 2001b). The continuation of the research on logistics processes occurring in companies of meat and dairy industry, combined with the analysis of the opportunities and risks arising from the Polish accession to the EU, was a period of transitions adapting the supply chain of export-import agribusiness (Drelichowski, 2005, Drelichowski and Sikora, 2006). An attempt to find answers to the cause of the unusual growth rate of exports is suggested by the publication title: "Virtualization of management, information technology and logistics systems as a source of synergy in the food industry" (Drelichowski and Sikora, 2015). The latest information on the level of import, export and the balance state justify the need of assessing the impact of changes in the internal and global challenges on trends of changes in Polish import and export concerning virtual supply chains of food, which is a research hypothesis of this study.

### **Methodology of research**

The research conducted between 2013 and 2015 concerned the analysis of the import-export stream flow in agribusiness assortment groups, applying the information from the period between 2004 and 2012 provided by Central Statistical Office of Poland (GUS). The data on trade turnover come from Intrastat and customs declarations and are presented at levels 2, 4 and 6 of combined nomenclature. The data collected as Excel files require further elaboration, enabling the preparation for automatic processing because of the formatting sheets and the inability to download all the data as one file. The above-mentioned information formed the basis for developing a data warehouse that allows obtaining reports on the flows of financial information relating to the import and export transactions in Polish agribusiness (Drelichowski and Sikora, 2012, Drelichowski, et al., 2014, Drelichowski and Oszuścik, 2014, Drelichowski, et al., 2014).

### **Results**

The analysis of 24 agribusiness commodity groups within the scope of export and import activities since 2004 till 2015 allowed to state clearly an upward trend in export, with a stable level of import and the balance level. Among the conditions of agribusiness development after the Polish accession to the European Union there are – according to the authors – the most important factors determining the level of achieved production and export.

These include changes in the infrastructure factors caused by operating in Poland since 1992 and vigorously expanded networks of hypermarkets. The elimination of quantitative barriers existing before the Polish integration with the EU also stimulated the development of specialist supply chain networks, the storage and processing base of various agribusiness sectors. For the purposes of working out the forecast of export and import, as well as balances, the forecast of final results in agribusiness export for 2016 was calculated.

The calculated level of export in 2016 is EUR 23.62 billion, import – EUR 16.78 billion and the balance – EUR 7.00 billion. Since the level of export in 2015 amounted to EUR 23.9 billion, it would mean its EUR 120 billion decline. Imports in 2015 amounted to EUR 16.1 billion, but it increased during three quarters of 2016 by EUR 0.5 billion, therefore the balance for 2016 will reach EUR 7.0 billion and will be reduced by EUR 0.8 billion (compared to EUR 7.8 billion for 2015). The scale of negative changes can be assessed as not large compared to the results from 2015, although the potential loss of an increase in export in 2015 by EUR 2 billion should be taken into consideration, together with increasing import by EUR 680 million – which is a negative phenomenon. The above considerations are to help us realize that the phenomenon of steady success lasting for eight years was not accidental, but was the result of the synergistic effect of the creating the super-virtual Polish agribusiness organization, which effects and stability cannot be explained on the basis of a traditional doctrine of Agricultural Economics and Agribusiness.

Despite of individual annual declines in some groups a combined trend has been increasing which is a factor indicating the stability of this development. Simultaneously, for the first time the need to clarify the phenomenon of radical acceleration between 2011-2013 was highlighted. Based on the indicated analytical data, the hypothesis of formatting a virtual model of management and coordination of supply chains in main sectors of agribusiness was developed. There has been attempts to explain this model by the specificity of the structures that make up the Polish and international corporations, international logistics corporations and large and medium-sized producers, as well as producer groups, creating the supply of raw materials of a vegetable and animal origin. The reasons placed in a quoted publication justified the stabilization of the process of virtualizing the management of Polish agribusinesses as a corporation of global interests of international and Polish corporations and manufacturers of raw materials and agri-food products.

An attempt was made to diagnose the systemic importance of logistics solutions in the area of agribusiness, which successes achieved in the last ten years, and especially in the last three ones, allow to be explained as the results of the inter-organizational, virtualized network and logistics system.

Based on the foregoing, it can be stated that the infrastructure and innovative activities of logistics solutions are means lowering the level of risk in the global economy of goods and services flows.

## **Conclusions**

Trends in the development of export in the world largest exporters of food products confirmed the presence of extensive opportunities for growth of foreign trade in this sector of the economy. A stable growth between 2003 and 2015 allowed Poland to achieve a good position among the largest exporters of the European Union. The results of analysis concerning 2016 seem to indicate the emergence of a new phenomenon of inhibiting the growth of export and positive balances in the food trade, what can be caused by the introducing a number of restrictive changes that - instead of increasing tax revenue - may reduce export and the balance of food products trade. Numerous sector analysis confirm that

the source of export successes are not so much low prices of Polish products, but their high quality and the continuity and reliability of supply.

Therefore, it can be concluded that the source of development is not an extensive growth, but a stable sustainable development of the production of agricultural raw materials, their modern processing, storage and logistics supply to final consumers, which is the basis for a stable development of this branch of the national economy. Effective interacting of different agribusiness producers' groups with global logistics companies and creating a climate of confidence for foreign investors in connection with the independence of the judiciary from politics are a very important factor for development. An equally important factor is the development of ERP systems and Internet technology solutions that create integration platforms for the information and material flows.

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### **8.3. Trends in the international position of Polish logistics**

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The study presents the methodology used to develop a ranking of the World Bank, used to determine the positions of all countries in the world in terms of business development (conditions) logistics, namely determining of LPI (Logistics Performance Index). An evaluation of the Polish position on the background of world leaders, as well as trends in the context taken into account the different activity groups and elements for determining the level of development of the logistics countries.

Logistics has many dimensions, so to assess its condition can be used for multiple gauges, various elements and activities. Comparing countries in terms of progress is a significant logistical challenge. At the same time today there is intense competition between countries seeking to achieve the best position in terms of attractiveness to potential investors and customers of logistics. Indicator recognized on an international scale, which allows evaluation of the relative level of development of logistics in the various countries in the international arena is the indicator LPI.

This ranking was conducted in the years 2007, 2010, 2012, 2014 and 2016 (in the last year covered 160 countries). The basis for preparation it's were the results of a survey of logistics professionals engaged in international freight forwarding. Questions posed to them concerned the situation in the countries in which they operate logistics. Components of the International Index LPI have been determined on the basis of current research on the theoretical and empirical, taking into account the practical experience of professional logistics.

The construction index LPI includes the following elements:

- effectiveness ( "friendliness") legislation on customs issues and the movement of goods across borders,
- the level of sophistication of logistics infrastructure of the country,
- the availability of ports, their technological advancement in the ease of sending and receiving of goods,
- the quality of logistics services in the country by operators and brokers logistics,
- the ability to identify and track shipments,
- timeliness and frequency with which shipments reach customers.

Analysis of the state in these six areas made it possible to demonstrate the level of sophistication of the logistics of almost all the world. As the most advanced level of logistics activities were the most economically developed countries in the world. The order forefront presented in table 1.

Table 1. Member States - leaders in the development of logistics activities and a place in the ranking of Polish LPI in the years 2007-2016

Position	State of the places in the rankings years				
	2007	2010	2012	2014	2016
1.	Singapore	Germany	Singapore	Germany	Germany
2.	Netherlands	Singapore	Hong Kong	Netherlands	Luxembourg
3.	Germany	Sweden	Finland	Belgium	Sweden
4.	Sweden	Netherlands	Germany	United Kingdom	Netherlands
5.	Austria	Luxembourg	Netherlands	Singapore	Singapore
6.	Japan	Switzerland	Denmark	Sweden	Belgium
7.	Switzerland	Japan	Belgia	Norwegia	Austria
8.	Hong Kong	United Kingdom	Japan	Luxembourg	United Kingdom
9.	United Kingdom	Belgium	USA	USA	Hongkong
10.	Canada	Norwegia	United Kingdom	Japan	USA
Place of Poland	40	30	30	31	33

Source: Own calculations based on International LPI. <http://lpi.worldbank.org/>

Best yet is the level of sophistication of the logistics in European countries, the most developed economically, especially for Germany, the Netherlands and Sweden. From countries outside Europe at the forefront appears in Asian countries (Singapore, Hong Kong, Japan) and North America (USA). The test results also indicate a fairly stable position of the Polish logistics internationally, at about the thirtieth place in the world. Total value of the index and its components for the Polish in the years 2007 - 2016 are presented in Table 2. For comparison, the results of the winners in the coming years.

Table 2. Level indicator LPI for the Polish in the years 2007-2016 against the leaders of the ranking

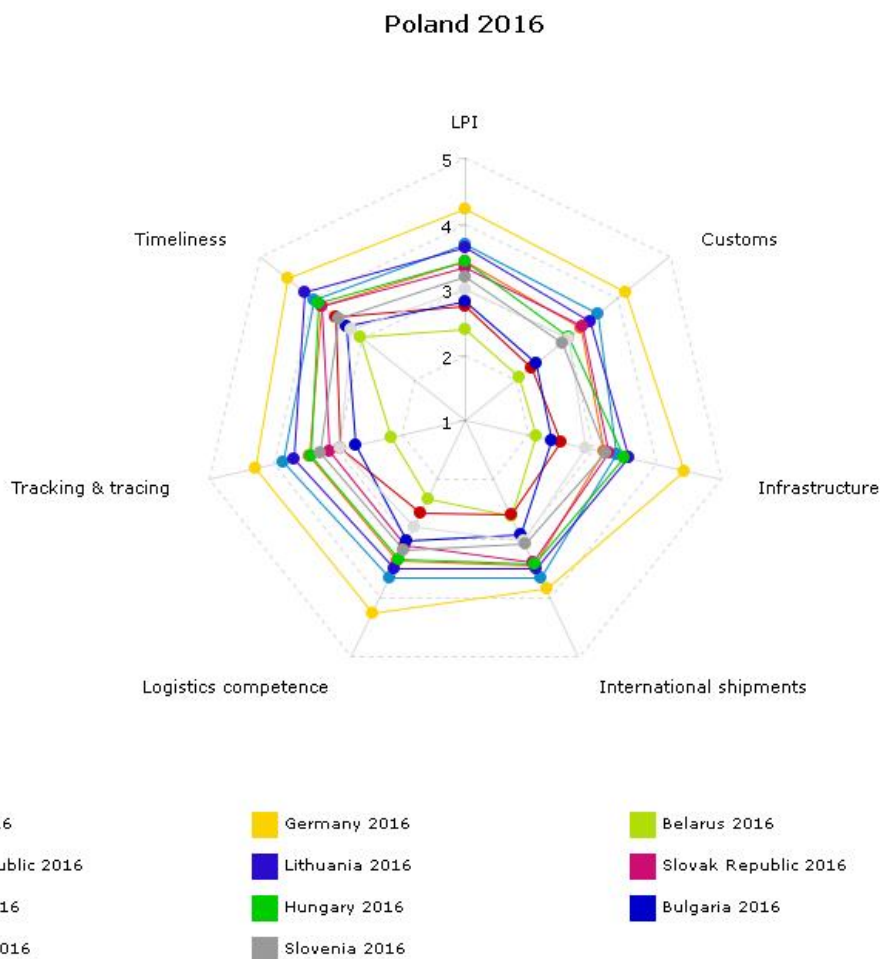
Years	Place of Poland	LPI score	Customs	Infrastructure	International shipment	Logistic competence	Tracking and tracing	Timeliness
2007	40	3,04	2,88	2,69	2,82	3,04	3,12	3,59
2010	30	3,44	3,12	2,98	3,22	3,26	3,45	4,52
2012	30	3,43	3,30	3,10	3,47	3,30	3,32	4,04
2014	31	3,49	3,26	3,08	3,46	3,47	3,54	4,13
2016	33	3,43	3,27	3,17	3,44	3,39	3,46	3,80
Singapore 2007	1	4,19	4,00	4,27	4,04	4,21	4,25	4,53
Germany 2010	1	4,11	4,00	4,34	3,66	4,14	4,18	4,48
Singapore 2012	1	4,13	4,10	4,15	3,99	4,07	4,07	4,39
Germany 2014	1	4,12	4,10	4,32	3,74	4,12	4,17	4,36
Germany 2016	1	4,23	4,12	4,44	3,86	4,28	4,27	4,45

Source: As in Table 1.

Based on changes in the level of indicators presented it is possible to analyze trends in the development of logistics in Poland in 2007-2016. It turns out, initially the position of Polish grew, expressed as a promotion of 40 to 30 in the world. Unfortunately, after 2012, the position of our country is deteriorating slightly, though not due to a contraction of logistics activities in Poland, but faster development in other countries. Invariably, the biggest weakness of the Polish state is logistics infrastructure, and in the second place regulations on customs law. Relatively most preferably experts evaluated the quality and timeliness of logistics services.

From the point of view of competitiveness is crucial position of Polish logistics to neighboring countries. The value of the indicator in the form of a total and its components are presented on Figure 1.

Figure 1. The level of logistics development index and its components in Poland compared to neighboring countries in 2016



Source: As in Table 1.

## **Summary**

The data show that in Poland in terms of the assessment of operating conditions and efficiency of the logistics still divides the distance from large countries in this regard leading. This applies especially to the state of the infrastructure. However, you can say that in terms of logistics, despite significant flaws and shortcomings Poland is a strong and stable as a place for exchange of goods and logistics services internationally. Her position in the region of Central and Eastern Europe is much worse than Germany, slightly weaker than the Czech Republic and Lithuania, similar to Hungary, while more favorable than the other countries in the region.



## **8.4. Effects of global supply chains on the safety of agrifood**

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**Keywords:** global supply chain systems, feed and food safety, logistics, transportation

### **Introduction**

International feed and food production and the associated intensification of global supply chains have increased the public concern about food and feed safety due to international foodborne disease outbreaks. The complex supply chains behind the global agrifood industry open up vulnerabilities at multiple points with respect to the contamination of feed and food. It can be assumed that the more complex the system, the higher the probability of errors resulting in feed and food safety risks, creating challenges for risk assessors. A big challenge is the lack of relevant data and insufficient information on flows of goods along supply chains. However, the question is what kind of data is essential to conduct risk assessment and to investigate international foodborne outbreaks as documented in the recent past. Regarding analyses of vulnerable points, the Federal Institute for Risk Assessment (BfR) has identified knowledge gaps in the field of transportation and logistics of agrifood and its role in the contamination of food and feed, with the result that such aspects are often missing in risk assessment. Therefore, our problem-oriented working hypothesis is that transportation and logistics play a crucial role in the occurrence and spread of contaminants throughout the food and feed chains.

### **Methods**

Within the framework of a BfR-research project on effects of global supply chains on the safety of agrifood, we aim at reducing knowledge gaps within global agrifood supply chains from a feed and food safety perspective. Therefore we firstly identify existing systems for analysis and / or (schematic) representations of feed and food chains or logistic chains respectively to get an overview over relevant tools and practical methods. Secondly we identify relevant data and related data sources, which provide information about flows of goods at each step of the agrifood supply chain from production in third countries to the import and distribution in the EU with special regard to the different modes of transportation (sea, railway and road). As a third step, we perform an analysis of vulnerabilities to point out weak points that favor the input of contaminants along the chain with special regard to the aspects transportation and logistics. Scientific publications and talks on logistics within the BfR-network serve as information sources.

## **Findings**

Two categories of tools/methods have been identified as relevant to illustrate and analyze supply chains and logistic systems. For the qualitative analysis (graphic representation) of feed and food chains and logistic systems, modular approaches or flow diagrams are used (FAO, 2014; Klevers, 2007). For quantitative analysis, mathematical models and computer tools are used to visualize flows of goods worldwide (e.g. BfR-Warenstrominfo) or within logistics companies (Hertel et al. 2006). Relevant data and data sources are identified and systematically evaluated, such as business data (e.g. Annual reports of associations of different agrifoods and of federations of cooperatives), data on quality management (e.g. GMP, HACCP), on transportation and logistics (e.g. international standards like IFS Logistics), and on trade (databases and data reports). An initial analysis of weaknesses with respect to the input of contaminants in the area of transportation of food and feed has shown that vulnerable points might be located for instance in the technical, legal, human and economic fields.

## **Conclusions and Implications**

The identified systems will be merged and modified in accordance to the requirements of risk- assessment to a risk-oriented global supply chain analysis. The approach will consist of the elucidation (graphic) and visualization (quantitative) of agrifood supply chains as well as of vulnerability (input of contaminants) and a hazard analysis (occurrence of contaminants) in each step of the agrifood supply chain. The approach shall contribute as a practical tool to increase supply chain integrity and to improve the predictability of emerging or potential risks.

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## 8.5. External costs of open-cast lignite mining (as illustrated by the case of Oczkowice reserve)

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**Key words:** Oczkowice deposit open-cast mine, funnel of depression, cost in crop production, animal production and agri-food industry,

### Introduction

According to estimations, from 2010 to 2050, as a consequence of rapid population growth and a shift in diets, the demand for agricultural products will double due to increased demand for food (by 70%) and biofuel (by 30%) [FAO 2009, Zegar 2012]. Additionally, the demand for high-quality (animal and horticultural) products grows at an even higher pace, reaching 6-7% p.a. in developing countries [Zegar 2013, WB 2008].

Already now, the shortage of fresh water poses an important barrier to production growth in the agriculture and beyond. In many regions around the world, the agriculture sector must compete for water with the industrial and processing plants or, recently, with the water-expensive shale oil and gas extraction sector. The increasing competition for water, which cannot be substituted, gives rise to increasingly stronger tensions that threaten the world's order [Zegar 2013, GOS 2011].

According to recent forecasts, by 2050, the global consumption of energy will grow by a rate ranging from 30% to over 100%, depending on the estimations. Forecasts which envisage lower energy consumption levels assume that the efficiency of energy use will increase by 50% or more [Frei et al. 2013, *Scenariusze ...* (Scenarios ...) 2008]. In Poland, by 2050, the demand for final energy will probably decrease by 10%-25% compared to 2010 [*Polityka energetyczna ...* (Energy policy ...) 2015, KIG 2012].

Due to exhaustion of lignite resources in active open-pit mines, Polish energy holdings look for new reserves to extract lignite. One of the potential sites is Oczkowice, a lignite reserve located in the Gostyń and Rawicz districts (poviats), with identified resources of 1.0 billion tons, approximately [ZE PAK].

The key to an environmentally friendly economy is to make the market (prices) reflect the full costs of products, including externalities, often very difficult to appraise [Brown 2011, Zegar 2013, Baum 2014].

In view of the above, the purpose of this study is to analyze the externalities (external economies) for the agriculture and the agri-food industry in the case of the planned open-cast lignite mining from the Oczkowice reserve.

Externalities (external economies) that affect the natural environment (fauna and flora), forestry, air quality, health, displacement, infrastructure and other issues are not covered.

The time interval for this analysis is a period of around 50 years where lignite is supposed to be extracted, extended with another 50-year period of hydrological recovery in the area of the exploited reserve.

### **Material and methodology**

The Oczkowice lignite reserve have 71.04 km<sup>2</sup> of total area and 996 million tons of fully reliable recoverable geological resources (531 million tons classified as C<sub>1</sub> and 465 million tons classified as C<sub>2</sub>) [Przybyłek and Górski 2016], with an estimated value of lignite ranging from PLN 75 billion to PLN 100 billion. The lignite deposit lies at a depth ranging from 111 to 134 m below ground level, in the area of the hydrotechnical system. The thickness of the deposit varies from 11 to 14 meters [Przybyłek 2015].

As regards land use, the planned excavation area is dominated by agricultural land (91%) with a negligible share of forests (4.7%) and buildings and roads (4.3%), which reflects the purely agricultural nature of this region. In this region, farms demonstrate very high levels of animal production concentration too

### **Methodological assumptions**

In 2017, the project to operate the Oczkowice reserve was not developed yet. Therefore, in this paper, external costs are calculated based on the development concept presented by Kasztelewicz et al. [2012]. The study is based on 2 options for the depression crater's impact (mine dewatering) on crop production and 2 scenarios of losses in livestock production. Therefore, is likely to extend over a larger area. To determine the mine's impact on the environment, arable crops and animal concentration, the evolution in crop yield and animal population in the former Konin province was benchmarked against corresponding data from the remaining part of today's Wielkopolska province in the 1956-1970 and 1976-1995 periods.

## **Results of research**

The construction of an open-cast mine involves multiple environmental, social and economic impacts. The value of unrealized agricultural production within the open-cast mine area depends on the cultivation area, yields and buying-in prices of specific plants and, in the case of livestock production, on the number, productivity and buying-in prices of animals.

The value of unrealized plant and livestock production within the open-cast mine site (including the external dump) is estimated at PLN 48.0 million per year. During the 50-year lifecycle of the mine and the subsequent 50-year period of hydrological recovery, this provides a total of PLN 4.8 billion (the share of plant production is 34%). With a gross margin of around 25%, this means external costs of PLN 1.2 billion, approximately (Table 4).

Also, significant costs will be caused by the depression crater. In the first scenario, where only the depression area is covered, the annual costs for plant production are estimated at the level of PLN 25.8 million. However, if the impact of dewatering on agricultural land in neighboring districts (scenario 2) is taken into account, the costs may reach as much as PLN 199.4 million per year (PLN 2.6-19.9 billion over the entire impact period). In this case, the decrease in crop yield means (almost entirely) the reduction of the farmers' profits which will be neither invested nor consumed. Therefore, it will also have an impact on the sales figures of local companies, whether related to the agricultural sector or not.

Because of the high concentration of livestock production, production losses related to the decrease in animal population are significantly higher than in the case of plant production. Within the area of the estimated depression crater (scenario 1), the estimated decline in livestock production ranges from PLN 31.5 million to PLN 60.5 million per year (or from PLN 220.6 million to PLN 561.1 million in scenario 2). With a gross margin of 25%, the annual external costs, extended over a 100-year period, result in a total ranging from PLN 0.8 billion to PLN 1.5 billion and from PLN 5.5 billion to PLN 14.0 billion, respectively.

During the 100-year period, the agriculture sector in the area concerned will not produce agricultural raw materials worth between PLN 10,5 billion and PLN 80.8 billion (including losses incurred within the open-cast mine site), provided that the most realistic amount of losses is PLN 46.8 billion. External costs, defined as income foregone, will account for PLN 4.6-35.2 billion, and the most realistic cost level will be PLN 26.6 billion.

Significant costs will be incurred by the agri-food industry. This is largely due to the restricted ability to import unprocessed raw materials such as pig and cattle livestock, industrial fruits and vegetables, and milk. Depending on the scenario used, the estimated annual decrease in sales turnover of processing companies may range from PLN 11.9 billion (in the most optimistic scenario) to PLN 93.3 billion (in the second, pessimistic scenario). The author believes that in the most probable scenario, the sales volume of Polish processors will decline by PLN 53.0 billion. The decrease in sales turnover will also have an adverse effect

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on profits. The yearly decline in investments and dividends will range from PLN 0.51 billion to PLN 4.25 billion (most of these costs will be incurred by companies located near the planned mine).

## **Summary**

In the most realistic scenario, the costs are estimated to reach around PLN 28.9 billion while the value of unrealized production in the agricultural and agri-food sectors is estimated to be PLN 99.8 billion. In a pessimistic scenario, the external costs and production losses may reach PLN 39.5 billion and PLN 174 billion, respectively. This will translate into lower investments and a decreased turnover in companies from the agricultural and agri-food environment. The employment level will also be adversely affected.

Compared to the value of lignite from the Oczkowice reserve, the level of external costs and production losses in the agricultural and agri-food sectors make open-cast lignite mining at that location an economically unviable project.

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## 8.6. Food quality marks as part of the Polish consumers food security

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**Key words:** quality mark, food security, food safety

### **Abstract**

Achieving food security is possible only if humanity provides at the same time, both physical and economic access to safe food (Małysz, 2008). Food safety is an integral part of food quality and it refers to the risk of the food contamination, poisoning and food fraud, amongst all, by falsifying food (Kołożyn-Krajewska, 2015) (Kowalczyk, 2016). Providing safety food is important to the consumers, who in most cases, are denied the possibility to an appropriate assessment of the food quality while buying it, especially in cases in which the main and at times the only source of information on the purchased products are contained on the packaging (Kalinowski, 1998). One form of marking both the product or its packaging is by using quality marks. Quality marks should guarantee products with specific features that meet quality requirements in terms of production methods, composition or organoleptic properties (Kuncewicz et al., 2012) (Ustawa... 2000).

The aim of this article is to present the role of quality marks in providing food security to the Polish consumers. The paper presents an overview character of food quality marks used in Poland and the results of a study on the knowledge of Polish consumers regarding quality marks.

Research shows that lack of a clear definition of “*quality*” means that Polish consumers may meet many quality symbols while buying food products, out of which just a few are granted by accredited certification bodies. A large number of quality labels and the small knowledge about these marks among the Polish consumers is the cause that buyers do not consider them while deciding on which to buy. Therefore, the role of quality marks in providing food security of Polish consumers is limited.

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