



## **FACTORS INFLUENCING FOOD SUPPLY CHAINS IN THE CONTEXT OF EXISTING FOOD QUALITY SCHEMES**

*Urszula Ziemiańczyk, Anna Krakowiak-Bal*  
*University of Agriculture in Krakow*

### **Abstract**

An attempt to combine the issue of food supply chains, the market of traditional products and food quality schemes was undertaken. The aim of the article was to indicate and discuss the most important factors influencing functioning of food supply chains in the context of food quality schemes existing in the European Union and on the domestic market. The following factors: food quality systems in force, added value in the entire food supply chains, requirements and nature of demand (consumer choices), challenges of the concept of sustainable development, collaboration and cooperation of the participants in the supply chain were discussed in the article. Attention was also paid to other elements (beyond the scope of this study) that are important in the development of food supply chains and in undertaking further research.

**Keywords:** food supply chains, food quality schemes, short supply chains

### **INTRODUCTION**

The food market/food industry is a very complex environment influenced by numerous industrial, technological, economic, social and political factors. The availability of food, the types of products offered as well as the ways of delivering food to consumers depend on them. Research on the coordination of the

supply chain of agri-food products is necessary and has gained public attention due to its decisive importance for accessibility, safety and food security.

The food supply chain is defined as a combination of processes, operations and entities whose purpose is to transfer products and services from their original source, through intermediate stages to the product consumed by the final customer. According to Stadtler and Kilger, the supply chain represents „a network of organizations that are involved, through links up and down the chain, in various processes and activities creating value in the form of products and services for the final customer” (Stadtler and Kilger 2008). The supply chain of agricultural products has become an important issue due to the fact that the public is increasingly aware of and concerned about the availability and safety of the food being consumed (Handayati *et al.* 2015). The consumers of agricultural products demand to have more information not only on the availability of a product in supermarkets but also on its farming, marketing, distribution, transportation, and processing activities (Ahumada and Villalobos 2009).

Short food supply chains (SFSC), without intermediaries between the farmer and the consumer, are particularly vital in this context. The basic advantages include high quality of food from local producers and a fairer remuneration for farmers. Today, on the conventional market, they receive only 21% of the price paid by the supermarket customer. The proposed, innovative solutions supporting the development of short supply chains are, for example: food cooperatives or the digital agricultural market.

Short supply chain, as legally defined by Reg. 1305/13, is able to reach goals of “sustainable agriculture”, through the reduction of transportation costs and consequently of CO<sub>2</sub> emissions. In addition, it promotes biodiversity and implements periurban agriculture. The interest for short food chain is growing in EU and in national legislations, considering its role in achieving environmental goals. This approach has a major effect on the reinterpretation of market performing principles, considering the role of Member States in defining more flexible rules applicable to local markets, as well as in interpreting the principle of free movement of goods within the local markets reasoning detecting (Canfora 2016).

The goal of entities operating in the food supply chain is to develop the functioning of the chain, improve quality and increase competitiveness, while maintaining total food safety.

The complexity of food supply chains results from the fact that they cover many diverse aspects, such as:

- agricultural production,
- involvement of various authorities and non-governmental organizations,
- processing and maintaining quality,
- consumer and market choices,

- logistics companies and many smaller companies actively involved in the given supply chain that contribute to creating value.

The external environment, the surroundings and the world are constantly changing. Technological innovations, new business models, globalisation and population migrations necessitate changes in the way of determining performance indicators and the effectiveness of supply chains. Innovations in processing and transport make it possible to distribute products over long distances, and new management methods as well as the development of ICT technologies allow for responding more effectively to more and more sophisticated consumer requirements. In turn, product safety is inseparably connected with the concept of its traceability in the supply chain, and thus the possibility of reproducing its path from the raw material to the final product delivered to the final recipient.

On the other hand, consumers while shopping for food are increasingly looking for proven, good quality products, often regardless of the price. The introduction, at the EU level, of regulations concerning, for example, the protection of geographical indications and designations of origin for agricultural products and foodstuffs being traditional specialty guaranteed – has accelerated the development of production of regional and traditional products and made it possible to implement the assumptions of Common Agricultural Policy reform.

The protection of these products against a dishonest appellation of their name or the counterfeit simultaneously influenced the diversification of the supply of agri-food products and enabled consumers to be better informed about the merits of the products they buy. Diversification of agricultural production and supporting the production of high quality products are among the most important elements of rural development. It is worth adding here that the development of rural areas concerns 93% of the area of Poland and almost 15 million people, and thus 39% of the total population of the country (Ziemiańczyk *et al.* 2013, 2014).

Many of the awards already given relate to produce processed under difficult soil and climatic conditions (e.g. „mountain” cheeses) or produce associated with very labour-intensive production methods. The awarding of „regional brand” increases the competitiveness of produce and can also be a key element of impact on a potential customer. The product, whose origin is guaranteed by the Union, co-creates the image of the area from which it originates and thus encourages tourists to visit a given region (contributing to the development of tourism). It is worth noting that the consumer who has access to a higher quality product is familiarized with its producer as well as the natural and cultural environment in which the product was made.

As far as consumer information is concerned, when a product is marked, it, on the one hand, certifies its authenticity and, on the other hand, it is a guarantee of quality. By means of this, the potential buyer has more data allowing them to make a choice while shopping. The price ceases to be the only or the most impor-

tant argument for a given product. Through the link between the product and the region, the purchase becomes the beginning of contact with the unique culture, tradition, history, community and nature of the area.

A strong tendency to emphasize regional affiliation can be observed both in EU countries and in Poland. More and more is being said and heard about the role and the meaning of „small homelands”. This trend is perfectly in line with the mechanisms that allow to promote and protect the cultural heritage of particular areas of Europe. Production of regional and traditional products may, on the one hand, be supported as far as the promotion of this type of production is concerned and, on the other hand, it might gain the interest of better-off urban population groups and tourists.

### **PURPOSE AND SCOPE**

The aim of the article is to indicate and discuss the most important factors that have an impact on the functioning of food supply chains in the context of food quality schemes existing in the European Union and on the domestic market. On the basis of literature studies and review of legal regulations, the basic factors were determined:

- requirements for food quality schemes in force,
- adding value to entire food supply chains,
- requirements and nature of demand (consumer choices),
- challenges to the concept of sustainable development,
- collaboration and cooperation of participants in the supply chain.

### **REQUIREMENTS FOR FOOD QUALITY SCHEMES IN FORCE**

Healthy, good food is the basis for the producers in order to be present on the market and therefore the issue of its safety is of utmost importance. Due to the increase in food safety requirements, holding recognized certificates helps producers to ensure that products are good for consumers (Szymonik 2016). Food quality schemes can be divided into community schemes – functioning in all EU Member States and national ones functioning only in Poland. In the European Union, the strategy of safe food is based on three pillars. These include: law, consultancy based on research and practical solutions as well as control and implementation. The provision of healthy food is related to the implementation of safety management systems, which include: the principles of Good Hygiene Practice – GHP, Good Manufacturing Practice – GMP and the HACCP scheme (Hazard Analysis and Critical Control Point System). The basic scheme is also the Food Safety System FSSC 22000, which is equivalent to the International Food Standard (IFS) and BRC. In the context of the traditional and regional

products market in the European Union, two basic systems of food distinction, promotion and protection are important: a protection system for regional and traditional products and a system for organic farming products.

### **The European Scheme for Protection of Regional and Traditional Products**

In order to distinguish and better protect the culinary heritage and common achievements of generations, which include the best and unique traditional and regional products around the world, the European Union introduced a special scheme of certification and labelling of such products. By means of the labelling of these products, consumers have clear and reliable information about their exceptional quality and originality, and producers are able to promote and protect against unfair competition and the counterfeit of their products. The registration and protection rules are regulated at the EU level by Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on Quality Schemes for Agricultural Products and Foodstuffs. Two product categories were distinguished in the European quality scheme: regional products of known origin and traditional products.

Based on Article 42a (4) of the Act of 17 December 2004 on Registration and Protection of Names and Symbols of Agricultural Products, Foodstuffs and Traditional Products, the Chief Inspector for Commercial Quality of Agricultural and Food Products keeps a list of manufacturers with a valid certificate of conformity or a valid quality certificate.

Organic Farming is an agricultural scheme that provides fresh food produced while respecting natural life cycles. The legal framework at all levels of production, distribution, control and labelling of organic products which can be sold and traded in the EU is established by Council Regulation 834/2007. It defines the continuous development of organic production through the establishment of clearly defined goals and principles. The specification of general guidelines for organic farming is specified in the Commission Regulation No. 889/2008.

The principles of organic farming concern the agricultural economy in the widest sense, from the management of soil, water, plants and animals, to the production, processing and distribution of food and other goods. These include respect for the landscape and the entire community of beings – values that make up the heritage of future generations. Organic farming functions like self-regulating ecological systems. It fits into processes and helps to sustain them.

The purpose of organic farming at the level of agricultural production, processing, distribution as well as consumption is to maintain and enhance the health of ecosystems and organisms – from soil microorganisms to humans. In particular, the aim of organic farming is the production of wholesome food.

### **National food quality schemes**

In Poland, however, there are several quality schemes recognized by the Ministry of Agriculture and Rural Development:

- Integrated Production (IP) Controlled by the State – a scheme less restrictive than organic farming,
- „Quality Tradition „ scheme (JT) – protection and promotion scheme for traditional products,
- QMP (Quality Meat Program) – quality scheme for beef,
- PQS (Pork Quality System) – quality scheme for pork,
- QAFP (Quality Assurance for Food Products).

The main distinguishing feature of national quality schemes is that the products being part of these schemes are systematically controlled and certified by accredited inspection bodies. The Rural Development Program provides for financial support for producers participating in food quality schemes.

National food quality schemes are recognized in accordance with Article 15 (2) of the Act of 20 February 2015 on supporting Rural Development with the use of the European Agricultural Fund for Rural Development under the Rural Development Program for 2014-2020 (Journal of Laws, 2015, item 349). Pursuant to this provision, the Minister responsible for rural development recognises, by means of an administrative decision, the quality schemes referred to in Article 16(1b) of Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005 (OJ L 347, p. 487), if the criteria set out in this provision are met:

1. the specificity of the final product produced under the scheme results from the clear requirement to guarantee any of the following:
  - specific product features,
  - specific cultivation or production methods,
  - the quality of the final product, which significantly exceeds the trading standards applicable to the product concerned in terms of public health, animal or plant health, animal welfare or environmental protection;
2. the scheme is open to all producers,
3. the scheme includes binding product specifications, and compliance with these specifications is verified by public authorities or an independent inspection body,
4. the scheme is transparent and ensures full traceability of products.

However, according to Article 15(3) of the aforementioned Act, in the event of ceasing to comply with one or more of the criteria set out in Article 16(1b) of Regulation No. 1305/2013, the Minister responsible for rural development shall withdraw, by means of an administrative decision, the above recognition.

International food transfer is carried out in accordance with the principles set out in the Agreement on the Application of Sanitary and Phytosanitary Measure (SPS Agreement) of the World Trade Organization (WTO). There are also other international standards relating to food hygiene, labelling, and so on. Such agreements and provisions ensure greater transparency of international food trade. EU law, on the other hand, focuses on risks and monitoring a supply chain from ‘the farm to the table’, putting great emphasis on human, animal and plant health and environmental protection. The EU applies a preventive policy, which is why the European Commission’s general food regulation introduced a principle that can be briefly described as one step back – one step ahead which requires operators/entities to identify direct suppliers and recipients. Another key element of the European regulations is proper labelling of food products. In addition, the implementation of quality improvement schemes is a stimulus for the growth of horizontal cooperation.

## **ADDING VALUE TO ENTIRE FOOD SUPPLY CHAINS**

The food supply chains should be seen as „value chain systems”, where produce (agricultural products) acquires more and more value by passing through subsequent links in the chain. There, it is then processed and prepared for consumption. Recognizing the food supply chain as the value chain also means that those involved in the food chain may strive to move up the chain to secure a larger share of profits. In some cases, operators in the supply chain are vertically integrated to increase their share of total revenues. Transformation of food supply schemes may affect their market power. Adding value to a product or service means transforming it into a product or service for which consumers will pay more. This can be done at all stages of the supply chain. The food value chain leads from the producer to the consumer through a network of stakeholders involved in the cultivation, processing and sale of food consumed by customers. Among the stakeholders, the following groups can be distinguished:

- suppliers of means of production,
- growers and breeders,
- processors (direct, indirect – dealing with processing, preparation and marketing of food products),
- distributors (including wholesalers and retailers – involved in distribution, marketing and sale of food),
- customers buying and consuming food products,



- authorities and non-governmental organizations (NGOs) that develop rules and programmes for food storage and security,
- supervisory organizations – involved in monitoring and regulating the functioning of the food value chains, from the producer to the consumer,
- logistics companies dealing with transport, storage and handling of food in the value chain,
- financial institutions that provide entities operating in the value chain with access to the funds they need.

The value of a product or service can be increased at various stages of production or delivery, adding characteristics for which consumers are willing to pay more. A key element of successful initiatives is a clear market orientation. Value adding can already be launched on a farm through the processing of basic products and waste valorisation. New and emerging trends regarding consumer preferences generate even more opportunities for effective value adding by differentiating products in terms of their additional properties.

The food value chains are also a key tool in creating new jobs. By means of investments and creation of jobs in the food industry, they generate opportunities for improving not only the quality of life but at the same time food security. The value chain in which the issues of reducing waste and increasing food security are taken into account in production and processing processes, should also consider aspects such as availability, safety and nutritional value of food products.

## **REQUIREMENTS AND CHARACTER OF DEMAND (CONSUMER CHOICES)**

Analyzing global trends in food consumption, several scenarios can be outlined. In the developed world, the level of consumption of processed products is growing, which is caused by the continuous lack of time of the current generation. A predilection for ready-to-eat dishes or those that can be made quickly has resulted in changes in the methods of selling and packaging products, which have been necessary to satisfy market requirements. Food for retail trade is often processed in huge quantities, which makes such processed food cheaper than, for example, raw materials, fruit or vegetables. The so-called economy of scale determines where processed food offering additional value for the consumer is cheaper.

However, a growing number of consumers are aware of the fact that processed food, though cheap and convenient, contains numerous substances which improve its parameters (taste, colour, shelf life) but which are unhealthy. The presence of such substances in various products and their accumulation in the human body results, in the long run, in body fatigue and propensity for various



types of diseases. Consumers are increasingly willing to select products that offer them more benefits than just only satisfying hunger.

Analysing, for example, data included in IJHARS reports on the condition of organic farming in Poland in the years 2004, 2005-2006, 2007-2008, 2009-2010, it can be stated that since 2004 the area of organic farming has been growing systematically: from 82 730 ha in 2004 up to 519 068 ha in 2010 (Report .... 2011).

Another trend shows that consumers in developing countries are moving away from a cereal-based diet to the protein one based on meat. However, increasing meat production requires more feed and other raw materials used in the process. This, in turn, leads to major changes and intensification of agricultural production. Numerous farmers focus on feed production instead of growing cereals for human consumption, which may affect food security (Dani 2016).

It is also worth noting the trend emphasizing the role of the agri-food sector in the national economy in Poland and its share in foreign trade. Over the past dozen or so years, the share of foreign trade in agri-food products in total trade has steadily increased (Baer-Nawrocka and Poczta 2018).

## **CHALLENGES FOR THE SUSTAINABLE DEVELOPMENT CONCEPT**

Global food supply chains have a significant share in global greenhouse gas emissions. They appear at all stages of the chain, from food production (and creation of means of production), through processing, distribution, consumption, to waste disposal. The sustainable development of food supply chains depends on numerous factors. The key ones include:

- energy consumption,
- carbon dioxide emission,
- water consumption,
- food availability,
- ethical behaviour,
- economic stabilization.

In addition, diverse sustainability feature of SFSCs cover the following aspects: health and wellbeing, environmental, social and economic factors.

## **COOPERATION**

Cooperation between various stakeholders in the food supply chain is an extremely important factor. It is worth investigating the interdependencies

between individual elements, as well as the wider environment, to search for cooperation opportunities. The occurring cases of food withdrawals from the market, as well as safety problems and the possibility of identification consist in a serious source of concern in the food sector. Cooperation between actors in the chain increases their confidence in the origin, handling and control of food quality. Common platforms provide individual partners with a comprehensive picture of the supply chain. Strategies based on cooperation between producers and processors (using appropriate technologies) can also help to reduce losses after the harvest period.

## **DISCUSSION**

The aim of the article was to discuss the most important factors affecting the functioning of food supply chains in the context of existing food quality schemes. These factors are of great importance due to the complexity of supply chains. The main participants involved in supply chains include:

- producers (suppliers),
- processors,
- distributors (carriers, logistics operators),
- companies from the tourism industry,
- retailers,
- consumers.

In the short chains, some of these participants can be eliminated, which is beneficial for consumers, as it gives an opportunity for greater transparency of product origin and quality. However, here, key factors shaping the food supply chains should be analysed.

Short supply chain is able to reach goals of “sustainable agriculture”, through the reduction of transportation costs and consequently of CO<sub>2</sub> emissions. In addition, it promotes biodiversity and implements periurban agriculture. The interest for short food chain is growing in EU and in national legislations, considering its role in achieving environmental goals (Canfora 2016).

However, it was found that producers had cultural difficulties for SFSC model adoption, but economic reasons as cutting costs of transportation and elimination of intermediary agents justified their initiatives. However, consolidation of SFSC implementation still requires environmental protection efforts linked to better production processes in small farms, and health safeguards for consumers, as well as the preservation of the cultural heritage associated with the region of origin of the production (Sellitto *et al.* 2018).

Factors such as food quality systems in force, added value in the entire food supply chains, requirements and nature of demand (consumer choices),

challenges of the concept of sustainable development, collaboration and cooperation of the participants in the supply chain were discussed in the article. They are of great importance in shaping the food market. Other factors affecting the functioning of food supply chains include modern technologies, new business models, and globalization and population migrations. Due to the volume of this study, they go beyond its scope. However, these are extremely important issues that should be considered in further study/research. Also, the inefficiencies observed in current agro-food supply chains, and recent trends in agro-food industry such as consolidation, increase the need for further studies on supply chain management (Jonkman *et al.* 2018).

### **ACKNOWLEDGEMENTS**

The publication and research was financed by the Ministry of Science and Higher Education of the Republic of Poland, funds no: DS 3600/WIPIE.

### **REFERENCES**

- Ahumada, O., Villalobos, J.R. (2009). Application of planning models in the agri-food supply chain: A review. *European Journal of Operational Research* 196(1): 1-20.
- Baer-Nawrocka, A., Poczta, W. (2018). Rolnictwo polskie – przemiany i zróżnicowanie regionalne [in] Wilkin J., Nurzyńska I. (eds.) *Polska wieś 2018. Raport o stanie wsi.* Wydawnictwo Naukowe Scholar. Warszawa.
- Canfora, I. (2016): Is the Short Food Supply Chain an Efficient Solution for Sustainability in Food Market? *Agriculture and Agricultural Science Procedia* 8: 402-407, doi: 10.1016/j.aaspro.2016.02.036.
- Dani, S. (2016) *Zarządzanie łańcuchem dostaw żywności.* PWN. Warszawa.
- Handayati, Y., Simatupang, T.M., Perdana, T. (2015). Agri-food supply chain coordination: the state-of-the-art and recent developments. *Logistics Research* 8(1): 5.
- Jonkman, J., Barbosa-Povoa, A.P., Bloemhof, J.M. (2018). Integrating harvesting decisions in the design of agro-food supply chains, *European Journal of Operational Research*, ISSN 0377-2217.
- Kieljan, K. (2011), *O systemach jakości żywności. Vademecum funkcjonowania produktów regionalnych i tradycyjnych.* Centrum Doradztwa Rolniczego w Brwinowie Oddział w Krakowie, Kraków.
- Raport o stanie rolnictwa ekologicznego w Polsce w latach 2009-2010. (2011). JHARS. Warszawa.

Regulation (EC) No 834/2007 of the European Parliament and of the Council on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.

Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control.

Regulation (EU) No 1151/2012 of the European Parliament and of the Council on quality schemes for agricultural products and foodstuffs.

Regulation (EU) No 1305/2013 of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

Rolnictwo ekologiczne w Polsce. Raport 2007-2008. JHARS Warszawa.

Sellitto, M.A., Machado, Vial, L.A., Viegas, C.V. (2018). Critical success factors in Short Food Supply Chains: Case studies with milk and dairy producers from Italy and Brazil, *Journal of Cleaner Production* 170: 1361-1368, doi: 10.1016/j.jclepro.2017.09.235.

Stadtler, H., Kilger, Ch. 2008: *Supply Chain Management and Advanced Planning, Concepts, Models, Software and Case Studies*, Springer, Berlin, Heidelberg.

Szymonik, A. (2016). Zapewnienie bezpieczeństwa żywnościowego w łańcuchu dostaw. *Gospodarka Materiałowa i Logistyka* (11), 255-267.

Ziemiańczyk, U., Krakowiak-Bal, A., Mięka, B. (2014). Knowledge Management in the Process of Building Competitiveness and Innovativeness of Rural Areas. *Online Journal of Applied Knowledge Management* 2(2): 43-56.

Ziemiańczyk, U., Krakowiak-Bal, A., Mięka, B., Woźniak, A. (2013). Zarządzanie wiedzą w procesie rozwoju obszarów wiejskich. *Infrastruktura i Ekologia Terenów Wiejskich* 4(3): 353-369.

Corresponding author: Urszula Ziemiańczyk, PhD, Eng.  
Anna Krakowiak-Bal, PhD, Eng.  
University of Agriculture in Krakow  
Faculty of Production and Power Engineering  
Institute of Agricultural Engineering and Computer Science  
Ul. Balicka 116 b  
30-149 Kraków  
Phone: + 48 12 662 46 56  
e-mail: urszula.ziemiancyk@urk.edu.pl

Received: 28.09.2018

Accepted: 21.12.2018