# Organic milk supply in Poland: market and policy developments

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## Abstract

*Purpose*

Global demand for organic milk products gives an opportunity to Polish organic farmers and dairies to supply national, European Union and international milk markets. The aim of this study is to review the historic and contemporary changes in organic milk production and processing in Poland, in order to identify the main factors of influence and to propose the direction of future market and policy development in the sector.

*Design/methodology/approach*

In this study, secondary data from a range of literature sources and databases is analysed. The Lorenz's concentration ratio is applied to the data derived to evaluate the degree of concentration of certified organic farms in the different regions of Poland and conclusions are drawn as a result.

*Findings*

Organic dairy farm operations in Poland are small scale and territorially dispersed. Although there is some evidence of growing supply concentration, Polish processors of organic milk face multiple barriers to development not least a lack of continuity of supplies. Whilst global markets are of interest, the development of alternative, innovative food networks in Poland that focus on provenance, integrity and promoting the special health benefits of organic milk would be of value to the sector, but further co-operation and integration is essential to take advantage of these market opportunities.

*Originality*

This research underpins the need for appropriate national policies in Poland for the development and actualisation of a dynamic organic milk supply system that delivers value to local, regional and international markets.

**Key words:** agribusiness, organic milk production, organic milk processing, dairy cooperative, health

## 1. Introduction

Organic agricultural movements can be traced back to the 1920s when the first certified organic coffee farm was established in Mexico, and the 'Demeter' biodynamic certification programme in Germany (Reganold, 1995) quickly spreading into Western Europe and North America (Aschemann *et al.*, 2007). In 1972, the introduction of the International Federation of Organic Agriculture Movements (IFOAM) consolidated and institutionalised meanings, principles and practice associated with organic production (Paull, 2010). The most recent IFOAM (2018) principles of organic agriculture relate to health, ecology, fairness, and care. However, whilst globally organic standards promote "chemical-free" farming they are largely devoid of broader principles. Studies have tried to quantify the value of organic production in terms of the triple bottom line: economic, environmental and social benefit. O'Hara and Parsons (2013) in their United States (US) research conclude that organic dairy farms may contribute more to the local economy than similar-size conventional dairy farms and as a result support economic development in rural communities.

According to the FiBL-IFOAM-SOEL surveys from 1999-2019 there has been a systematic growth in hectares of organic farmland and also the organic share of global food production (Willer and Lernoud, 2019). Whilst 1.4% of global agricultural land is organic, two-thirds of this area is covered by grassland with the majority located in Oceania (mainly Australia). Global sales for organic products saw dynamical growth from $17.9 bn to $97 bn between 2000 and 2017 (Weidmann *et al.*, 2010; Willer and Lernoud, 2019) with the biggest markets being the US (40.0 billion euros), Germany (10.0 billion euros) and France (7.9 billion euros). Retail sales are growing fast in France, Spain, Denmark and Liechtenstein (Willer and Lernoud, 2019). These markets experience regional undersupply, resulting in imports from regions such as Oceania (Aschemann *et al.*,2007; Willer and Kilcher, 2012), Latin America, Central and

Eastern Europe. The aim of this study is to review the historic and contemporary changes in organic milk production and processing in Poland, in order to identify the main factors of influence and to propose the direction of future market and policy development in the sector. The paper considers the structure of the existing production system in order to identify the barriers and enablers to improving the sector. The paper is structured as follows: firstly in Section 1 there is an introduction to organic food production. Section 2 includes a narrative review of existing literature sources on organic milk production in Poland and the health-promoting aspects of organic milk. The next section (Section 3) considers the methodological approach, the results are presented and analysed (Section 4), followed by recommendations for policy and practice (Section 5).

## 2. Literature review

The positive perceptions of the environmental, social and economic benefits of organic farming among policy/decision-makers led to the introduction of financial support programmes from the late 1980s onwards initially in seven European countries including Denmark, Sweden, Finland, Germany and Austria. In 1994, the first programme implemented under the Common Agricultural Policy (CAP) was the development of support for organic agriculture in all EU countries. However, the tools introduced within the EU were subsequently modified to make them more efficacious (Padel and Lampkin, 2007).The Polish organic agriculture movement started in 1924, when Rudolf Steiner gave a lecture course on biodynamic agriculture in Kobierzyce, near Wrocław (Runowski, 1996), but World War II interrupted progress. Around 1960, Julian Osetek attempted and failed to re-popularise biodynamic agriculture (Sołtysiak, 1993; Tyburski, 1996). The policy priority at the time was to maximise agricultural and food production at the expense of both quality and the impact of such production on the environment. However, in 1989, the ‘Ekoland’ association was founded to promote organic agriculture (Kobielska, 2002), the main drivers being increasing interest in the environmental impact of

highly intensive agriculture, and the availability of relatively "clean" agricultural production areas in Poland, where 80% of the farmland was managed by small and medium sized traditional private farmers (Kowalska, 2010a; Kowalska, 2010b). In contrast to the Central and Eastern European large collective and state farms, where intensive application of chemical fertiliser and pesticides was common practice, the lack of finance for Polish farmers meant they did not make common use of these products. Further in Poland there was abundant and largely under-utilised, labour resources in rural areas that could support the labour intensity of organic agriculture.

Relatively low average prosperity of Polish agricultural holdings between 1990 and 2004 contributed to an increasing interest in switching to organic farming (Kowalska, 2010a; Zegar, 2015). The rurality of Poland provides a distinct dimension here. 83% of Poland's area is rural with under 100 inhabitants per $km^2$ (Zegar, 2015); 39.9% of the population live in villages, 15.2% of employed people work in agriculture, forestry, hunting and fishing but the gross value added share of this sector is only 2.8% (CSO, 2018a; CSO, 2019a; CSO, 2019b). Most of the Polish farms have been family-owned for over 150 years. The average size of an agricultural holding in Poland is 10.8 ha and there are only seven EU countries with smaller average utilised agricultural area per holding being Croatia, Hungary, Greece, Slovenia, Romania, Cyprus and Malta (ARMA, 2018; Eurostat, 2013). However, the average size of an organic agricultural holding in Poland is 22 ha, which is double the aforementioned figure (AFQI, 2017); this represents an opportunity for improving profitability. Conventional dairy farms in Poland have taken advantage of the opportunities created by EU accession and strengthened their position on the European market. However, these are mainly large, prosperous farms, and the investments made, as well as technical and biological progress in milk production, has contributed to their competitive scale of production in the European market.

The real development of organic dairy production in Poland started in 2004, when Polish organic farmers began to obtain EU subsidies. There has been a noticeable trend of moving production from Western Europe to Central and Eastern Europe, where the cost of production is lower (Skarżyńska, 2017). Organic agricultural production has risen in Poland (AFQI, nd). In 2004, there were 3,760 organic holdings (82,730 ha) in Poland, whereas in 2017, the number of organic holdings was 20,257 with the total land area of nearly 494,978 ha (AFQI, 2007; CSO, 2019b). Further, the number of organic processing plants also increased from 55 in 2004 to 705 in 2016 (AFQI, 2007, 2017). Over 76% of farms have converted to organic production, rather than being in transition (CSO, 2019b). However, regulatory changes such as the Regulation of the Minister of Agriculture and Rural Development of 13 March 2015 on the detailed conditions and procedures for granting financial assistance, under the "Organic Farming" action covered by the EU Rural Development Programme 2014-2020 have led to a partial restructuring of organic farm production in Poland. The financial support instruments for rural development set out in Regulation (EU) No 1305/2013 mean to access funding Polish farmers must be compliant with the regulation (Mickiewicz *et al.,* 2016). Thus, evolving regulatory requirements and access to subsidy are factors that influences organic farm structure and strategy (Brodzińska, 2010; Kisiel and Grabowska, 2014).

In 2010, the majority of Polish agricultural raw material and/or pre-processed organic products were exported to Western European countries (e.g. Germany), the US and other parts of the world; the main Polish organic exports being fruits and vegetables (Kowalska, 2010a). However, growing and unsatisfied global demand for other products, e.g. organic milk, also gives an opportunity to Polish organic farmers. The growth of the Czech Republic organic milk industry is also due to an export focus (Peterková *et al.,* 2015). Between 2007 and 2015 European organic milk production almost doubled, and in Canada, a new strategic plan has

been put in place to double the amount of organic milk produced in Quebec by 2023 (Komorowska, 2014; Willer and Lernoud, 2017).

Consumers purchase organic product believing it is healthier and more nutritious (Seufert *et al.,* 2017). Whilst consumer demand for organic milk is driven by this perception that organic milk is more nutritious than conventional milk, there is some uncertainty whether organic farm production standards affect the intrinsic quality of milk (Średnicka-Tober *et al.,* 2016). Conversely, other studies suggest due to the content of bioactive compounds, aroma and flavour characteristics from high biodiversity organic pastures with numerous species of grasses, legumes and herbs, organic dairy products have special health benefits (Bergamo, 2003; Brodziak *et al.,* 2018; Ellis *et al.,* 2007; Kuczyńska *et al.,* 2012; Popović-Vranješ *et al.,* 2017). Pasture feeding is obligatory on organic farms often exceeding 180 days, whereas on conventional farms the grazing period usually lasts no longer than 140 days or not at all – so called "zero-grazing" systems (Kuczyńska *et al.,* 2012; Commission Regulation (EC) No 889/2008). Interestingly the organic dairy standards in the US state a minimum period of 120 days grazing per calendar year (USDA, nd), considerably less than the Polish standard.

Organically produced milk, despite its lower content of protein (3.24%), has a higher protein-to-fat ratio (0.88) than conventional milk (Król *et al.,* 2016). Evaluation of goat milk from organic and conventional farms in the Central Beskidian Piedmont micro region of Poland, found organic milk had a more favorable chemical composition containing significantly ($p<0.01$) more total fat (by 13%), total protein (by 16%), including casein (by 16%), and dry matter (by 10%), and protein-to-fat ratio (0.87 vs 0.84) see Barłowska *et al.,* (2013). Cows' milk obtained from certified organic farms is a valuable source of antioxidant compounds: β-lactoglobulin (3.32 g/l), lactoferrin (123.8 mg/l), vitamin E (2.044 mg/l) and β-carotene (0.257 mg/l) in comparison to intensive farms (Brodziak *et al.,* 2018). Organic dairy products contain significantly higher protein, α-linolenic acid, total omega-3 fatty acid, cis-9, trans-11

158 conjugated linoleic acid, trans-11 vaccenic acid, eicosapentanoic acid, and docosapentanoic
159 acid than milk from conventional types of production (Palupi *et al.,* 2012). This is important
160 because over the last century omega-3 (ω-3) intake in the human diet has fallen. According to
161 Simopoulos (2016), the omega-6/omega-3 ratio has substantially risen from 1:1 in our ancestral
162 diets, to around 20:1 in today's Western diets. Authors reported that over the last 150 years,
163 intakes of ω-6 have increased and intakes of ω-3 have decreased in parallel with the increase in
164 heart disease. However, dairy products still contribute significantly to dietary intakes of
165 saturated fat in both Europe and the US, which has led to widely endorsed recommendations to
166 limit consumption of whole milk and other high-fat dairy products, in favour of low and non-
167 fat dairy products (U.S. Department of Agriculture, 2010). Health concerns stemming from
168 increasing dietary ω-6/ω-3 ratios have stimulated research on ways to improve the fatty acid
169 profile of common foods, including milk and dairy products. To address these concerns, several
170 European and US studies have compared the composition of organic and conventional milk.
171 Benbrook *et al.,* (2013) argued that the ω-6/ω-3 ratio of both conventional and organic dairy fat
172 is healthier than the ratio of most other commonly consumed fat sources, so full-fat organic
173 dairy products offer clear advantages for individuals striving to reduce their overall dietary ω-
174 6/ω-3 ratio.

175 **3. Methodology**

176 The review of existing literature led to some key research questions:

177 (Q1): What factors inhibit Polish dairies and agricultural holdings from taking advantage of
178 the development opportunities for organic milk?

179 (Q2): What aspects of the Polish organic dairy supply chain need to be addressed to enable
180 a dynamic supply chain for organic milk products?

In order to consider these questions, secondary data is analysed from sources such as the Agricultural and Food Quality Inspection, Poland (AFQI) webpage; the Central Statistical Office of Poland (CSO), Eurostat, the Food and Agriculture Organisation of the United Nations (FAO), the Research Institute of Organic Agriculture FiBL & International Federation of Organic Agriculture Movements (FiBL&IFOAM). The number of organic farms highlighted is based on unpublished data received in September 2017 from AFQI. The regional concentration of certified organic farms is considered as being the number of certified pastures and meadows, cows or milk. To evaluate the degree of concentration of certified organic farms in the regions of Poland i.e. voivodships, the Lorenz's concentration ratio is applied. The higher the ratio value (closer to 1) the higher the concentration of a given phenomenon (Sobczyk, 2006) and the application of this ratio and the implications are considered. Additionally, graphical methods are used to emphasize the differences between the concentration of the several types of certified organic farms.

The level of development of the agricultural sector in Poland is distant from the situation in other EU countries and this creates the unique lens for analysis and also a limitation of the study in terms of its generalisability to other EU settings. However, Szczukocka (2015) has confirmed some similarities among the factors determining the level of development of the agricultural sector in Poland, Greece, Portugal and Hungary. Thus this research will provide input into policy development in these countries. Therefore, the secondary data is used to gain insight into the structure and nuances of the Polish organic dairy supply chain in order to address the two research questions and also to inform public and private (market) policy instruments that can aid the development of the market further.

## 4. Results and analysis

### 5.1 Current and development opportunities for Polish agriculture within the global market for organic milk products

In terms of total milk production, Poland holds the fifth position in the EU, with a share of over 8%, (see Figure 1), but its share of EU organic milk production falls to just 0.56% putting it in 15th position amongst member states (Eurostat, nd; CLAL, nd). In Poland, the availability of organic meadows and pastures gives a real opportunity for the further development of organic milk production. The production of organic cow milk in the EU has systematically grown, now accounting for 2.7% of total milk production. In 2016, the production of organic milk in Poland totalled 24.9 thousand tonnes representing 0.19% of national milk production (CSO, 2018b; FAOSTAT, nd; AFQI, nd). This production output in Poland has declined to two thousand tonnes lower than in 2004, which was then 0.23% of total production (see Figure 2).

**Take in Figures 1 and 2**

The regional concentration of organic milk production at farm and processing facilities is now considered.

### 5.2 Regional concentration of organic milk production at farm level in Poland

Organic milk production in Poland is characterised by a strong regional concentration that has intensified in the recent years. In 2016, three regions, i.e. Małopolskie, Podkarpackie, and Zachodniopomorskie delivered over 56% of national organic milk production, whereas in 2004, this figure was around 45% (AFQI, nd). These three voivodships have significantly stressed their specialisation in the manufacture of organic cow's milk, even if they are not highly specialised regions for total volume of milk production. However, apart from Podkarpackie, they are not the most suitable regions for organic production in terms of the usability and fertility of soil, and their climate, terrain, landscape differentiation, water availability and degree of soil pollution (Krasowicz, 2009). Further, between 2004 and 2016, the regions became highly specialised in conventional cow's milk production (Mazowieckie and Podkarpackie), having seen their share of national production grow from 33% to over 44%. At the same time these regions have decreased their share of total organic milk production from

25%, to just short of 15%, showing an uncoupling of conventional and organic milk production in the region. Indeed, 71% of all certified organic farms keeping milk cows and 81% of all certified organic milk farms are concentrated in five voivodships (Table 1). A large proportion (42%) of organic farms in Poland keep cows, but farmers have not applied for organic certification of their dairy products. In a majority (n=10) of the voivodships, this percentage is even higher. Voivodships with large production of organic milk also host large numbers of certified organic milk cows. However, the number of cows does not reflect the volume of milk production declared by farmers in their certificates, as it is usually significantly lower than the average productivity expected. Frequently, the farmers do not put large volumes of milk on their certificates, or do not include it at all, as they intend to market the output as conventional milk, or use it for their own needs. This is not a new phenomena (Kwasek, 2013), but considering the global undersupply of organic milk and dairy products, it is definitely an area that needs to be addressed.

**Take in Table 1**

Geographically, there is a regional concentration of organic farms and areas of organic arable land in Poland. Factors that can influence this concentration include location of customers, level of farmer training and the organisation of collection of organic agricultural produce, as well as the mimicking of other agricultural producers who stand out as a result of their high profitability. The current average cow herd size on certified organic dairy farms is 8 cows, which indicates the low scale of milk production at the farm level (see Table 1). Figure 3 shows over a half of these farms have 5 cows or less, and three-quarters have up to 10 animals. That means that ¾ of all organic farms in the country are micro-businesses, and this percentage is even higher (from 80% to 94%) in seven voivodships (Lubelskie, Lódzkie, Małopolskie, Podlaskie, Pomorskie, Śląskie, Świętokrzyskie). The very small number of dairy cows per farm highlights the insufficient resource base at farm level and this may limit the development of

organic milk processing and the innovations in this sector. The value of Lorenz's concentration ratio indicates a stronger regional concentration of organic dairy farms than the concentration of certified farms both with regard to the number of dairy cows and area of meadows and pastures (Figure 4). It should be noted that the ratio shows the concentration of certified farms, only and allows researchers to consider those regions of a distribution where significant inequality differences do, or do not occur.

**Take in Figure 4**

Thus, the wide geographic spread of Polish organic dairy farms with very low scale of production can result in high unit production costs that subsidy payments could offset (Żekało, 2015). The geographic spread means high costs too for milk collection and transfer to processing plants and difficulties in keeping the physiochemical properties of the milk during this process increases the risk of discontinuity of supply.

### 5.3 Regional concentration of organic milk processing in Poland

The production volume of organic dairy products has been increasing dynamically in Poland. In 2010, four dairies generated over 664 tonnes of organic dairy products (cows' milk) whereas in 2016, 149.3 thousand tonnes of milk were processed in 25 dairies, including 4 plants that processed 42.4 tons of organic sheep or goat milk (AFQI, nd). Mazowieckie based dairies process 92.2% of the volume of Polish organic milk (AFQI, nd). In 2016, dairies from three voivodships (Podkarpackie, Warmińsko-mazurskie and Małopolskie) had a similar processing share, with an appropriate material base, as the production of organic cow's milk was the largest therein (see Table 1). There is however a predominance of Mazowieckie based dairies especially that many dairies face a lack of organic material to meet demand. The most efficient organic food distribution in Poland is in the voivodships with the greatest number of processing plants e.g. in Kujawsko-pomorskie, Mazowieckie and Lódzkie, especially around major cities (Jezierska-Thöle, *et al.*, 2017).

The national average for the scale of milk production is 28.2 thousand litres (kl). In a few regions, and only in two of those specialising in organic milk production, the average milk production is higher than the national levels (Dolnośląskie 31.8 kl, Kujawsko-pomorskie 59.4 kl, Pomorskie 151.1 kl, Warmińsko-mazurskie 79.8 kl, Zachodniopomorskie 162.4 kl). Indeed, only 35 large farms have more than 40 organic milk cows, including just 6 farms with more than 100 (Figure 3). Half of the processors (n=10) are located in the Mazowieckie, four in Małopolskie, two in Podlaskie, and one in each of: Podkarpackie, Warmińsko-mazurskie, Pomorskie, Kujawsko-pomorskie, and Wielkopolskie. These are usually mid-sized or large dairies (employing over 50 people). There are just four small dairies, including two that produce exclusively organic products. Moreover, every third organic dairy is a cooperative (unpublished AFQI data). When Poland is compared to other European countries, the growth of number of organic milk processors is slower (Table 2). The secondary data analysed here shows in recent years a concentration of the organic dairy sector in Poland mainly via cooperatives such as e.g. Mlekovita or Mlekpol. This consolidation of the processing sector facilitates the diversification of products and strengthens Polish dairy brands from basic to more differentiated/sophisticated milk products.

**Table in Table 2**

Therefore, insufficient supply is the main impediment to a Polish national market for organic dairy products (see Table 2) especially the mismatch between supply and processing capability, low scale of production and increased logistics costs. To increase organic dairy production, the relationship between the processor and farmers in their respective region must be deepened via the development of closer cooperation and collaboration that focuses on quality and appropriate price structures. The dairies, in turn, have to secure a guaranteed supply of consistent material, i.e. the required volume of milk that also meets the appropriate quality parameters. This requires better alignment and coordination of activities such as logistical planning, knowledge and skills

306 at farm level and the development of advisory services to promote improvements in cow
307 nutrition, health planning, good agricultural practice especially around sanitary and hygienic
308 conditions in the cowsheds. The dairy cooperative movement has a long, almost 200-year old
309 history in Poland, resulting in a build-up of experience and competencies that gives it a cachet
310 of credibility and trust (Zuba-Ciszewska, 2016), building lasting competitive advantage
311 (Brodziński, 2014) and protecting the interests of member farmers as co-owners (MacDonald
312 and McBride, 2010). However, co-operatives share of the market systematically fell to 68.7%
313 of total milk purchase in 2015. Dairies with lower milk processing volumes may also specialise
314 in organic production offering the opportunity to develop, not only within the national market,
315 but also through export, especially since the demand for these products in the European and
316 world markets is growing. Indeed local dairy cooperatives have shown reduced distribution
317 level losses in Poland (Zuba-Ciszewska, 2018).

318 Food product innovation influences purchasing behaviour (Lundahl, 2012). Indeed the
319 most important factors determining the consumption of organic food in Poland is product safety,
320 respecting the natural environment, seasonal supply and the ethnocentric attitudes of consumers
321 (Śmiechowska, 2011). Thus, Polish consumers perceived organic food as "healthy", "natural"
322 and "safe" (Firlej, 2008; Żakowska-Biemans, 2011). Consumers also value the tradition
323 associated with the production of dairy products and so provenance i.e. Polish origin, including
324 regional origin, is significant for a large percentage of buyers of dairy products (Grześ, 2014).
325 The European Commission has registered three Polish cheeses as Protected Designation of
326 Origin (PDO), and two Polish names of cheeses as Protected Geographical Indication (PGI)
327 (EC, 2018). Provenance claims, geographic or country of origin designations are subject to
328 Council Regulation (EEC) No 2081/92 and 2082/92 of 14 July 1992 that define standards for
329 designation including PGI see Pieniak *et al.*, (2009).

The Trade Co-op (SOT) in Białystok, was founded (27 years ago) by dairies in the Podlaskie voivodship. SOT has 11 warehouses all over Poland, offering more than 2,000 products not only to retail chains but also to retail stores (SOT, 2018). The Dairy Cooperative (LSUM) operating in the Lubelskie (Lublin) voivodship, trades over 800 dairy products from the Lublin region and serves about 2,000 recipients in the Lublin province and neighboring provinces (LSUM, 2018). These are two examples of local rather than global food networks that support milk production. An important element in local food networks in Poland is also agri-food wholesale markets, including Lubelski Agri-Food Wholesale Market, Elizówka that offer organic as well as conventional products (Elizówka, 2018). The market supports the development of organic production in the region (Zuba, 2011); increasing consumers' access to organic food, and its associated value (Kwasek, 2014). Local food systems support food manufactured, processed and sold within a specific geographic area (Kneafsey *et al.*, 2013), and contribute to food security and health (Cowell and Parkinson, 2003; Martinez *et al.*, 2010). Further, local food systems offer strategic partnerships (Christopher and Jüttner, 2000), marketing processes, and through this interaction create additional value (Grönroos, 2004) by the provision of clear signals on provenance (Manning and Smith, 2015). This demonstrates that opportunities exist in both the local and export markets for organic milk production in Poland.

Two research questions were identified in the development of this research: firstly, what factors inhibit Polish dairies and agricultural holdings from taking advantage of the development opportunities for organic milk; and secondly, what aspects of the Polish organic dairy supply chain need to be addressed to enable a dynamic supply chain for organic milk products? The review of existing data highlights that the consumption of organic food is influenced by numerous market and policy factors and their intensity of impact varies according to location. In Poland, the *market factors* on the *demand side* include: value orientation, food

culture, level of income; whilst *supply factors include* the appropriate soil and climate, relative prices, and distribution channels. The development of the supply chain infrastructure and the market in terms of the value proposition are key to building a dynamic supply chain and investment is required to address these current weaknesses. Factors that can add value to the product, that were highlighted in this work, include the intrinsic health benefits of organic milk and again these benefits should be promoted strongly to consumers. The *policy factors* of influence encompass firstly regulations (EU-federal laws and regulations, national (state) laws and regulations, subsidies) and secondly market development i.e. control, certification, branding and information (Thøgersen, 2010). Thus further work needs to be undertaken to build brand value and wider sustainable value propositions for organic milk from Poland.

## 5. Conclusion

European countries differ significantly from each other in terms of natural conditions and cultural heritage which both determine the directions for agricultural and rural development. Szczukocka (2015, 2018) showed that there are groups of EU countries with a similar level of development of their agricultural sector i.e. Poland, Hungary, Croatia, Greece, Lithuania, Cyprus, Slovakia, Portugal, and Slovenia etc. Poland, Greece, Portugal and Hungary have something in common. Thus, similar factors are determining the level of development of the agricultural sector in these countries: the level of employment in agriculture, the gross value added of agricultural sector, the number of agricultural holdings, the use of mineral fertilisers, the size of utilised agricultural area and so on. Therefore, this research might be useful when developing national food polices in these countries too.

Due to globalisation, various problems arising along the food supply chain are transnational in nature. The consequences of them are felt by a wide circle of purchasers and competitors from other countries. For years, organic production has been concentrated in southern regions which have been export-oriented, while the largest markets for organic

agricultural produce have been located in northern countries. Countries where production costs are lower, e.g. Poland, are export-oriented, and consumers from richer countries, e.g. the UK are more interested in organic foods. Global demand for organic milk products is growing and organic milk products' supply is not keeping pace with demand. Although the volume of organic milk production is currently decreasing, the underdevelopment of the supply side of the chain is a weakness. Geographic concentration and small scale farming enterprises create supply pressure points, rising sales give a market opportunity to Polish organic farmers and dairies. It is important, that Polish dairies take advantage of the dynamically developing global market for organic products and actively participate in it, otherwise the market opportunities will be lost. The cost advantages of Polish organic dairy sector are insufficient to sustain the industry in terms of delivering to an internal market alone. Therefore, in a situation where organic dairy products in Poland are manufactured above internal market needs, exports will remain the main stimulator of development and differentiation in the Polish organic milk market.

Organic dairy farms are territorially dispersed, but there is opportunity for smaller local dairies to specialise in processing and marketing of organic dairy products, although funding will be required to drive this investment. Increasing national and international consumption of Polish organic dairy products may require more focus on the derived health benefits, but this relies on assuring the consistency of product quality and continuity of supply. In the face of the reported health benefits of organic dairy products, the Polish government could adopt a strategy of supporting the development of organic milk production and processing. This policy could have a positive effect on public health, the sustainable development of Polish rural areas, and as a result the economy as a whole. Market developments to add value to these products should support such a strategy. This research serves as the basis for further work investigating the creation of appropriate national policies and strategies in Poland that will contribute to the

405 development and actualisation of a dynamic organic milk supply system that delivers to local,
406 regional and international markets. The development of such food networks should ensure
407 provenance and integrity can be assured and deliver resilience within the domestic and export
408 organic dairy market in Poland.
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690 **Table. 1. Organic farms involved in milk production in Poland in 2016**

| Voivodships | Number of farms in the range of | | | | | | Number of certified | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pastures and meadows | | cows | | milk | | pastures and meadows (k ha) | | cows (individual beasts.) | | milk (kl) | |
| | A | B | A | B | A | B | A | B | A | B | A | B |
| Dolnośląskie | 465 | 81 | 76 | 2 | 26 | 0 | 8.6 | 1.2 | 787 | 32 | 827.9 | 0.0 |
| Kujawsko-pomorskie | 145 | 45 | 31 | 2 | 15 | 1 | 1.5 | 0.4 | 267 | 20 | 891.0 | 72.0 |
| Lubelskie | 982 | 122 | 55 | 0 | 29 | 0 | 7.7 | 0.4 | 271 | 0 | 189.5 | 0.0 |
| Lubuskie | 516 | 75 | 23 | 0 | 4 | 0 | 9.5 | 1.5 | 279 | 0 | 38.5 | 0.0 |
| Lódzkie | 229 | 61 | 18 | 0 | 15 | 0 | 1.2 | 0.2 | 81 | 0 | 227.7 | 0.0 |
| Małopolskie | 696 | 60 | 441 | 7 | 322 | 5 | 4.6 | 0.5 | 2585 | 33 | 6337.7 | 59.0 |
| Mazowieckie | 1036 | 174 | 138 | 1 | 87 | 2 | 11.8 | 0.8 | 959 | 1 | 2253.8 | 18.0 |
| Opolskie | 33 | 3 | 1 | 0 | 0 | 0 | 0.6 | 0.0 | 47 | 0 | 0.0 | 0.0 |
| Podkarpackie | 549 | 46 | 190 | 5 | 146 | 1 | 5.3 | 0.9 | 1400 | 24 | 3864.0 | 6.0 |
| Podlaskie | 1618 | 153 | 113 | 0 | 44 | 0 | 10.5 | 0.8 | 651 | 0 | 1228.8 | 0.0 |
| Pomorskie | 318 | 40 | 34 | 0 | 11 | 0 | 4.6 | 1.3 | 536 | 0 | 1662.0 | 0.0 |
| Śląskie | 86 | 12 | 14 | 0 | 11 | 0 | 1.5 | 0.1 | 113 | 0 | 70.5 | 0.0 |
| Świętokrzyskie | 554 | 66 | 148 | 1 | 91 | 1 | 2.2 | 0.3 | 635 | 8 | 1093.9 | 10.0 |
| Warmińsko-mazurskie | 1894 | 263 | 72 | 1 | 24 | 0 | 25.7 | 2.9 | 1306 | 5 | 1915.5 | 0.0 |
| Wielkopolskie | 289 | 49 | 16 | 0 | 6 | 0 | 6.2 | 0.6 | 182 | 0 | 27.0 | 0.0 |
| Zachodniopomorskie | 1334 | 138 | 73 | 0 | 21 | 0 | 21.3 | 2.6 | 1644 | 0 | 3410.5 | 0.0 |
| Poland | 10744 | 1388 | 1443 | 19 | 852 | 10 | 122.9 | 14.6 | 11743 | 123 | 24038.2 | 165.0 |

691 A-certified B-in conversion

692 Source: Own elaboration based on unpublished AFQI data.

693

694 **Table. 2. Dairies in EU countries* with the highest organic milk production**

| Country | Number of dairies | | | | | Organic production of cows milk (million tones) |
|---|---|---|---|---|---|---|
| | **2008** | **2010** | **2012** | **2014** | **2016** | **2016** |
| France | 180 | 204 | 238 | 238 | 336 | 0.58 |
| United Kingdom | 212 | 183 | 160 | 144 | 83 | 0.52 |
| Denmark | 36 | 58 | 64 | 72 | 70 | 0.52 |
| Sweden | 25 | 43 | 35 | 38 | 69 | 0.37 |
| Italy | 333 | 438 | 482 | 735 | 595 | 0.21 |
| Netherlands | 101 | 105 | 112 | 139 | 144 | 0.20 |
| Latvia | 5 | 17 | 15 | 22 | 24 | 0.10 |
| Belgium | 39 | 53 | 79 | 64 | 67 | 0.09 |
| Finland | 15 | 22 | 34 | 34 | 38 | 0.06 |
| Lithuania | 5 | 6 | 7 | 7 | 6 | 0.04 |
| Czech Republic | 31 | 45 | 79 | 63 | 99 | 0.03 |
| Romania | 9 | 4 | 7 | 8 | 18 | 0.03 |
| Poland | 4 | 5 | 17 | 11 | 26** | 0.02 |
| Slovakia | 7 | 16 | 16 | 18 | 17 | 0.02 |
| Spain | 67 | 98 | 131 | 121 | 137 | 0.02 |

695 * no data on dairies for Germany and Austria

696 **Including 5 dairies that process sheep and goat milk.

697 Source: Eurostat, nd.

698

699

700

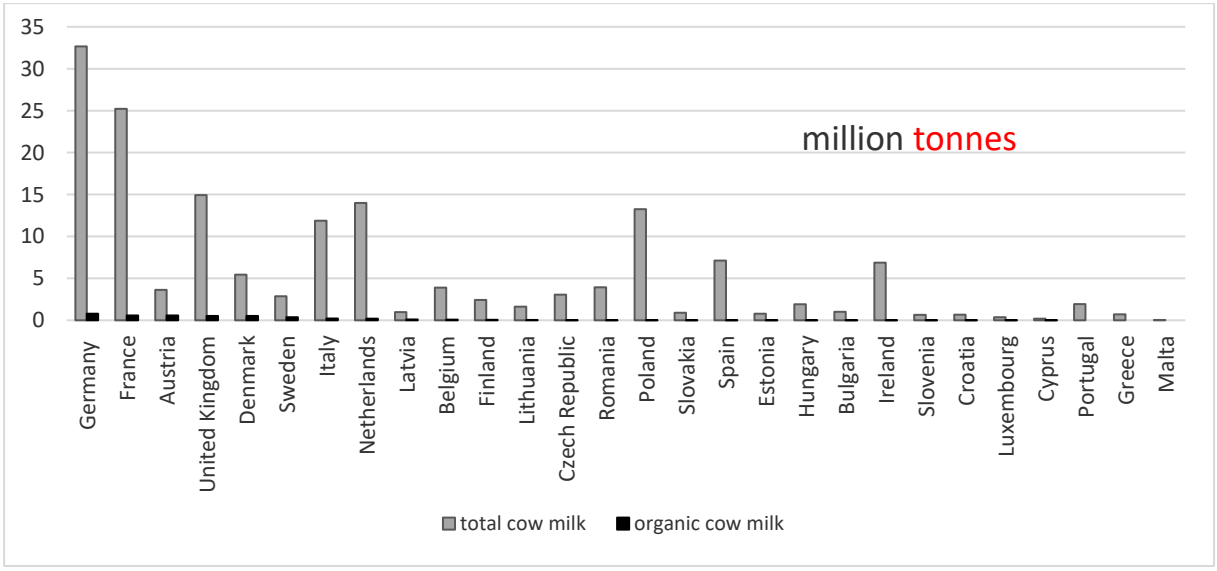
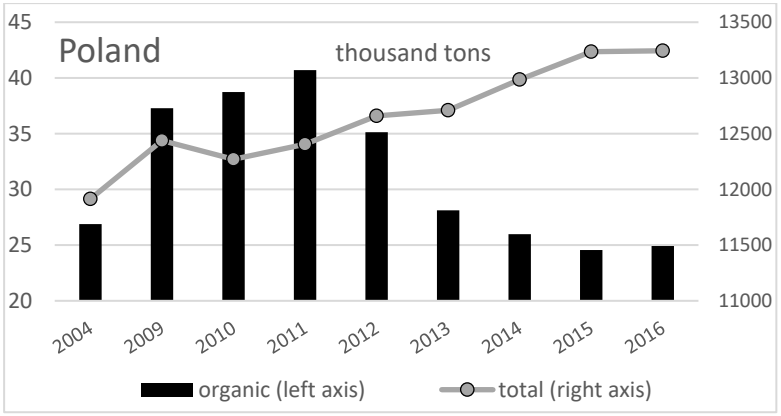



**Figure 1. Organic production of cow's milk in 2016 in EU countries (Adapted from Eurostat, nd and CLAL, nd data)**



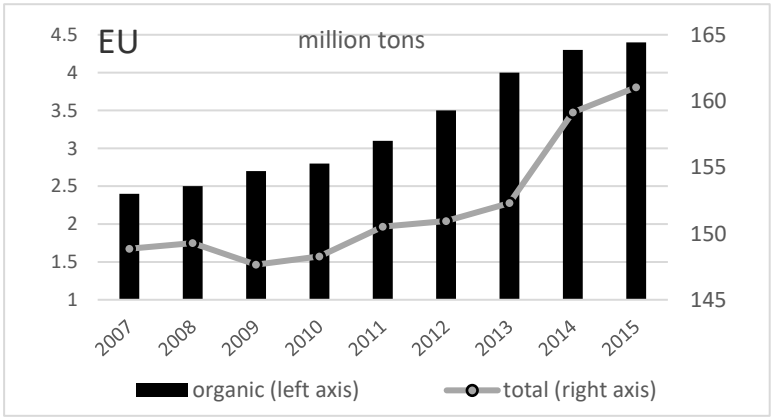




**Figure 2. Milk production volumes in Poland and the EU (Adapted from AFQI, nd; CSO, nd and FAOSTAT, nd data)**

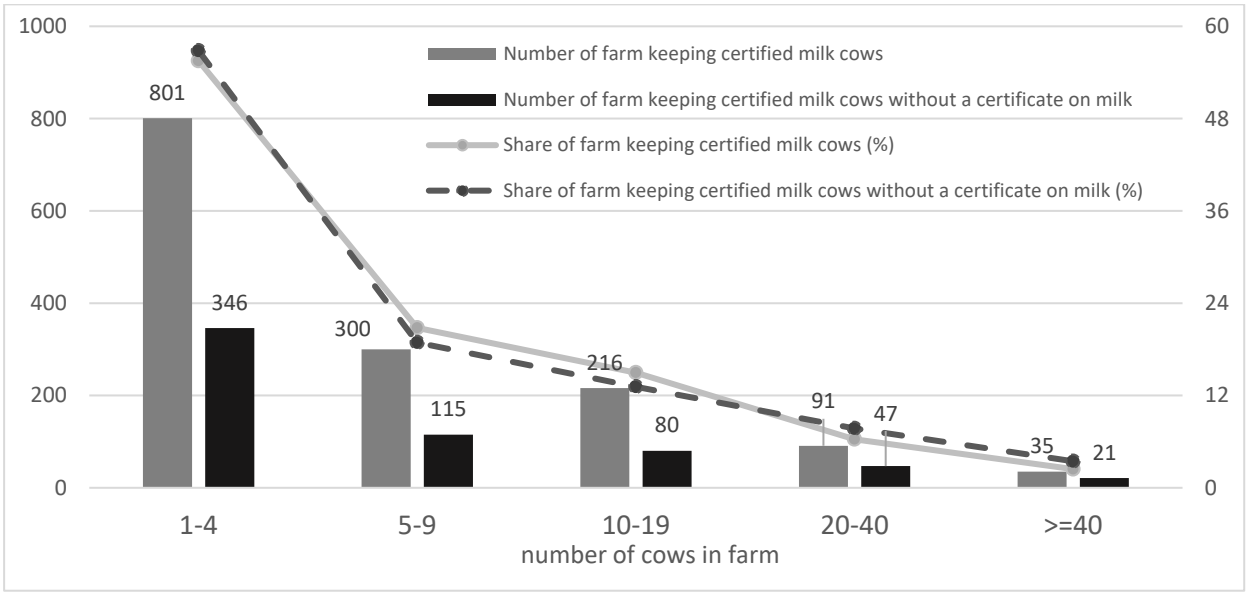



**Figure 3. Structure of organic farms keeping certified milk cows, including these without a certificate of milk, in Poland in 2016 (Adapted from AFQI, nd data)**

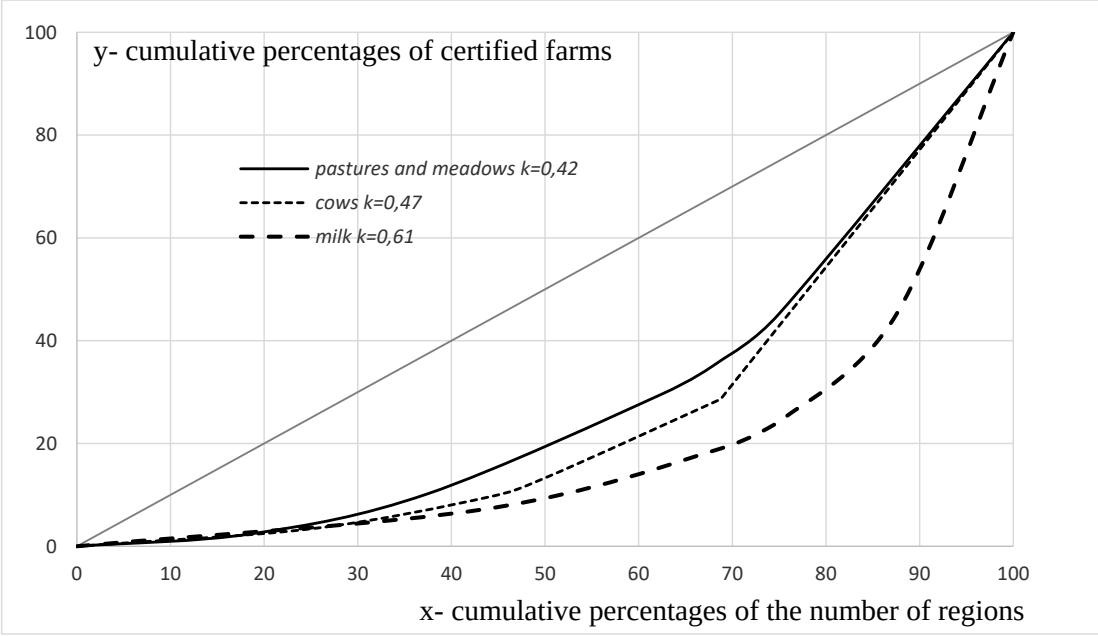



**Figure 4. The regional concentration of certified organic farms considering certified pastures and meadows/cows/milk (Adapted from data in Table 1)**

***k- Lorenz's concentration ratio***