Premises of dairy systems development on an example of Polish and Portuguese conditions

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Abstract: Premises of dairy systems development on an example of Polish and Portuguese conditions. The paper aimed to compare some data concerning dairy production in two European countries to show effect of environmental conditions and different kind of dairy potential on some indices expressing dairy production development. An index of dairy production development delay was proposed to compare the current situation in the field of biological and economic potential of dairy production in Poland and Portugal against the background of the EU countries. As a result of the carried out consideration it was concluded that different level of the dairy production development can decide about effectiveness of the used technical infrastructure for milking.

Key words: country, dairy production, development, EU, farm

INTRODUCTION

Dairying is an important tool for sustainable rural development in many areas and has lifted millions of rural people out of poverty. Dairying generates more jobs and income per unit of land than do crops [Dugdill et al. 2013]. Milk has always been counted among products characterized by strategic importance in the food programme, regardless of globalization [Borowski 2008b] and some limitations on amount of produced milk [Borowski 2008a]. However, the available methods for milk production and distribution have changed [Parzonko 2013].

Dairy production systems vary across agro-ecological zones and as a result there can be different profitability of dairy activities. The profitability of dairy production is influenced by many factors as quantity of the produced milk, the feeding cost as well as the productive and reproductive parameters that will contribute to the economic success or failure of the dairy farm or dairy industry.

Including the mentioned changes in available methods of dairy production as well as differences between the dairy regions there are premises to undertake comparative analyses to show some specific conditions to develop dairy production at the current and future time.

The paper aimed to compare some data concerning dairy production in two European countries to show effect of environmental conditions and different kind of dairy potential on some indices expressing dairy production and its technical infrastructure development.

MATERIAL AND METHODS

The potential of dairy production in the considered region or country can be
expressed by amount of produced and purchased milk. Poland is the twelfth largest producer of milk in the world, with 12.67 million of tons of produced milk (FAO database from 2011). In European scale Poland is the fourth largest producer in the EU after Germany, France and the UK [MARD 2012]. However Portugal occupies the 39th position in the world, with 1.906 million of tons of milk production, and in the European ranking occupies the 20th position (FAO database from 2011).

But total annual amount of produced milk does not give objective information about dairy system in particular countries. There are necessary other data to develop more precise analysis concerning dairy production in unit (farm) and national scale.

Such data like annual milk yield per cow as well as prices paid for purchased raw milk constitute important information about potential of dairy production in the considered scale.

According to Gaworski and Leola [2014], it is possible to distinguish the following type of potential in the area of dairy production:

- technical potential – set of technical equipment needed to operate herd of cows and milk stream in the farm, including construction complexity;
- technological potential – methods, how dairy cows are kept in the barn, including tie system and loose housing system;
- biological potential – set of data describing dairy cows, i.e. annual milk yield per cow, cows herd size, amount of produced milk;
- economic potential – set of data deciding about economic effectiveness of farm dairy production, e.g. ex-farm milk price, dairy production costs.

Each type of the mentioned potential can be source of detailed research considerations expressed by set of indices to compare conditions of dairy production in different regions.

In our paper we would like to develop some aspects of biological and economic potential concerning dairy production to show and discuss their effect on assessment of technical infrastructure for milking, which is used in dairy farms.

To compare dairy production in two countries (Poland and Portugal) it is possible to propose some indices basing on biological and economic potential expressed by statistical data coming from available database. To propose the indices for comparison it was necessary to include set of dairy data coming from 27 EU countries.

RESULTS

In practice it is possible to include many indices to assess some relationships between biological potential, economic potential and some aspects of technical potential utilization in dairy production. Gaworski and Dumas [2012] proposed use of index of lost functional benefits and index of lost economic benefits to express changes in amount of produced milk within the period of one year and as a result effectiveness of milking systems utilization.

In our paper we would like to propose some index, to compare differences between biological and economic potential of dairy production in two countries against the background of data describing set of countries – producers of milk. The mentioned index referring to dairy production value bases on such data as
The annual milk yield per cow and price paid for the unit mass of purchased milk for 27 EU countries were presented in Figures 1 and 2, respectively.

The Figure 3 presents annual value of produced milk per cow in 27 EU countries. To calculate the value of produced milk for each country we multiplied annual milk yield per cow by milk price.
The data given in Figure 3 were used to calculate the index of dairy production development delay \((i_{dpd})\). The proposed general formula to calculate the index is as following:

\[
    i_{dpd} = \frac{v_{max} - v_c}{v_{max}}
\]

where:

- \(v_{max}\) – maximum value of the parameter;
- \(v_c\) – value of the parameter for considered country.

The parameter in the given above description it is value of produced milk. Including data given in Figure 3 the index of dairy production development delay was calculated and presented in Figure 4.

Including the general formula (1) there is possible to calculate the same way the index of delay on the base of data given in Figures 1 and 2 to show “distance” between the considered country (countries) and the best country in the set of considered data coming from 27 EU countries. The results of calculation and comparison were presented in Figures 5 and 6. Figure 5 includes comparison of index of annual milk yield per cow delay, while Figure 6 gives the index of milk price delay.

The data given in Figures 4 and 5 show near the same difference (about 0.3) in the indices of delay between Poland and Portugal, but it is different “distance” in relation to countries with the indices amounted to 0.00.

There are scientific premises for identifying technical and biological solutions for optimising farm dairy production system, including sustainable improvement. Dynamic implementation of dairy farms with modern technical equipment for milking needs simultaneous improvement of dairy cow herds and other
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factors, e.g. economic profitability [Gaworski et al. 2011].

Development of dairy production system in Poland and Portugal can also be considered on the base of SWOT analysis. SWOT analysis indicates on advantages and faults as well as challenges and threats at the market. Internationaliza-
tion of economy including dairy market decides about situation, that agricultural markets are more sensitive for any global changes. Results of the SWOT analysis were given in Table 1.

In Poland the three main regions with the biggest number of cows and efficiency per cow are, i.e. Mazowieckie, Podlaskie and Wielkopolskie.

They have good conditions for shepherding. The Podlaskie region has the largest proportion of the pasture acreage of Poland.

In Portugal, the dairy cattle farming is concentrated in four regions: Douro, Minho, Beira Litoral and Azores, where 78.5% of holdings are focused on milk production and have 78.1% of the total of dairy cows [PORTUGALFOODS 2012].

Although the number of dairy cows has decreased over the last 10 years with the disappearance of 22% of the dairy cows and 68% of farms, domestic production cow’s milk has remained fairly constant, as a result of increased productivity in the sector largely due to investments in technology and the genetic improvement of dairy cattle with producers supporting the rising costs of inputs without having counterparts in the price of milk [www.ine.pt, 2011].

The archipelago of Azores is located approximately at 1600 km from the west coast of the European continent. The islands that constitute the archipelago are grouped in three groups as it follows: Western Group – Flores and Corvo; Central Group – Terceira, São Jorge, Pico, Faial and Graciosa and the Eastern Group – São Miguel and Santa Maria.

The regional microclimate is essentially dictated by the geographical location of the islands in the context of oceanic and atmospheric global circulation.
The oceanic islands have unique ecosystems and generally a high biodiversity with impact in the ecological and ecosystem processes [Rodrigues et al. 2012]. Biodiversity is the foundation to the existence of fertile soils, sustainable agriculture, balanced production forests and food availability [Almeida 2012].

In the Azores, milk production based in permanent intensive pastures or semi-permanent are a threat to biodiversity, an obstruction to infiltration and retention of water in the soil and a source of water pollution due to the use of fertilizers [Antonio et al. 2012].

However, the extensive exploitation of medium and high semi-natural pastures that occurs for example in Pico, Santa Maria, Flores and part of Terceira is benefit to biodiversity. For the maintenance of the natural value, mainly the medium altitude semi-natural pastures (medium and high) is necessary to continue the extensive cattle production, giving preference to high value meat and milk production.

The autonomous region of the Azores, according to the annual report and accounts of FINISTERRA, in 2012 occupied about 3.3% of utilized agricul-

### TABLE 1. SWOT analysis in the area of dairy production in Poland and Portugal

<table>
<thead>
<tr>
<th>POLAND STRENGTHS</th>
<th>PORTUGAL STRENGTHS</th>
<th>POLAND WEAKNESSES</th>
<th>PORTUGAL WEAKNESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Modern</td>
<td>• Recent</td>
<td>• Decreasing profit sector</td>
<td>• Many small farms, deficient in hygiene and sanitation and milk quality</td>
</tr>
<tr>
<td>• Production technology</td>
<td>• Technological modernization</td>
<td>• Distance from the selling markets</td>
<td>• Export focused on products with low added value and dependent on the price factor</td>
</tr>
<tr>
<td>• Skilled labor</td>
<td>• Existence of a business group with dimension Iberian</td>
<td>• Fragmentation of the structure of the business sector</td>
<td>• Peripheral location allows not to diversify sources of supply of raw material</td>
</tr>
<tr>
<td>• Low cost</td>
<td>• Credibility of the sector of consumer</td>
<td>• Reduction in the price advantages</td>
<td></td>
</tr>
<tr>
<td>• High quality products</td>
<td>• Awareness of national brands market leaders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Innovation</td>
<td>• Recognition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
<th>POLAND OPPORTUNITIES</th>
<th>PORTUGAL OPPORTUNITIES</th>
<th>POLAND THREATS</th>
<th>PORTUGAL THREATS</th>
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<tbody>
<tr>
<td>• Abolition of quotas</td>
<td>• Develop differentiated products tailored to niche markets</td>
<td>• Low consumption of milk and dairy products in Poland</td>
<td>• Reduced levels of market support and eventual dismantling of the quota regime</td>
</tr>
<tr>
<td>• Increased export development</td>
<td>• Consolidate and strengthen the position in the European markets</td>
<td>• Liberalization of trade</td>
<td>• Geographic conflict in peri-urban areas</td>
</tr>
<tr>
<td>• Promoting the consumption of milk and milk-based products in the local market</td>
<td>• Empower and strengthen the foundation of dairy companies</td>
<td>• Existence of an underground economy</td>
<td>• Concentration and increase the bargaining power of large retailers with supply capacity beyond national borders</td>
</tr>
<tr>
<td>• Promotion of Polish brands in foreign markets</td>
<td>• Promoting the consumption of milk and milk-based products in the local market</td>
<td>• Appreciation of the national currency (Zloty)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration on the base of literature review.
tural area of Portugal, thus producing about 30% of national milk production (Table 2). The islands have about 20,000 livestock farms and in factories they delivered almost 566 million litres of milk [FINISTERRA 2012].

**TABLE 2. The islands with the biggest milk production in Azores, in 2012**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Share of milk production by island (%)</th>
<th>Milk production (l, in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>São Miguel</td>
<td>63</td>
<td>358</td>
</tr>
<tr>
<td>Terceira</td>
<td>26</td>
<td>147.6</td>
</tr>
<tr>
<td>São Jorge</td>
<td>5.2</td>
<td>29.5</td>
</tr>
<tr>
<td>Faial</td>
<td>2.8</td>
<td>13</td>
</tr>
<tr>
<td>Other islands</td>
<td>3</td>
<td>17.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>566</td>
</tr>
</tbody>
</table>

Source: FINISTERRA [2012].

Azores are characterized by a temperate maritime climate, so in the winter and summer period the temperatures are soft, which increases the stability of the animal promoting thereby an increase in milk production. Availability to natural resources as the use of pasture in feeding promotes the increase in milk quality and the costs of production are low.

Azores have great climate conditions and natural resources so in this way; dairy farms are more profitable, producing more and better milk at low costs.

Poland is characterized by having a temperate climate with severe winters with frequent precipitation, cold and occurrence of long periods of snow and mild summers, with showers and thunderstorms. All these climatic and environmental factors are severe for the reduction of milk production. The intensive system resources, life in housing and food ration-based also help in decreased milk quality and higher costs for exploration.

**CONCLUSIONS**

The carried out calculations indicated some differences between biological and economy potential of dairy production in Poland and Portugal at the current decade. As a result there is different distance separating European countries and effectiveness of their dairy systems.

Regardless of differences between dairy production systems in European countries there is necessary to develop and implement technical infrastructure supporting milking activities although effectiveness of milking installations use can differ between dairy farms.

Dairy production in Azores region, according to specific climate conditions can generate lower costs as an effect of more simple livestock building infrastructure in comparison with Polish conditions.

Sustainable development of dairy production in regional scale, according to local conditions constitutes challenge for many dairy farms to improve their production and significance on the local market.

**REFERENCES**

Streszczenie: Przesłanki rozwoju systemu mleczarskiego na przykładzie warunków produkcji mleka w Polsce i Portugalii. Celem pracy jest porównanie zestawu danych charakteryzujących produkcję mleka w dwóch krajach europejskich w kontekście wpływu warunków środowiskowych i zróżnicowanego potencjału produkcyjnego na wybrane wskaźniki wyrażające rozwój produkcji mleczarskiej. Zaproponowano wykorzystanie wskaźnika opóźnienia rozwoju produkcji mleczarskiej w celu porównania bieżącej sytuacji w obszarze biologicznego i ekonomicznego potencjału produkcji mleczarskiej na przykładzie Polski i Portugalii rozpatrywanych na tle danych charakteryzujących produkcję mleka w 27 krajach Unii Europejskiej. W efekcie przeprowadzonych rozważań na bazie obliczonych wskaźników zwrócono uwagę na zróżnicowany poziom rozwoju produkcji mleczarskiej, który może kazać wpływ na efektywność wykorzystania technicznej infrastruktury przeznaczonej do pożyskiwania mleka.

MS. received August 2014

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