

Summary of doctoral dissertation:

Significance of water use for the Polish trade of agricultural products

In the economic theory, the issues of localization of production activities and trade development factors have been studied for many years. In the economics, water used in production has been included so far in the land as a factor of production. However, in the last decades there occurred such considerable changes in the natural environment and human population explosion that water resources cannot be further identified with land resources. The factors that will exert the strongest impact on global water resources in the future are: population growth, economic growth, changes in the production and trade systems, increasing competition for water resources between economy sectors, as well as methods of coping with growing water scarcity and water pollution.

Ensuring food security is one of the important socio-economic challenges that is related to high extent with availability of water resources as a factor of production. A concept of virtual water as a mean to assess the impact of trade flows on the water resources of individual countries appeared in the literature relating to this topic. Another contribution to the mentioned research field is this dissertation devoted to the analysis of the Polish trade of agricultural products concerning use of water resources. The research hypothesis has been formulated as follows: the virtual water concept enables evaluation of water use connected with the Polish international trade of agricultural products and in the long term allows to indicate a favourable foreign trade structure modification.

Poland is a significant exporter of agricultural products. The value of the Polish export of agricultural products in 2015 amounted to 12.6% of the total value of the Polish export. While the total positive trade balance was +9.9 billion PLN, the trade balance in the agricultural sector was +34.3 billion PLN. At the same time, Poland is a country of one of the lowest indicators of renewable water resources per inhabitant (1658 m³/pc/year), in the European Union. It reaches only 30% of the average for the EU countries. Water resources *per capita* in Poland are comparable to those of India, Pakistan or countries in the Horn of Africa.

In the first chapter of the dissertation, various terms related to the concept of virtual water were defined and the methodology for determining the volume of virtual water flows related to agricultural products trade was described. Moreover, the literature review was presented concerning analysis of virtual water flows among countries.

The second chapter covers results of the analysis of selected factors influencing the demand for agricultural products, including demographic changes and changes in the wealth of societies. Then, the regulations in the trade of agricultural products

concerning Poland, resulting from the participation in international agreements and organisations, especially EU and GATT/WTO were described. The impact of regulations resulting from EU Common Agricultural Policy on the Polish trade of agricultural products on selected markets was also analysed. The next part of the chapter characterises water resources influencing Polish agricultural production and trade, as well as describes the methods of assessment of water use for the need of agriculture and trade of agricultural products. In the dissertation the use of economic water efficiency indicators in the analyses of the Polish trade was proposed. The indicators are calculated by dividing trade values by the associated virtual water flows and expressed in [PLN/m³].

In the third and fourth chapter, the results of comprehensive studies of the author concerning virtual water flows connected with Polish trade of 456 agricultural goods from 18 chapters of the Combined Nomenclature were presented. The analyses have been performed both in the selected product categories, as well as separately for plant and animal production sectors. Trade of selected product groups concerning main trade partner countries have been also analysed. In the dissertation, the trends in the virtual water flows in the years 1994 – 2015 were determined and it was shown that for many years Poland was a net importer of virtual water, while, since 2013, it became a net exporter of virtual water connected with the trade of agricultural products. The net export of virtual water amounted to 5.9 km³, i.e. ca. 9.4% of the total renewable water resources in Poland. The study has shown decreasing economic water efficiency along with increase of the Polish export value what is an undesirable effect. Product groups and trade partners with the highest economic water efficiency in the Polish export and import have been also indicated. Among analysed product groups, the highest economic water efficiency indicators in the export were observed for apples and chicken meat, while in the import the most beneficial indicators for Poland were found for beef and sugar.

Summing up, the study showed that using the virtual water concept, sectors of and favourable modifications to the trade directions, enabling increase of the economic efficiency of the water resources use can be pointed out.