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## Comparative assessment of the agricultural production potential and its efficient use in Poland and Norway

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Ocena porównawcza potencjału produkcyjnego rolnictwa oraz efektywności jego wykorzystania w Polsce i Norwegii

**Abstract.** The aim of the paper was a comparative assessment of the agricultural sector of Poland and Norway, in terms of its economic significance, production potential and changes in efficient utilisation, considering the specificity of agricultural policy. The source material was data retrieved from the FAOSTAT database, Statistics Norway (SSB), reports by the Norwegian Institute of Bioeconomy Research (NIBIO), and Statistics Poland (GUS). Studies have shown that due to natural conditions, Poland has a much greater potential for agricultural output, and in particular crop output. However, Norwegian agriculture features higher land and labour productivity. Despite the high growth rate of the analysed ratios in Polish agriculture, the difference in their level between these countries remains more than threefold and more than twofold in favour of Norway, respectively for labour and land productivity. Due to its large production potential of agriculture, Poland also has much greater agricultural export opportunities than Norway.

**Keywords:** agriculture, Norway, Poland, productivity, production potential

### INTRODUCTION

An efficient agriculture sector underpins national food security and an important position as an exporter of food to foreign markets [Kraciuk 2018]. The comparison of agriculture in Poland and Norway is interesting since they are countries with different devel-

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opment paths, potential and specificity of agricultural production. Norway is the northernmost European country, which – due to natural conditions – has a small utilised agricultural area. It is a country that is not a member of the European Union (EU) and it experienced explicit structural transformations, also affecting agriculture [Forbord et al. 2014]. These transformations were partly due to the fact that Norwegian agriculture is one of the most strongly state-regulated agricultural sectors in Europe [Neuenfeldt et al. 2021]. The OECD [2023] reports a very high level of support for agriculture in Norway. Between 2020 and 2022, it accounted for 83% of its total output in national agriculture. This percentage is considerably above the average of 25% indicated by the OECD. In addition, more than half of the income of agricultural holdings is associated with market price support and subsidies [Neuenfeldt et al. 2021]. Adverse climatic and topographical conditions affect the country's specific structure of farms.

One of the most essential impulses to transformation in the agriculture of Poland was the political transformation, and recently European integration including the implementation of Common Agricultural Policy (CAP) instruments in Polish agriculture. The transformation of Polish agriculture has been the subject of numerous scientific studies [Bański 2018, 2020, Filipiak and Wicki 2022], as has the impact of Poland's accession to the EU on this sector of the economy [Potori et al. 2014, Kapusta 2021]. Integration with the EU gave rise to new conditions for agricultural development in Poland. It provided Polish farmers with access to funds that allowed them to improve the profitability of and conditions for production but also implement structural transformations [Czyżewski et al. 2020]. Among many CAP mechanisms, direct payments to support the agricultural producers' income, play a special role. The funds allocated for Polish agriculture under agricultural policy derive from domestic public revenues and funds transferred to Poland from the European Union budget. In 2021, the aggregate support for the agricultural sector under CAP was PLN 24,669,000,000, accounting for 18.3% of global agricultural output and 24.6% of agricultural commodity production [GUS 2023b, Nowak and Budzyńska 2023].

Although Norway is a non-EU country, it remains an essential business partner for Poland. In 2022, exports of Polish agri-food products to Norway amounted to EUR 296 million, while their imports from Norway reached EUR 1442 million [MRiRW 2023]. Given these relationships, the aim of the paper was a comparative assessment of the agricultural sector of Poland and Norway, in terms of its economic significance, production potential and changes in efficient utilisation, considering the specificity of agricultural policy.

#### MATERIAL AND METHODS

For purposes of the study, we formulated the following research questions: 1) How significant is agriculture for the economies of both countries? 2) What is the production potential of agriculture in Poland and Norway? 3) What are the production and economic outputs of the sector under review?

To answer these questions, we used several ratios calculated mostly for the period from 2010 to 2022. We evaluated the production potential based on the utilised agricultural area (UAA), UAA per inhabitant, and the number and percentage of agricultural workers. The efficiency with which the production potential is utilised was measured based on the value of agricultural output and land and labour productivity ratios. Land productivity was calculated as agricultural output per utilised agricultural area, and labour

productivity as the value of agricultural output per number of workers employed in this sector and the relationship between gross value added and the number of workers employed in the agricultural sector.

To ensure the comparability of figures, the source data concerning economic categories derived from FAOSTAT. We also leveraged data from Statistics Norway (SSB), reports by the Norwegian Institute of Bioeconomy Research (NIBIO), and Statistics Poland (GUS).

## RESULTS AND DISCUSSION

Norway has a small utilised agricultural area compared to other European countries, with only 1,121,900 ha in 2022, corresponding to about 3.5% of the country's total area [SSB 2024]. Due to its location and considerable latitudinal extent, Norway's climatic conditions adversely affect the productive capacity of its agriculture. Only about 30% of the UAA is suitable for growing cereals (barley and oats), but in practice up to 90% is used for animal feed crops [Ministry of Agriculture and Food 2024]. Poland has one of the highest UAAs in the European Union (4th place), which accounts for almost 60% of the country's area (Table 1). In addition, it has twice as much UAA per capita as Norway.

Farms in Poland and Norway predominantly have private owners. In 2020, their numbers in Poland and Norway were, respectively, 1,317,400 [GUS 2022] and 38,713 [SSB 2024]. The area of the farms varies greatly. Polish agriculture is characterised by high fragmentation. Accession of Poland to the EU boosted structural transformations, which was also reflected in the changing number and structure of farms [Nowak and Budzyńska 2024]. The latest agricultural census showed that the number of agricultural holdings dropped from 1.8 to 1.3 million, and the farm's average surface area increased from 9.85 ha to 11.35 ha [GUS 2022]. The structure of Norwegian farms according to surface area, the distribution of different groups by area is more even, with the highest percentage of farms between 20 and 49.9 ha in 2020. In 2020, it amounted to about 31.4%. The average size of a Norwegian farm in 2022 was 26.1 ha, i.e. 17.9% more than in 2012 [SSB 2024]. Both countries also differ in terms of the effect of agriculture on gross value added. In Poland, this share is nearly twice as high as in Norway.

The turnover of agricultural land and production methods in Norway are strictly controlled by several legislative acts. We should mention, for example, the obligation to cultivate land classified as agricultural land or the right of first refusal by family members. As regards the production method, the quota system for cow and goat milk production, which in the EU, including Poland, was abolished on 1 April 2015, is still in force. Differences between the two countries also relate to the length of the growing season. In Norway, due to the short growing season of 100 to 240 days [Skaalsveen et al. 2022, Svendgård-Stokke 2022], crop production opportunities are limited. There is no sugar or maize cultivation, and cereal yields are lower than in many European countries. The limited possibility of crop production, combined with the terrain and climate, directly affects animal husbandry [Neuenfeldt et al. 2021]. Predominant are agricultural holdings specialising in sheep farming (13,377), cattle farming (11,700) and pig farming (1,853) [SSB 2024]. As regards the sowing structure, however, barley is the most important, followed by oats and wheat. In addition, natural and climatic conditions are essential determinants of agricultural specialisation in the regions. According to data from the Institute of Soil Science and Plant Cultivation (IUNG), from 2001 to 2020, the average growing season in

Poland was 236 days long [Żyłowska and Kozyra 2022]. In the 2022 sowing structure, 65.6% were cereals (10,977,000 ha), and 12.7% were industrial crops, of which 9.8% were rapeseed and agrimony. In addition, crop production accounted for 53% of the total agricultural output. In the value structure of livestock production, cow's milk production and poultry had the largest share. Pigs for slaughter constitute about 8% of the gross agricultural output, with a downward trend observed from 2019 [GUS 2023a].

Table 1. Selected characteristics of agriculture in Poland and Norway from 2010 to 2022

Indicator	2010	2015	2019	2020	2021	2022
Norway						
Total area of the country in thousands of hectares	31,465	32,375	32,378	32,377	32,378	32,378
Utilised agricultural land (UAA) in thousands of hectares	1,097.2	1,111.4	1,118.9	1,120.5	1,121.4	1,121.9
UAA % of the total area of the country	3.4	3.4	3.5	3.5	3.5	3.5
UAA per capita	0.23	0.22	0.21	0.21	0.21	0.21
Average grain yield (dt ha <sup>-1</sup> )	34.4	48.0	47.1	46.8	41.8	47.3
Milk yield (kg per cow)	7,221	7,706	7,920	8,034	8,166	8,016
Average farm size (ha)	21.6	23.5	25.2	25.5	25.9	26.0
Share of agriculture in GVA (%)	1.5	1.5	1.8	1.8	1.6	1.7
Poland						
Area of the country in thousands of hectares	31,268	31,268	31,270.5	31,270.5	31,270.6	31,272
Utilised agricultural land (UAA) in thousands of hectares	18,931.1	18,682.8	18,759.8	18,741.5	18,719.2	18,696.5
UAA % of the total area of the country	60.5	59.8	60.0	59.9	59.9	59.8
UAA per capita	0.37	0.37	0.38	0.38	0.38	0.38
Average grain yield (dt ha <sup>-1</sup> )	35.8	37.3	36.7	47.8	46.5	49.5
Milk yield (kg per cow)	4,487	5,395	5,803	5,946	6,136	6,647
Average farm size (ha)	9.9	10.5	10.9	11.3	11.2	11.3
Share of agriculture in GVA (%)	3.3	2.7	2.7	2.9	2.6	3.2

Source: Authors' elaboration based on data from Statistics Poland [GUS 2023b], World Bank [2024], NIBIO [2024], and SSB [2024]

In Poland, the adoption of EU CAP has created the conditions for increasing agricultural output and, above all, farmers' income. CAP instruments affect both the supply and the demand in Polish agriculture. Fund transfers from the EU budget, including direct subsidies, influence the supply. The development possibilities for Polish agriculture and the whole food economy in the post-accession period largely depend on the dynamic growth of agri-food exports, which affects the demand [Poczta 2020].

Changes in Polish agriculture during EU membership also included employment in the sector. Structural transformations in the economy and progress in agriculture have

contributed to decreasing the number of the sector's workers, simultaneously increasing socio-economic development. Wicki [2012] underlines that, on the one hand, high labour input determines the development potential of agriculture, while on the other hand, it reduces the dynamics of modernisation processes in that sector. In 2004, Polish agriculture employed 2.28 million workers on a full-time basis. By 2021, the figure declined to 1.4 million, meaning a decrease of 37.4% [Nowak and Budzyńska 2023]. In 2021, Norwegian agriculture employed 65,350 people. The percentage working in this sector was 8.4% and 2.3% in Poland and Norway, respectively (Tab. 2).

Table 2. Labour input in the agriculture of Poland and Norway from 2010 to 2021

Years	Employment level (in thousands of workers)		Percentage of agricultural workers	
	Norway	Poland	Norway	Poland
2010	63.69	2018.49	2.5	13.1
2011	60.02	2008.07	2.4	12.9
2012	57.50	1960.23	2.2	12.6
2013	57.26	1866.98	2.2	12.0
2014	58.92	1819.48	2.2	11.5
2015	52.96	1849.35	2.0	11.5
2016	54.95	1707.71	2.1	10.6
2017	54.41	1672.20	2.1	10.2
2018	56.49	1577.72	2.1	9.6
2019	55.30	1498.49	2.0	9.2
2020	57.09	1567.97	2.1	9.6
2021	65.35	1390.53	2.3	8.4
Dynamics (2010 = 100) Change in p.p.	102.61	68.89	-0.2	-4.7

Source: Own elaboration based on FAOSTAT database [2024]

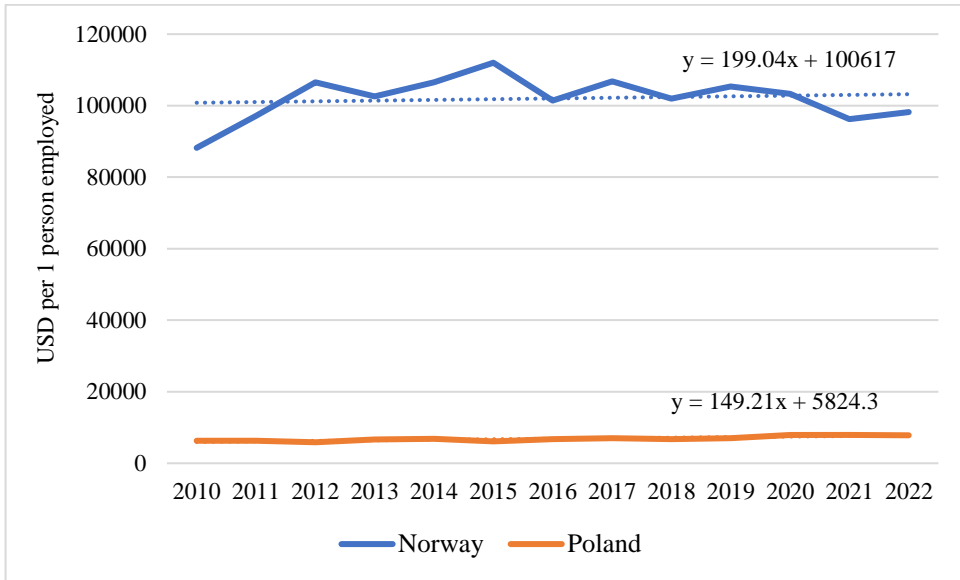
Individual countries have distinctive characteristics (including natural conditions) that stimulate or inhibit the development of specific areas of agriculture, thus shaping the level and structure of production. This also stems from the level of socio-economic development, the structural characteristics of agriculture, agricultural policies and the market situation [Nowak et al. 2019]. The underlying measure for evaluating the level of development in agriculture is the productivity of production factors expressing the economic relationship between outputs and inputs. This relationship is most often reflected by land and labour productivity ratios [Ściubeł 2021]. The values of these ratios for Poland and Norway, along with a change in the value of agricultural production between 2010 and 2021, are summarised in Table 3 (at constant 2014–2016 prices), and Figure 1 shows the labour productivity index measured by gross value added per worker in agriculture (at constant 2015 prices). The land productivity index was calculated as agricultural output per utilised agricultural area, and labour productivity as the value of agricultural output

per worker employed in this sector. Norway's agricultural output between 2010 and 2021 showed low change dynamics (105.2%). In Poland, the value of production increased by 19.4% during the period under review. It should also be noted that the value of agricultural production in Poland in 2021 was more than six times higher than in Norway. However, land and labour productivity ratios show a much higher growth dynamics in Poland. In contrast, the value of the two partial productivity ratios was more than three times and more than two times higher in Norway for labour and land productivity, respectively. These differences are explained, among other things, by Poland's unfavourable agrarian structure and the predominance of crop output over livestock output, which determines lower production intensity.

Table 3. Agricultural production value and labour productivity in the agriculture of Poland and Norway from 2010 to 2021 (constant 2014–2016 prices in thousands of dollars)

Years	Agricultural output value (1000 USD)		Labour productivity (USD per 1 AWU)		Land productivity (USD per 1 ha UAA)	
	Norway	Poland	Norway	Poland	Norway	Poland
2010	3669846	20787397	57620.4	10298.5	3648.3	1438.7
2011	3531193	21030709	58833.6	10473.1	3534.7	1423.0
2012	3582040	21514864	62296.3	10975.7	3608.0	1480.8
2013	3587342	21429905	62650.1	11478.4	3634.1	1487.2
2014	3718296	23043318	63107.5	12664.8	3768.2	1597.6
2015	3773568	22001047	71253.2	11896.6	3827.0	1530.9
2016	3832664	22915502	69748.2	13418.8	3896.3	1594.2
2017	3850896	24170734	70775.5	14454.5	3909.1	1671.3
2018	3679136	23017810	65129.0	14589.3	3730.3	1586.1
2019	3864570	23117339	69883.7	15427.1	3926.4	1591.8
2020	3846416	25196303	67374.6	16069.4	3901.2	1710.2
2021	3861221	24830138	59085.2	17856.6	3920.0	1712.5
Dynamics (2010=100)	105.2	119.4	102.5	173.4	107.4	119.0
Geometric mean	3731255.0	22712321.2	64640.0	13104.4	3772.9	1565.8

Source: Authors' elaboration based on FAOSTAT database [2024]



Source: Authors' elaboration based on FAOSTAT database [2024]

Figure 1. Agricultural gross value added per worker (USD per 1 person, constant 2015 prices)

An analysis of the labour productivity index in the agricultural sector, calculated as the ratio of gross value added to the number of workers, reveals an even greater gap between Norway and Poland in this respect. In 2022, one worker employed in Polish agriculture generated gross value added of USD 7794.8 per capita per year, compared to USD 98,178.7 per capita in Norway. In contrast, from 2010 to 2022, a higher growth rate for the indicator under review was recorded in Poland (124.5%) than in Norway (111.3%). Considering the level of support to agriculture in Poland and Norway, it appears that a very high level of farming subsidies contributes to the high level of labour productivity in Norwegian agriculture. Agricultural input subsidies, as a form of social protection, are often considered to be an important means of improving agricultural productivity. However, their effectiveness and efficiency remain contentious with respect to productivity, economic and consumer welfare measures, and food and nutrition security. Kumbhakar et al. [2023] in their studies confirmed a positive effect of agricultural subsidies in Norway on productivity and profitability. Simultaneously, the OECD report [OECD 2023] shows that much of Norway's productivity growth in recent years came from labour-saving initiatives, but did little to reduce environmental pressures. By contrast, in Poland, the low level of labour productivity is a consequence of, among other things, structural problems, including over-employment in agriculture. Modernisation investments play an important role in the process of improving productivity and profitability in Polish agriculture, as demonstrated, among other authors, by Kusza et al. [2020].

Integration and international trade agreements foster development and innovation, drive new technologies, strengthen competition and provide access to new markets. Nor-

way, together with Iceland, Liechtenstein and Switzerland, negotiates free trade agreements through the European Free Trade Association (EFTA). Since 1994, it has been a member of the European Economic Area (EEA), which has led to undertaking significant liberalisation measures and the country's integration into Europe. The EU Common Agricultural Policy (CAP) and Common Fisheries Policy (CFP) are not part of the EEA Agreement, and, therefore, the free movement of goods within this framework does not apply to all products [OECD 2021]. In addition, to secure a selling base for domestic output, the Norwegian Agricultural Agency [2024] applies a system of tariffs and quotas on imports. The most severe restrictions apply to commodities such as beef and dairy products successfully supplied to the market by domestic producers. In 2020, the highest percentage of imported goods were fruit and vegetables. The total volume of imports of these products exceeds 950,000 t, which accounts for almost 31% of the total volume of imports of agri-food products. Cereals and cereal products were another group with an output of 714,600 t, accounting for 23%. The lowest import volumes were recorded for dairy products and eggs (1%), meat and meat products (1%), and tobacco products (0.2%). In 2020, total imports of agri-food products oscillated at nearly 3.1 million tonnes [Rekdal 2021].

Upon accession to the EU, Poland was incorporated into the Single European Market (SEM), ensuring free movement of goods, persons, capital and provision of services between the member states of the Community. This has significantly improved the foreign trade performance of agri-food products. Poland has also adopted all the instruments and rules of the Common Commercial Policy (CCP) applicable to trade with third countries. Among the commercial policy instruments affecting trade, tariff instruments play a particular role, notably import duties and tariff quotas, which effectively protect the EU market from an influx of cheaper products from other countries [Tereszczuk 2016]. Given its considerable production potential of agriculture, Poland has much more agricultural export opportunities than Norway. In 2021, the value of exports reached 28.4 billion dollars and was 42 times higher than in Norway. It is also worth noting the upward trend in Poland's exports of this product group, which increased by 240.9% between 2010 and 2021. In Norway, the agricultural export value dynamics reached 155.9% over the same period (Table 4).

In 2022, 74% of Polish agri-food products were exported to the EU, mainly to Germany, the Netherlands, and France. The major products exported to the EU were poultry meat, dairy products and beef. The main exports from Poland to non-EU countries were dairy products, poultry meat, and wheat [KOWR 2023]. According to the report titled *The outside world to Norwegian agriculture and food industry 2022* [Norwegian Agriculture Agency 2023], dairy products and meat constituted the highest percentage of Norwegian exports of agri-food products in 2022. The target buyers were neighbouring countries such as Sweden (nearly 20% by value), Denmark (11.5%) and the UK (7.5%), and outside Europe – the USA (7.2%) and Japan (3.3%). When analysing trade between Poland and Norway, it can be concluded that fish, seafood, and seafood preparations form the basis of trade in agricultural products. According to the Norwegian Seafood Council, Poland is the second biggest export market for fish and seafood from Norway. In 2023, fish exports to Poland amounted to 275,250 t, compared with 266,305 t (2022) and 284,652 t (2021) in the preceding years, respectively. The largest share of exported fish consists of salmon, herring and cod. In 2022, agri-food imports from Norway accounted for 4.5% of the total imports of this product group in Poland, according to data provided by the Ministry of Agriculture and Rural Development [MRiRW 2023]. It is worth highlighting that the agri-



food trade balance in Poland was positive in 2022, reaching EUR 15,548,000,000. In contrast, the balance of trade in this product group with Norway was negative for Norway (EUR -1,146,000,000).

Table 4. Agricultural products exports in Poland and Norway from 2010 to 2021

Years	Value of exports (thousands of USD)	
	Norway	Poland
2010	445,058	11,801,664
2011	422,479	10,979,399
2012	481,011	14,888,938
2013	464,447	17,726,411
2014	538,660	20,291,980
2015	562,483	21,971,434
2016	622,334	22,328,280
2017	622,523	21,870,113
2018	643,137	21,208,570
2019	677,297	22,272,954
2020	721,829	27,907,495
2021	694,059	28,427,707
Dynamics (2010=100)	155.9	240.9

Source: Authors' elaboration based on FAOSTAT database [2024]

## CONCLUSIONS

This survey was aimed at a comparative assessment of agriculture in Poland and Norway to the extent of their specificity, production potential and efficient utilisation. The sector has been shown to play a much greater role in Poland's economy, as testified, among other things, by its share of over 8% in total employment. This is due to natural conditions and the production potential of agriculture, but also to its structural characteristics. Polish agriculture has considerably more land and labour inputs and twice as big cropland per capita than Norwegian agriculture. In contrast, economic, organisational and structural conditions contribute to the much higher farming efficiency of Norwegian agriculture. Its specificity stemming from natural conditions determines the predominance of livestock production over crop production. On the contrary, in Poland, for many years crop production has constituted a higher percentage of the total agricultural output.

The production performance and structure of agriculture are due not only to the production resources at hand and natural conditions but also to the structural conditions of agriculture and the regulations stemming from agricultural policy. The conditions for the development of agriculture differ between Poland and Norway. This is because Poland is a member state of the European Union and Polish agriculture is governed by the CAP. By

contrast, Norway's agricultural sector remains one of the most strongly supported in Europe. Both agricultural policy and the structure of agriculture (e.g. size distribution of farms, ownership form etc.) are strictly regulated and controlled by the state, through appropriate legal and economic instruments. This is to protect the domestic market and farmers' interests and ensure food security. This determines the direction of production and the opportunities for exports and imports of agricultural products. While agricultural exports do not play a significant role in Norway, they have increased in importance in Poland, particularly after it acceded to the EU. Considering further opportunities to increase the efficiency of agriculture, real chances exist for further development of exports of this product group from Poland. Furthermore, it can be argued that strong interventionism in Norwegian agriculture provides crucial support for agricultural incomes, but also imposes some constraints on spontaneous structural transformation processes. Similar opinions exist regarding certain CAP instruments, and, in particular, direct payments, which restrict the rate of change in the agrarian structure.

#### REFERENCES

- Bański J., 2018. Phases to the transformation of agriculture in Central Europe – Selected processes and their results. *Agric. Econ.* – Czech. 64, 546–553. <https://doi.org/10.17221/86/2018-AGRICECON>
- Bański J., 2020. Selected aspects of the transformation of agriculture in the CEECs following the fall of the Eastern Bloc. *Studia Obszarów Wiejskich* 56, 5–31. <https://doi.org/10.7163/SOW.56.1>
- Czyżewski A., Kata R., Matuszczak A., 2020. Wpływ wydatków budżetowych na zmiany strukturalne i dochody w rolnictwie w warunkach funkcjonowania w Polsce instrumentów WPR [Impact of budget expenditures on structural changes and income in agriculture under the conditions of CAP instruments operated in Poland]. *Ekonomista* 6, 781–811 [in Polish]. <https://doi.org/10.52335/dvqp.te199>
- FAOSTAT database, 2024. <https://www.fao.org/faostat/en/#data/MK> [access: 10.01.2024].
- Filipiak T., Wicki L., 2022. Is the structure of Polish agriculture changing? A comparison based on the results of recent general agricultural censuses. *Annals PAAAE* 24(1), 37–53. <https://doi.org/10.5604/01.3001.0015.7103>
- Forbord M., Bjørkhaug H., Burton R.J.F., 2014. Drivers of change in Norwegian agricultural land control and the emergence of rental farming. *J. Rural Stud.* 33, 9–19. <https://doi.org/10.1016/j.jrurstud.2013.10.009>
- GUS, 2022. Powszechny spis rolny 2020. Charakterystyka gospodarstw rolnych w 2020 r. [The agricultural census 2020. Characteristics of agricultural farms in 2020], Warsaw [in Polish].
- GUS, 2023a. Rolnictwo w 2022 r. [Agriculture in 2022]. Warszawa [in Polish].
- GUS, 2023b. Statistical Yearbook of Agriculture 2022, Warsaw.
- Kapusta F., 2021. Fifteen years of Polish agriculture in the European Union. *Probl. Agric. Econ.* 4(369), 5–24. <https://doi.org/10.30858/zer/142839>
- KOWR, 2023. Wyniki polskiego handlu zagranicznego towarami rolno-spożywczymi za cały 2022 r. – rekordowy wzrost wartości polskiego eksportu [Results of Polish foreign trade in agri-food goods for the entire year 2022 – record increase in the value of Polish exports]. Biuro Analiz i Strategii, Warszawa [in Polish].
- Kraciuk J., 2018. Bezpieczeństwo żywnościowe Polski na tle wybranych krajów Europy Wschodniej [Poland's food security compared to selected Eastern European countries]. *Zesz. Nauk. SGGW, Ekon. Organ. Gospod. Żywn.* 121, 41–53 [in Polish]. <https://doi.org/10.22630/EIOGZ.2018.121.3>

- Kumbhakar S.C., Li M., Lien G., 2023. Do subsidies matter in productivity and profitability changes?. *Econ. Modell.* 123, 106264. <https://doi.org/10.1016/j.econmod.2023.106264>
- Kusz D., Zając S., Dziekan R., 2020. Regional diversification of investment outlays and labour profitability in agriculture in Poland. *Annals PAAAE* 22(4), 116–126. <https://doi.org/10.5604/01.3001.0014.5686>
- Ministry of Agriculture and Food, 2024. <https://www.regjeringen.no/en/topics/food-fisheries-and-agriculture/landbrukseiendommer/innsikt/jordvern/soil-conservation/id2009556/> [access: 21.01.2024].
- MRiRW, 2023. Polski handel zagraniczny artykułami rolno-spożywczymi w 2022 roku [Polish foreign trade in agri-food products in 2022]. Departament Rynków Rolnych i Transformacji Energetycznej Obszarów Wiejskich, Warszawa [in Polish].
- Neuenfeldt S., Gocht A., Heckelei T., Mittenzwei K., Ciaian P., 2021. Using aggregated farm location information to predict the regional structural change of farm specialisation, size and exit/entry in Norway agriculture. *Agriculture* 11, 643. <https://doi.org/10.3390/agriculture11070643>
- NIBIO, 2024. Account results in agriculture and forestry 2022. Oslo. <https://hdl.handle.net/11250/3120578> [access: 20.05.2024].
- Norwegian Agricultural Agency, 2024. <https://www.landbruksdirektoratet.no> [access: 10.01.2024].
- Nowak A., Budzyńska A., 2023. Impact of the Common Agricultural Policy on the development of the Polish agricultural sector. In: E. Bukalska, T. Kijek, B.S. Sergi (ed.) *Modeling economic growth in contemporary Poland (Entrepreneurship and Global Economic Growth)*, Emerald Publishing Limited, Leeds. 175–188. <https://doi.org/10.1108/978-1-83753-654-220231013>
- Nowak A., Kijek T., Krukowski A., 2019. Polskie rolnictwo wobec wyzwań współczesności. T. 1. Wymiar ekonomiczno-strukturalny [Polish agriculture in the face of modern challenges. Vol. 1. Economic and structural dimension]. Wydawnictwo UP w Lublinie, Lublin [in Polish].
- OECD, 2021. Policies for the future of farming and food in Norway, OECD agriculture and food policy reviews. OECD Publishing, Paris. <https://doi.org/10.1787/20b14991-en>
- OECD, 2023. Agricultural Policy Monitoring and Evaluation 2023: Adapting Agriculture to Climate Change. OECD Publishing, Paris. <https://doi.org/10.1787/b14de474-en>.
- Pocza W., 2020. Przemiany w rolnictwie polskim w okresie transformacji ustrojowej i akcesji Polski do UE [Changes in Polish agriculture in the period of political transformation and Poland's accession to the EU]. *Więś i Rolnictwo* 2(187), 57-77. <https://doi.org/10.7366/wir022020/03>
- Potori N., Chmieliński P., Fieldsend A.F. (ed.), 2014. Structural changes in Polish and Hungarian agriculture since EU accession: lessons learned and implications for the design of future agricultural policies. Research Institute of Agricultural Economics, Budapest.
- Rekdal K.E., 2021. Import av matvarer 2014–2020. Virke Statistikk og rapporter [Imports of food products 2014-2020. Virke statistics and reports], <https://www.virke.no/analyse/statistikk-rapporter/import-av-matvarer/> [in Norwegian, access: 21.01.2024].
- Skaalsveen K., Gillund F., Aandahl T.R., 2022. Jordhelse i arktisk grøntproduksjon. Forprosjekt 2021–2022 [Soil health in Arctic vegetable production. Pilot project 2021–2022]. NIBIO Rapport 8(86) [in Norwegian].
- SSB, 2024. <https://www.ssb.no/en> [access: 12.01.2024].
- Svendgård-Stokke S., 2022. Vekstsesongens lengde [Length of the growing season]. NIBIO 20.05.2022 [in Norwegian].
- Ściubeł A., 2021. Productivity of production factors in Polish agriculture and in the selected European Union countries with regard to the Common Agricultural Policy payments. *Probl.f Agric. Econ.* 1, 46–58. <https://doi.org/10.30858/zer/134229>
- Tereszczuk M., 2016. Instrumenty polityki handlowej Unii Europejskiej a polski handel zagraniczny produktami rolno-spożywczymi [European Union trade policy instruments and Polish foreign trade in agri-food products]. *Pr. Nauk. UE Wrocł., Ekon.* 449, 627–638 [in Polish].
- Wicki L., 2012. Convergence of labour productivity in agriculture in the European Union. *Econ. Sci. Rur. Develop.* 27, 279–284.

World Bank, 2024. <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=NO> [access: 24.05.2024].

Żyłowska K., Kozyra J., 2022. Zmiany warunków agroklimatycznych w Polsce [Changes in agro-climatic conditions in Poland]. St. Rap. IUNG-PIB Puławy 67(21), 9–23. <https://doi.org/10.26114/sir.iung.2022.67.01>

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