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[1] Department of Economics and Agribusiness, Faculty of Agrobioengineering, University of Life Sciences in Lublin, 20-950 Lublin, Poland
[2] Faculty of Management, Economics and Law, Department of Management, Lviv National Agrarian University, 80381, Str. V. Velykoho, 1, Dubliany, Ukraine
[3] Faculty of Management, Economics and Law, Department of Economics, Lviv National Agrarian University, 80381, str. V. Velykoho, 1, Dubliany, Ukraine
* e-mail: anna.nowak@up.lublin.pl

ANNA NOWAK[1]*, VOLODYMDYR KOVALIV[2], KAROLINA RULITSKA[3]

Assessment of the productive potential of agriculture and its efficient utilisation in Poland and Ukraine

Ocena potencjału produkcyjnego rolnictwa oraz efektywności jego wykorzystania w Polsce i na Ukrainie

Summary. The aim of the paper was a comparative assessment of the agricultural sector of Poland and Ukraine, considering their productive potential and its efficient utilisation. The source material was data from FAOSTAT database for the period from 2010 to 2020. Based on these, a number of indicators were calculated. The production potential was evaluated based on the resources of production factors and the relationship between them, cropland per capita and the importance of agriculture to the economy, while its efficiency was measured according to the value of agricultural output, gross value added and land and labour productivity. The study showed that, in the analysed period, Ukraine featured a higher agricultural production potential determined by land and labour resources. In addition, this sector was more significant to the national economy than in Poland as in 2020 it engaged approx. 17% of all labour resources (9.5% in Poland) and generated more than 9% of gross value added (2.7% in Poland). However, the utilisation of land and labour resources was considerably less effective in Ukraine than in Poland. In the analysed years, land productivity in Poland was nearly four times higher than in Ukraine, while the level of labour productivity was two times higher in Poland. Since Poland is among the European Union's member states featuring the lowest labour productivity in agriculture, its level in Ukraine should be evaluated as very low.

Key words: agriculture, Poland, productive potential, productivity, Ukraine

INTRODUCTION

Efficient agriculture and the whole agribusiness sector are the conditions underpinning national food security and ensuring a country's important position of an exporter of

food to foreign markets [Cherevyk and Hamulczuk 2018, Kraciuk 2018]. A comparison of agriculture in Poland and in Ukraine seems interesting because, due to political factors, these countries adopted different models of development. As a consequence, they feature diverse socio-economic systems and their development level varies. The economic transformation in both countries involved reducing the scope of state control and increasing the role of private enterprises and the free market. The design and implementation of economic stabilisation programmes varied for respective economies, depending on the economic conditions [Kraciuk 2018]. Poland followed radical programmes to make the economy more liberal. By contrast, the economic programmes implemented in Ukraine were more conservative. Ukraine, together with Russia, adopted the 'eastward' orientation in economic cooperation within the Commonwealth of Independent States established in 1991 [Kraciuk 2018]. In addition, the agriculture of Ukraine was oriented at production for the internal market to a higher extent than the agriculture of Poland [Wicki and Orlykovskyi 2019]. Another limitation to the development of agriculture and agribusiness in Ukraine – compared with the conditions observed in Poland – was the state-owned land and absence of major programmes supporting agriculture [Orlykovskyi and Wicki 2016].

Over the past thirty years, Polish agriculture has experienced an essential and, at the same time, turbulent period featuring numerous economic and political developments. The system transformation, Poland's membership in the European Union and the common impact of globalisation have significantly altered the conditions in which agriculture existed. The transition from the market economy intrinsically triggered changes to the inter-industry relations in the national economy. As a result, the significance of the agricultural sector in generating the national income and engaging production factors has declined [Poczta 2020, Szczepanowski 2020]. Throughout the period of Poland's membership in the EU, the intensity of changes in the area structure of individual agriculture could be observed to increase along with changes in the productivity of the production factors [Kijek et al. 2020, Nowak et al. 2020, Poczta 2020].

Ukraine is, potentially, highly capable of developing its agricultural production. This is mostly due to its natural environment offering advantageous conditions to agricultural development. Ukraine has fertile soils, predominantly chernozem (black soil), and the climate is favourable in most of its territory [Dzun and Tereszczuk 2009]. The Land Market Act, adopted in 2020, allows free trading in agricultural land from the second half of 2021, which was previously forbidden. In the long run, this act should boost the interest in intensifying agricultural output and developing the industries in need of long-term investments, such as fruit growing and animal husbandry [Matuszak 2021]. However, at present, the economy of Ukraine, including its agricultural sector, is exposed to the adverse consequences of continuing war. These hazards are associated with a risk of crops and agricultural infrastructure being destroyed, depletion of mineral fertilisers, high prices of fuel, and inability to export due to blockades of sea ports. According to UNCTAD, in 2020, Ukraine accounted for 36% of the global export of oil and sunflower seeds, 13% of corn, 11% of rye, 10% of rapeseed and 9% of wheat. These products are mainly exported to the developing countries of Africa and the Middle East [UNCTAD 2022]. Thus, the armed conflict in Ukraine has had a considerable impact on global food security. This is manifested in three main ways. Firstly, the prices of some products directly increase due to their reduced supply. Secondly, the war has an intermediate effect on the agri-food market, leading to an increase in the prices of energy crops. Thirdly, the war limits the possibilities for international humanitarian aid and increases its costs [Behnassi and Haiba 2022].

This paper aimed at a comparative assessment of the agricultural sector of Poland and Ukraine, taking their productive potential and its effective utilisation into account. Such an assessment is significant in the context of war continuing in Ukraine and its consequences for the agriculture and the whole economy of Ukraine, and for the global agri-food market.

MATERIAL AND METHODS

The subjects of research were two neighbouring countries – Poland and Ukraine. The object was the agricultural sector and its selected characteristics. The analysis covered the productive potential of agriculture and its efficient utilisation. In order to accomplish this objective, the following research questions were formulated: 1) How significant is agriculture for the economies of both countries? 2) What land and labour resources does agriculture in Poland and Ukraine have at its disposal, and what is the relationship between such resources? 3) What are the effects of production in the analysed sector? What was the level of land and labour productivity achieved by agriculture in Poland and in Ukraine?

These questions were answered based on several indicators calculated for the period from 2010 to 2020. The productive potential was evaluated based on utilised agricultural area (UAA), cropland per capita, number of agricultural workers per 100 ha UAA, and the share of agriculture in the total number of workers and in the gross value added (GVA) of the national economy. The efficiency with which the productive potential is utilised was measured based on the value of agricultural output, gross value added of agriculture and land and labour productivity ratios. Land productivity was calculated as agricultural output to utilised agricultural area, and labour productivity as gross value added of agriculture to the number of workers employed in this sector. Due to the unavailability of data for 2020, for some variables the analysis was limited to years from 2010 to 2019.

To ensure the comparability of figures, the source material derived from FAOSTAT. It was particularly significant for the assessment of the value of production, export and gross value added due to the fact that these economic categories were shown in US dollars. The paper also makes use of data derived from the State Statistics Service of Ukraine (UKRSTAT) and from Statistics Poland (GUS).

RESULTS AND DISCUSSION

The accession of Poland to the European Union accelerated the concentration of production resources in agriculture [Miniszewski 2021]. Data collected during the National Agricultural Censuses demonstrate that the number of agricultural households from 2010 to 2020 decreased from 1.5 million to 1.3 million, and their mean utilised agricultural area increased from 9.8 ha to 11.1 ha at that time [GUS 2021]. Land, next to labour and capital, is a fundamental factor of agricultural production. It is a specific means of production with both a passive and an active role in agriculture. Agricultural land resources are subject to relatively extensive changes triggered by economic and social factors [Nowak et al. 2019]. According to FAOSTAT, in 2019 Poland had 14.5 million ha of utilised agricultural area, and Ukraine's agriculture managed 41.3 million ha UAA. The country's resources of agricultural land play an important role from the point of view of national food security. Throughout the study period, the UAA to the population size ratio, depicting cropland per

capita in Ukraine, was more than two times higher than in Poland (Tab. 1). This means that food security, understood as the volume of agricultural resources produced, does not need to be ensured by intensifying the production as it is the case with countries where the UAA resources are small compared to the population size.

Table 1. Utilised agricultural area (UAA) and cropland per capita in Poland and Ukraine from 2010 to 2019

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
UAA (thousand ha)										
Poland	14449	14779	14529	14410	14424	14371	14374	14462	14512	14523
Ukraine	41267	41281	41297	41526	41511	41508	41515	41489	41329	41311
cropland (ha per capita)										
Poland	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Ukraine	0.90	0.90	0.91	0.92	0.92	0.92	0.93	0.93	0.93	0.93

Source: Own elaboration based on FAOSTAT database [https://www.fao.org/faostat/en/#data/MK]

Labour as a production factor is a significant element affecting the efficiency and competitiveness of agriculture. It is believed that a rational level of employment in agriculture in the European Union will foster its sustainable economic and social development [Kołodziejczak 2020]. Structural transformations in the economy and progress in agriculture have contributed to decreasing the number of workers in the sector, at the same time increasing the level of socio-economic development. The economic utilisation of labour in agriculture was presented as the number of workers employed in agriculture per 100 ha UAA. In Poland this ratio was considerably higher than in Ukraine, which can be mainly attributed to differences in their agrarian structure. On average, from 2010 to 2019, nearly 13 workers were recorded per 100 ha in Poland, compared to less than eight in Ukraine. Furthermore, Poland shows a clear downward trend in the level of the analysed ratio over the study period (Tab. 2). Wicki [2016] underlines that, on the one hand, high labour resources denote the development potential of agriculture, while on the other hand, they reduce the dynamics of modernisation processes in that sector. It is worth adding that in 2020 the agricultural sector in Poland employed 1 568 000 workers, and Ukrainian agriculture engaged labour resources represented by 2 721 200 people. In both cases, from 2010 to 2020 the number of workers, amounting to 34.1% and 12.7%, respectively in Poland and in Ukraine, decreased.

Table 2. Workers employed in agriculture per 100 ha of UAA (people·100 ha^{-1})

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
Poland	16.4	13.6	13.5	13.0	12.6	12.9	11.9	11.6	10.9	10.3	12.7
Ukraine	7.5	10.0	9.7	9.8	6.4	6.0	6.1	6.0	7.1	7.3	7.6

Source: Own elaboration based on FAOSTAT database [https://www.fao.org/faostat/en/#data/MK]

Analysis of the percentage of agricultural workers in Poland and in Ukraine reveals a clear difference between the countries. In 2020, Polish agriculture employed 9.5% of all workers of the national economy. By contrast, Ukrainian agriculture accounted for 17.1% of all workers (Tab. 3). Puzio-Wacławik [2006] highlights that transformations in the three-sector employment structure in Poland are consistent with structural transformation patterns observed in the economic development of the European Union's member states. However, the proportions of its employment structure still differ from those of the old EU-15 but are similar to those of new member states. Wigier [2013] notes that a high number of agricultural workers implies that the relationship between labour resources and land and capital resources is unfavourable, which has an adverse impact on labour efficiency. Both analysed countries show a downward trend in the examined indicator, which is consistent with the common trend.

Table 3. Share of agricultural workers in the total employment in Poland and Ukraine from 2010 to 2020 (%)

Years	Share of agricultural workers in total employment (%)	
	Poland	Ukraine
2010	13.00	20.20
2011	12.90	20.30
2012	12.60	19.80
2013	12.0	20.00
2014	11.50	14.80
2015	11.50	15.30
2016	10.50	15.60
2017	10.20	15.40
2018	9.60	18.00*
2019	9.10	18.20*
2020	9.50	17.10*

* Data derived from the State Statistics Service of Ukraine (UKRSTAT).
Source: Own elaboration based on FAOSTAT database [https://www.fao.org/faostat/en/#data/MK]

Table 4. Share of agriculture in gross value added (GVA) in Poland and Ukraine from 2010 to 2020

Years	Share of agriculture in total GVA (%)	
	Poland	Ukraine
2010	2.92	7.45
2011	3.22	8.20
2012	3.01	7.82
2013	3.24	8.79
2014	2.95	10.15
2015	2.48	12.06
2016	2.70	11.73
2017	3.13	10.18
2018	2.56	10.14
2019	2.45	8.97
2020	2.68	9.31

Source: own elaboration based on the State Statistics Service of Ukraine (UKRSTAT), EUROSTAT and Statistics Poland.

An important measure of economic effects in agriculture is gross value added [Wigier 2013]. Along with the increasing level of the economic development of respective countries, the share of agriculture in the structure of GVA decreases [Jarosz-Angowska 2015, Nowak and Marczak 2021]. This share was observed to vary both inside Poland and Ukraine, but clear differences in its level could be seen between these two countries. In 2020, Ukrainian agriculture generated more than 9.3% of the total GVA, which implies an increase by 1.86 p.p. compared to its level in 2010. However, from 2015 to 2019, this share tended to decline. In Poland the economic significance of agriculture is lower; in 2020, agriculture generated 2.7% GVA (Tab. 4). This was a consequence of structural transformations and a faster growth of the non-agricultural divisions of the national economy [Mrówczyńska-Kamińska 2008, Chudzik 2020].

It should be emphasised that the absolute values of agricultural output and gross value added varied in the analysed years (Fig. 1 and 2). In Poland the biggest decline in the analysed economic categories was recorded in 2015, and in Ukraine – in 2014 and 2015. In Poland this was due to a big decline in plant output (by 11.2%) with a slight increase in the animal output (by 3.1%). In addition, 2015 was the fourth year in a row when the economic conditions in agriculture were not favourable for agricultural producers [GUS 2016]. In contrast, the decrease in agricultural output and the GVA of agriculture in Ukraine was a result of crisis that country experienced in 2014 and 2015. It is worth noting that, although Ukraine had a three-times bigger utilised agricultural area, the value of its agricultural output and GVA was lower than that in Poland; however, a clear upward trend can be observed in the most recent years covered by the analysis. Throughout the period covered by the research, the mean annual increase in the value of agricultural output in Ukraine was USD 101.67 million, and the GVA, on average, increased by USD 89.3 million a year.

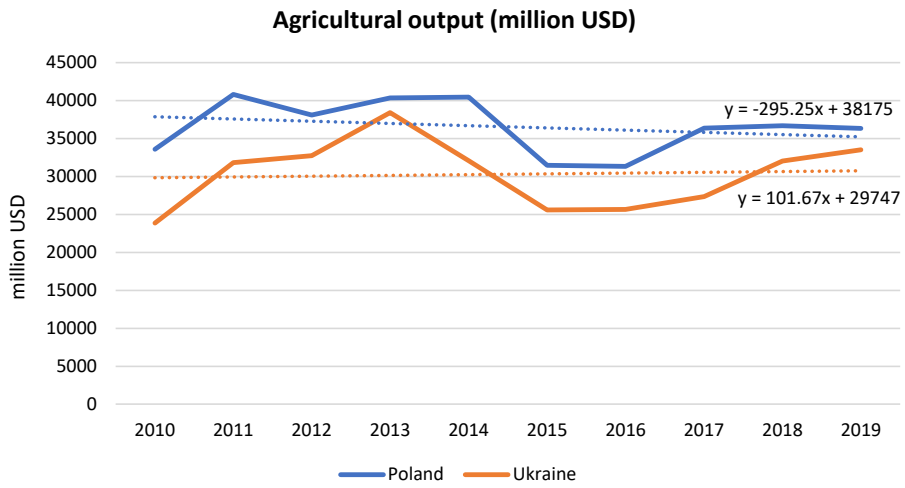

Fig. 1. Changes in the value of agricultural output in Poland and Ukraine from 2010 to 2019 (million USD)
Source: Own elaboration based on FAOSTAT database [https://www.fao.org/faostat/en/#data/MK]

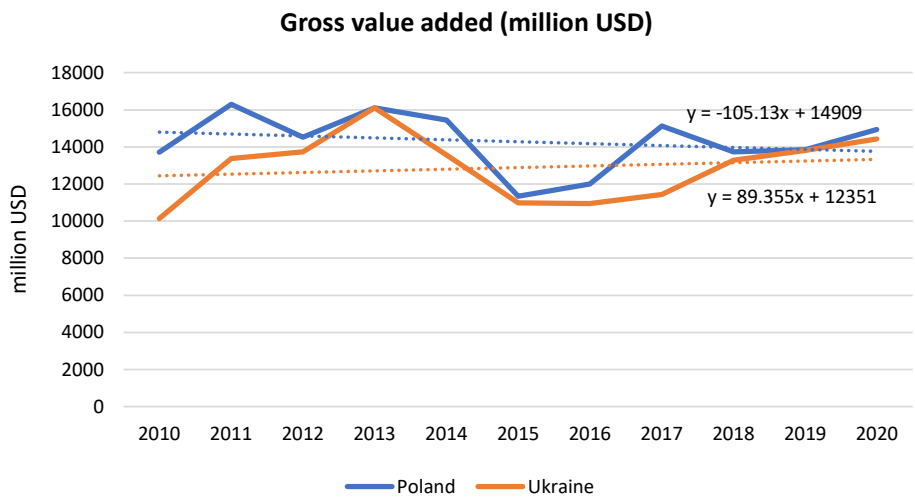

Fig. 2. Changes in gross value added of agriculture in Poland and Ukraine from 2010 to 2019 (million USD)
Source: Own elaboration based on FAOSTAT database, https://www.fao.org/faostat/en/#data/MK (10.08.2022)

Table 5. Land and labour productivity in agriculture of Poland and Ukraine from 2010 to 2020

Years	Land productivity (USD·ha^{-1})		Labour productivity (USD person^{-1})	
	Poland	Ukraine	Poland	Ukraine
2010	2323.6	578.3	5771.0	3251.3
2011	2762.5	770.7	8116.4	3247.9
2012	2621.3	793.0	7411.7	3415.2
2013	2801.3	924.9	8626.4	3944.9
2014	2804.4	772.6	8491.7	5077.6
2015	2189.6	616.3	6135.1	4375.7
2016	2180.0	618.0	7021.8	4311.2
2017	2515.8	659.2	9043.6	4590.7
2018	2527.2	775.7	8706.3	4520.1
2019	2502.5	811.2	9234.2	4585.7
2020	no data	no data	9520.8	5299.1

Source: own elaboration based on FAOSTAT database [https://www.fao.org/faostat/en/#data/MK]

The basic 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]. Table 5 presents the values of these ratios for Poland and Ukraine.

The presented data imply that, from 2010 to 2019, the average agricultural output per 1 ha in Poland was worth USD 2522.8. In the analysed period, land productivity in Ukraine amounted to USD 732 per 1 ha. In both cases, the level of the examined ratio increased from 2010 to 2019, but its growth dynamics was considerably higher in Ukraine

than in Poland. Labour productivity also tended to increase both in Poland and Ukraine. In this case, in 2020 the value of the said ratio increased by 65% in Poland and by 63% in Ukraine compared to that recorded in 2010. However, labour productivity in the agriculture of Poland and that of Ukraine clearly varied. From 2010 to 2020 this ratio, on average, reached USD 8007.2 per capita in Poland and USD 4238.1 in Ukraine (Tab. 5). Nevertheless, it should be emphasised that Poland is among the EU member states having the lowest labour efficiency [Kijek et al. 2020, Nowak et al. 2020]. On the other hand, Gołaś [2019] argues that, as regards the growth of the labour efficiency in agriculture, Poland was a leader from 2005 to 2016. This was due to an increase in the value added and a reduction of employment in the agricultural sector. Wicki [2012] claims that without further significant structural transformations in agriculture the low labour efficiency barrier cannot be overcome. This refers more to the agriculture of Poland than that of Ukraine, since in Ukraine large-area farms play a very important role [Wicki and Orlykovskyi 2019]. In addition, the efficiency of labour in agriculture depends on its technical equipment and the area per employee [Czyżewski and Kryszak 2016, Góral and Rembisz 2017]. Wicki [2019] demonstrated that the productive potential of land in Ukraine has not been well-used yet, and possibilities of exporting to the European Union and global markets will certainly result in profitable production in the future.

CONCLUSIONS

This survey was aimed at a comparative assessment of agriculture in Poland and Ukraine to the extent of their productive potential and its effective utilisation. The potential for the development of the agriculture of Ukraine, stemming from its land and labour resources, is bigger than in Poland. Ukraine has three times larger resources of high-quality land and, at the same time, its climate is more favourable for growing many agricultural products. Labour resources, expressed as the number of agricultural workers, are 1.7 times larger in Ukraine than in Poland. However, calculated per 100 ha UAA, they remain much smaller than in Poland due to differences in the agrarian structure conditioned by the transformation processes. Differences were also noted in the role agriculture plays in the national economy of both countries in connection with the advancement of their development processes. Ukraine features a share of agriculture in total employment and in gross value added that is much higher than in Poland, but in both countries a downward trend in the level of these ratios can be observed. Therefore, this means that these countries follow the path of development characteristic of countries that have already achieved a higher level of development. The high share of agriculture in the structure of Ukraine's economy did not correspond to this sector's high competitiveness manifested in land and labour productivity. Although, within the European Union, Poland is not a country with highly productive production factors, in comparison with Ukraine, Poland's agriculture achieved a relatively high level of productivity. In the analysed years, land productivity in Poland was nearly four times higher than in Ukraine, while labour productivity was two times higher. Considering the favourable natural conditions for agriculture in Ukraine, the country has a clear potential for increasing the production volume and the productivity of production factors in agriculture. In addition, the increase in the intensity of production should be facilitated by the Land Market Act allowing free trade in agricultural land. Unfortunately, these trends were inhibited by the Russian aggression on and warfare continu-

ing in Ukraine. This will bear long-term consequences not only for the agricultural sector but for the entire economy. The reason is that agriculture is a key sector of Ukrainian economy, which is illustrated by the fact that in 2020 agricultural products accounted for as much as 46.6% of Ukraine's total export. Thus, it is feasible to continue research taking into account prospects for the development of Ukrainian agriculture in the new reality, together with its impact on Polish agriculture.

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