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CATALYSTS OF CHANGES IN AGRICULTURAL PRODUCTION IN POLAND DURING THE COVID-19

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The aim of the article is to show the impact of the COVID-19 pandemic on the size and product structure of agricultural production in Poland. The research conducted using the comparative method based on data from Statistics Poland covers the years 2017-2021. The results of the study indicate that longer stays at home related to the implementation of the remote work and education system contributed to a significant increase in the share of food in household expenses and an increase in the consumption of low-processed products, including meat, vegetables and fruit. Additionally, the high quality and price competitiveness of Polish food products allowed for an increase in the value of their exports. These factors, together with the improvement of sanitary conditions permitted for the increase in the production of the food industry, and in consequence global agricultural production. Higher consumer demand contributed to an increase in the purchase of plant products, leading to a significant increase in the share of cereals, industrial plants and fruit in the total amount of purchased agricultural products. As a consequence, during the COVID-19 pandemic, the value of plant production increased significantly and for the first time its share in total agricultural production exceeded the share of animal production.

Keywords: Poland; agriculture; food industry; COVID-19.

INTRODUCTION

The COVID-19 pandemic caused a significant slowdown, and sometimes a complete freeze, of economic activity in most countries, including Poland. The threat of a pandemic was so serious that, according to the International Monetary Fund, global public spending in the period from the announcement of the pandemic to March 2021 to support the health system as well as businesses and households, amounted to USD 16 trillion (IMF, 2021). In Poland, uncertainty as to the possibility of further profitable activity resulted in a strong deterioration in the assessment of enterprises and households regarding the current and future economic situation. According to the survey of Statistics Poland, between 2019 and 2021, the assessment of food producers of the current and future economic conditions dropped from 9.1 and 1.5 to 4.8 and -10.8, respectively (Statistics Poland, 2023). Similarly, the current and leading consumer confidence indicators fell from 1.3 and -2.3 to -36.4 and -47.7, respectively (Statistics Poland, 2023a). In order to stop the downward trends in the economy, public support was directed mainly to entities seriously affected by the crisis, i.e., the sector of small and medium-sized enterprises (SME) and farmers (Regulation, 2020; ARMA, 2020; Regulation, 2022).

The COVID-19 pandemic has significantly disrupted agricultural activities (Adelodun et al., 2021) and has also generated a major shock, challenging the resilience of many agri-food systems around the world (Stephens et al., 2020; Coopmans et al., 2021). Moreover, such strong disruptions in the activities of the agri-food sector have significantly increased the risk to food security (Laborde et al., 2020) and the continuation of production (Torero, 2020). On the other hand, it has been noted that the existence of such risks in agriculture could be mitigated by cooperation between farmers and their participation in a locally embedded food systems (Prosser et al., 2021), as well as by having strong interconnections with other actors in food systems (Perrin and Martin, 2021). Moreover, research has shown that during the pandemic, younger farmers maintained high levels of sales of their products by using digital market channels (Erjavec et al., 2021).

In Poland the need for a large group of employees to be quarantined and the switch to the system of remote work and education contributed to an increase in the share of food in household consumption expenditure (Statistics Poland, 2022). At the same time, due to maintaining price competitiveness and high quality (Szczeniak et al., 2020), in the years 2020-2021 the value of Poland's exports of food products increased by 27% (Statistics Poland, 2023b). As a result, despite the difficult conditions caused by the pandemic, the production value of the food industry increased, contributing to the increase in financial stability of food industry enterprises (Kozak, 2022), as well as the purchase and production of agricultural products. In addition, higher demand for plant products has led to an increase in their share in total agricultural

production. The presented problems prompted us to examine the impact of the COVID-19 pandemic on the size and product structure of the agricultural production in Poland

RESEARCH METHODS

In order to achieve the research goal, it was decided, using a comparative method, to check how household consumption, exports and imports of food industry products, as well as the size and structure of agricultural production have changed in 2020-2021 compared to the state before the pandemic period. The study put forward the following research hypothesis that during the COVID-19 pandemic in Poland, changes in consumption and the activities of food producers had a noticeable impact on the size and the product structure of agricultural production. The conducted research covers the years 2017-2021. The main source of data came from the publications of Statistics Poland, e.g., Statistical Yearbooks of Industry and Statistical Yearbooks of Agriculture.

RESEARCH RESULTS AND DISCUSSION

The COVID-19 pandemic caused the greatest losses to the Polish economy in the second quarter of 2020, when, for sanitary reasons, the public was periodically obliged to stay in their place of residence and some enterprises had to completely stop their production or service activities. As a consequence, the annual GDP growth rate fell from 3.1% in the first quarter to -7.3% in the second quarter of 2020. During subsequent quarters the negative impact of the pandemic weakened, especially after the start of the SARS-CoV-2 vaccination program in the first quarter of 2021. This allowed to release the suspended demand for consumer goods and services. In result, in the fourth quarter of 2021, the annual GDP growth rate reached 8.7% (Statistics Poland, 2022a). Variability of the severity of the COVID-19 pandemic in Poland and other countries impacted the performance of the food industry. The size and the structure of its production were largely dependent on the domestic demand and the volume of exports and imports of food products. Restrictions on movement, stricter sanitary requirements, remote work and teaching of children and youth have contributed to a change in the structure of expenses incurred by households. Reduced demand, incl. for clothing and footwear, public transportation, recreation and culture, or restaurants and hotels, as well as the need to stay longer and eat only at home, increased the household demand for food, frequently low-processed products. As a result, between 2019 and 2021, the value of expenditure per capita on food increased by about 11% and its share in total expenditure increased from 25.1% to 26.4%.

The extraordinary situation also changed the structure of household consumption (Table 1). The consumption of bread, potatoes, sugar, rice, poultry meat and cold cuts and meat products decreased. On the other hand, the consumption of butter, cheese and cottage cheese, yoghurt and flour increased. These shifts in the product structure resulted from, among others, limited mobility of people, who were forced to prepare their own meals, the closure of restaurants and other common eating facilities, as well as the threat of contaminating of coronavirus through products prepared in food industry enterprises. Additionally, the growth of consumption of fruit, vegetables as well as fruit and vegetable juices could be associated with the growing positive attitude of the society towards healthy foods.

When assessing the increase in the volume and product structure of household consumption, it can be pointed out that the COVID-19 pandemic has changed dietary behaviour and the structure of demand for the production of the food industry, and indirectly, agriculture.

Table 1. Average monthly consumption per capita in households in 2017-2021

Item	2017	2018	2019	2020	2021	Change 2021/2019
Rice (kg)	0.15	0.15	0.15	0.15	0.14	-6.7%
Bread (kg)	3.31	3.15	2.98	2.75	2.67	-10.4%
Flour (kg)	0.63	0.60	0.59	0.70	0.63	6.8%
Meat (kg), including:	5.28	5.20	5.08	5.09	4.97	-2.2%
Raw meat (kg), including	3.00	2.96	2.87	2.90	2.83	-1.4%
poultry (kg)	1.56	1.52	1.53	1.55	1.45	-5.2%
sausages and meat products (kg)	2.04	2.00	1.97	1.96	1.91	-3.0%
Fish and seafood (kg)	0.29	0.28	0.27	0.27	0.28	3.7%
Milk (liter)	2.99	2.94	2.87	3.06	2.90	1.0%
Yoghurts (liter)	0.52	0.52	0.54	0.57	0.58	7.4%
Cheese and cottage cheese (kg)	0.86	0.87	0.89	0.95	0.97	9.0%
Eggs (pcs.)	11.42	11.09	10.99	11.04	10.80	-1.7%
Oils and fats (kg)	1.11	1.07	1.05	1.08	1.02	-2.9%
including butter (kg)	0.26	0.25	0.28	0.32	0.32	14.3%
Fruit (kg)	3.64	3.75	3.79	3.86	3.95	4.2%
Vegetables (kg)	8.24	7.92	7.61	7.72	7.43	-2.4%
including potatoes (kg)	3.16	2.97	2.75	2.68	2.47	-10.2%
Sugar (kg)	0.93	0.94	0.80	0.84	0.75	-6.3%
Mineral waters (liter)	5.16	5.70	5.78	5.83	5.93	2.6%
Juices (fruit and vegetable) (liter)	0.97	0.99	1.04	1.11	1.14	9.8%

Source: Statistics Poland, Household budget survey in 2021. Available at:

https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5486/9/17/1/budzety_gospodarstw_domowych_w_2021_popr_pl.pdf.

During the COVID-19 pandemic, despite the negative results of the national economy, the value of exports and imports of food products increased by 27% and 30%, respectively (Table 2). However, the structure of exports and imports did not change significantly. At the end of 2021, among the main export products, the most important items, with a share of 16%, was occupied by preparations from cereals, flour, starch or milk and pastry, followed by preparations from meat, fish or crustaceans, molluscs and other aquatic invertebrates (11%), cocoa and its preparations (10%) and preparations of vegetables, fruits, nuts or other parts of plants (8%). Among imported food preparations, the most important items were cocoa and its preparations (13%), followed by preparations of cereals, flour, starch or milk and pastry (10%) and preparations of vegetables, fruits, nuts or other parts of plants (9%).

It can therefore be concluded that during the COVID-19 pandemic, exports and imports of food products preserved a stable product structure and had a balanced impact on the volume of production of all groups of agricultural products.

Table 2. Exports and imports of major groups of processed foods in 2017-2021 (PLN billion)

Item	2017	2018	2019	2020	2021	Change 2021/2019
EXPORTS (PLN billion)						
Sugars and confectionery	3.3	3.0	3.0	3.3	3.7	23%
Cocoa and preserves	6.1	6.6	7.5	8.4	9.3	25%
Preparations of cereals, flour, starch or milk, pastry	9.9	10.5	12.0	13.1	14.5	21%
Preparations of vegetables, fruits, nuts or other parts of plants	5.2	5.9	6	6.2	7.3	23%
Preparations of meat, fish or crustaceans, molluscs and other aquatic invertebrates	6.7	7.3	7.7	8.8	9.9	28%
Other	28.1	31.6	35.3	41.7	46.1	31%
IMPORTS (PLN billion)						
Sugars and confectionery	1.7	1.6	1.8	1.9	2.1	19%
Cocoa and preserves	4.8	4.9	5.2	6.2	6.6	26%
Preparations of cereals, flour, starch or milk, pastry	3.6	3.6	3.8	4.3	5.0	31%
Preparations of vegetables, fruits, nuts or other parts of plants	3.1	3.3	3.6	4.0	4.5	25%
Preparations of meat, fish or crustaceans, molluscs and other aquatic invertebrates	1.0	1.0	1.2	1.5	1.7	36%
Other	18.7	20.6	22.2	25.9	29.2	32%

Source: Statistics Poland, Statistical Yearbook of Industry - Poland 2022. Available at: <https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/statistical-yearbook-of-industry-poland-2022,5,16.html>.

In 2020, unlike the entire economy, which contracted by 3%, the value of sold production of the food industry increased by 2%, and in the following year, along with the improvement of the pandemic situation, by 13% (Statistics Poland, 2023b). This acceleration in production resulted, among other things, from an increase in the share of household expenditure on food to 26.4% and the value of exports of food products by 27%. However, the increase in production varied and depended on the size of the enterprise. Between 2019 and 2021, the highest increase in sold production, by 36% and 23% occurred in the groups of the largest enterprises, i.e., those employing over 1,000 and between 25 and 249 employees, respectively. On the other hand, the production fell the most in the group of the smallest enterprises with an annual production of up to PLN 2 million. This means that during the crisis caused by the COVID-19 pandemic, large enterprises coped best, taking advantage of the scale effect, thus reducing operating costs and maintaining price competitiveness.

The impact of exports and household consumption on the activity of the food industry could be confirmed by the positive correlation between the increase in exports of "processes made from cereals, flour, starch or milk, confectionery" (Table 2) as well as the increase in household consumption of flour, milk and yoghurts (Table 1) with the increase in the production of butter, cheese and curd, starch and pasta (Table 3). Similarly, the increase in the exports of "prepared vegetables, fruit, nuts or other parts of plants" as well as the consumption of fruit, vegetables and fruit and vegetable juices can be associated with the increase in the production of such products as: fruit and vegetable juices, frozen vegetables, canned vegetables and fruit jams. Also, the increase in exports of the group of products "processed meat, fish or crustaceans, molluscs and other aquatic invertebrates" and the increased consumption of fish and seafood are among the catalysts for the increasing production of such products as: beef and veal meat, pork meat, poultry meat, frozen fish and canned fish.

The changing consumption of households, exports and imports of food products and the food industry's demand had a noticeable impact on the volume and structure of agricultural production during the COVID-19 pandemic. In 2020, the purchase value of agricultural products, which depends mainly on the demand from the food industry, increased by 2%, which resulted from the increased purchase of plant products (by 10%) and at the same time the decreased purchase of animal production (by 1%) (Table 4). Within the plant products, the value of purchased basic cereals increased the most (from 28% for barley to 55% for triticale), legumes (54%) and rape (20%). The decrease in the value of purchased animal products resulted, among others, from a drop in the purchase of chicken eggs (by 36%), calves (by 32%) and poultry (by 10%). In the second year of the pandemic, i.e., in 2021, the purchase of animal products accelerated significantly and its annual increase amounted to 12% and approached the increase in the purchase of plant products of 15%. The value of purchased chicken eggs increased the most, by 94%. The increases in the purchase value of calves, poultry, milk and cattle were respectively: 27%, 18%, 14% and 13%. The

faster growing purchase of plant products than animal products caused that by the end of 2021 their share in the total purchase value increased to 32%.

Table 3. Volume of sold production of major groups of food products in 2017-2021 (thousand tonnes)

Item	2017	2018	2019	2020	2021	Change 2021/2019
Beef and veal	224	216	211	227	229	9%
Pork meat	1 321	1 413	1 328	1 140	1 359	2%
Poultry meat	3 038	3 056	3 079	3 286	3 158	3%
Rendered animal fats	123	130	128	137	151	18%
Cold cuts	842	817	788	739	775	-2%
Canned meat	64	60	60	70	65	9%
Frozen fish	66	81	93	81	96	3%
Canned fish	64	69	67	75	72	7%
Fruit and vegetable juices (million hl)	9.0	11.4	11.6	11.6	12.6	9%
Frozen vegetables	750	645	539	553	572	6%
Canned vegetables	381	363	370	399	453	22%
Fruit jams	48,0	46,7	49,0	54,3	52,1	6%
Margarine	335	320	319	329	308	-3%
Liquid milk (million hl)	3 436	3 383	3 448	3 709	3 672	6%
Butter	212	222	237	255	241	2%
Cheeses and curds	889	928	945	961	993	5%
Wheat flour	2 409	2 457	2 438	2 353	2 405	-1%
Rye flour	238	253	263	236	226	-14%
Potato starch	200	177	146	206	196	34%
Fresh bread	1 549	1 519	1 470	1 387	1 352	-8%
Pasta	180	180	190	208	199	5%
Sugar	2 215	2 211	2 200	1 992	2 151	-2%
Vinegar (10%) (thousand hl)	546	576	596	614	563	-6%

Source: Statistics Poland, Statistical Yearbook of Industry - Poland 2022. Available at: <https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/statistical-yearbook-of-industry-poland-2022,5,16.html>.

Table4. Purchase value of agricultural products (current prices, in PLN million)

Item	2017	2018	2019	2020	2021	Change 2021/2019
Total	65 308	64 243	65 594	67 114	75 843	15.6%
Plant products, incl	19 545	19 080	19 152	21 124	24 246	26.6%
Wheat	5 165	4 392	3 923	5 124	5 489	39.9%
Rye	505	487	522	710	770	47.5%
Barley	522	498	493	633	752	52.5%
Oat	60	80	64	91	85	32.8%
Triticale	488	604	589	914	979	66.2%
Corn	1 317	1 629	1 573	1 873	2 581	64.1%
Consumer legumes	39	40	26	40	33	26.9%
Potatoes	673	735	909	868	947	4.2%
Sugar beets	1 408	1 560	1 539	1 450	1 811	17.7%
Rapeseed and agrimony	2 728	2 463	2 582	3 103	3 501	35.6%
Vegetables	1 808	2 208	2 220	1 781	2 087	-6.0%
Fruit	3 299	2 923	3 271	3 504	3 955	20.9%
Other vegetable products	1 533	1 461	1 441	1 033	1 256	-12.8%
Animal products, incl	45 763	45 162	46 442	45 989	51 596	11.1%
Cattle	5 957	5 941	5 065	4 968	5 630	11.2%
calves	64	58	53	36	46	-13.2%
Pigs	11 388	10 628	11 597	11 940	12 232	5.5%
Sheep	13	16	17	18	23	32.0%
Poultry	11 606	11 884	12 731	11 474	13 546	6.4%
Cow milk	15 731	15 633	15 999	16 738	19 087	19.3%
Chicken eggs	206	164	188	120	233	23.9%
Other animal products	798	838	792	696	799	0.9%

Source: Statistics Poland, Statistical Yearbook of Agriculture 2022. Available at: <https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/statistical-yearbook-of-agriculture-2022,6,17.html>.

The purchase of agricultural products during the COVID-19 pandemic was of a similar nature both in terms of value and quantity. In 2020, the volume of purchased cereals increased the most, including primarily triticale (by 60%), oats (by 54%), rye (by 46%) and barley (by 36%). At the same time, the purchase of animal production brought in much worse results. The amount of purchased chicken eggs decreased by 36% and calves by 20%. In the second year of the pandemic, the trend changed and vice versa, the amount of purchased animal products increased, including chicken eggs (by 68%) and pigs (by 10%). On

the other hand, the amount of purchased of plant products decreased, among others legumes by 31%, rape by 20%, rye by 19%, triticale by 19%, wheat by 17% and oats by 15%. The decrease in the cereals was mitigated by the increase in the amount of purchased fruit by 22%, vegetables by 8% and potatoes by 7%.

Changes in the demand generated mainly through the purchase of agricultural products significantly impacted the volume of the total agricultural production. Greater demand for plant products (Table 5) motivated farmers to increase their production. This was especially noticeable in the first year of the pandemic, when the crop production increased by 14% and animal production decreased by 1%.

Table 5. Global agricultural production by product (current prices, PLN million)

Item	2017	2018	2019	2020	2021	Change 2019/2021
Global production	115 611	113 150	119 645	126 572	134 821	12.7%
Crop production	56 106	52 778	56 832	64 698	70 076	23.3%
Cereals, incl	18 739	17 315	19 162	22 694	28 663	49.6%
wheat	7 601	6 967	7 877	9 334	11 665	48.1%
rye	1 469	1 294	1 544	1 705	1 901	23.1%
barley	2 193	1 991	2 217	1 817	2 309	4.1%
other cereals	7 476	7 063	7 524	9 838	12 788	70.0%
Potatoes	4 686	3 955	5 173	4 262	4 310	-16.7%
Industrial plants, incl	7 176	6 413	6 387	8 460	8 569	34.2%
sugar beets	2 355	2 228	1 872	2 103	2 426	29.6%
other industrial	4 821	4 184	4 519	6 357	6 142	35.9%
Vegetables	10 077	10 426	11 945	11 558	11 445	-4.2%
Fruit	6 092	6 152	6 098	11 087	8 287	35.9%
Meadow hay	1 848	1 634	1 628	1 780	1 758	8.0%
Other vegetable products	7 488	6 883	6 439	4 857	7 044	9.4%
Animal production	59 505	60 372	62 812	61 873	64 744	3.1%
Livestock, incl	32 829	33 258	35 644	33 969	35 390	-0.7%
cattle	6 918	7 160	7 048	6 767	7 720	9.5%
calves	78	67	63	47	56	-11.1%
pigs	13 322	12 433	14 041	13 368	12 619	-10.1%
sheep	17	19	23	24	30	30.4%
poultry	12 273	13 374	14 270	13 584	14 777	3.6%
Cow milk	18 514	18 556	19 082	19 934	22 747	19.2%
Chicken eggs	5 827	6 347	6 371	6 378	5 970	-6.3%
Other animal products	2 335	2 211	1 715	1 592	637	-62.9%

Source: Statistics Poland, Statistical Yearbook of Agriculture 2022. Available at: <https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/statistical-yearbook-of-agriculture-2022,6,17.html>.

As in the case of the purchase value, the higher growth dynamics of plant production (by 7%) comparing to animal production (by 5%) was also maintained in 2021. As a consequence, during the COVID-19 pandemic, the share of plant products in the total agricultural production increased to 52%, and of animals fell to 48%. When assessing changes in the production of individual groups of agricultural products, it can be observed that the demand for, among others, cereals, rapeseed, legumes, fruit contributed to the increase in the production of e.g., total cereals by 50%, wheat by 48%, rye by 23%, industrial plants by 34%, fruit by 36%. At the same time, the fall in demand for animal products during the COVID-19 pandemic caused their production to increase only slightly, and livestock and chicken eggs to decrease by 1% and 6%, respectively. It can therefore be indicated that the COVID-19 pandemic had the strongest negative impact on the production of calves (decrease by 11%) and pigs (decrease by 11%), however positive on the production of milk (increase by 19%) and cattle (increase by 10%).

CONCLUSIONS

The COVID-19 pandemic was the source of a global economic crisis and negatively impacted the Polish economy. Temporary freezing of the activities of enterprises and public institutions, restrictions on movement, tightening of sanitary regulations and absenteeism of employees resulting from the need to undergo sickness quarantine contributed to the consolidation of food industry enterprises aimed at using the economy of scale, reducing costs and maintaining price competitiveness and domestic and foreign market shares. In the crisis conditions caused by the COVID-19 pandemic the food industry performed better than other industrial processing sectors. In the first year of the pandemic, food producers increased the value of production, while entities from other sectors significantly reduced it.

Longer stays at home related to quarantines, as well as the implementation of the remote work and education system, contributed to a significant increase in the share of food in household expenditures. The threat of infection with the Sars-Cov-2 coronavirus motivated households to reduce consumption of processed food products, e.g., sausages, canned meat and increase consumption of plant products, including fruit, vegetables and fruit and vegetable juices. Additionally, the high quality and price competitiveness of Polish food products permitted for an increase in the value of their exports while maintaining its current product structure. The improvement of the sanitary condition in the country,

the increase in food consumption and the increase in previously restrained demand helped food producers to increase their production even during the COVID-19 pandemic.

The increasing production of the food industry contributed to the increase in the purchase of agricultural products from farmers. The change in consumer preferences, who increased their interest in less processed products and fruit and vegetables, meant that purchases of plant products grew much faster than those of animal products. This led to an increase in the share of plant products in the total amount of agricultural production. The share of cereals, industrial plants, fruit and vegetables increased strongly in total agricultural production. Consequently, during the pandemic, the value of plant production increased significantly and for the first time its share in global production exceeded the share of animal production. All presented changes were at a significant level, which confirms the hypothesis put forward in the study that during the COVID-19 pandemic in Poland, changes in consumption and the activities of food producers had a noticeable impact on the size and the product structure of agricultural production.

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REFERENCES

1. Adelodun, B., Kareem, K., Kumar, P., Kumar, V., Choi, K., Yadav, K., Yadav, A., Denglawey, A., Cabral-Pinto, M., Son, C., Krishnan, S., & Khan, N. 2021. Understanding the impacts of the COVID-19 pandemic on sustainable agri-food system and agroecosystem decarbonization nexus: A review. *Journal of Cleaner Production*, 318, 128451, <https://doi.org/10.1016/j.jclepro.2021.128451>
2. ARMA. 2020. Announcement of the President of the Agency for Restructuring and Modernization of Agriculture on the possibility of submitting applications for aid for operations of the type "Aid for farmers particularly affected by the COVID-19 crisis". Available at: <https://www.gov.pl/web/arimr/ogloszenie-prezesa-agencji-restrukturyzacji-i-modernizacji-rolnictwa-w-sprawie-mozliwosci-skladania-wnioskow-o-przyznanie-pomocy-na-operacje-typu-pomoc-dla-rolnikow-szczegolnie-dotknietych-kryzysem-covid-19-w-ramach-dzialania> (accessed on 30 July 2023).
3. Coopmans, I., Bijttebier, J., Marchand, F., Mathijs, E., Messely, L., Rogge, E., Sanders, A., & Wauters, E. 2021. COVID-19 impacts on Flemish food supply chains and lessons for agri-food system resilience. *Agricultural Systems*, 190, 103136, <https://doi.org/10.1016/j.agsy.2021.103136>
4. Erjavec, K., Janžekovič, M., Kovač, M., Simčič, M., Mergeduš, A., Terčič, D., & Klopčič, D. 2021. Changes in use of communication channels by livestock farmers during the COVID-19 pandemic. *Sustainability*, 13(18), 10064, <https://doi.org/10.3390/su131810064>.
5. IMF. 2021. Fiscal Monitor. International Monetary Fund. Available at: <https://www.imf.org/-/media/Files/Publications/fiscal-monitor/2021/April/English/text.ashx> (accessed on 25 July 2023).
6. Kozak, S. 2022. The impact of the COVID-19 pandemic on the risk of bankruptcy of enterprises in the agri-food sector in Poland. *31 International Scientific Conference Agrarian Perspectives XXXI. Green Deal – Future Perspectives*, 2022, 14-09-2022 - 15-09-2022, Prague, Czechia, pp. 113-123. Available at: <https://ap.pef.czu.cz/en/r-12193-conference-proceedings>.
7. Laborde, D., Martin, W., Swinnen, J., & Vos, R. 2020. COVID-19 risks to global food security. *Science*, 369(6503), 500-502. <https://doi.org/10.1126/science.abc4765>.
8. Perrin, A., & Martin, G. 2021. Resilience of French organic dairy cattle farms and supply chains to the COVID-19 pandemic. *Agricultural Systems*, 190, 103082, <https://doi.org/10.1016/j.agsy.2021.103082>.
9. Prosser, L., Lane, E.T., & Jones, R. 2021. Collaboration for innovative routes to market: COVID-19 and the food system. *Agricultural Systems*, 188, 103038, <https://doi.org/10.1016/j.agsy.2020.103038>.
10. Regulation of the Council of Ministers of 4 January 2022 amending the regulation on the detailed scope and ways of implementing certain tasks of the Agency for Restructuring and Modernization of Agriculture (Journal of Laws 2022, item 45).
11. Regulation of the Minister of Agriculture and Rural Development of August 24, 2020 on the detailed conditions and procedure for granting and disbursing financial aid for operations such as "Aid for farmers particularly affected by the COVID-19 crisis" under the measure "Exceptional temporary support for farmers, micro-enterprises and small and medium-sized enterprises particularly affected by the COVID-19 crisis" covered by the Rural Development Program for 2014-2020 (Journal of Laws 2020, item 1467).
12. Statistics Poland. 2022. Household budget survey in 2021. Available at: https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5486/9/17/1/budzety_gospodarstw_domowych_w_2021_popr_pl.pdf (accessed on 20 July 2023).
13. Statistics Poland. (2022a). Information of Statistics Poland on the updated quarterly GDP estimate for 2010 -2021 and the 1st and 2nd quarter of 2022. Available at: <https://stat.gov.pl/en/topics/national-accounts/quarterly-national-accounts/information-of-statistics-poland-on-the-updated-quarterly-gdp-estimate-for-2010-2021-and-the-1st-and-2nd-quarter-of-2022,6,3.html> (accessed on 25 July 2023).

14. Statistics Poland. 2023. Business tendency in manufacturing, construction, trade and services 2000-2023 (January 2023). Available at: <https://stat.gov.pl/en/topics/business-tendency/business-tendency/business-tendency-in-manufacturing-construction-trade-and-services-2000-2023-january-2023,1,71.html> (accessed on 25 July 2023)..
15. Statistics Poland. 2023 (a). Consumer tendency - July 2023. Available at: <https://stat.gov.pl/en/topics/business-tendency/business-tendency/consumer-tendency-july-2023,3,43.html> (accessed on 25 July 2023)..
16. Statistics Poland. 2023 (b). Statistical Yearbook of Industry - Poland 2022. Available at: <https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/statistical-yearbook-of-industry-poland-2022,5,16.html> (accessed on 25 July 2023)..
17. Statistics Poland. 2023 (c). Statistical Yearbook of Agriculture 2022. Available at: <https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/statistical-yearbook-of-agriculture-2022,6,17.html> (accessed on 25 July 2023)..
18. Stephens, E., Martin, M., van Wijk, M., Timsina, J., & Snow, V. 2020. Impacts of COVID-19 on agricultural and food systems worldwide and on progress to the sustainable development goals. *Agricultural Systems*, 183, 102873, <https://doi.org/10.1016/j.agsy.2020.102873>.
19. Szczepaniak, I., Ambroziak, Ł., & Drożdż, J. 2020. Impact of the COVID-19 pandemic on food processing and Polish agri-food export. *Ubezpieczenia w Rolnictwie-Materiały i Studia*, 73, 141-163, <https://doi.org/10.48058/urms/73.2020.3>
20. Torero, M. 2020. Without food, there can be no exit from the pandemic. Countries must join forces to avert a global food crisis from COVID-19. *Nature*, 580, 588-589, <https://doi.org/10.1038/d41586-020-01181-3>.