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IMPACT OF COVID-19 PANDEMIC ON AGRO-INDUSTRIAL COMPLEX DEVELOPMENT

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Abstract

The global problems of the agro-industrial complex deserve a priority solution, which is primarily due to food security at all levels. Only after the primary needs of the population are met, it makes sense to make any efforts to find options to overcome other obstacles standing in the way of the development of the world economy. The complexity of the current situation in the world is due to the unceasing course of the COVID-19 pandemic. This article provides an analytical overview of the opinions of researchers from different countries and international organizations on the impact of SARS-CoV-2 coronavirus infection on the functioning and development of the agro-industry in the world. Including the advantages and disadvantages of the presented theories are indicated. The authors consider it important to apply a scientific approach to highlighting the classification of the results of the impact of the COVID-19 pandemic on the agricultural sector of the world economy. This study will allow forming a systematic approach to the development of measures to minimize their negative impact, the manifestation of which is observed to the greatest extent than positive. The result of the study is the author's classification of the consequences of the impact of the COVID-19 pandemic on the agro-industrial sector. Given the novelty of the category under consideration, the authors consider it inevitable that further research in this area is necessary.

Keywords: Agrarian economy, agro-industrial complex, COVID-19, pandemic, the impact of a pandemic

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1. Introduction

The branches of agriculture and the agro-industrial complex as a whole are the main spheres of human life support. This statement is an unequivocal statement of the paramount importance of agriculture and the agro-industrial complex at all stages of human development. The issues of the functioning and development of this area are currently the most significant on a global scale. Agricultural engineering research constantly attracts the attention of modern scientists. Food security, climate change, energy conservation are just the beginning of the list of global problems of the agro-industrial complex, which, unfortunately, is constantly increasing.

The end of 2019 became a fundamentally new challenge for the entire world community and forced everyone to respond to the spread of the SARS-CoV-2 coronavirus infection, recognized by the World Health Organization as the COVID-19 pandemic on March 11, 2020. The agro-industrial complex was no exception among the industries that were negatively affected by force majeure. Naturally, the current situation entailed a surge in scientific research on the part of scientists of all levels and categories, including in the field of the agro-industrial complex. Today, the activity of both Russian and foreign researchers in the study of this problem should be noted. This interest is evidenced by the publications of the following authors: Kazarova (2020), Razin et al. (2020), Trushina et al. (2020), Vartanova (2020), Sidorchukova (2020), Kuandykova (2021), Kerr (2021), Mishra et al. (2021), Cardwell and Ghazalian (2020).

At the same time, it is important to note that the problem of the impact of the COVID-19 pandemic on the agro-industrial complex is quite new, the situation continues to change, and the prospects are difficult to predict. This circumstance emphasizes the relevance of using the scientific approach in this direction and requires further systematization of the already accumulated knowledge.

2. Problem Statement

The current global outbreak of COVID-19 has disrupted agricultural and food systems around the world. Timely and reliable information is essential to prevent panic reactions that can exacerbate these disruptions, worsening the food and nutritional security of the most vulnerable people (FAO, 2020). The impact of the coronavirus pandemic on agriculture and global food security will be complex (Torero, 2020) and many of the impacts remain to be identified and understood (Jámbor et al., 2020).

In 2020, the world hunger situation deteriorated sharply – a tenth of the world's population, about 811 million people, is undernourished. Such a significant increase is likely associated with a pandemic, but this is far from the only reason. This is stated in a new report prepared by experts from several United Nations (UN) agencies "And before the pandemic, we lagged behind the pace of progress towards the goal of completely freeing the world from hunger and malnutrition by 2030," says Maximo Torero, FAO's chief economist. "We have been hampered by conflicts, climate change, and the economic recession, but today's figures are even more alarming." Last year, he said, the situation worsened significantly, even considering population growth: in 2020, 9.9 percent of all inhabitants of the planet were undernourished, 1.5 percent more than a year earlier (UN, 2021).

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It is obvious that it is the work of the agro-industrial complex that is responsible for saving humanity from hunger. Moreover, the fact that this intersectoral system was among those subjected to negative pressure from pneumonia of a new type emphasizes the importance of research by scientists worldwide to find ways to confront the global problem. Experience shows that a clearly formulated problem is half of the solution. Therefore, using a scientific approach to understanding the impact of the COVID-19 pandemic on the agro-industrial complex is an important stage in the process of developing recommendations to reduce its negative manifestations.

3. Research Questions

Currently, in different countries and at the level of international organizations, scrupulous work is underway to study the impact of the COVID-19 pandemic on the agro-industrial complex. A generalization of publicly available information environment sources on this issue became the basis for analyzing the opinions of various representatives of the world scientific community on the classification of this category. Table 01 presentes these results.

Table 1. Existing approaches to classifying the impact of the COVID-19 pandemic on the agro-industrial complex[a].

Authors of the classification	Criteria for the classification	Group of consequences
Henry R.b	Not specified	1. Impact on demand and food 2. Impact on food supply 3. Impact on agricultural research 4. Long-term effects 5. Changes and trends in meeting demand
Yambor A., Tsin P. and Balog P.c	Not specified	1. Impact associated with the proposal 2. Demand-related impact 3. Impact on labor force 4. Impact on food security and safety 5. Trade and other impacts
Food and Agriculture Organization of the United Nationsde	Development and transformation	1. Rebalancing supply chains 2. Supply chains and restrictions on the movement of consumers
	Incentives and costs	1. Measures to stimulate agricultural production 2. Mitigating the impact of cutbacks and disruptions in the agricultural budget
	Nutrition Priorities	1. School Feeding Programs / Home School Feeding Programs 2. Food waste 3. Nutrition-sensitive value chains
	Smallholders' Market Access	1. Ensuring Smallholders' Access to Farmer Markets and Public Procurement 2. Maintain the availability of rural workers and improve their working conditions 3. Increased demand for smallholder products 4. Facilitate financial support for small farmers 5. Provide physical access to the market during blocking
	Trade and Markets	Not specified
	Emergency situations	Partially not specified

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		1. Fragile / Conflicted Settings 2. Lessons from the Past I: The Impact of HIV / AIDS on Agriculture and Food Security 3. Lessons from the Past II: Impact of the Ebola Epidemic in West Africa on Agricultural Production and Rural Welfare 4. Lessons from the Past III: The 2008 Global Food Price Crisis 5. Contexts of humanitarian assistance
	Social protection systems	1. Social assistance 2. Access to health insurance and services 3. Promotion of decent employment and the labor market 4. Prevention of child labor 5. Social insurance
	Data and statistics	1. Violation of collection of national data (agricultural censuses) 2. Real-time information for policy development
Chepeleva K.V. f	Not specified	1. Logistic 2. Financial 3. Organizational and technical

a Compiled by the authors
b Robert Henry, University of Queensland, Brisbane, Australia (Henry, 2020).
c Attila Yambor Department of Agricultural Economics and Rural Development, Corvinus University of Budapest Budapest, Hungary, Peter Tsin and Peter Balog. Department of Statistics and Methodology, University of Debrecen, Debrecen, Hungary (Jámbor, Czine & Balogh, 2020).
d Food and Agriculture Organization of the United Nations (FAO) (FAO, 2020).
e Classification criterion – area, group of consequences (response measures) – area, consequences – possible failures
f Kristina Chepeleva, Krasnoyarsk State Agrarian University, Krasnoyarsk, Russia (Chepeleva, 2020)

In addition to the approaches described above in the information space, dozens of articles are devoted to this topic. However, these sources are characterized by a descriptive approach to the analyzed consequences. They cannot be analyzed due to the absence of classification criteria (signs), designation of their groups. We have to admit that the volume of the article does not allow listing all the consequences indicated within each of the groups. So, for example, the description of failures in the operation of the agro-industrial complex under the influence of a pandemic from the point of view of FOS takes seven pages. Moreover, the texts of other researchers are also voluminous. In addition, we believe that direct citation is not required to study classification issues.

4. Purpose of the Study

The purpose of this article is to study the impact of the COVID-19 pandemic on the functioning and development of the agro-industrial complex in the context of globalization, including bringing into the system the main consequences in the form of their classification.

5. Research Methods

When carrying out the research, we used such general scientific methods as abstraction, analysis and synthesis, induction and deduction, observation, comparison.

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The information base for the preparation of the article was the official data of the United Nations Organization (UN), the Food and Agriculture Organization (FAO), the International Fund for Agricultural Development (IFAD) and the World Health Organization (WHO). In addition, the works of various international and Russian scientists, published in periodicals and conference proceedings, were studied.

6. Findings

The information presented (Table 01) made it possible to identify the advantages and disadvantages of the existing classification of the consequences of the impact of the COVID-19 pandemic on the agro-industrial complex. Table 02 shows the results of the analysis performed.

Table 2. Advantages and disadvantages of existing classifications of the consequences of the impact of the COVID-19 pandemic on the agro-industrial complex [a]

Authors of the classification	Advantages	Disadvantages
Henry R.	Attempt to isolate short-term and long-term consequences	Lack of classification criteria
Yambor A., Tsin P. and Balog P.	Highlighting supply and demand implications	Lack of classification criteria
Food and Agriculture Organization of the United Nations	1. Data is constantly updated 2. The most complete list of groups of consequences	1. Impact effects mix with response measures 2. When specifying the classification criteria, not all groups of consequences are presented 3. Non-obvious and / or controversial classification criteria
Chepeleva K.V.	An attempt to isolate the consequences on a functional basis	1. Lack of criteria 2. Analysis at the Russian level 3. Analysis only from the point of view of international trade for the agro-industrial complex.

a Compiled by the authors

Based on the analysis of the existing theories of classification of the results of the influence of pneumonia of a new type on the operation of the agro-industrial complex, the author's classification is proposed (Table 03).

Table 3. Proposed classification of the impact of the COVID-19 pandemic on the agro-industrial complex [a]

Impact classification criteria	Consequence groups	Effects [b]
1. Period of exposure	1. Long-term	1. The long-term impact on progress in agribusiness research remains unclear. 2. Development of risk management strategies in the field of the agro-industrial complex, including ensuring greater self-

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		sufficiency in food production. 3. Automation in order to reduce the risks of using labor force, which may be unavailable due to illness or restriction of labor migration.
	2. Short-term	1.Diversion of researchers involved in ongoing agribusiness projects to COVID-19 research projects. 2. Threats to food security around the world due to the disruption of supply chains.
2. Field of activity	1. Agriculture	1. Increasing trend towards more protected farming allows the production of products close to the point of consumption. 2. Accelerated introduction of improved crop varieties using new genetic technologies.
	2. Branches and services providing agriculture with means of production and material resources	1. Malfunctions of tractor and agricultural machinery. 2. Malfunctions in the production of mineral fertilizers, chemicals, seeds, feed, etc.
	3. Industries that are engaged in the processing of agricultural raw materials	1. Processing of agricultural raw materials is interrupted or out of order due to restrictions on labor movement. 2. The food and light industries are experiencing the effects of the COVID-19 pandemic.
	4. Infrastructure block	1. Truck drivers, ship dockers, etc. may become sick, quarantined, or forced to stay at home. 2. Increase in the cost of transportation and an increase in the cost of storage. 3. Supply disruptions due to limited trade flow in food systems are highly dependent on imports (for example, for equipment that chills meat, for inputs such as feed and fertilizers, or for the food itself).
3. Market elements	1. Demand side	1. Panic purchases and stockpiling of the most consumed foods. 2. Reduced demand for indoor plants and fresh flowers. 3. Growth in demand for home delivery services, take-out shopping, etc. 4. Decrease in demand for services of restaurants, cafes, etc.
	2. On the supply side	1. Farmers reduce or stop functioning of their farms due to illness of workers, which leads to a decrease in production and an increase in prices for agricultural products. 2. Decrease in the production of perishable goods due to difficulties in the distribution system
4. Sectors of the economy involved in the agro-industrial complex [c]	1. Chemical industry, including biochemistry	1. Stopping or reducing the production of some fertilizers (carbomide, phosphate fertilizers – India, fertilizer mixtures – Nigeria, phosphate fertilizers – Tunisia, etc.). 2. Logistics problems in the chemical industry due to restrictions due to the COVID-19 pandemic.
	2. Forestry industry	1. Stopping or reducing the volume of production of furniture, lumber, some fertilizers (furniture – Italy, lumber – Canada,

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		USA, woodworking industry – China, etc.) 2. Logistics problems in the forestry industry due to restrictions due to the COVID-19 pandemic.
	3. Transport	1. International transportation has been seriously disrupted by COVID-19 in such modes of transport as water, rail, road, air, the work of which is also involved in the agro-industrial complex. 2. Transportation is one of the sectors of the global economy most affected by the pandemic.
	4. Information technology (IT)	1. The intensity of the use of information technologies at all stages of production in the field of the agro-industrial complex has increased. 2. Stimulating the development of IT as a way to minimize the negative consequences of the impact of the COVID-19 pandemic on the agro-industrial complex.
	5. Light industry	1. Moving sales of textile, leather, and other types of light industry to the online format. 2. Deficiency of factors of production, primarily raw materials and workers, influenced the decline in production.
5. Factors of production	1. Labor	1. The closure of national borders has limited the availability of migrant workers in the agro-industrial complex. 2. Some food processing plants have been closed due to the infection of workers with the virus.
	2. Land	1. Potential reduction of cultivated areas in the future as a reaction to a decrease in demand for some agricultural crops. 2. Reduced access to such types of resources like seeds, fertilizers, etc., due to the disruption of supply chains.
	3. Capital	1. Central banks reacted to the pandemic by changing the key (discount) rate, which affected, among other things, the agro-industrial complex. 2. Commercial banks have offered preferential lending programs to entrepreneurs in the agro-industrial sector.
	4. Entrepreneurship (entrepreneurial ability)	1. The pandemic has forced agribusiness entrepreneurs worldwide to look for new ways of interacting with counterparties (suppliers and intermediaries). 2. The relevance and activity of developments in the field of risk management in the agro-industry have increased.
	5. Information	1. The high speed of updating information on the development of the pandemic is the basis for making relevant management decisions by farmers 2. Qualified personnel in the field of management of the agro-industrial complex, who are the carriers of this resource, switched to a remote work format
6. Category of influence	1. Minor influence	1. Consumption of essential goods, including most food, has not undergone significant negative changes. 2. The agricultural sector and the sectors involved will not respond quickly due to the seasonality of production.

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	2. Medium influence	1. Soon, the agro-industrial complex is waiting for diversification, considering the impact of the COVID-19 pandemic. 2. The production of luxury goods (fur, leather goods) will be reduced.
	3. Significant influence	1. Decrease in the income of the population aggravates the problem of food security. 2. The risk of reduced productivity and food security in the agro-industrial sector due to sickness in workers, disruptions in the supply chain.
7. Production stages	1. Production	1. Disruptions of sowing and harvesting campaigns due to disruptions in the supply of spare parts and illness of workers. 2. The need to change the production program by changing production technologies, including replacing seeds, fertilizers, etc.
	2. Distribution	1. The pandemic has highlighted the critical importance of the continuous production and distribution of food and some of the approaches developed to ensure the long-term preservation of food supplies. 2. Perishable products may not reach the market or consumers due to transportation restrictions.
	3. Exchange	1. Rising prices for fuel, spare parts for agricultural machinery. 2. Rising prices for food products, mainly imported ones.
	4. Consumption	1. There is a shift in demand in the food sector from visiting grocery stores and catering outlets towards home delivery of groceries and ready meals. 2. The share of the low-price segment in sales of foodstuffs and FMCG increased.
8. Enterprise size[d]	1. Large enterprises	1. Large businesses, including those in the agro-industrial complex, are more resistant to stress concerning force majeure, which is primarily due to their high financial capabilities. 2. Support for large businesses in the agro-industrial complex from the state is selective.
	2. Medium-sized enterprises	1. The financial capabilities of small and medium-sized enterprises, including those in the agro-industrial complex, to respond to external risks are lower than those of large businesses. 2. Under their characteristics, small and medium-sized enterprises are especially vulnerable to the multifaceted negative impact of the COVID-19 pandemic on economic relations in the agricultural sector. 3. Small and medium-sized enterprises, including those in the agro-industrial complex, have become a priority area of state support in the new economic conditions.
	3. Small enterprises	
9. The nature of the influence	1. Positive influences	1. Acceleration of digitalization of all types of activity, including the sphere of the agro-industrial complex, which will increase labor productivity e. 2. Growing demand for essential goods, including food.

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2. Negative influences	1. The main problem of the functioning of the agro-industrial complex is the rupture of international supply chains, including raw materials and finished products in the sphere of the agro-industrial complex. 2. Increased threat to food security in the world.

[a] Compiled by the authors
[b] For some items selectively, as an example
[c] According to different sources and approaches to the classification, the branches of the economy related to the agro-industrial complex include from 5 to 80 branches
[d] Criteria for identifying enterprises in groups differ by country, but they are usually based on indicators such as turnover, capitalization, and the number of employees.
[e] Confirmed by author's developments (Aleshina, Baranova & Gurunovich, 2021; Golova & Baranova, 2021)

Infection with the SARS-CoV-2 coronavirus has had a more negligible impact on the agro-industrial complex compared to sectors of the economy such as tourism and transportation. However, the consequences of the pandemic for the agro-industrial complex are already colossal. The inconsistency and duration of the impact of the consequences of the pandemic are still challenging to measure and will remain in effect for an indefinite period. The long-term impact is difficult to predict. This circumstance is associated with the low elasticity of production in terms of price in the agro-industrial complex, due to its seasonal nature and low elasticity of demand, both in terms of price and income, since the overwhelming majority of agricultural products satisfy basic needs.

7. Conclusion

The study made it possible to formulate the author's approach to classifying the consequences of the impact of the COVID-19 pandemic on the agro-industrial complex, which includes ten criteria for each of which groups and corresponding examples are given. It is important to remember that any classification in the scientific community is viewed as a controversial area. This fact means that the proposed option can be supplemented by the authors or challenged by opponents. So, the presented classification can be supplemented with the following grouping options:

- by external factors of influence (economic, political and legal, demographic, scientific and technical, natural, cultural, and others);
- according to the levels of economic development of the country (developed, developing, least developed countries);
- by economic levels (world economy, macroeconomics, mesoeconomics, microeconomics);
- by the chronology of influence (functioning and development).

At the same time, the last criterion, in our opinion, is correlated with the criterion "exposure period" and assumes the division of consequences into short-term and long-term, respectively.

In addition, it is evident that each of the groups contains more consequences than those given above. However, the recommended lists are limited both by the volume of the article and by future effects that will still manifest themselves in the process of the agro-industrial complex, the development of a pandemic, and other circumstances. All this indicates the need to continue studying the contact area

between the agro-industrial complex and the COVID-19 pandemic, which will ensure the formation of scientifically based developments to reduce the identified adverse impacts and develop positive aspects.

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