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Ecological-Industrial Problems while Realizing the Strategy for the Development of a Large Agro-Industrial Manufacture Sector In the National Food Supply System

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Abstract

The article discusses the ecological-industrial problems emerging while implementing the development strategy for the large agricultural manufacture sector in the national food supply system of the Russian Federation.
The authors propose the main directions for improving the mechanism of managing the development of the sector of a large agro-industrial manufacture in the national food supply system, including from the perspective of the management system.

Keywords: National Food Supply System, Large Agro-Industrial Manufacture Sector, Ecological-Industrial Problems, Environmentally Friendly Production

Introduction

The article examines the ecological-industrial problems pertaining to development of national food supply systems with regard to various aspects of the impact on the parameters of the functioning of food markets, on the level of provision of certain types of products. This is explained by the fact that environmental influence factors are considered to be critical owing to the increase in the manufacture of food products and the need to maintain a balance of anthropogenic impact on the environment due to a certain concentration of large agro-industrial manufacturing.

In the article "Is Meat Too Cheap? Towards Optimal Meat Taxation" Funke, F., Mattauch, L., Bijgaart, I. van den, Godfray, C., Hepburn, at all (2021). Is Meat Too Cheap? Towards Optimal Meat Taxation scientists from University of Oxford, University of Gothenburg, Joint Research Centre of the European Commission and University of Toulouse propose to increase taxes on meat production, which will mitigate some of the negative impacts on the environment, as well as help improve public health, since the level of meat consumption in developed countries does not work toward reducing the risk of a number of diseases.

The current level of the lower boundary of global ecological costs is 5.76-9.21 USD / kg for beef (depending on the production of dairy products, offal), 3.71 USD / kg for lamb and mutton, 1.94 USD / kg for pork and 1.51 USD / kg for

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poultry. The authors note that their estimate is conservative as it does not include the costs of biodiversity loss and health effects caused by air pollution from livestock production. The average retail price of beef in high-income countries in 2017 was $ 16.53 / kg ($ 10.49 / kg for pork; $ 19.04 / kg for lamb; $ 6.15 / kg for poultry) (World Bank data, 2020). As noted above, the theory of optimal taxation requires careful consideration when modeling tax levels. However, an ecological tax on meat in high-income countries is needed as a first "tentative" estimate, which would increase the current retail price of meat by about 20-60%, depending on the type of meat.

In the article "Introducing a Degrowth Approach to the Circular Economy Policies of Food Production, and Food Loss and Waste Management: Towards a Circular Bioeconomy" (2021) study by Spanish scientists point out the contradictions between the relentless increase in resource use and the search for ecological sustainability. Therefore, a concept of sustainability is being formed, aimed at introducing new social values and new policies in society that can meet human needs while reducing environmental impact and resource consumption. Within this framework, circular economy strategies for food production and food loss and waste management systems are developed based on seeking circularity, but without imposing constraints on the continuous increase in environmental impact and resource use. In this regard, the need to reduce greenhouse gas emissions from 26.8% in 2020 to 58.9% in 2040 is emphasized. The proposal is based on four pillars:

- strategies to reduce the consumption of various categories of meat, fish and seafood (the most useful way, which can reduce total greenhouse gas emissions by 78.5%;
- to increase the consumption of seasonal products in winter;
- to reduce the distance when transporting products;
- to reduce the use of agrochemicals.

Materials and Methods

The proposed article uses a systematic approach in the methodology of modernizing the mechanism for managing the development of the national food supply system on the basis of structural-analytical, logistic, graphical research methods, substantiates the methodological foundations of the strategy for improving the quality of agricultural products, considers environmental and production problems raised while implementing the strategy for the development of the large agro-industrial sector.

The scientific community is considering the need to develop strategies for improving the ecological performance of food production and supply chains and options for their management.

In the Russian Federation, the production potential of the national food supply system is being built up, which in the long term contributes to increased concern about ecological problems in the regions where large industrial agricultural holdings are concentrated. At the same time, the level of influence of the applied technologies on the environment is not fully ensured even at the stage of their design and use in the agro-industrial complex. Assessment of the consequences of the application of technologies for the production of agricultural products and their processing at the design stage is not always linked to the processes of pollution of natural resources. The basis for such a statement is the currently implemented approach to solving food security, based on the formation of a sector of large agro-industrial production in regional food supply systems. The localization of large agro-industrial production in a certain area usually leads to an excess of the concentration of emissions harmful to the environment and contributes to violations of the atmospheric, soil, and water balance. Its stable position in the market cannot be without the intensive use of the available resource potential, and therefore the intensification of agro-industrial production and uncontrolled concentration without taking into account the consequences of concentration of agro-industrial production on the state of the biosphere; the technology of land cultivation in the context of a decrease in the level of requirements for agricultural cultivation of agricultural crops, negatively affects the quality of the soil, its fertility, and the creation of large livestock complexes contributes to an increase in uncontrolled emissions of harmful substances into the atmosphere. Uncontrolled local concentration of waste products of animals and poultry in the process of agricultural production leads to an excess accumulation of high concentrations of gases (ammonia, CO_2, NH_2, hydrogen sulfide, etc.) in settling tanks (storage facilities). This leads to the summation of gases in the air of individual zones of territories, and to passive inhalation of toxins by humans and animals.

Results and Discussion

Gases, acting on the respiratory tract and cardiovascular system of the body, disrupt its metabolism and most importantly, worsen the immune system, and the consequences become clear only over time, and cause serious diseases (cancer and DNA defects). At the same time, the well-being of humans and animals is aggravated by 2-5 times in the environment due to the lack of light. A high concentration of gases leads to the degeneration of individual plants and especially trees.

At the same time, the production of oxygen by plants is reduced, and as a consequence, its deficiency in the atmosphere arises. The constant lack of clean air leads to genetic changes in subsequent generations of mankind. The imperfection of the

modern system of environmental monitoring in the national food supply system can be traced in the following example (In a research study by Georgievsky V.I., 1990, Table 1).

Table 1: average daily amount of excrements excreted by animals

Farm animals	Defecation once a day	Average amount, kg		Moisture of the feces, %
		feces	urine	
Cow	12	22	7	84
Horse	8	16	5	70
Sheep	6	2	1	65
Pig	4	1,7	4	72
Dog	3	0,2	0,6	75
Rabbit	7	0,12	0,10	75
Chicken	5	0,04	0,10	72

Taking into account the production capacity of large agro-industrial holdings, it is possible to calculate the total waste in the production of, for example, pork.

Table 2: annual productivity (capacity) and permanent number of pig farms (example)

Name	Annual capacity of the complex, heads			
	100000	50000	24000	10000
Annual pork production, tons	11000	5500	2750	1150
Permanent livestock, head:				
total pigs	80000	40000	18500	8000
incl. sows	5000	2700	1200	500
Daily weight, tons:				
- feces	230	70	32	14
- urine	400	160	75	32
- technical water	200	100	50	20
The amount of feces, tons				
per day	830	310	160	65
in year	303000	115000	58500	24000
Annual volume of feces per 1 ton of pork	28	21	22	21
The need for arable funds, hectares	12000	6000	3300	1800
Grain volume, tons	45000	22500	1200	7500
Feces per year per 1 hectare of arable land, tons	20	15	15	16

Table 3: estimated data on the accumulation of excrements from farm animals and poultry on the example of one of the regions of the Russian Federation - the Republic of Mordovia in 2018

Indicators	Constant livestock, heads	Farm animal dung, kg		Total excrement	Farm animal dung, per day, ton
		feces	urine		
Cattle	210000	22	7	29	6090
Pigs	390000	2	4	6	2340
Sheeps	45000	2	1	3	135
Poultry	4533000	0,04	0,1	0,15	680
Total					**9245**

Note: a) 9245 tons x 365 days per year = 3 374 425 tons of excrement per year.
b) for the maintenance of farm animal dung, more than 30% of industrial water or more than 1 million tons per year is consumed.

The ecological problems of the national food supply system are associated with the use of intensive industrial technologies for the production of crop and livestock products and their processing, and the main pollutant is the sector of large agro-industrial production. We believe that it is also important to reduce the time of raising farm animals and intensive use of the

resource potential of crop production based on productivity growth technologies. In the conditions of imperfection of the mechanism for managing governmental influence on the state of environmental parameters and the development of the sector of large agro-industrial production, maintaining the balance of influencing factors and the growing negative impact on the natural environment is not ensured.

This is facilitated by the peculiarity of the territorial dispersion of large agro-industrial production across the regions of the Russian Federation. In modern conditions, the sector of large-scale agro-industrial production becomes a local source of destructurisation of the environment, land and water resources (waste and wastewater from livestock complexes, farms and poultry farms, as a rule, do not always go through a full-fledged stage of cleaning, like waste from the processing industry), which, against the background of intensive use of pesticides and pesticides lead to increased environmental problems. The imperfection of the mechanism for monitoring the biosphere load at large agro-industrial enterprises, the lack of serious legal responsibility for violation of environmental requirements leads to the conclusion that the state of land resources and the environment in their areas of concentration, according to expert assessments and state reports on environmental protection, is degrading. And in a number of regions of the Russian Federation, they seem to have signs of zones of an ecological emergency or even an ecological disaster, and require immediate intervention. The reported emissions of harmful substances, which are the objects of monitoring, are shown in Table 4.

Table 4: emissions of the most common harmful substances coming from stationary industrial sources of air pollution in the region – Republic of Mordovia (thousand tons)

	2013	2014	2015	2016	2017	2018[2)]	2019
Total	36	35	32	40,50	53,85	37,854	51,067
including: solid substances	3	3	3	3,02	2,81	2,489	2,600
gaseous and liquid substances	33	32	29	37,52	51,04	35,365	48,467
from them:							
nitrogen oxides	11	7	7	7,16	6,11	6,179	8,054
carbon oxides	6	5	6	7,63	6,48	7,007	6,697
hydrocarbons (without volatile organic compounds)	13	16	13	17,47	34,04	18,929	29,518
volatile organic compounds sulfur	3	3	3	3,25	3,47	2,314	3,130
sulfur dioxide	-	0,2	0,3	1,40	0,32	0,357	0,234
other substances	*	*	*	0,61	0,62	0,579	0,834

Note: The table shows data for all enterprises with an annual emission standard of 10 tons or more. Since 2018, according to the data of the Rosprirodnadzor Department for the Republic of Mordovia

The state program "Environmental Protection" for 2012-2024, which envisages the implementation of a set of environmental measures (enhancement of the level of environmental safety of citizens, preservation and restoration of natural systems, including the number of populations of rare and endangered species of flora and fauna (State Program of the Russian Federation "Environmental Protection"), does not fully cover a complex of problems on environmental safety, and in conditions of imperfect environmental control at the design stage of agro-industrial facility and further monitoring of technologies for the production of food products, the level of negative impact of this sector on the environment continues to grow.

The environmental consequences of a large-scale agro-industrial production are associated with the degradation and depletion of soil fertility of land resources, a decrease in the genetic diversity of the plant world, deterioration of natural landscapes and phytosanitary conditions, a decrease in the level of water and air quality, a reduction in the number of non-renewable energy sources, which contributes to local climate changes. The concentration of agro-industrial production within the boundaries of the enterprise and on a certain territory increases the degree of influence of production activities in crop and livestock production on the environment:
- the use of intensive technologies in crop production in conditions of imperfection of the biosphere control mechanism degrades the quality characteristics of the soil (porosity, moisture, air, insect permeability, compaction, etc.);
- low-cost technologies for the removal of farm animal dung by hydraulic flushing in order to obtain a large volume of products, without the use of technologies of subsequent processing and utilization in the form of highly concentrated effluents stored in open containers, accompanied by actual losses of a huge amount of organic matter necessary to maintain and increase soil fertility, losses of large masses of by-products contributes to the growth of environmental problems in the region. One of the directions of the intensification of agricultural production is the chemicalization of crop production, which provides for the introduction of both chemical fertilizers and pesticides (herbicides, insecticides, nematocides, fungicides, insecticides, defoliants) into the soil.

Uncontrolled application of chemical fertilizers leads to the condition that annually, together with the harvest, tens of millions tons of nutrients are removed from the soil layer: nitrogen, potassium, phosphorus, etc. Therefore, the introduction of optimal doses of organic and mineral fertilizers within the framework of the applied agricultural technologies seems to be one of the main ways to increase soil fertility and reduce the burden on the environment. The use of pesticides as a chemical method of plant protection stops massive outbreaks of various pests spreading, being at the same time especially dangerous for living organisms, entering the human body through food which leads to organic damage to the liver, kidneys, and reduces immunity. The ingress of untreated wastewater into natural reservoirs because of breaching the standards of maximum permissible discharges by agro-industrial and processing enterprises (sugar, dairy, meat, oil, vegetable, etc.) the penetration of pollutants in the form of nitrates, phosphates, chlorides, sulfates, fats lead to a violation of the oxygen regime, specific changes in microflora and destruction of natural ecosystems.

Conclusions

Therefore, the main directions for improving the mechanism of managing the development of the sector of a large-scale agro-industrial production in the national food supply system should be as follows:

- compliance with the technological requirements of environmentally friendly production (control of the introduction of farm animal dung and droppings into the soil without preliminary treatment, its storage, processing, introduction into the soil; monitoring the use of mineral and organic fertilizers; stimulating the use of non-waste biological technologies for biological waste processing) in order to switch to implementation of environmentally friendly technologies for the use of natural-climatic, organizational-technological, biological potentials of the national food supply system based on compliance with the laws of agricultural technology for plant cultivation, concentration of production as the basis for self-regulation of the natural climatic, biological, water, air and economic balance.

At the same time, an important aspect is the implementation of the state program for the formation of institutional, legal, organizational and economic rules and norms of behavior of economic entities in the sector of large agro-industrial production in compliance with the laws of agricultural technology for plant cultivation, technologies for the production of livestock products and their processing in accordance with the requirements of the ecological balance. In modern conditions, in relation to the management system for the development of this sector, this implies:

- development of norms and rules for conducting state monitoring in regional food supply systems to assess the level of concentration of agro-industrial production and its compliance with the ecological balance;
- establishment of standards of environmental expertise for the design and location of a large agro-industrial production related to the maintenance of the ecological balance of the territorial unit - the subject of the Russian Federation;
- substantiation of measures of organizational and legal actions to be implemented against violations of the ecological balance.

Considering the above, formation of environmental requirements for compliance on the basis of the norms of the balance of production and the environment, taking into account the natural and climatic potential, land and biological resources of the territory. This should become the main principle in the ongoing strategy for the further development of a large-scale agro-industrial production in the national food supply system, in accordance with which the development of comprehensive programs for the location of production and the conditions for its use in order to fill the food market and minimize environmental consequences should be taken as a basis for managing the development of this sector.

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