

Digital transformation of agricultural business processes in the system of factors ensuring food security in Russia

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Abstract. The article examines the concept of food security as a key element of the country's national security system, describes its tasks in the context of sanctions pressures on the main sectors of the economy, including agriculture. The author's classification of the factors influencing the provision of food security in Russia is given, their content and dynamics of development are disclosed. The definition of agricultural business processes is given, the classification of their types and decomposition for the sub-sector of field farming with the allocation of precision agriculture is given. The problematic field of practical implementation of the process of digital transformation of the agricultural sector has been identified and the main directions for overcoming it have been outlined.

1 Introduction

The problem of ensuring food security in Russia in modern socio-economic conditions is currently one of the most relevant among both scientists and practitioners [1, 2, 3, 4]. It became particularly important in connection with the adoption of the "Food Security Doctrine of the Russian Federation" [5] and the elimination of the consequences of the COVID-19 pandemic [6, 7].

Food security occupies a special place in the overall national security system of Russia, along with its elements such as economic, social, demographic, information, political, environmental and man-made security.

As for the definition of food security, its various variants are given in the economic literature, but all of them, to one extent or another, link it with a multi-purpose system, the development strategy of which consists in fully providing the country's population with high-quality food by creating competitive domestic agricultural production through the use of innovative technologies and the implementation of import substitution policy [8, 10].

The main composition of the issues that are debatable in the problem field under consideration, in addition to determining the essence of food security, includes: conditions and directions for its provision; the role of agriculture in this process [11]; spheres of

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influence, tasks and problems of its assessment [12, 13]; as well as risks arising during the implementation of the program import substitution [14, 15].

In our opinion, the central place, from the point of view of theoretical and methodological aspects and the implementation of the integrated approach principles, is occupied by the study of factors affecting food security and allowing it to be provided at the proper level for the population of Russia. Several publications can be noted, which provide a classification of such factors, consider their features and trends of change [15, 16, 17, 18].

Nevertheless, in the available publications, such a factor as the digital transformation of agricultural business processes is insufficiently represented, which, to a certain extent, is explained by the fact that the process of digitalization in the agricultural sector is still at the stage of its formation and preliminary study. Nonetheless, despite this, the analyzed area of scientific research should undoubtedly be widely developed, considering the positive domestic and foreign experience, as well as the identified negative trends.

2 Materials and Methods

To constantly maintain Russia's food security, as a state of the country in which the population is guaranteed food security at the level necessary for its normal functioning, regardless of the conditions of the external and internal environment, it is necessary to constantly monitor and predict the factors that affect it.

Etymologically, the term "factor" is interpreted as "a driving force, an essential circumstance in any process or phenomenon" [19]. In other words, a factor is a phenomenon or process, an object or a subject that causes various changes in a certain system.

Considering this circumstance, the approaches of various authors regarding the classification of food security factors in Russia, as well as the authors' own point of view, the following classification can be formed (Figure 1).

Let's explain some of the factors affecting the country's food security.

Regarding the availability of long-term programs and projects for agriculture development, first of all, it should be noted the "State Program for the development of agriculture and regulation of markets for agricultural products, raw materials and food", the main activities of which should be implemented by 2025 [20]. At the first stage (2013-2017), the purpose was to ensure food independence, and at the second, starting in 2018, to ensure food independence, increase exports of agricultural products and increase the amount of investments in fixed assets of the industry. The main software objectives have been implemented over the past period, but experts express concern that further achievement of targets is associated with certain risks due to a decrease in funding for the State Program of the Russian Federation "Integrated Rural Development" [21].

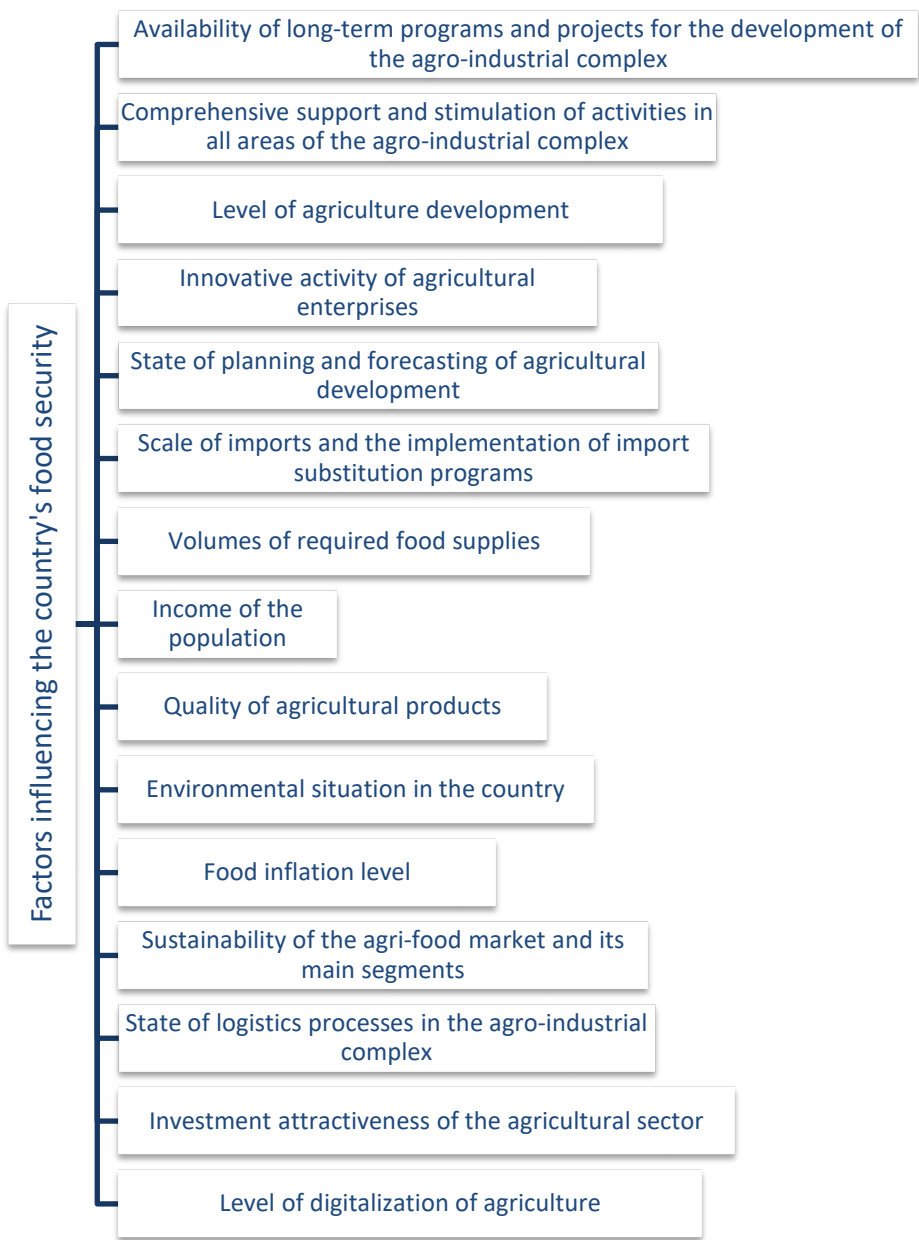


Fig. 1. Factors affecting the country's food security

Undoubtedly, government support, currently provided in a wide range of areas, is crucial for ensuring Russia's food security (Figure 2).

A large number of factors that ensure Russia's food security are related to the level of agricultural development (innovative activity of agricultural enterprises, the state of planning and forecasting in the industry; the quality of agricultural products; the state of logistics processes; investment attractiveness, the level of digitalization; the scale of imports and the implementation of import substitution programs).

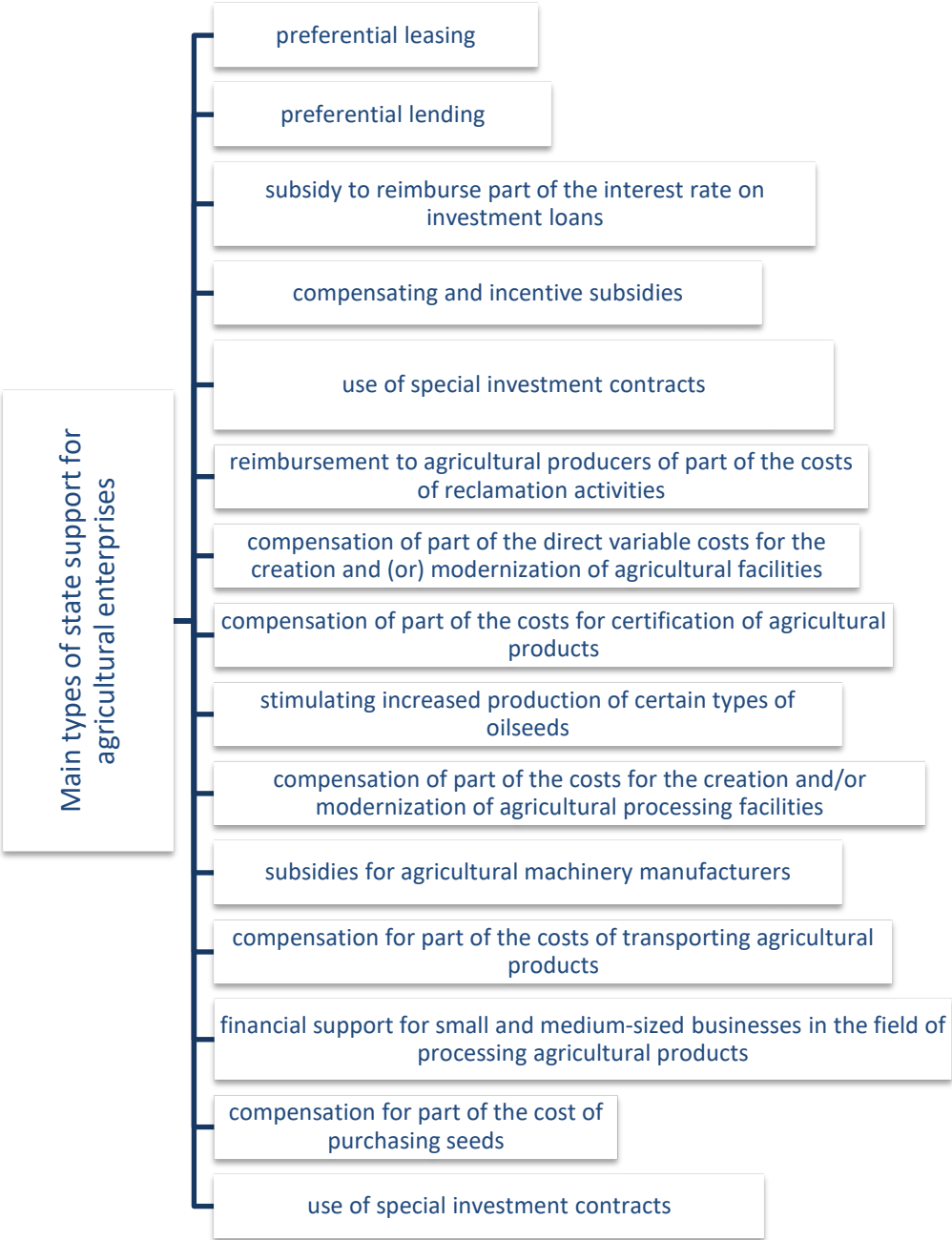


Fig. 2. The main types of state support for agricultural enterprises in Russia

According to experts, it is still impossible to ensure high rates of agricultural development in Russia due to objective reasons caused by the socio-economic situation in the country. The Russian Federation is currently in a situation of foreign policy sanctions pressure, the use of a wide range of discriminatory measures against key sectors of the national economy, an increase in conflict potential in the regions of the country's economic interests, changes in the structure of global demand for energy resources, vulnerability of

information infrastructure and exhaustion of the export-raw material model of further development of the country. It should also be noted that the development of the country's economy as a whole, as well as its agricultural sector, was negatively impacted by the COVID-19 pandemic.

In addition, agriculture is characterized by various risks that interfere with improving the efficiency of its functioning. The main ones are the following: technological risks caused by the lag in the production base of agricultural production; climatic and agroecological threats caused by adverse climatic changes and natural phenomena of an abnormal and spontaneous nature; increase in the share of degraded lands; decrease in the fertility of agricultural lands; high inflation and banking system crisis; decrease in the level of investment attractiveness of domestic agricultural enterprises; low level of purchasing power of the population; insufficient financing of sectoral domestic science; unsatisfactory dynamics of updating the logistics infrastructure; social threats caused by a decrease in the attractiveness of the rural lifestyle and a decrease in the rural population in all regions of the country.

Possible scenarios for the remaining factors can be presented as follows.

The creation of the necessary food reserves in the country makes it possible to form a certain level of its food security in the medium term. The country has created State material reserves of the Russian Federation, the so-called state reserves, which represent a strategic fund of reserves of vital resources for several years. State reserves support the stable functioning of the domestic economy in a situation of force majeure, aggravation of the geopolitical situation in the country, natural disasters, as well as reduction or cessation of supplies of imported goods. Given the current realities: the COVID-19 pandemic, a special operation in Ukraine and sanctions pressure from the EU and the United States, it is safe to assume that the volume of food sent to the state reserve will increase.

The impact of household incomes on Russia's food security has, in our opinion, a multidirectional impact. In general, the increase in the average per capita monetary income of the population of the Russian Federation shows a tendency to increase (Table 1, calculated according to Rosstat data).

Table 1. The average per capita monetary income of the population of the Russian Federation for 2014-2022.

Indicator	2014	2015	2016	2017	2018	2019	2020	2021	2022
Average per capita monetary income of the population of the Russian Federation, rub.	2714.2	30254	30865	31897	33361	35506	36240	40304	44937
Basic growth rates, %	100	111,5	113,7	117,5	122,9	130,8	133,5	148,5	165,6
Chain growth rates, %	-	111,5	102,0	103,3	104,6	106,4	102,1	111,2	111,5

In general, over the period 2014-2022, the average per capita income of the population of the Russian Federation increased by 65.6% and amounted to 44937 rubles in 2022. At the same time, the increase in the indicator occurred regularly during the analyzed period, the largest increase in the chain growth rate was in 2015 and 2022 – 111.5%.

Despite this positive trend, part of the population has incomes below the poverty line, i.e. the minimum subsistence level (Table 2, calculated according to Rosstat).

Despite the decrease in the number of people with monetary incomes below the poverty line, and their share in the total population, as a result of the implementation of various social support measures, 14.3 million residents of the country, or 9.8% of their total number, are still in distress.

Table 2. The population of the Russian Federation with monetary incomes below the poverty line and their share in the total population of the country for 2014-2022.

Indicator	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 by 2014, growth rate, %
Population with monetary incomes below the poverty line, million people	16.3	19,6	19,4	18,9	18,4	18,0	17,7	16,0	14,3	-12,3
Share of the population with monetary incomes below the poverty line in % of the total population	11.3	13,4	13,2	12,9	12,6	12,3	12,1	11,0	9,8	-1,5

The analysis of the state of the agri-food market and its main segments is considered in detail in economic publications containing detailed conclusions on this factor of ensuring food security in Russia [22, 23].

All the considered factors affecting Russia's food security are considered in sufficient detail in the economic publications of scientists and practitioners. The only exception is such a factor as the level of digitalization of agriculture, which is only at the stage of its study, which determines the direction of further, promising scientific research on the studied problem.

In the process of performing scientific research, the following methods were used: the index method, the method of comparative analysis, the method of absolute and relative values.

3 Results

Digitalization of agriculture means, first of all, the digital transformation of business processes taking place within the framework of both agricultural enterprises and infrastructure organizations that support their activities.

In its most general form, agriculture digitalization means the process of introducing digital solutions into business practice. At the same time, it is possible to identify the main trend features of agricultural sector digitalization [24, 25]:

- 1. Collecting huge amounts of information and its comprehensive analysis.
- 2. Using the IoT ("Internet of Things").
- 3. Transmission of large amounts of information using digital communication channels.
- 4. Using computer vision to process satellite maps and control robotic equipment.
- 5. Using autonomous control, i.e. the absence of even remote human intervention.
- 6. Integrated use of modern technological solutions.

Scientists quite reasonably believe that the next evolutionary stage of the agro-industrial complex development called "Agriculture 5.0" will be based on comprehensive robotics using artificial intelligence.

Economic publications provide a wide variety of definitions of the "business process" concept, but common to all is its understanding as a set of consistent actions aimed at the rational use of the organization's resources to obtain the maximum possible economic and social effects and increase its competitiveness.

In agriculture, in our opinion, it is advisable to distinguish the following types of business processes (Figure 3).

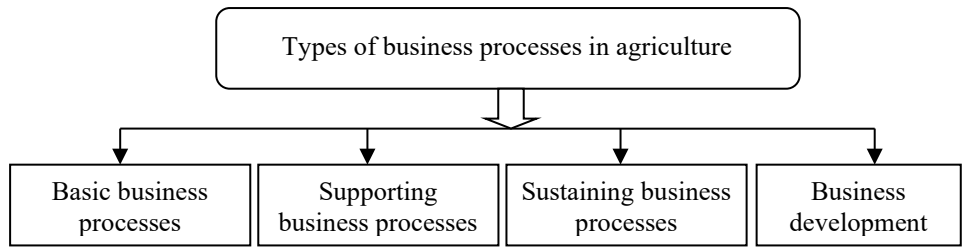


Fig. 3. Types of business processes in agriculture

The main business processes are value-added operations that are directly related to the production of agricultural products.

Auxiliary business processes are not directly related to the production of agricultural products, but without them it is impossible to perform operations that contribute to the creation of added value.

Business development processes contribute to the development of agricultural enterprises.

The supporting business processes are designed to ensure the vital activity of all other business processes and maintain their universal characteristics.

Each of the types of business processes, in turn, can be represented as separate components, which can be shown by the example of animal husbandry (Table 3).

Table 3. Characteristics of the main business processes of animal husbandry as a agriculture sub-branch.

Types of business processes in animal husbandry	Characteristic
Basic business processes	Breeding of cattle, pigs, sheep and goats, rabbits, poultry, fish, bees, horses to obtain a product (milk, meat, wool, skins, down, feather, honey, respectively, etc.)
Supporting business processes	Veterinary and zootechnical services, maintenance of technical equipment, etc.
Types of business processes in animal husbandry	Characteristic
Business development processes	- introduction of innovative management communication technologies; - introduction of resource-saving, knowledge-intensive technologies; - modernization of technological lines, equipment, buildings, premises, storage facilities
Sustaining business processes	Provision of qualified personnel, legal support and support of activities, financial support for the production activities of agricultural organizations

The digital transformation of agricultural business processes will take place within the framework of major innovations in this area:

- safe genetic engineering of seed material;
- zero-flow hydrosystem fishing;
- trough-condensate irrigation systems;
- heart urchins;
- computer management of cattle;
- bioinsecticides and pollinators;
- cocoon-sleeve granaries;
- precision seeding technologies;
- smart greenhouses;
- sensors for monitoring the tillage depth;
- aeroponic farms (growing plants without soil).

Industry 4.0 and innovative technologies are changing agriculture and turning it into a new field – agriculture 4.0.

According to experts, the period of digital transformation of agricultural business processes in the Russian Federation will include three stages [21, 22].

At the first stage (2021-2024), pilot projects related to stimulating the introduction of digital technologies will be implemented, data will be collected from industry representatives and enriched by government information sources.

The second stage (2025-2027) will be associated with large and medium-sized agricultural enterprises. Proven technologies will be scaled up, and government support will be shifted in favor of enterprises implementing digital agricultural production technologies.

The third stage (2028-2030) involves the organization of digital production in crop production and animal husbandry.

Private digital agricultural management platforms, cloud-based management systems for cyber-physical systems and the Internet of Things will be implemented at all stages.

It is quite obvious that the introduction of digital solutions into the business processes of agriculture is very costly, they can be financed mainly by large companies, i.e. agricultural holdings. Nevertheless, there are positions that can be implemented by any category of agricultural enterprises. This means precision farming as the leading trend of resource-saving technologies in agriculture.

The problems of precision farming are actively discussed on the pages of the economic press, causing discussions among practitioners [22, 23, 24, 25, 26].

Precision farming is a modern concept of agricultural management based on the use of digital methods to monitor and optimize business processes of agricultural production to increase the quantity and improve the quality of agricultural products, save all types of resources and increase profits, as well as reduce the negative impact on the environment.

In other words, the use of chemical plant protection products and fertilizers in precision farming is carried out in a differentiated manner, considering soil fertility and other conditions of plant growth and development. At the same time, savings of various types of resources are achieved due to their more rational use.

The advantages of precision farming are presented in table 4.

Despite such obvious advantages, at present the precision farming system is used to some extent only in a few Russian regions [27, 28, 29, 30].

Precision farming equipment is very expensive and is mainly manufactured abroad. Farms are afraid to take risks, i.e. to take loans for these purposes, which, due to the risks, they will not be able to repay. In addition to the cost of the equipment, a subscription to the signal for the car navigator is also paid. Therefore, government support measures for the digitalization of agriculture are being practiced in the regions. For example, in the Rostov region, a regional program is being implemented to support agricultural producers in case they purchase modern agricultural machinery, including using elements of digitalization, in the form of subsidizing 20% of this agricultural machinery cost.

Table 4. The economic result from the use of precision farming elements.

Precision farming element	Economic result
1. Differentiated tillage	1.1 Yield growth 1.2 Fuel economy 1.3 Shortening of work deadlines 1.4 Improving tillage quality
2. Application of differentiated seeding	2.1 Yield growth due to better seed distribution 2.2 Reduction of seed consumption 2.3 Reduction of fuel consumption
3. Using parallel driving systems	3.1 Improving labor productivity 3.2 Improving work quality 3.3 Shortening of work deadlines 3.4 Reduction of fuel consumption
4. Application of differentiated fertilization	4.1 Yield growth 4.2 Saving fertilizers 4.3 Improving crop quality 4.4 Reducing the environmental burden 4.5 Reduction of fuel consumption
5. Application of differentiated use of herbicides	5.1 Saving preparations 5.2 Improving crop quality 5.3 Reducing the environmental burden
6. Irrigation differentiation	6.1 Saving water 6.2 Reduction of energy consumption 6.3 Increasing yields

Thus, it can be concluded that only one of the directions of introducing digital innovations in agriculture raises a lot of problems that agricultural enterprises have to solve to make optimal management decisions in this area. For this reason, the work carried out should be systematic and carried out by implementing the following stages: studying the innovation market in the field of agricultural production; choosing alternative options for innovation; developing an investment and innovation project as part of all its sections and training personnel for innovation.

The digital transformation of agricultural business processes is carried out in all its diversity, problems arise mainly of a personnel and financial nature, therefore it needs state support as one of the key factors in ensuring food security in Russia.

4 Discussion

In today's difficult socio-economic conditions, when Russia is under the influence of an extensive list of discriminatory measures against the leading sectors of the national economy, including agriculture, the country's food security is of great importance as a process of providing its population with high-quality food products in the assortment and high quality necessary for the normal process of life. Agriculture has a decisive role in ensuring the food security of the population of the Russian Federation as part of its two sub-sectors: animal husbandry and field farming.

Increasing the efficiency and effectiveness of the agro-industrial complex functioning in an economy whose leading trend is information technology is the digitalization of its business processes: basic, auxiliary, supporting and business development processes. So far, this process is in its very initial stage with its inherent problems and the non-obvious nature of their solution. Therefore, it is necessary to intensify scientific research and

practical actions in this direction based on the analysis of existing positive domestic and foreign experience.

5 Conclusions

Russia's food security is one of the key elements of the country's economic security in the difficult modern conditions of the functioning of its regions and the transformation of the main sectors and spheres of the national economy. Sanctions measures against the main sectors of the domestic economy, including agriculture, create certain difficulties in ensuring the food security of the country's population, as one of the main factors of their work at enterprises and organizations. In such a situation, radical transformations are required in the activities of all business entities, the leading place among which in the conditions of the digital economy is occupied by the digital transformation of their business processes. In agriculture, it affects such sub-sectors as animal husbandry and field farming, whose business processes are based on the widespread use of information technologies for agricultural production. The practical implementation of measures for the development and implementation of digital business processes has made it possible to identify a number of systemic problems, the solution of which is possible through the introduction of innovations and the use of government support in various types and forms.

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