

## The Concept of Food Security Formation on the Basis of Sustainable Development of Agricultural Land Use

Olena Kotykova\*

Mykolaiv National Agrarian University  
54008, 9 Georgiy Gongadze Str., Mykolaiv, Ukraine

**Abstract.** Solving the problems of food security of those that already exist and those that await us in the near future lies in the formation of a food security system on the basis of sustainable development of agricultural land use. Theoretical and practical aspects of the research problem are carried out by domestic scientists, mainly in two separate areas: food security and sustainable development of agricultural land use. The World Scientific Society pays considerable attention to this problem, but they are distinguished by a practical orientation for a particular region, which often makes it impossible to implement such scientific achievements in Ukraine. In order to develop the Food Security Program on the basis of sustainable development of agricultural land use in Ukraine, an appropriate theoretical and methodological basis is needed, which was determined by the purpose of our study. As a result of the study, the following results were obtained. First, a logical and semantic model of the methodology of food security formation on the basis of sustainable development of agricultural land use, which includes organizational, economic and environmental prerequisites for the transition of modern land use to a model of sustainable development. Secondly, the provisions and directions of implementation of the relevant Concept, based on the historical and socio-economic preconditions of food security, have been formed and includes the following components: purpose; historical and social preconditions; monitoring and evaluation system; assessment of compliance of the level of food security; mechanism for implementing the Concept; target directions and main tasks; expected results. Areas of implementation of the Concept, tools and mechanisms for implementing the model of food security on the basis of sustainable development of agricultural land use on the one hand are fully consistent with the global objectives of 2<sup>nd</sup> Sustainable Development Goals (zero hunger), and on the other – take into account national characteristics

**Keywords:** food system, zero hunger, the model of methodology for the formation of food security, land use in the agricultural sector

### INTRODUCTION

The agriculture is necessary to ensuring food security and improving nutrition, namely: production in sufficient quantities, quality and variety of food; the agricultural sector is a driver of economic transformation and a major source of income for rural households. "Income from agriculture is the basis of livelihood for 1.3 billion people working in this sector, and directly determines their food security" [1]. Many years of world experience show that both agricultural development and economic scaling are necessary factors to improve food security, and the agricultural sector can strengthen the economy as a whole [1].

The development of agriculture "after the Second World War has led to impressive progress in food production. This is largely due to a number of factors:

economic growth, advances in technology and knowledge, and improved supply chain management" [1]. From the point of view of production factors, the increase in agricultural production was due to increased concentration and scaling of processes. However, extensive livestock farming systems on national households and small farms have also significantly contributed to the increase in food production.

"In Ukraine, unlike the member states of the European Union, households still remain the main producers of agricultural products, growing and producing food not only for their own consumption. Currently, this category of households grows much more than all types of crop products (except industrial crops) compared to farms, and the volume of potatoes, vegetables and fruits

#### **Article's History:**

Received: 10.12.2021

Revised: 08.01.2022

Accepted: 11.02.2022

#### **Suggested Citation:**

Kotykova, O. (2022). The concept of food security formation on the basis of sustainable development of agricultural land use. *Ukrainian Black Sea Region Agrarian Science*, 26(1), 40-49.

grown is 98% (98 in 2000 and 99 in 2020), 86% (85 in 2000 and 83 in 2020) and 82% (83 in 2000 and 82 in 2020) of their total volume, respectively. Regarding livestock products, the figures are high as well: 74% (71 in 2000 and 70 in 2020) of milk, 87% (61 in 2000 and 91 in 2020) of wool and 98% (93 in 2000 and 99 in 2020) of honey from their total number in 2016 were produced by households (the data given in parentheses are added by the authors)" [2].

"At the same time, there are well-founded arguments that call into question the fact that current and future directions of agricultural development are sustainable" [1]. In particular: the global agro-food system is unable to ensure food security for everyone – maintaining significant food security, achieving zero hunger and reducing obesity through irrational diets; insufficient social efficiency of food systems; degradation of land, fresh water and ecosystems; significant impact of agricultural sector activities on increasing greenhouse gas emissions and, consequently, climate change, which in turn have a negative impact on agriculture [28].

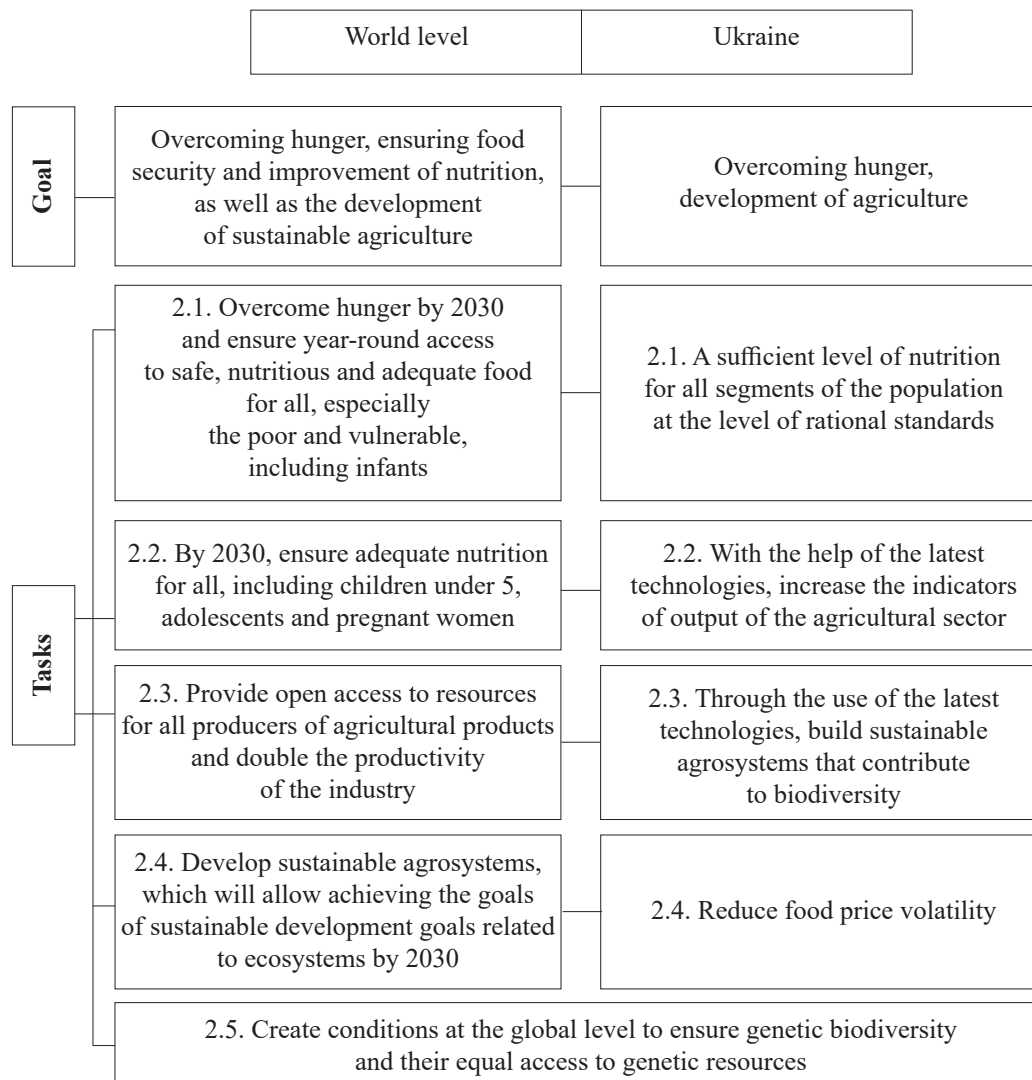
Given the fact that agricultural land is the main method of production, it is fair to say that solving the problems of food security of those that already exist

and those that await us in the near future, including due to significant population growth with ever-decreasing population the area of arable land suitable for growing agricultural products lies in the plane of the food supply system formation on the basis of sustainable development of agricultural land use. Theoretical and practical aspects of the researched problem are carried out by Ukrainian scientists mainly in two separate directions:

– food security – on the basis of the state of the system [3-5], on the basis of the security mechanism [6-8], on the basis of access level [9-10], on the basis of hierarchical level [11];

– sustainable development of agricultural land use [12-14] et al.

After 2015, when Ukraine joined the 2030 Agenda for Sustainable Development, the circle of scientists examining food security through the prism of sustainable agriculture has expanded. However, it should be noted that researchers do not always interpret the concept of sustainable development and use it in their own interpretation, sometimes very different from the content and objectives of 2<sup>nd</sup> Sustainable Development Goals – zero hunger (SDG2), both global and national (adapted to the conditions of Ukraine) (Fig. 1).



**Figure 1.** Tasks of SDG2 at the global and national levels

Source: made by the author according to data [24; 25]

Ukrainian Black Sea Region Agrarian Science, 26(1), 40-49

From the perspective of finding a solution to the problem of food security through the prism of sustainable development, it is advisable to consider the food system. At the same time, there is no consensus among domestic scientists on the essential content of the category "food system". In addition, sometimes in one scientific work you can find several different terms, which the authors, apparently, use to mean "food system". Thus, in the work "Formation of the national food system: present and prospects" [15] the authors, except for the title of the article and annotation, no longer use the term "food system", using instead the concept of "food complex", "agro-industrial complex", "food subcomplex" and others, which obviously identify.

M.P. Sychevskiy [16] in one of his scientific works, uses the term "social food system", but without explaining what meaning the author puts into this concept. At the same time, the researcher identifies the main measures for the formation of the social food system: "full provision of the population with the main types of food products of domestic production; improving the quality of raw materials and finished products; energy and resource saving; introduction of innovative high-performance technologies and equipment; strengthening state influence on the process of full and high-quality food supply of all segments of the population; improving the management system and supporting the priority areas of food industry development" [16]. Thus, according to the measures identified by the author, the social food system is almost identical in content to the global food system. The research of the researcher's scientific work in general gives grounds to claim that using the term "social food system" the author is talking about the introduction of special state food aid programs for the poorest sections of the population, following the example of the United States.

It should also be noted that until recently, scientists have often replaced the concept of "food system" with the term "food security". Thus, Zelenska notes that "food security is a system that includes functional-targeted (agro-industrial complex, consumption, sales, food distribution and reserve) and providing (management, financial, information, logistics, technological, scientific support) subsystems" [17]. The author also notes that food security refers to open systems, which have the properties of dynamic equilibrium, and the mechanisms of action of the components of the system under the influence of various factors determine their stability. From the point of view of content in this case we are talking about the food system, the main task of which is to ensure food security under the influence of external and internal factors.

O.I. Goychuk [18] also in determining the content of the components of food security distinguishes 5 subsystems (provision, functional, target, controlling and regulating), which in terms of content correspond to the categories of the food system. The only difference is that the author adds a control subsystem, which includes food safety indicators, i.e., monitoring the system. The

World Scientific Society pays considerable attention to this problem.

It should be noted that the predominant focus of scientists in food safety research or on certain aspects of the problem with the development of practical recommendations, or on finding systemic solutions, including – the development of appropriate policies that have a more theoretical and methodological direction. In any case, the results of the research should be reconsidered taking into account the specifics of each country and region.

Thus, agree with M. Danse [19] and other researchers, who, in matters of food and nutrition security, emphasize the importance of transforming agriculture and food systems and the role of the private sector in this process. However, the scientists' proposals are based on the results of the study Africa, Asia and Latin America, which differ significantly from the Ukrainian ones in the construction and principles of functioning of food systems and, even partially, cannot be adapted to our realities.

According to the authors of the work "Understanding food systems drivers: A critical review of the literature" it is necessary to identify 12 defining drivers that are crucial for the formation of the dynamics of food systems [20]. The identified trends have a significant impact on the level of food security, and the situation will only get worse over time. After all, according to some indicators, the load on available resources is already beyond the limits of possible reproduction on a planetary scale [21]. In particular, irreversible processes of deterioration of soil quality are already taking place, which requires completely new approaches in the production of agricultural products, in the conditions of climate change, reduction of natural biodiversity and the impossibility of providing the planet with sufficient animal protein without significant disruption of the already unstable ecosystem [22]. These factors are generally recognized and reflected in the CSD-2030, but to eliminate their negative impact on the development of the food system for each country must develop its own policies and programs for their implementation.

F. Galli [23] and other researchers focus on the need to radically reconsider the understanding of the functioning of the food formation system in connection with the development of new policies for healthy eating and sustainable development of agriculture. The work of the researchers is focused on the study of the impact of the Common Agricultural Policy (CAP) on the development of food systems, depending on the policies and practices that were proposed as part of the implementation of the CAP, with the aim of determining the determinants of both positive and negative impact on the system and, based on established patterns, providing proposals for the introduction of strategic tools for ensuring the sustainable development of the food system.

In summary, wash the following. The peculiarity of such research is their practical orientation, and thus – scientific achievements are focused on specific proposals to address a limited range of issues for a particular

region. That is why the implementation of such scientific achievements in Ukraine is not always expedient and, in general, possible. In order to develop the Food Security Program on the basis of sustainable development of agricultural land use in Ukraine, an appropriate theoretical and methodological basis is needed.

*The purpose of the article.* The study envisages: first, to develop a logical and semantic model of methodology for the formation of food security on the basis of sustainable development of agricultural land use, which includes organizational, economic and environmental preconditions for the transition of modern land use to sustainable development; secondly, to form the provisions and directions of implementation of the relevant Concept, based on the historical and socio-economic preconditions of food security.

## MATERIALS AND METHODS

The theoretical basis of the research is the fundamental scientific provisions of food security, state land management and food security; the economic theory that determines the laws of development of land relations; scientific works of Ukrainian and foreign scientists on the evolution of food security and agricultural land use.

The study uses the following methods: an abstract-logical method (the formation of principles, theoretical generalizations and conclusions; the study of the Concept content of the sustainable land use); monographic (the study of the scientific papers on the agricultural land use sustainability issues, the study of the historical and socio-economic preconditions for food security); elementary and theoretical analysis and synthesis (the study of the relationships and the impact

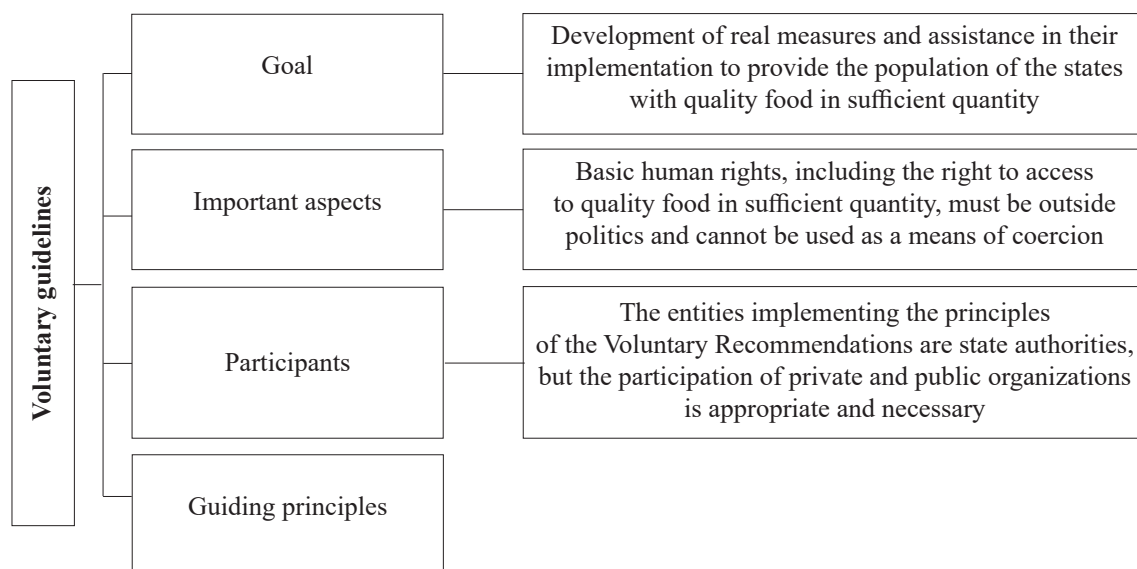
of the agricultural land use development on the level of food security); the direct synthesis and analysis (the analysis of the environmental, agricultural and land legislation of Ukraine and the EU countries); modelling (modelling of the food security system).

The research is based on open data, reports, protocols, program documents, etc. official and authorized bodies of Ukraine and EU countries; open research results of scientists; open global sources of information, such as analytical reports and statistics, were used in the research State Statistics Service of Ukraine, Food and Agricultural Organization, United Nation.

## RESULTS AND DISCUSSION

The model of food security methodology based on sustainable development of agricultural land use, should include: principles of food security formation; levels of food security; levels of food security management; mechanism for achieving food security; tools for food security management.

Taking into account the fact that the content of food security determines everyone's access to quality food in sufficient quantity, we have laid the basis of the principles of food security on the basis of the sustainable development of agricultural land use, we were guided by Right to Food Guidelines [26]. Since the achievement of food security should be based on sustainable development of agriculture in general and agricultural land use as a basis for agricultural business, the principles of sustainable food development based on sustainable development of agricultural land use, we also include the principles of sustainable bioeconomy. The main content of the Voluntary guidelines is shown in Figure 2.



**Figure 2.** Contents of the Voluntary guidelines to support the progressive realization of the right to adequate food in the context of national food security

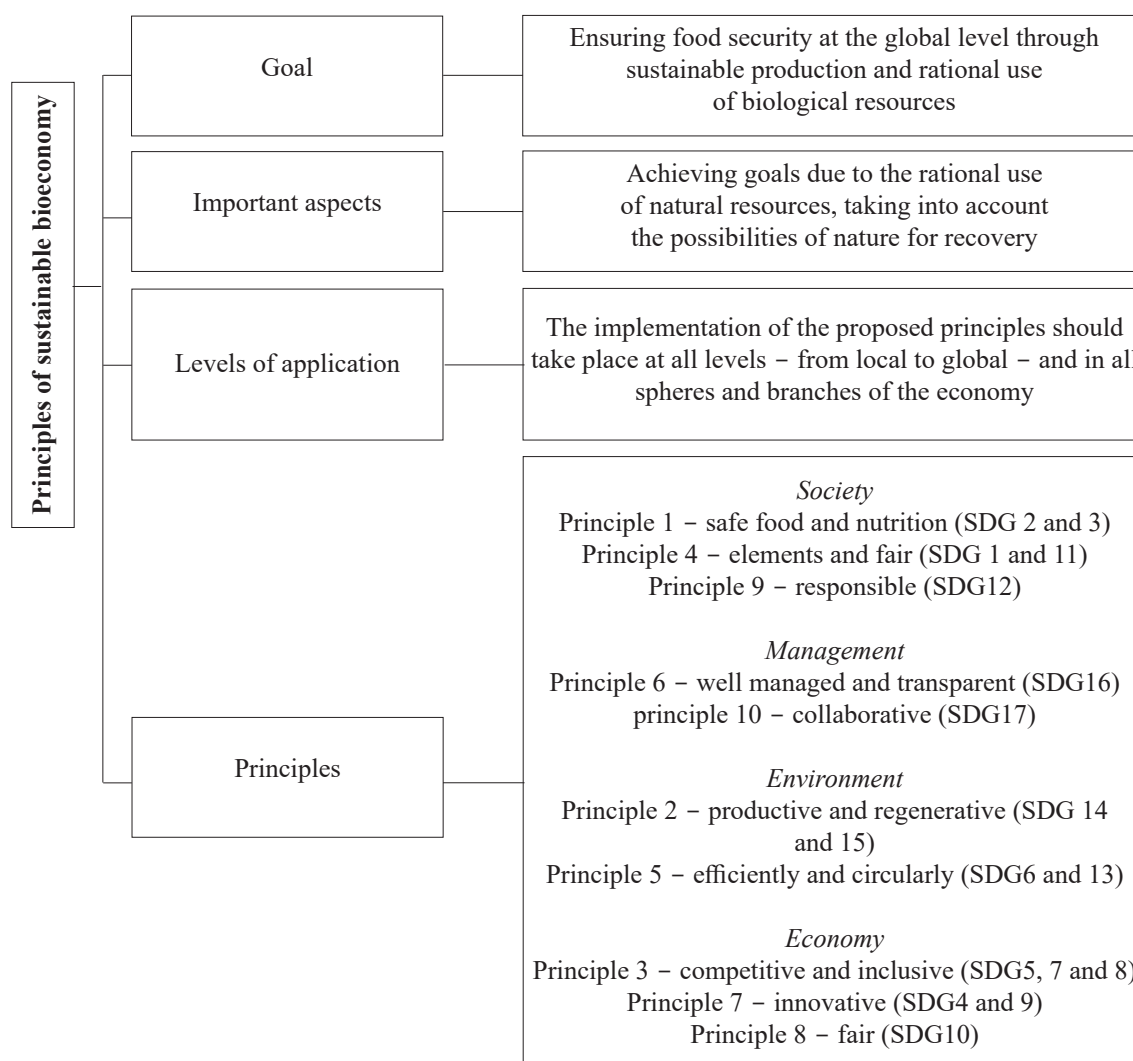
**Source:** made by the author according to data [26]

In 2016, the International Working Group on Sustainable Bioeconomy (ISBWG) was established, the purpose of which is to help in the development of programs

and strategies for the introduction of zero-waste bioeconomy [27]. ISBWG is also an advisory body to FAO on the technical work of the Organization for sustainable

bioeconomy of closed cycle [28]. FAO's extensive experience in biomass production and technology, processing and consumption complements other global bioeconomic initiatives, focusing primarily on the sustainable transformation of agri-food systems [28]. For example, new products based on the use of biological technologies instead of the use of traditional chemical compounds aimed at both the producer and the consumer; deployment of new technologies that contribute to sustainability without reducing the level of productivity; virtually waste-free production due to the use of all biomass through repeated processing for both production needs and consumption; focus on technologies that are natural; application of

technologies aimed at restoration and protection of natural resources involved in the production process, etc. [29]. Bioeconomic strategies are multi-sectoral and face greater challenges than sector-oriented sustainable development strategies, as the implementation of a sustainable bioeconomy compromises between different sustainable development goals, on the one hand, and sectors, on the other. Through enhanced dialogue between international partners, the ISBWG raises awareness of potential synergies and trade-offs related to the implementation of the bioeconomy, as well as opportunities for sustainable development and non-waste [28]. The content of the principles of sustainable bioeconomy is presented in Figure 3.



**Figure 3.** The content of the principles of sustainable bioeconomy

**Source:** made by the author according to data [28]

The levels of management of the food security system are determined by the levels of its provision. Thus, to ensure food security at the national level, tools, means and mechanisms of state regulation are used, at the regional level – local government, at the household level – internal government, and at the individual level – it is necessary to use joint initiatives.

Full organizational and economic mechanisms to reduce food losses and food waste are described in

the work of M.M. Babych [2]. It is important that the proposals are presented in terms of stages (from production to consumption) in the food chain. In particular, the organizational mechanisms include the following [2]:

- at the stage of production – donation of crops unsuitable for sale; conversion of unsuitable agricultural crops into value-added products; use of the latest technologies and modern equipment in the production process and during the collection of products; improving access to infrastructure and markets;



– at the storage stage – improvement of food storage technologies; introduction of energy-efficient equipment for storage of products with low carbon content; use of equipment and technologies that protect products from the penetration and reproduction of non-specific microflora; improving infrastructure (e.g. roads, access to electricity);

– at the stage of processing and packaging – reengineering of technological processes of products' processing and packaging; improving the supply chain management system; use of packaging that will ensure longer storage of food without losing its quality, taking into account the optimal volume of packaging; reprocessing or repackaging of products that have not lost their nutritional properties and quality;

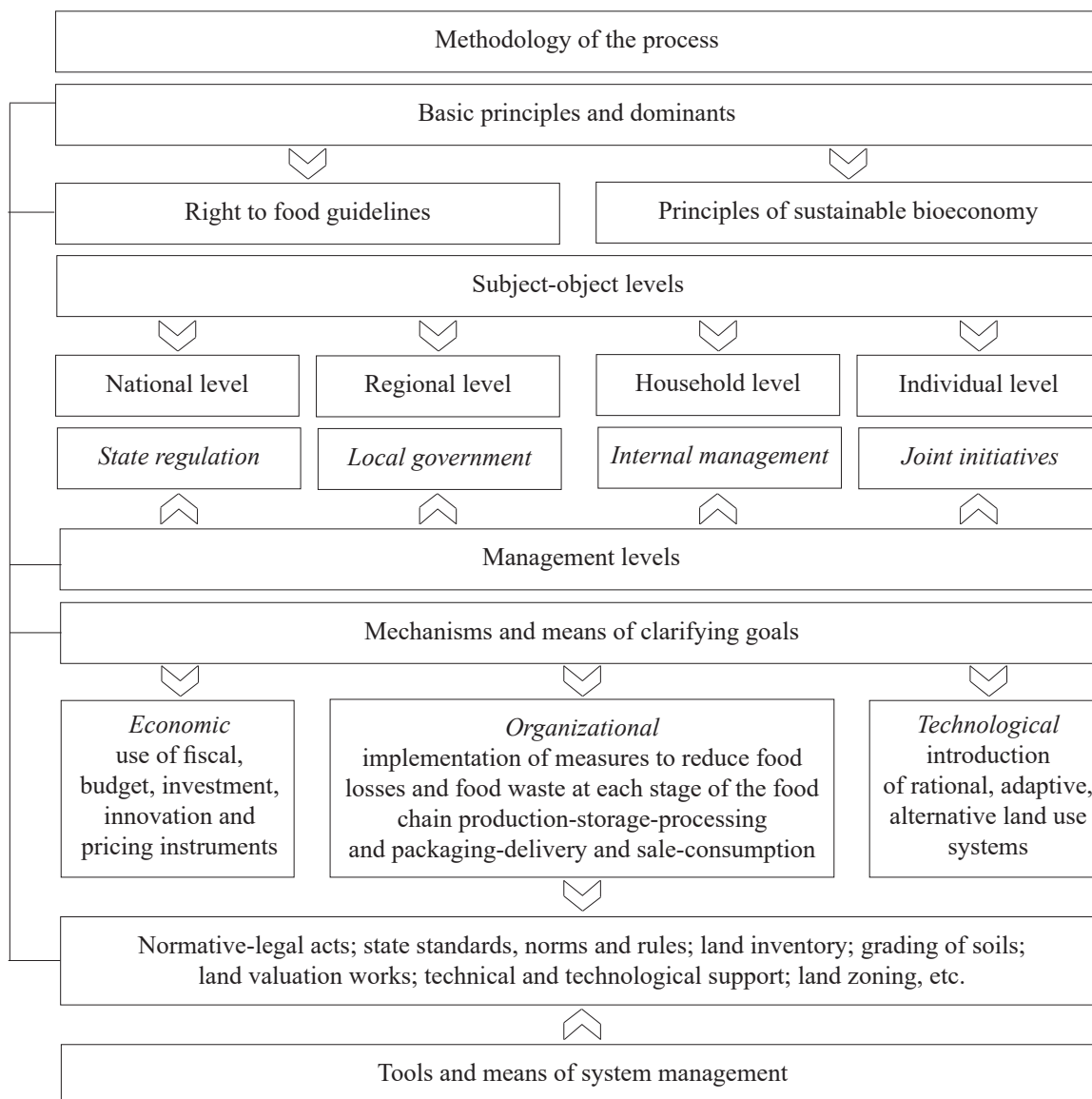
– at the stage of delivery and sale – donation of unfit for sale food (for example, damage to packaging); clear guidelines for food storage and strict adherence; improving the rules of food labeling; extensive use of promotions;

– at the stage of consumption – donation of unfit for

sale food in catering establishments; reduction of portion size or the possibility of ordering different portion sizes; conducting campaigns on consumer education (the general public, especially schoolchildren); consumption of "imperfect" in appearance products.

Regarding economic mechanisms, we support the position of M.M. Babych [2]. Among the technological mechanisms for achieving food security on the basis of sustainable development of agricultural land use, include rational, adaptive and alternative land use systems. Forms of sustainable agricultural land use and farming systems are closely interrelated, as the former determine the latter [30]. System management tools include a fairly wide spectrum of measures, means, mechanisms and methods of both economic and legal, administrative, agro-technological and ecological direction [30].

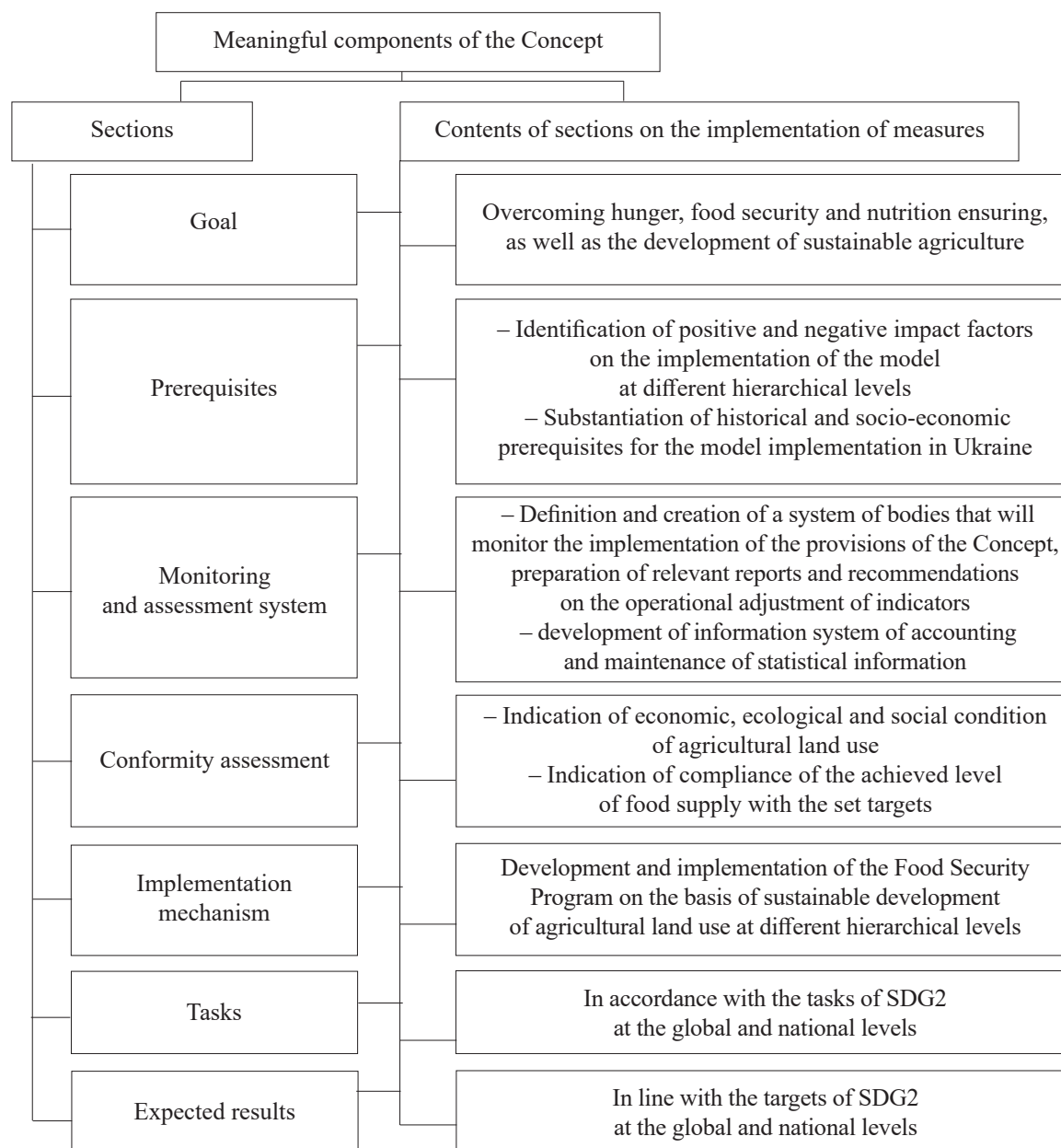
In general, the author's vision of the methodological requirements for the formation of food security on the basis of sustainable development of agricultural land use is presented in Figure 4.



**Figure 4.** Logical and semantic model of methodology for the formation of food security on the basis of sustainable development of agricultural land use

Source: made by the author

The proposed model of the methodology of food security formation on the basis of sustainable development of agricultural land use allows to form the provisions and directions of implementation of the relevant Concept (Fig. 5).



**Figure 5.** The main provisions and directions of implementation of the Concept of food security on the basis of sustainable development of agricultural land use

**Source:** made by the author

Components of the Concept of food security on the basis of sustainable development of agricultural land use (hereinafter – the Concept) are based on the approach proposed earlier in the construction of the Concept of sustainable development of agricultural land use in Ukraine [23].

The goal of the Concept is the global goal of sustainable development – this approach ensures the

achievement of the defined goals of the Sustainable Development Goals. It is also necessary to take into account the peculiarities of Ukraine, which have both a negative and a positive impact on the process of introducing a food security model based on the principles of sustainable development of agricultural land use (Fig. 6).



**Figure 6.** Influencing factors and preconditions for the implementation of the Concept of food security on the basis of sustainable development of agricultural land use

**Source:** made by the author according to data [23]

In order to obtain data on the implementation of the Concept, it is advisable to conduct ongoing monitoring. It is proposed to indicate the economic, environmental and social status of agricultural land use according to the proposed method [30]. It is advisable to assess the compliance of the achieved level of food security with the established targets according to the indicators defined by the State Statistics Service of Ukraine and FAO, comparing them with the defined targets (paragraph 7 of the Concept "Expected Results").

Implementation of the Concept involves the development of an appropriate Program, which includes a financial unit for the implementation of certain tasks (paragraph 6 of the Concept "Tasks").

## CONCLUSIONS

The investigated problem is complex and multifaceted, which requires a combination of knowledge and efforts in various spheres of life: from political-economic to natural-climatic. Taking into account the fact that in Ukraine the development of the food system on the basis of sustainable development is at the stage of its

formation, the results of the study are concentrated in the theoretical and methodological plane, in particular:

- methodologies of food security formation on the basis of sustainable development of agricultural land use – the application of Voluntary guidelines and principles of sustainable bioeconomy is substantiated; the expediency of application of certain hierarchical and managerial levels is proved; the use of specific mechanisms and tools of economic, organizational and technological direction is proposed;

- the main provisions and directions of implementation of the Concept of food security on the basis of sustainable development of agricultural land use, which includes 7 sections necessary for the development of the program and agreed with the Sustainable Development Goals in terms of achieving zero hunger and sustainable agriculture.

Further research should focus on the development of the Food Security Program on the basis of sustainable development of agricultural land use and regulatory support of this issue in Ukraine, taking into account European standards and norms.



### ACKNOWLEDGMENTS

This study is prepared as part of the implementation of the grant “The European experience of forming a food security system based on principles of sustainable

agricultural land use development”. This study was supported in part by the Erasmus SUPPA program – Jean Monnet Associations Application No. 611556-EPP-1-2019-1-UA-EPPJMO-SUPPA.

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## Концепція формування продовольчої безпеки на засадах сталого розвитку сільськогосподарського землекористування

Олена Іванівна Котикова

Миколаївський національний аграрний університет  
54008, вул. Георгія Гонгадзе, 9, м. Миколаїв, Україна

**Анотація.** Вирішення проблем продовольчого забезпечення тих, які вже наявні, та тих, які очікують нас у найближчій перспективі, лежить у площині формування системи продовольчого забезпечення на засадах сталого розвитку сільськогосподарського землекористування. Світове наукове товариство приділяє значну увагу визначеній проблемі, проте їх відрізняє практична спрямованість для певного регіону, що часто унеможлиблює імплементацію таких наукових здобутків в Україні. Для вироблення Програми продовольчої безпеки на засадах сталого розвитку сільськогосподарського землекористування в Україні необхідним є відповідне теоретико-методологічне підґрунтя, що було визначено метою нашого дослідження. В результаті проведеного дослідження отримано наступні результати. По-перше, розроблено логічно-смыслову модель методології формування продовольчої безпеки на засадах сталого розвитку сільськогосподарського землекористування, що включає організаційно-економічні та екологічні передумови переходу сучасного землекористування на модель стійкого розвитку. По-друге, сформовано положення і напрями реалізації відповідної Концепції, що базується на історичних та соціально-економічних передумовах продовольчого забезпечення та включає наступні складові: мету; історичні та соціальні передумови; систему моніторингу та оцінки; оцінку відповідності рівня продовольчого забезпечення встановленим цільовим показникам; механізм реалізації Концепції; цільові напрями та основні завдання; очікувані результати. Напрями реалізації Концепції, інструменти та механізми реалізації моделі продовольчої безпеки на засадах сталого розвитку сільськогосподарського землекористування, з одного боку, повністю узгоджуються із глобальними завданнями 2-ї Цілі сталого розвитку (подолання голоду), а з іншого – враховують національні властивості

**Ключові слова:** продовольча система, нульовий голод, модель методології формування продовольчої безпеки, використання земель в аграрному секторі