

## **Section Two**

# **INTELLIGENT MATTER**

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### **Ensuring Biosphere Balance in the Context of Agricultural Waste Management**

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Andreichenko, Andrii, Svitlana Andreichenko and Nataliia Smentyna (2021) Ensuring Biosphere Balance in the Context of Agricultural Waste Management. *Philosophy and Cosmology*, Volume 26, 46-61. <https://doi.org/10.29202/phil-cosm/26/4>

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*The article focuses on the relationship between the state of the biosphere and the development of non-waste agricultural production. The objective character of the increasing level of the agricultural business activity's intensity, which generates considerable waste, intensifies adequate resource use. The accelerated development of the non-waste production at the agriculture becomes relevant for the rational combination of this business's effectiveness, ecological safety and social orientation of the business and economic activities. The study specifies the role of science for setting up the "science — technology — non-waste agriculture — society" system. The article considers the importance of non-waste agricultural production for the rational use of raw-materials and energy at the "raw materials — production — consumption — secondary raw materials" cycle and the ecological balance in the biosphere, thereby taking us closer to noosphere. The features of the "mental" attitude to the agro-residues' problem at the national and global levels are disclosed. The article highlights the complex economic, social, ecological, and institutional indicators necessary for the effectiveness of agricultural non-waste production.*

*Keywords: biosphere, resource efficiency, agro-residues, agricultural production, noosphere, circular economy*

Received: 27 September 2020 / Accepted: 2 November 2020 / Published: 29 January 2021

## Introduction

The highest form of rational environmental management is such as human activity, characterized by almost entirely the use of natural resources, which does not pollute the environment and product wastes, and finally returns to nature without breaking its state. The state of the current resource consumption and size of agricultural wastes leads to the conclusion that one of the ways of efficiently solving the problem of adequate natural resource use and environmental protection is non-waste agricultural production. Implementation of the non-waste agricultural production will ensure the rational use of all the components of raw materials and energy and the ecological balance in the biosphere.

Many factors cause the scientific research relevance of the non-waste agribusiness development, the main of which is the need for national and international food security; the importance of environmental preservation in the conditions of the increased intensity of the natural resources use; the objectivity of rising anthropogenic impact on the environment owing to the accelerate scientific and technical progress and vigorous implementation its results into the business practice; the need for the harmonization of the economic, ecological, social and institutional spheres of human activities, which are directly or indirectly involved into the production and marketing the agricultural products; balancing of the results of the manufactures, consumers, business sector and society considering the equality of the current organizational and legal business forms on the market basis.

The complexity of the modern socio-economic and ecological relations and processes occurred while the implementation of non-waste agricultural production significantly raises the importance of developing its methodology (Kucher, 2017; Kravchenko et al., 2020; Andriushchenko et al., 2020). Wide-ranging fundamental issues at the non-waste agricultural production, which are caused by the new socio-political and socio-economical conditions, require its emergent expounding on the basis of the new methodology.

One of the main obstacles to the Ukrainian sustainable development of the agricultural sphere is the resource gap (Bilan et al., 2017; Awwad, 2018; Yatsenko et al., 2019). But

subsistence practices show that this deficit is artificial. Nowadays, a vast amount of resources is not used, namely wastes. The enormous funds are being used to reduce the negative impact of the wastes on the environment. Meanwhile, even greater funds are used for precious mining commodities, which is not strictly necessary if we use an appropriate non-waste technological approach. This implies the need for solving the task of the transformation of the waste into resources. One of the necessary tools of this task's achieving is shifting to the primary use of secondary resources and implementing the non-waste and resource-efficient technologies in agriculture. Thus, the expenses could be transformed into profit. In such a case, the resolute and coherent policy aimed at the economic promotion of the agricultural branch and enterprises to secure the primary resources and replace them with secondary ones, is necessary.

Therefore, it is necessary to look for the most appropriate way to use the agro-residues to emerge from the current negative situation in this sphere (Nitsenko et al., 2018; Jiang et al., 2019). So, non-waste production is the link between nature and economic activity, which determines their balance. Its main goal is to achieve the most effective use of natural resources, conducted simultaneously with concern for future generations.

The research aims to provide a modern conceptual understanding of the interconnection between the state of the biosphere and non-waste production development in the agricultural business. The article presents methodical aspects of the non-waste agricultural production; the links between the effective functioning of the non-waste agricultural production and the study of the noosphere are disclosed; the features of the "mental" attitude to the problem of the agro-residues at the national and global levels are described; the approaches to the assessment of the non-waste agricultural production's development are proposed.

## **Theoretical basis**

Theoretical and practical research in waste management has been emerging since the beginning of the twentieth century. In the 1930s, Bruttini and Fersman have focused their attention on the necessity of the effective use of all countries' overt and covert resources, among which is the huge amount of industrial and agricultural waste and trash (Bruttini, 1931; Fersman 1932).

Bruttini assumed that in case of calculating the cost of losses from the non-use of useful qualities of raw materials, at least approximately, huge figures would appear. Achieving a more rational and intensive use of waste would result in hundreds of millions of public savings in any country (Bruttini, 1931).

The concept of non-waste production was proposed and developed by scientists in the 1950s and 1960s. It was noted that the development and implementation of non-waste technological processes as a major factor of environmental protection from industrial pollution and the rational use of natural resources require careful economic evaluation of the effectiveness of decisions and capital investments. This is especially important because society is not interested in either damaging or increasing capital construction costs because of the extra cost of its maintenance (Gromov et al., 1983).

The problem of the non-waste technologies implementation and non-waste production gained increased attention in the 1980s and 1990s. In those years, the shift to low-waste, non-waste and resource-saving technologies was made. It is defined as the most perspective direction of scientific and technological progress. According to Balatckii and Voloshin (1983), a high degree of production efficiency can be achieved by means of an intensification of public production with reuse or harmless disposal of waste. In the field of production

and consumption, based on economic laws, all aspects of human activity are confronted. The transition to low and waste technologies is a complex process that has the main objective of achieving a closed production and consumption system. Yuri Lebedinskii, Yuri Skliankin, and Pavel Popov assessing the economic characteristics of non-waste production, highlight the following important economic objectives which can be achieved as a result of its implementation: (a) saving “resources for production,” (b) saving “resources for life,” (c) intensification of the use of all material resources involved in economic turnover (Lebedinskii, 1990).

Ukrainian scientists give some aspects of the problem of the non-waste technologies application in agriculture attention.

According to Viatkin (2010), the introduction of non-waste production technologies is an urgent need for those agricultural enterprises that generate a large amount of waste in the production process. Ukraine has a highly developed agricultural sector, in particular crop production, which annually generates a large number of various wastes. Some of the waste is used for the needs of agriculture (organic fertilizer, litter and livestock feed), some for other sectors of the economy, and the rest of the biomass is left unused and often recycled (incinerated, dumped) without any benefit. Much of the unused biomass seems appropriate to involve in energy production (Geletukha & Zhelyezna, 2014).

To ensure sustainable development of the state and quality waste management, it is of utmost importance to respect the principle of formation of environmental consciousness of people, based both on their own behavior and on the promotion of “ecological culture” among others; the principle of greening the socio-economic environment, which implies the creation of institutional conditions for the formation of ecological culture both in the generation system and in the process of waste disposal; the principle of the implementation of the objective function of the system, which provides for the economic benefits of waste management, which are positioned as raw materials for recycling processes in production systems, as well as social effects; the payback principle, which is a motivational component in attracting investment to the construction of utilization capacities for both foreign and national investors (Kolodiichuk, 2017; Sokiran, 2019).

The problem of the shift to the cycle economy, including the questions of rational waste management in the agricultural business, is within the scope of scientists’ interest worldwide.

In some EU countries, the term “pure or more pure technology” is used instead of “low and non-waste technology.” For manufacturing processes, pure production involves the saving of raw materials and energy, the elimination of toxic raw materials, as well as the reduction and decrease of toxicity of all emissions and waste before they leave the process. For the final manufactured goods, a pure production strategy focuses on reducing their negative impact on the environment throughout the life cycle: from raw material production to final disposal of the product. Pure production is achieved through the use of know-how, technology improvement and/or a change in the attitude towards the usual reality (Bjerke, 2014; Osaulenko et al., 2020).

Murray, the author of the concept “Zero Waste,” emphasized: “The idea that waste could be useful, that it should come in from the cold and takes its place at the table of the living, is one that goes far beyond the technical question of what possible use could be made of this or that. It challenges the whole way we think of things and their uses, about how we define ourselves and our status through commodities, by what we cast out as much as by what we keep in” (Murray, 2002).

According to Pauli, the author of the concept of the blue economy, which had become the

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new trend of the twenty-first century, “Our economy is stressed because our material world operates on the basis of physical resources we do not have, and waste we have nowhere to hide” (Pauli, 2012). “With any luck, what we will realize is that making waste is not the problem we must solve. If a living species do not generate waste, it is most likely dead, or at least very ill. The problem we have, and that we must address, is that we waste the waste we create. Consider that the conversion of waste into nutrients both requires and generates energy. While we are always looking for sources of energy for commercial and home applications, ecosystems never need to be wired. No member of an ecosystem needs fossil fuel or a connection to the grid to achieve output, nor is waste an outcome in natural systems. In nature, the waste of one process is always a nutrient, material, or energy source for another. Everything stays in the nutrient stream. Thus, the solution not only to the environmental challenges of pollution but to the economic challenges of scarcity may be found in the application of models we can observe in a natural ecosystem. Perhaps we can turn the dilemma into a solution by broadening our perspective and abandoning the concept of waste” (Pauli, 2012).

However, the issue of the implementation and development of non-waste production has not yet been illuminated sufficiently. Existing studies cover a certain range of issues of this complex problem, but ignore the non-waste agricultural production development’s conceptual aspects.

## Results

Non-waste production is the agricultural production’s type, which uses raw material and energy in the most rational and comprehensive manner in the cycle “raw materials — production — consumption — secondary raw materials” in such a way that any environmental factors do not violate its normal functioning. Such interpretation particularly reflects the essence of the processes, relevant to the modern agricultural sector’s real economy. The above-mentioned definition is not based on the hypothetical possibility of non-waste production per se. Still, it implies that any industrial process is accompanied by the wastes generation, which could be transformed into a consumption product or environmentally friendly component. Non-waste agricultural production provides for achieving the highest level of economic, social and ecological restiveness of such production. The economic, social and ecological benefits from the implementation of non-waste agricultural production into the business practice are:

1. Economic benefits: reduced production cost price and improved quality of the agricultural products; costs reduction for the raw materials, energy, fuel, water; costs reduction for cleaning wastewater and agricultural waste recycling; reduced ecological penalties; minimizing transport costs; revenue growth.
2. Social benefits: improving working conditions and increasing security of the workplace; risk reduction for the staffs’ health; generation positive public opinion; the increasing reputation of the domestic entities at the non-waste agricultural business.
3. Ecological benefits: reduced production resource-intensity; reducing the amount of the agricultural wastes; reduced use of land zoned for the agricultural wastes; emission reduction; improving the nation’s health.

Shift to non-waste agricultural production is the objective process, closely linked to decreasing natural resources and energy use. Today, accelerated research in this field and its results at the business activity become important requirements.

### **Methodological aspects of the non-waste agricultural production development**

The fullest use of agro-residues is the important scientific, technical, and economic challenge of our age. Resolving this problem will be key in achieving effectiveness and balance at the agricultural and agribusiness. Diversity of features characterizes specific agricultural wastes, and it causes the complexity of the management of involving these residues into the business practice. So, it is important to focus on this process by using particular methods at different management levels (Nitsenko et al., 2019; Ostapenko et al., 2020).

Implementation of the non-waste agricultural production into the business practice provides for the research of the following blocks:

- a) theoretical, conceptual and methodological support of the non-waste agricultural production implementation, which involves researching the essence and the concept of non-waste agricultural production, demonstration of the differences between the non-waste and low-waste production, classification of the agro-residues according to different criteria on the basis of reviewing Ukrainian legislation and rules of European law;
- b) analysis of the current state and tendencies of the agricultural business development, including resource-saving technologies use at this sphere, market resource and assessment of the product's competitiveness of the non-waste agricultural production;
- c) organizational and economic support of the non-waste production formation and development, i.e., research of such organizational form of non-waste agricultural production, which allows to increase the production volume and to diversify the assortment; to decrease the expenses for agricultural production; to decrease the cost price for the additional product with the same commodities expenditures; to improve the effectiveness of the fixed capital use and the investment savings;
- d) investment, innovation and marketing ensuring of the non-waste agricultural production, which is an integral part of the technological and organizational decision-making process at the non-waste agriculture;
- e) increasing the economic, social and ecological resultiveness of the non-waste agricultural production, which is key to the competitive development of the non-waste agricultural business entities and the national economy, in general. Thus, the task is to correctly choose the economic, social and ecological resultiveness criterion of the non-waste agricultural production and find ways to improve it.

It should be mentioned that science is one of the leading drivers at the process of socio-economic development of the level of non-waste agricultural production. In a plane of our research, science is the basis of the “science — technology — non-waste agricultural production — society” system's development. Advances in science and technology provide great opportunities for modification of the methods used by agricultural production on the basis of its technological improvement in combination with the most complete and cost-effective use of the material, human and financial resources. The continuous broadening of the range of theoretical and practical issues and increased focus on the methods and tools

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of scientific and practical activity is typical for the development of scientific cognition. There is a growing understanding that receiving significant results depends directly upon the basic theoretical position, more precisely, on the principles-based approach to the problem statement and defining the common directions of scientific research. Science and practice should consolidate their efforts for providing the shift of agriculture towards non-waste production through the improvement of technological, economic and organizational facilities.

### **Research of the non-waste agricultural production's development as the component of the scientific study of noosphere**

Achieving the harmonious development of nature and society is the key issue of the theory of developing noosphere (Petinova, 2014; Melnyk, 2018; Nitsenko et al., 2018; Tytarenko, 2019). Development of the joint vision of humanity, which should secure this harmonious development, is high on all the countries' cooperate actions. The concept of noosphere characterizes changes occurring in the biosphere influenced by the human. It is of great importance in theory and practice.

Vernadsky has defined the biosphere as the holistic geological envelope of the Earth, populated and qualitatively changed to create and improve liveable properties. In his opinion, humanity is a strong geological force and is faced with the challenge of the biosphere's transformation in its own interest. And noosphere is such a new state of the biosphere (Vernadsky, 1987).

Investigations conducted by academician Alexander Fersman — a colleague of V. Vernadsky — and many others have shown that practical human activity nowadays does not get us any closer to higher intelligence, despite significant scientific achievements, and even pull away us from it. The natural environment degrades technogenically. History of the twentieth and the beginning of the twenty-first centuries is characterized by (a) two World Wars and the threat of nuclear war, which could destroy the human civilization; (b) human's inability to reject from the wars as the way to address the conflicts; (c) further extension of the nuclear weapon. These trends demonstrate that the question of the continuous bottom-up development of humanity is far from reality. Since the pattern, identified by James Dwight Dana and which argues the inevitability of occurring noosphere, is typical for the biosphere and could be realized by different human species and civilizations. Thereby, we cannot argue, that *Homo sapiens* is one, who will finally achieve the goal of the shift from biosphere towards noosphere. Much needs to be done, especially in human minds, to bring forward the prediction of Vernadsky about the mental sphere developed in harmony with nature. It remains to be seen that humankind will be able to transform according to the principle of noosphere interaction with nature (Zahorodnyi et al., 2011).

Studying the different aspects of the noosphere concept's development allows proving its importance to address the global challenges to human development in the twenty-first century, among which is the sensible attitude to the agro-residues and resource-savings problem. Solving the problem of rational nature resource use and environmental protection is possible only by improving the recycling methods, neutralization, and utilization. Implementation of the non-waste agricultural production will ensure the rational use of all the components of raw materials and energy at the complete cycle "raw materials — production — consumption — secondary raw materials" and the ecological balance in the biosphere, thereby taking us one step closer to noosphere.



## **The ideology of the conduct with agricultural wastes: national and global aspects**

The necessity of the scientific understanding of the ideology of conduct with agricultural wastes at the national and global levels is due to its affiliation to the public consciousness. Public consciousness is the attitudes and value system of the different social groups and classes, politically, legally, philosophically, ethically, artistically and religiously oriented (Melnik, 2018; Tytarenko, 2019; Osaulenko et al., 2020). Its main goal is consolidating or changing the existing public relations. Due to its logical function, ideology largely determines human behavior and actions to realize the socio-economic and ecological problems of society. An ideology based on the non-waste production principle influences its development and changes production mode through human activity. The key idea of the agricultural non-waste ideology is to ensure their integral highly technological recycling and minimize their negative impact on the biosphere.

Murray is one of the world's leading experts on economic conduct with the wastes and the author of the Zero Waste concept. The Zero Waste concept has its origins in the Japanese industrial TQM concept (total quality management) (Murray, 2002). Its background is the "zero defects" idea, the "approach whereby producers have achieved results as low as one defect per million." Transferred to the arena of municipal waste, Zero Waste forces attention onto the whole lifecycle of products. Zero Waste encompasses producer responsibility, ecodesign, waste reduction, reuse and recycling, all within a single framework. It breaks away from the inflexibility of incinerator-centered systems and offers a new policy framework capable of transforming current linear production and disposal processes into "smart" systems that utilize the resources in municipal waste and generate jobs and wealth for local economies. In his book, Murray has emphasized that "Waste has suddenly become an issue too important to be left to the waste industry. It is seen no longer as simply a sectoral matter — though the waste industry itself has been put under pressure to change. Rather, waste like energy and water is now recognised as pervasive, connecting as it does to every sector of the economy. ... As the questions have widened, so has the response. There has been a shift from the concentration on pollution control to a broader policy of "Zero Waste." "Zero Waste" as a concept has only recently been applied to waste management." So, his main idea is that waste must be useful not only for the waste industry but also for other economic branches. And this is one of the defining features of the postindustrial era. On his opinion, "Waste — both in its process of generation and its treatment — thus takes a central place in strategies of industrialized economies. ... Resource productivity is becoming a major theme of environmental policy" (Murray, 2002).

A significant number of national and international bodies have proposed and implemented the idea of non-waste production and some of them have adopted it in the National Environment Plans or Strategies (e.g., Australian, Dutch, UK governments).

Ukrainian state institutions, public environmental organizations and others, including the private ones, do not sufficiently draw attention to this problem. Therefore, the problems in the conduction with wastes became not only the prerogative of the industry, but also of the general Ukrainian national culture. In Ukraine, in comparison with the developed and highly developed countries, it so happened that there is a huge volume of wastes and there is no waste infrastructure and management (National strategy, 2018).

Thus, it is essential to undertake the retrospective analysis of the conduct with agro-residues in different countries.



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Already in 1930, attention was paid to the idea that the non-use of industrial and agricultural wastes would amount to the wastage of the resources without obtaining proper equivalent. At the same time, the number of industrial wastes has increased in proportion to the industrial production's growth, and industrialization of agriculture, which all this time has been developing, has created new types of wastes, which could be the valued commodity for the new industries, the new fodder base for livestock and the basis for new chemical fertilizers (Bruttini, 1931).

American and West European experience has demonstrated that agricultural waste recycling has become the inexhaustible raw materials source.

In the early 1970s, a significant change took place in animal housing technology. Most European and American countries have refused the straw-based systems and moved to the hydraulic system for manure collection. First of all, it was caused by the refusal to use physical labour in the manure collection process. Hereby, the expenses for the floor cleaning, transportation of the straw to the animal shelters, its refreshment, and further transportation to the field could not be offset by a better harvest. Besides, the microclimate in the building has been deteriorating due to the permanent contact with hummus in an open humus channel (Loehr, 1981).

Not only the USA was concerned with the problem of environmental pollution, namely agricultural wastewater, but also Belgian, Bulgarian, French, Polish, USSR's governments have developed requirements for classification of the main water resources. Many countries have set standards for draining industrial wastewater.

In the late 1970s, Raymond Loehr has emphasized that the state desire to improve the environment's needs from the agricultural entities to decide on the patterns of production and pay considerable attention to waste management (Loehr, 1981). This idea is still urgent for the beginning of the twenty-first century.

In 2014, the issue of changes in the environment, which resulted from economic activity, was the main focus at the World Economic Forum in Davos (World Economic Forum, 2014). More than 30 meetings of the forum focused on climate changes, investment in environmentally sound production, "smart" waste management, and the circular economy's capacities.

A closed-loop economy (in other words — circular economy or non-waste economy) becomes a research subject not only of the highly developed countries, but also developing ones (e.g., China, India, Brazil, and so on). Such a type of economy is considered the potential strategy of society's development and designed to improve its welfare. Such an economy's main idea is to reduce the state's dependence on raw-material and energy resources. Circular economy functioning is modelled on the natural ecosystem example, in which there is no waste.

The circular economy is the concept directed at reducing the material dependence (so-called "loop") and extending the service life of the materials due to their prolonged and wider use (Yi, 2003; Musina & Kvasha, 2014; Pubule, 2014; Nitsenko et al., 2018). The circular economy system provides the long-term retain products' value-added, minimizes, or even nullifies waste production. In this, resources remain in the economic circulation even after the expiration date and are used for creating new value-added all over again. Shift to the new economic system with waste reuse requires changes in the chain of creating value-added — form the product's design to the new business models, from the new ways of wastes transformation into the resources to the new conduct models of the consumers (European Commission, 2014; Jiang et al., 2019; Ostapenko et al., 2020).

From the beginning 2010s, there has been an upsurge in interest in the cycle economy. It is a result of the significant ecological challenges of the twenty-first century, among which are resource gap (namely strategic one, such as rare earth elements) and the negative impact on the environment of industry and unsustainable consumption. The main economic reasons for this increasing interest are price volatility (and its growth) for the goods and potential economic benefits from the new markets with the model of circular economy (Taranic et al., 2016).

In December 2015, the European Commission adopted the plan of action for the economic shift towards circular till 2019. This plan implies that this model becomes the general strategy of the EU sustainable development.

In 2016, the Center for European Policy Studies (CEPS) presented a study *Understanding the Circular Economy in Europe, from Resource Efficiency to Sharing Platforms: The CEPS Framework* (Taranic et al., 2016). It has determined such advantages of the economic shift towards circular one: (1) ecological benefits; (2) cost savings from decreasing the demand for natural resources; (3) additional economic benefits received from establishing new markets.

German, Japanese, Swedish, South Korean, Swedish, American, Danish, Chinese, and Baltic governments have developed, adopted and are realizing the state plans and strategies of the circular economy creation and development on the basis of the resources recycling.

Ukraine still needs urgent reformation of waste management's legal and economic basis, including the agricultural sphere. It should be done using world experience. The problem of the agricultural wastes in Ukraine needs the new vision's development:

1. Sustainable waste management should become the strategic part of the agricultural entities.
2. Agro-residues should be considered as the source of secondary material and energy resources.
3. Agricultural waste generation in production and consumption is needed to minimize.
4. It is necessary to ensure the maximum recycling and utilization of agricultural waste by introducing effective non- or/and low-waste technologies.
5. It is necessary to define resource reuse methods (recycling methods).
6. Agricultural non-waste management must be started by planning rational use of natural resources and agricultural production.

### **Methodological approaches to the resultiveness evaluation of the non-waste agricultural production**

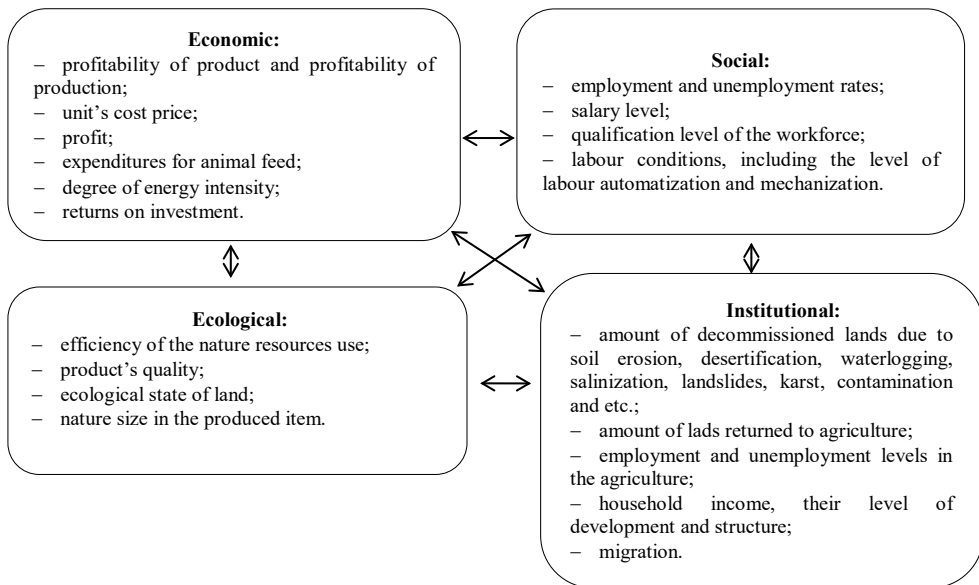
The changes taking place in the Ukrainian agricultural sphere, due to the transition to a market economy, Ukrainian membership in World Trade Organization (WTO), association with EU, necessitated seeking the modern methodological approaches to the resultiveness evaluation of the agricultural non-waste production's development. Thus, the study of the methodological support of the economic, ecological, and social effectiveness of agricultural non-waste management is the key issue of this research.

Still, the universal criterion for evaluation of the production's waste degree has not been proposed. Different production areas have their corresponding criteria. Thus, non-ferrous metallurgy widely uses the rate of complexity, i.e., the ratio of components, extracting from raw-material, which are processed their whole amount relatively. Some industries use the degree of raw-materials and materials used in the technological processes. For example, there is a stripping ratio in mining, which refers to the ratio of the waste material volume required

to be handled to extract some tonnage of ore. In a number of chemical industries, there is a waste ratio with the special its determination. As a result, a particular technological process is ranked by non-waste, low-waste, and traditional characteristics.

It is necessary to evaluate the economic resultiveness and effectiveness of the agricultural waste management's development by the set of indicators that characterize non-waste activities' contribution to the final economic performance.

Different ways can calculate the non-waste management's effectiveness: (1) measuring the absolute economic efficiency of the expenses for the environmental protection; (2) measuring the relative efficiency of the expenses; (3) determining payback periods of the additional capital expenditures. Besides these, there are also combinations of these methods. Thus, agricultural non-waste production is part of the general problem of rational nature resources' use, environmental protection, and increasing the production's effectiveness and organizational level. Hence, the resultiveness of the agricultural non-waste production needs to be evaluated by the complex of indicators, reflecting economic, social, ecological, and institutional features of the researches object (see Figure 1).



Thereby, the economic resultiveness of the agricultural non-waste production is evaluated by the indicators, determining general features of the resource base's scope and the results of this economic and business activity, cash, and in-kind.

The main resources of the agricultural non-waste production are (a) labour; (b) land; (c) material; (d) financial; (e) technical and technological; (f) informational; (g) innovative resources. The efficiency of their use shows the ability to make products and is evaluated by comparison of the volumes of received goods and resource expenditures.

The degree of product's competitiveness of the agricultural non-waste production and degree of the non-waste agricultural entities' competitiveness is the integral indicators of economic resultiveness.

Resultiveness of the agricultural non-waste production could also be evaluated by the indicators of social resultiveness, which is not limited to material well-being (Bilan et al., 2017; Yatsenko et al., 2019; Osaulenko et al., 2020). We shall notice that the deteriorating living conditions of the population in the highly polluted area because of agro-residues creates socio-economic conditions for the shift towards non-waste production. Evidence of the negative social impact of pollutants is primarily evident in the population's health. An integral indicator of the social resultiveness of the agricultural non-waste production is the improvement in the living conditions and life expectancy.

Human as a part of nature is closely related to the environment. Ecology and technology are the two areas, the mutual influence of which develops in the process of society's and its productive forces development. The highest state of technological development must be its "greening." Its main goal is to maintain ecological balance in the implementation process into the business practice of such industrial processes, which guarantees the maximized high-quality production. This objective is met by means of the agricultural non-waste technologies implementation.

Evaluation of the institutional resultiveness of the agricultural non-waste production includes the following indicators: the existence of (a) formal society's institutes (law, property, power), and (b) non-formalized institutes (traditions, customs, mentality).

The transition of agriculture towards a non-waste structure is the objective requirement of its intensification. It is the degree of non-waste in agriculture that most accurately displays the level of economic intensity, technological and technical progressiveness, and production organization. The existence of a link between inputs of materials and the effectiveness of material and labour resource use indicates that non-waste technologies implementation is essential for recourse, funds, and labour maintaining economy. The focus on the Zero Waste Concept in agriculture leads to (a) growing efficiency of the material and raw-material use; (b) reduction of the labour intensity and capital-output degree at the final product; (c) reduction of the expenditures for environmental protection; (d) increased productivity; and (e) increased social benefits.

## **Discussion**

It is important to emphasize the complexity and value of the tasks of Ukrainian and other countries' business transformation into non-waste agricultural production, which are put before our science and practice. It is necessary to push the research in the right direction and to provide practical orientation, in other words, to carry out in-depth and focused research of a certain sphere. The concept of the non-waste agricultural production's development, in turn, directly impacts the scientific and technical activity and defines its directions and, even, its results. Finding solutions to the transcend differences related to ecological, economic, and social problems due to the excessive number of agro-residues is possible only by the agricultural business refocusing on its development's non-waste direction.

Efficient non-waste agricultural production needs for balancing the interests of agricultural business and the state of biosphere. Environmental protection is an integral part of the non-waste agricultural production's implementation process. The economic, ecological and social components of effective agricultural production have a single integrated system. Understanding the scope and the nature of the ecological problems, their correlation with the operating conditions of agriculture allows defining necessary resources that are needed for their solution.

Studying the various aspects of the concept of noosphere formation enables to prove its importance for addressing global challenges to human development in the twenty-first century, among which is the sensible attitude to the agro-residues and resource-savings problem. Implementation of the non-waste agricultural production will ensure the rational use of all the components of raw materials and energy at the complete cycle “raw materials — production — consumption — secondary raw materials” and the ecological balance in the biosphere.

Ideology owing to its logical function largely determines human actions to realize the socio-economic and ecological problems of the society. Ideology, based on the non-waste production concept, will influence its development and is able to change the mode of production through the activity of the humans supporting this idea. The key idea of the ideology of the conduct with agricultural wastes must be ensuring their complex high technological recycling and minimizing the negative impact on the biosphere.

There is no infrastructure of the conduct with wastes in Ukraine, unlike in the other developed countries. The conditions under which the scope of agricultural wastes accumulation exceeds the scale of their recycling, utilization, or neutralization lead to the ecological crises and hamper the country's economic development. The experience of the conduct with agricultural wastes of the developed countries is very illustrative. Since the 1970s, the countries have made many efforts to create low- and non-waste technologies for processing raw materials and production. USA, Great Britain, Canada, Poland, Japan, and some other countries effectively use the huge volume of agro-residues on the ecosystem model.

Ukraine needs the urgent reformation of the legal and economic systems, which regulate the use of the waste, including the agricultural sphere, taking into consideration the world and European experience. Inadequacy of existing methodological base of the analysis of technological, technical and organizational progressivity of the agricultural production complicates the optimal business decision-making process. Underestimation of the effect of agricultural waste use does not allow business entities to receive complete data about the by-products' feasibility and waste industrial recycling. As a result, agriculture suffers considerable economic losses. Systemic application of the non-waste agricultural production of the European development level in Ukrainian practice is a challenge for the leaders of our country. Nevertheless, ensuring the proper state regulation in this sphere and the creation of the necessary organizational and economic conditions is the important step towards addressing complex problems of the country's sustainable development.

## Conclusions

The article presents conceptual, theoretical principles of ensuring a balance between the biosphere and development of non-waste production in the agricultural sector. The examination of questions of the non-waste agricultural production promoting has been carried out through the consideration of such “blocks”: methodological aspects of the non-waste agricultural production development; the link between the efficient functioning of non-waste agricultural production and the noosphere teaching, which are aimed at achieving the development of nature and society; the ideology of the conduct with agricultural wastes; methodological approaches to the resultiveness evaluation of the non-waste agricultural production.

The triad of properties of non-waste agricultural production has been proved: 1) to extract the most valuable and complex components of raw materials, transforming them into useful

products; 2) to ensure the social effectiveness of agricultural production; 3) to eliminate or minimize the harm done to the environment as a result of production and economic activity.

Results of the evaluation of the non-waste agricultural production development's effectiveness are the basis for the managerial decision-making process regarding the selection of ways of the non-waste agricultural production's development; rationalization of the non-waste agricultural production's organization; search for the ways and methods of achieving agricultural business efficiency and its forecasting on the future; creation the system of informational and analytical support of non-waste agricultural production's functioning; ecological balance in the biosphere.



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