AGRISHARING AS THE BASIS OF SUSTAINABLE AGRICULTURE IN THE CONDITIONS OF SOLVING THE WORLD FOOD PROBLEM AS A RESULT OF WAR IN UKRAINE

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The study proves the relevance of solving the problems of the Ukrainian agrarian complex based on innovative approaches, taking into account the importance of the relevant sector of this country in the global dimension. The research used methods of scientific abstraction, analysis of facts and the use of information methods of collecting and processing statistical data in the study of the root causes of the connection between the introduction of martial law in the country and the world food problem, the potential of agricultural production of Ukraine and its place in the world food system. The authors defined the prerequisites for the implementation of the Agrisharing model based on the GIS platform separately for the three elements of the system. The main contribution to the business is providing the material and technical base and investments; educational institutions - training and personnel retraining; scientific institutions – advisory support and development of algorithms.

agrisharing, GIS platform, sustainable agriculture, joint development, sharing economy.

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INTRODUCTION

The degree of importance and necessity of rational and effective development of agriculture in the world is beyond question. The global value added to agriculture has increased by 73% since 2000 to about $ 3.5 trillion. The share of agriculture in the world GDP has remained at about 4% since 2000. Agriculture employed 874 million people in 2020, or 27% of the global workforce (FAO, 2021).

There is a differentiation in the development of agricultural sectors due to the heterogeneity of the relief, soil fertility, and the specifics of the territories in the world. And it is Ukraine that is one of the most powerful agricultural countries in the world, and its problems have already become a global problem (Food and agriculture organization of United Nations, 2022).

Prior to the introduction of martial law on the territory of Ukraine, the country was the source of almost half of the world's oil exports. And in 2021, the Ministry of Agrarian Policy and Food of Ukraine (2021) determined that Ukraine had produced 106 million tons of grains, legumes and oil crops, which was a record. If we compare, in 2023 due to hostilities and worsening weather conditions, Ukraine had a significantly smaller harvest than last year. Namely, 65 million tons of grains and oilseeds will be produced (Ministry of Agrarian Policy and Food of Ukraine, 2022). More than 55% of the territory of Ukraine is arable land, and agriculture provides employment for 14% of the population (Kyridon, 2021).

The Foreign Agricultural Service of the United States Department of Agriculture (2022) estimates that Ukraine

Table 1. Ukraine Agricultural Production and Export (2021/22 year)

Culture	Production			Export		
	Volume (1,000 MT)	Rank among Global Producers	% of Total Production	Volume (1,000 MT)	Rank among Global Exporters	% of Total Exports
Corn	41,900	No. 6	3.5	23,000	No. 4	12.0
Wheat	33,000	No.7	4.3	19,000	No. 5	9.0
Sunflower	17,500	No. 1	30.6	75	No. 9	3.0
Barley	9,900	No. 4	6.8	5,800	No. 3	17.0
Sunflower oil	5,676	No. 2	30.6	4,950	No. 1	46.0
Sunflower meal	5,452	No. 2	27.5	4,100	No. 1	54.0
Rapeseed	3,015	No. 6	4.2	2,700	No. 3	20.0

Source: according to the data (Foreign Agricultural Service of US Department of agriculture, 2022).

exported more than $27 billion worth of agricultural products to the world in 2021, representing 41% of the country's total exports of $68 billion. Ukraine's main export markets were 27 countries, now including the European Union ($7.6 billion), the People's Republic of China ($4.2 billion), India ($2 billion), Egypt (1.5 billion) and the Republic of Turkey ($1.5 billion). These top five markets accounted for more than 60% of Ukrainian agricultural exports. Ukraine had major products with export sales of over 1 billion dollars, such as corn ($5.8 billion), sunflower seeds ($5.7 billion), wheat ($5.1 billion), rapeseed ($1.7 billion), barley ($1.3 billion) and sunflower meal ($1.2 billion) (Table 1). These six major products accounted for over 77% of Ukraine's agricultural exports (Foreign Agricultural Service of United States Department of Agriculture, 2022).

Problems with the export of agricultural products and the potential decline in production in Ukraine will have serious consequences for the world (UN Sustainable Development Group, 2022). The Food and Agriculture Organization of the United Nations (2022) estimates the potential impact of a sudden and sharp decline in agricultural exports in the amount of an 8-22% increase in world prices for both food and feed, as alternative sources can partly offset the shortfall.

Global commodity prices reached an all-time high across the board in March 2022. The Food and Agriculture Organization of the United Nations (FAO) set the third all-time high Food Price Index (Fig, 1) for that period. Over the past 9 months, the world community has achieved a decrease in the corresponding indicator. However, for 2022, the consumer price index averaged 143.7 points, which is 18 points or 14.3% higher than in 2021. Food prices rose at their peak by 34% from the same time last year and have never been so high since FAO collects related analytics (Global Crisis Response Task Team of UN, 2022).

Since the time of the World Wars, there has been no such precedent for a country whose agricultural sector would be of global importance, like Ukraine. This is due to the fact that Ukrainian agriculture plays a key role in the country's economy, and is also a major exporter of staple foods globally. Thus, the consequences of the ongoing war in Ukraine are unprecedented not only for the country's economy but also for global food security. According to preliminary estimates by the United Nations Global Crisis Response Group (2022), 1.7 billion people worldwide live in 107 countries that are highly exposed to at least one of the three global transmission channels of this crisis - rising food prices, rising energy prices and tightening financial conditions. That is, it can be as-

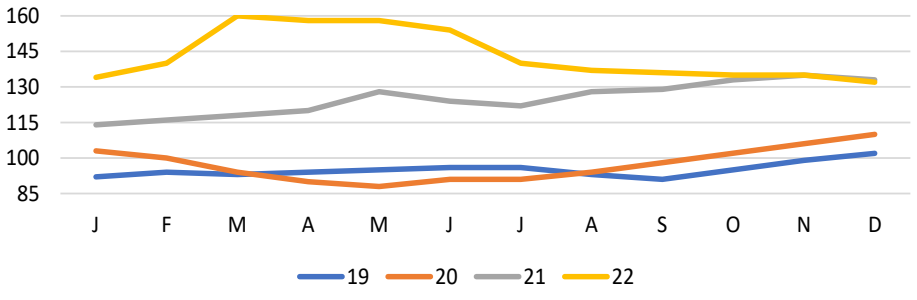

Fig.1. Dynamics of the global consumer price index
Source: developed by the authors and based on the database of the Food and Agriculture Organization of the United Nations (Official website of Food and Agriculture Organization of the United Nations, n.d.)

Table 2. Practical examples and real-world applications of sharing economy in different sectors

No	Examples	Essence	Connection with GIS
Transport services and logistics			
1.	BlaBlaCar, Uber, Just Park, Lyft, Turo, Didi Chuxing, Cooltra, Grab	Platforms for sharing the transport expenses and costs, finding the most effective way of transfer or use of parking space.	GIS-based platforms
Agriculture			
2.	Plantbaby, Europe-agriculture.com, bartsparts.eu, CircleUp, SeedInvest	Platforms for selling local seedlings, renting and selling agricultural machinery and its components,	Partial connection with GIS and its certain elements. Significant prospects for development can be observed, if spatial characteristics are taken into account (on the basis of GIS)
Education and science			
3.	Google Workspace, Knowmax, Wikipedia, Knack, Salesforce Knowledge, Slab, Notion, MOOC, Coursera, TaskRabbit, Zaarly, LivePerson, Simplist, Mechanical Turk	Access to knowledge around the world, allowing you to listen to the best teachers online anywhere and anytime, access to educational platforms.	Certain functions are related to GIS
Food			
4.	Feastly, Traveling Spoon, S- Cambia Cibo, Eatwith, Munchery	Collection of food and distribution among poor families and pensioners; assistance in the use of food products with a final expiration date.	GIS-based platforms
Renting real estate			
5.	Airbnb, HouseTrip, Wimdu, 9flats, Homaway, Neighbor, Djeepo	Real estate rental and sale platforms.	GIS-based platforms
E-commerce and online auctions			
6.	Amazon, eBay, OLX, Retykle	Platforms exchange, sale products	Certain components are related to GIS
Social and health sphere			
7.	Upwork, WeWork, Good Gym ,Vital Health, Bravo Care	Shared workplaces, active and proper movement around the city with things for the elderly instead of gyms; "talent bases" that teach users how to launch startups, cook vegetarian meatballs, knit, etc.	Some are based on the GIS platform, others have links to external GIS.
Media and entertainment			
8.	YouTube, Dailymotion, Amazon Family Library, Netflix, Spotify, Wix, TikTok, Wistia	Shared use and viewing of media and board games using one account.	Partially related to GIS and separate functions related to external GIS

Source: developed by the authors

sumed that these countries will suffer as a result of the military and political situation in Ukraine in the absence of an intensive scenario for overcoming the consequences of the military crisis in Ukraine.

FAO (2022) estimates that between 20% and 30% of the Ukraine areas where winter crops are sown are likely to remain unharvested during the 2022/23 season due to the military and political situation. The foregoing indicates the need to urgently resolve the situation of overcoming the food problem in Ukraine in order to avoid a global food crisis.

This requires a combination of efforts from business, scientific areas, and the educational community. This is possible if the latest tools are introduced that meet the needs and aspirations of the respective triad based on the sharing approach.

Belk (2017, 2010, 2014, 2019), Botsman (2010, 2014), Mont (2020), Walsh (2011), Dabbous (2020) with co-authors have devoted their work to the sharing economy. The very idea to share the surplus resource came from San Francisco designers, Brian Chesky and Nathan Blecharczyk. It has grown into a powerful business in the form of Airbnb.com, the largest sharing platform. The concept of shared consumption was formed by scientists in 2010. Botsman and Rogers (2010) in their work substantiate the basic concept of sharing, which consists in the idea of the absence of ownership and the dominance of the definition "what is mine is yours". The sharing economy promotes the sharing of goods that are underutilized and show a systematic excess of capacity that allows them to be shared. Experts define the sharing economy as an area of relationships that allows you to earn money from lost assets. Thus, physical assets are provided as services. Analysts agree that the sharing economy favors the use of property over ownership (Hartl et al., 2016; Dupuis et al., 2016). Therefore, the sharing economy is

Table 3. Production and trade of the main agricultural products of Ukraine - facts and forecasts

	Production, kt		% in the world		Import, kt		% in the world		Export, kt		% in the world	
	2018-20	2021-30	2018-20	2021-30	2018-20	2021-30	2018-20	2021-30	2018-20	2021-30	2018-20	2021-30
Wheat	26011	35858	3.46	4.27	15	15	0.01	0.01	17679	27247	9.77	12.39
Corn	33988	44009	2.95	3.35	38	39	0.02	0.02	27997	36903	15.73	17.83
Other coarsegrain	9599	11662	3.19	3.55	17	17	0.05	0.04	4429	6408	10.30	12.09
other oilseeds	18366	22580	11.77	12.61	30	31	0.12	0.14	2651	3535	12.50	14.70
Protein food	7589	9140	2.15	2.25	30	29	0.03	0.29	5245	6672	5.65	6.64
Vegetable oil	6876	8403	3.24	3.40	281	212	0.33	0.22	6373	7648	7.30	7.89
Meat	2234	2696	0.68	0.72	414	324	1.20	0.85	445	550	1.20	1.38

Source: compiled by the authors and based on data from the Organization for Economic Cooperation and Development and FAO (OECD/FAO, 2021)

a system based on the sharing of material and human resources. It is a model where process participants can exchange assets that they do not use with the help of technology and online platforms. Practical examples and real-world applications of sharing economy in different sectors are shown in Table 2.

As for the interaction between government structures and the private sector, it should be noted that scientists from all over the world, such as Felsinger (2008), Rankin (2017), Pattberg (European court of auditors, 2018) studied the details and features of the development of public and private partnerships in different sectors. Currently, research on the sharing economy in public and private partnerships is ongoing (Ilbiz et al., 2023).

Roger Tomlinson, Howard Fisher and Jack Dangermond (ESRI, n.d.) are the most prominent figures in the use of GIS technologies as the basis of an Agrisharing platform. Roger Tomlinson is the 'father of GIS'. He was responsible for the creation of the Canadian Geographic Information System (CGIS) in the 1960s. In 1964, Howard Fisher created one of the first computer mapping programs, known as SYMAP, at Northwestern University. In the 1970s, the first vector GIS, called ODYSSEY GIS, was developed at the Harvard Computer Graphics Laboratory under the direction of Jack Dangermond.

But scientific research that combines the interaction of educational, scientific and business structures on the basis of a sharing platform requires attention and disclosure of the relevant opportunities.

MATERIALS AND METHODS

The study aimed to determine the prospects and stages of the implementation of Agrisharing as a general consumption of material goods, natural resources and intellectual capital of scientific, educational and business structures of the agricultural sector in the context of solving the world food problem as a result of military events in Ukraine.

As a result of scientific abstraction, the authors studied the root causes of the connection between the introduction of martial law in the country and the world food problem in the period from February to April 2023. When analysing the facts and using information methods for collecting and processing statistical data, the authors determined the potential of Ukraine's agricultural exports and their place in the world's food system. The global significance of Ukraine in the world food system has been determined through a combination of historical and logical methods of research. The authors reflect on the dynamics of the consumer price index in

the world over the past 4 years using the graphical modelling method and clearly show its increase during the critical period of the introduction of martial law in Ukraine. The study used tabular modelling to determine the potential and the place of Ukraine in the 2021/2022 marketing year in the context of the main crops.

The authors proposed a combination of the efforts of science, education and business on the basis of a GIS platform to overcome the food problem of the world in the process of Ukraine's exit from the crisis period as a result of a synergistic approach to solving global problems of the food system.

Taking into account the main participants in the Agrisharing system, an analysis and comparison of the advantages of using GIS for each area separately was carried out - in the scientific field, in education and in the agricultural business. With the help of information research, empirical information was obtained, which gave a holistic view of the fundamentals of Agrisharing, making it possible to form its structural components and make a qualitative description of the structure and procedure for creating a platform for the harmonious development of the corresponding process.

RESULTS AND DISCUSSION

Position of Ukraine in the World Food Security System

All countries have already recognized Ukraine's role and place in the world food security system. Over the years of independence, a full-fledged vision of Ukraine's main product and brand has not yet been formed. However, there is an undoubted fact about Ukraine's wealth in terms of natural resources. Therefore, in the world, it is considered a raw material base, and 70% of Ukrainian exports are raw materials assets (Ministry of Agrarian Policy and Food of Ukraine, 2022).

According to the forecast data for 2021 of the Organization for Economic Cooperation and Development and FAO (2021), the percentage of world exports of wheat, corn, other grains, oilseeds, vegetable oil and even meat from Ukraine should have grown by all of the above indicators by an average of 1.3% (from 0.2% meat to 2.6% wheat) (Table 3).

In recent years, the position of Ukraine has significantly increased in various world rankings, and not only as a source of raw materials. So, since 2018, Ukraine has been featured in the cybersecurity rating, occupying the best average positions. It has risen in the world ranking of English proficiency, and it is in 44th place out of 100. There is progress in the overall innovation rating. Namely, this is the 49th place, which ensured entry into the TOP -50 in the Global Innovation Index (World Intellectual Property Organization, 2022). According to the European Data Portal (Hesteren et al., 2021), Ukraine (it took part in this rating for the first time in 2020) was included in the list of fastest-growing countries (Fast trackers). Ukraine demonstrated the maturity level of the open data sphere at the level of 84%, scoring 2447 points (while it was 2180 points in 2020) out of a possible 2600 points (this is the 6th place after France, Spain, the Republic of Poland, Ireland and Estonia), while the average maturity level of the open data in Europe was 81% in 2021. The first place in the corresponding rating was taken by France (2535 points), and the last place was taken by Georgia (443 points). Ukraine received high scores for public policy. It includes the compliance of legislation with international standards; state strategy for the development of open data, the only state open data web portal; the impact of open data in various areas: in the economic, public administration, as well as in the social and environmental spheres; the quality of the data published on the portal. In the category of leading countries, Ukraine ranked 21st among 100 countries of the world, including 81% in scientific data and 93% in technology. In the ranking of technological competencies, Ukraine took 8th place. This result is accepted in the annual study (Coursera, 2022). This means that Ukrainians are among the best at working with computer networks, databases, operating systems, security engineering, software engineering, computer programming, cloud computing, web development, mobile application development, etc., in the world. The foregoing suggests that Ukraine is ready to digitalise the national economy and participate in an open joint data portal with all participating countries.

Basics of Agrisharing

We propose the Agrisharing platform as a suitable portal for the agro-industrial complex (as the main source of economic indicators and the most interesting sector of Ukraine for the world economy). It unites the agricultural sector's higher education, business and science for the consumption of goods, natural resources, material and technical base and intellectual capital in the system of appropriate sustainable development based on the GIS platform.

It is envisaged (taking into account the importance of combining the efforts of the scientific, educational and private sectors of agriculture at the state level, as well as the prospects for obtaining a basis for making management decisions) that certain elements of Agrisharing system will be under control state authorities and will ensure the specific interaction mode between Agrisharing and state authorities. Thus, the Ministry of Digital Transformation of Ukraine will provide technical support and modernization of software for the development of the corresponding system

at the request of higher education institutions, whose employees will ensure filling and updating of attributive information. The Ministry of Agrarian Policy and Food of Ukraine and its structural subdivisions will provide information and control compliance with legislation in the agricultural sector regarding the state of land resources as the main basis of production. The Ministry of Economy of Ukraine will provide an annual analysis of the platform development from the position of the efficiency and cost recovery. The Ministry of Environmental Protection and Natural Resources of Ukraine will ensure compliance with domestic and international environmental protection requirements. The State Statistics Service of Ukraine will provide relevant and updated data to higher education institutions for constant updating of attributive information with the possibility of further analysis. General control of the reliability and relevance of data entry is expected to be entrusted to local authorities and branch departments.

The GIS system has shown its effectiveness both in the agricultural sector and in the scientific field and education in different ways. The tools provided in the system allow users to create datasets geo-referenced to the area, create interactive questionnaires, analyse three-dimensional information, edit data on maps, display the results of operations, and much more. GIS is an advantage for both scientists and representatives of educational structures and representatives of the agricultural sector business, as it helps them achieve better results in terms of production, research, and training and reduces additional costs that could be involved in the process of operation. This, in turn, leads to better management.

GIS as Agrisharing Platform

The authors analysed the areas of successful individual use of GIS technologies in the agricultural sector, scientific research and education, and the management of territories and the economy as a whole (Fig. 2). Although the 'Agrisharing of establishments' system provides for the direct interaction of 3 components - science, education and agricultural business- the systems of government and the national economy are integral components and a superstructure of any process that develops.

GIS is used in the agrarian business in the following areas:

• Agricultural mapping. Agricultural GIS can be used to map current and future changes in snow sleet, crop yields and soil temperature. This allows scientists and farmers to work together towards the same goal of creating different, more efficient and effective farming practices. In addition, it helps to increase the country's food production and eliminate the problems of food shortages in individual countries. Using satellite technology and unmanned aerial vehicles

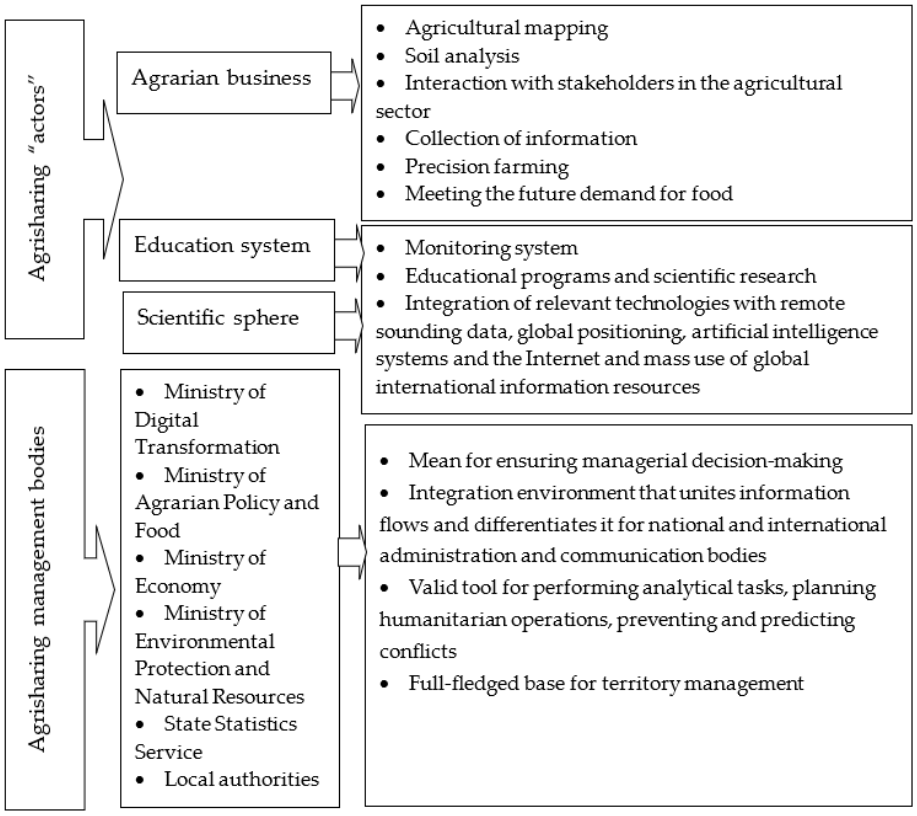

Figure 2. Areas of individual successful use of GIS technologies in the Agrisharing system

Source: developed by the authors

in GIS helps collect real-time data from the earth's surface and access and monitor the state of the earth. This advancement in technology has helped reduce the time that could be spent searching for data and processing it. GIS technologies make it possible to map and separate spatial and attributive information of the corresponding source material.

• Soil analysis. GIS helps determine the soil type and predict crop growth, nutrient conservation, and sustainable yields based on land use dynamics.

Interaction with stakeholders in the agricultural sector. GIS helps stakeholders in accessing data about their lands. It also provides information on the status and prospects for using similar lands by other land users.

Collection of information. GIS allows you to collect and layer different types of information, interact with data, 'ask questions" and get answers to them, and have reliable ground data in real time. Structured storage of geospatial data and the issuance of analytical information in dynamics over certain periods of time became possible thanks to a set of GIS platform tools and the ability to store and access databases.

Precision farming. Sensors found in tractors, satellites and fields play a vital role in data collection. Using a geographic information system in this area helps turn the collected data into viable information accessible and easily interpretable by the agri-food sector. Farmers can 'map' current and future changes in rainfall, temperature, crop yields, plant health, etc. using GIS in agriculture. It also allows the application based on GPS and compatible smart technologies to optimize the application of fertilizers and pesticides in agriculture.

Meeting the future demand for food. It is necessary for the current government institutions to secure food sources in the face of a constant population growth that is causing concern. For such purposes, GIS is used for real-time analysis and historical data comparison.

Raising awareness. World GIS («Feeding the World» by the Institute on the Environment and the University of Minnesota, «the World Hunger Map» by the Food and Agriculture Organization of the United Nations, etc.) provides a unique insight into global food production. By identifying the root causes of food insecurity, GIS data and technologies help protect areas from food crises.

The authors combined the description of GIS technology's importance for the education system and the scientific sphere through their single vector – the higher education system provides for conducting scientific research and training staff for the scientific sector, as a result of which GIS becomes the basis for certain identical branches of both scientific and educational spheres. GIS for education and science is used in the following areas:

Monitoring system. GIS forms the basis for a powerful system of monitoring resources, processes, phenomena, and events, which uses spatial-coordinate reference (positioning) – the most important factor for any scientific activity.

Educational programs and scientific research: geological direction; development and exploitation of natural resources; meteorology; cadastral databases of land, water, forest and other natural resources, real estate; urban planning and municipal administration; design, construction, operation of facilities; ecology, biology, nature management; economic and political directions (making managerial decisions, trade, marketing, logistics, management of banking law, politics and state administration, etc.); planning and forecasting; national defence, security and emergencies, etc.

Integration of relevant technologies with remote sounding data, global positioning, artificial intelligence systems and the Internet and mass use of global international information resources.

The significance of GIS for administrative bodies and the national economy as an integral superstructure for the development of all processes in the state is as follows:

GIS has become the main means for ensuring managerial decision-making because it is a powerful tool for modelling processes and phenomena, interactions and connections, and forecasting.

GIS has become an integration environment that unites information flows and differentiates them for national and international administration and communication bodies. The information is presented in thematic atlases open to all interested persons.

The ability to obtain such information and modelling situations make GIS valid tools for performing analytical tasks, planning humanitarian operations, and preventing and predicting conflicts.

GIS provides a full-fledged base for territory management. Creating a unified municipal GIS allows a systematic approach to solving any territorial problem and conducting territorial planning (Zatserkovny et al., 2016).

That is why the UN adopted an agenda for sustainable development until 2030, considering the active development of GIS technologies. It focuses on specific recommendations for using technologies capable of monitoring problems and achieving goals on a global scale (UN General Assembly, 2015). It is obvious that visualization and analytics, as derived from geospatial technologies, have significantly influenced the development of programs related to population welfare.

This will determine the development of GIS technological problems when working in corporate networks. The Internet network expands its audience to tens of thousands of new users and offers users route maps that ensure the 'entry' of GIS into the full life of the population. In this regard, GIS is in demand both to find an answer to a request concerning a selection of objects' locations and to distribute one's own

location on one or another GIS platform. All of the above shows that the demand for space technologies is constantly growing. Currently, GIS are turning into powerful integrated and interactive systems of shared global use with the main features: shared (which is the key to using them as a basis for 'sharing' processes), territorially distributed, modularly expandable, and easily accessible in real time.

System and Stages of Agrisharing Implementation

Based on the GIS platform, the authors offer the introduction of Agrisharing as a joint consumption of material goods, natural resources and intellectual capital in the agricultural sector (Broshkov et al., 2021) (Fig. 3).

Considering the stages of Agrisharing system creation, the following should be noted.

1. At the stage of participants' selection, it is necessary to carry out analytics by number, as well as the territorial location of participants – higher education institutions of agrarian direction, agricultural business structures and scientific organizations in the countries of Agrisharing.

2. At the stage of collecting information, the necessary steps are:

Create questionnaire tables of three types - separately for business, scientific institutions, and natural universities- indicating their main characteristics and specific contributions to the Agrisharing system. Data on the main characteristics of participants will be the basis for further filling in the attributive tables for them, and the contribution will help to optimize the work of the system further, taking into account the participation of each organization;

Each of the three types of system participants should submit a specific list of services and resources they are ready to share.

The authors provide for obtaining:

• from business – a quantitative indicator of possible investments, a list of the material base for joint consumption, a list of resources for conducting scientific research and introducing new technologies.

• from the higher education system – a list of directions for training specialists; the quantitative indicator of students and scientific and pedagogical staff capable of assisting and filling the GIS platform; a list of staff development courses.

• from scientific structures – a list of possible business consulting directions and potential directions for innovative developments in the agrarian sector.

• database of agricultural land plots and their existing quality characteristics (type and condition of soils, type of ownership, possibility of involvement in the Agrisharing system) from the executive authorities on land relations matters.

3. The stage of creating the GIS platform structure involves forming all the future GIS elements, consider-

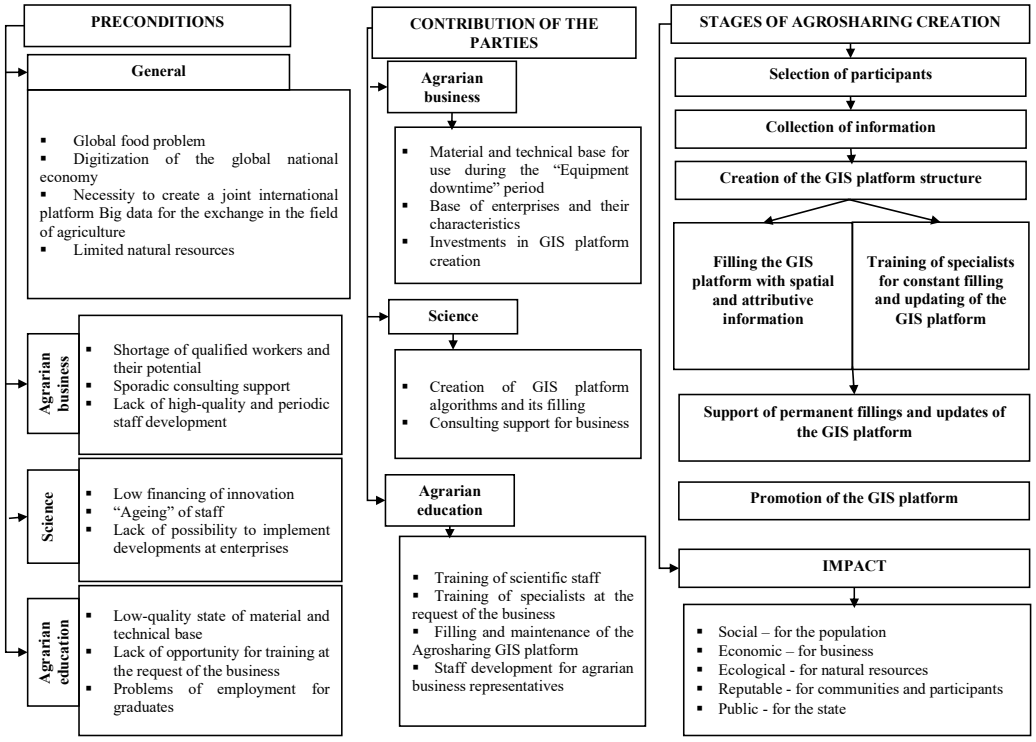

Figure 3. Prerequisites, system and stages of Agrisharing implementation

Source: developed by the authors

ing existing and developing algorithms, connections, and types of information presentation.

Based on the fact that GIS combines six key components: equipment, software, data, people, methods and network, the Agrisharing system will need to pay significant attention to each of them:

• Key component 'equipment' implies that powerful computer equipment, printers, output and input devices and large volumes of space for storing large sets of GIS data should be provided from the beginning of the Agrisharing project development.

• Choice of 'software' comes down to a choice between two directions – free with a limited set of functionalities or commercial, allowing to perform a larger list of functions and add more modules.

• Preliminary stage (collection of information) is partly the basis for 'data' (as an important element of GIS). However, the careful selection and correct distribution and the formation of a quality management system for the database are important. The ability of GIS to use a wide range of data in almost any format can lead to data overload that is not needed. Avoiding the problem of data overload requires GIS professionals to spend significant time on data management and its preparation for maintenance, storage, analysis, and output.

• 'People' in the Agrisharing system include the developers of the relevant GIS platform, qualified specialists in its filling, students-interns, business representatives as participants in the process, as well as the general public who can use this GIS.

• The 'Methodical part' of GIS consists of the creation of algorithms, formulas, statistical tools, and GIS analysis, which will be used to transform data into information and its use, understandable to the user of the Agrisharing system.

• 'Network' can be applied to the computer component and the Internet, as well as to social media, which indirectly (but no less important) help disseminate data about the software product and the development of the Agrisharing system.

4. The stage of filling the spatial and attributive information of the GIS platform involves the introduction of previously obtained data in a clear structure. The spatial component of the Agrisharing GIS platform involves entering the following information:

• Cartographic base as a basic layer, based on the Earth's remote sounding data (processed space image). The information on it will be clarified using UAVs if needed, taking into account the dynamics of changes in the agrarian sector.

• Layers of the territorial location of business structures of the agrarian sector, higher education institutions, scientific organizations and research centers.

• Layers of existing agricultural land with division by land types.

• Layers of degraded, conserved and decommissioned lands as promising agricultural areas provided investments are made, and soil quality is improved.

• Other layers, taking into account the sharing base characteristics.

The attributive component of the Agrisharing GIS platform involves entering the following information:

• Characteristics of agrarian, natural resource, technical and polytechnic higher education institutions, taking into account their potential for the agrarian sphere, a list of courses and services, and opportunities for staff training.

• Characteristics and potential of scientific institutions of the relevant direction.

• List of possibilities and the proposed range of services of agricultural laboratories.

• Qualitative characteristics of agricultural lands and other territories involved in the Agrisharing activities.

• Results of monitoring studies of agricultural lands potential, taking into account the requests of agrarian enterprises, on the condition of making investments in these lands.

• Characteristics of agricultural enterprises participating in the Agrisharing model, considering the list of their sharing equipment, the potential of financial investments and resources as a base for experiments.

5. In parallel with the stage of information filling, we offer enhanced training of specialists in the constant support of the GIS platform development by higher education institutions. The Agrisharing system will require specialists to have knowledge in various fields – agriculture, economics, engineering, data management, etc. Therefore, the training of such specialists will require sufficient amount of time.

6. The stage of supporting constant updates of the GIS platform does not foresee its end since the platform will require constant updates of both the software product and its high-quality filling with constantly changing information.

7. The promotion of the GIS product of the Agrisharing system involves a broad marketing campaign, which requires the intervention of specialists from all fields of relevant activity and further meaningful research on raising the awareness of business entities, state and communal bodies, the population and other stakeholders in terms of the benefits of participation in the Agrisharing system.

In terms of the effectiveness of a shared consumption economy in the agrarian sector, it is worth noting the following impacts that are subject to discussion and require further research:

• Social: mobility and availability of information from the platform anywhere in the world and at any time on your own device. With the appropriate system, both process participants and other interested parties will have access to transparent and open necessary information regarding the potential for joint development of the agrarian direction of science, education

and business. In addition, such a system allows for the creation of new jobs and increasing competitiveness.

• Economical – the need to purchase expensive agricultural equipment, spend money on high-priced research testing and find ways to use the material and technical base rationally during the 'idle' period is lost.

• Ecological - the rationalization of natural resources use and the reduction of harmful emissions into the atmosphere are the key to the 'ecological' development of Agrisharing.

• Reputable – 'actors' of Agrisharing will have open access to rating assessments of the Agrisharing platform as a whole and its individual participants.

• Public – national and international recognition of innovations in the agrarian complex and the priority of joining efforts around the sector that 'feeds humanity'.

CONCLUSIONS

In the study, the authors have identified the prerequisites and the urgent need for rationalization of the 'actors' of the agrarian sector of Ukraine in the conditions of martial law and exit from the post-war crisis, taking into account the importance of the agrarian sector of Ukraine in the world. Ukraine's state and place in the agro-food sector's world system have been analysed; the country's innovative development trends and prospects have been defined. The advantages of using GIS in agrarian business, scientific field and educational space have been determined. Namely, it has been proven that the GIS system has shown its effectiveness both in the agricultural field and in the scientific area and education in different ways, namely in agrarian business, it has become useful for agricultural mapping, soil and resource analysis, interaction with stakeholders, and information gathering, precision agriculture, demand response and awareness raising; in educational and scientific fields – in monitoring system, educational programs and scientific research, as well as in the integration of relevant technologies with remote sensing data. Attention has been focused on the importance of GIS for administration bodies and the national economy as an integral superstructure for the development of all processes in the state, namely as a means for ensuring decision-making of an administrative nature, an integration environment, a toolkit for performing analytical tasks, as well as a basis for territory management. The authors have proposed the implementation of Agrisharing as a joint consumption of material goods, natural resources and intellectual capital in the agricultural sector and have defined the prerequisites for using the appropriate model for three elements of the system, as well as have outlined the contribution by each participant of the process. The main contribution from the business structures is provided for material and technical base and investments at the start of Agrisharing implementation; from educational institutions – training and retraining of staff, as well as support for filling out the platform; from scientific institutions – advisory support and development of algorithms. The proposed stages of Agrisharing creation have been studied, the main ones of which being: selection of participants, collection of information, creation of the GIS platform structure (filling with spatial and attributive information, training of specialists), support for permanent filling and updates of the GIS platform and its promotion.

So, the authors reasoned the need to introduce the basics of the sharing economy into the system of interaction between agrarian business, science and education. The effectiveness of the GIS platform as the basis of the corresponding interaction has been proven. An Agrisharing GIS platform with a certain structure and stages of its implementation is proposed, taking into account the contributions of the leading 'players' of the corresponding system. Predicted directions of Agrisharing implementation's effectiveness in solving the world food problem because of military events in Ukraine have been determined.

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Conceptualization, M.B. and D.B.; methodology, M.B.; software, G.Z.; validation, M.S., M.B. and D.B.; formal analysis, X.X.; investigation, G.Z.; resources, D.B.; data curation, M.S.; writing—original draft preparation, D.B.; writing—review and editing, M.B.; visualization, D.B.; supervision, M.B.; project administration, M.B.; funding acquisition, D.B. All authors have read and agreed to the published version of the manuscript.

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The authors confirm the absence of real and/or potential conflicts of interest in the development and submission of the manuscript for publication.

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