

Economic Mapping of Crops in Kharkiv Region

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Abstract: The role of economic cartography in modern economic activity is estimated. The main tasks of modern economic mapping in accordance with the development of the world economy are revealed. Examples of large-scale cartographic studies using NASA technologies and intelligent information processing technologies are given. The description of economic specifics of crop production of Kharkiv region with the use of cartography is made. The dynamics of sunflower and wheat cultivation are highlighted and the reasons for their leading positions in the production of plant products in the region are revealed. Structural changes in the long-term period of dynamics of sown areas of crops grown in the region are studied. A cartographic differentiation of the productivity of the main crops of the region was carried out in accordance with the natural, climatic and economic conditions of their cultivation. The specifics are revealed and reflected through the maps of the location of the main types of crops, their structural distribution and yield levels in the regions. A cartographic model of the structural distribution of the sown areas of grain crops and sunflower on the territory of the studied region was formed. The dynamics of fluctuations in the profitability of crop production and individual crops is determined. Recommendations for the use of economic cartography in economic activities for the production of crops have been developed.

Keywords: Economic cartography, plant growing, territorial distribution, profitability, agricultural crops, productivity, districts, natural and climatic specifics.

1. INTRODUCTION

The rapid development of social relations in the XXI century became one of the decisive factors in the formation of innovative approaches to cartography, including its economic component. The application of new methods and technologies for the formation of cartographic research, the creation of new types of cartographic works - is a condition for the development of economic cartography in a global environmental and socially oriented society.

The specificity of modern economic cartography is its affiliation to thematic cartography, and the main tasks are the development, creation and use of economic and economic-geographical maps that characterize the dynamics of the development, current status and features of geographical-

spatial organization of economic activity. The first economic and geographical maps were created in Europe in the 18th century, in the 19th century their formation acquired a significant role in economic and geographical research.

The international scientific practice of economic cartographic research in the 21st century considers this scientific activity as a complex and multifaceted process. Its main task is to map and clarify the key economic indicators that affect business results. The growing importance of intellectual capital in cartography also requires the inclusion of its economic component, according to American scholars Abhichek Nagaraj and Scott Stern, in the study of economic issues such as: the cost of creating maps, the nature of demand for maps, intellectual property and competitive environment, mapping technologies, economic incentives for cartographers.

K. Martin also highlights the assessment of the potential impact of maps on the dynamics of investment in regional natural resource and the importance of exogenous and endogenous factors as an important economic component of cartog-

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raphy. AbhicekNagaraji emphasizes that the most striking example of the US experience in investing effectively in economic cartography is the history of gold exploration and discovery, when NASA Landsat introduced satellite imagery in the 1970s to help identify geographic lines that clearly indicate gold deposits. New maps have almost doubled the probability of discovering new gold deposits in comparison with unmapped regions, the effect is disproportionately related to the findings of smaller and younger exploration firms.

An important economic role of mapping in the spatial distribution of economic activity is highlighted by L. Schaum, F. Rauch and T. Williams, when maps can highlight the economic results in the region they are to describe. Thus, in the world scientific community, modern economic cartography is considered not as an information resource, but as a tool for forming an effective business mechanism.

The development of economic cartography of Ukraine is based on the historical conditions of the evolution of the state. The first economic and geographical studies of Ukrainian lands were reflected in the cartographic works of the 19th century, according to the territories, scientists from Russia, Austria-Hungary, Poland. During the Soviet period, a significant number of cartographic atlases were published for Ukraine, including economic ones. After the proclamation of Ukraine's independence, cartographic research continued in accordance with the specifics of the country's economy. The following scientists made a great contribution to the economic cartography of Ukraine: Baransky M., Preobrazhensky A., Zolovsky A., Levitsky I., Zhupansky J., Rudnytsky S., Rudenko L., Sossa R., Sharanevich I. and others. In the period from the 1980s of the twentieth century. The development of economic cartography in Ukraine is focused on the creation of new types of maps, which are based on the principles of systematic modeling of cartographic systems. Despite the significant amount of work in this scientific field, it should be noted that it needs further updating and expansion of research, as, dynamically developing, society is constantly demanding innovative approaches to economic mapping.

2. METHODOLOGY

The method of dialectical cognition was used in the process of scientific research of the subject and object. The main methodological principle of conducting this scientific research is the systematic study of scientific phenomena based on historical evolution and modern paradigms for the implementation of economic mapping tasks. Also methods of economic analysis and synthesis, as well as cartographic systematization were applied, which provided identification of the main specific factors influencing the complex solution of economic cartography. The display of the research results was carried out through a systematic analysis and using the grapho-analytical method. Cartographic modeling of the obtained research results was also used. The generalization of research results and the conclusion of conclusions is realized through the use of abstract-logical methods of cognition.

3. RESULTS AND DISCUSSIONS

The development of economic cartography is closely linked with the development of human civilization: the specifics of

social production, the organization of social relations, the level of achievements of science, technology and culture. Modern realities of digitalization of society have had a significant impact on the methodology and specifics of the implementation of economic cartography, ensuring its computerization in the process of cartographic research. Economic maps have become widely used not only as an object of knowledge, but also as a tool for many economic and practical tasks related to entrepreneurship, effective organization of market management in them, the use of natural resources, nature protection, etc.

The agricultural sector of Ukraine is an important part of the national economy. According to the State Statistics Committee, the share of agriculture in the total GDP of the country in 2020 amounted to 9.3%. Sunflower and grain production provides Ukraine with leading positions in their world exports. In total, about 500,000 Ukrainians officially work in the industry. Effective activity of this industry is an important component of the country's development, the formation of its stability. In accordance with the conditions of effective location of agriculture, economic maps become decisive in the organizational process of economic activity. It is through the maps that the spatial analysis of economic processes is provided, the relationship between the results of production and production resources is assessed, as well as the distribution of the product of the agricultural sector.

The processes of economic cartography in modern conditions are based on the creation and use of appropriate thematic maps on the specifics of economic processes in the activities of the population, enterprises and government. Its main task is a cartographic assessment of the specifics of economic processes in terms of territories, their impact on social development. Economic cartography, according to its positioning in cartographic research, can be defined as one of the main components of thematic cartography.

Assessing the relief of Kharkiv region from the standpoint of economic cartography, we note that it is represented by a rolling plain. Effective land use is due to their high fertility, the region is dominated by typical chernozems (39.44%), common deep (34.56%), common (11.68%), podzolic (3.37%), gray forest (1.44%). However, at the same time there are problems with soil conservation, there are 6.2 thousand hectares of moderately acidic soils in the region, which require constant reclamation measures. Favorable temperate-continental climate without significant variations, favorable geographical location of the region form positive conditions for the use of strong agricultural potential of Kharkiv region.

Implementation of economic cartography of crop production, on the example of Kharkiv region, is necessary, first of all, as a way to assess the natural and economic conditions of entrepreneurial activity in this area of agriculture in the region. The development of crop production is one of the key elements in the formation of agricultural entrepreneurship in the region, as Kharkiv region, being located in the northeast of Ukraine, includes two natural areas of the Left Bank of Ukraine, Forest plains and Plains, which have favorable conditions for growing crops.

The specifics of crop production for the study region can be called a significant level of its focus on cereals, legumes and

Table 1. Structural Dynamics of Sown Areas of Agricultural Crops of Kharkiv Region in 2000- 2020.

Crop	2000		2010		2020		2020vs 2000, %
	Thous. ha	% of Total Area	Thous. ha.	% of total area	Thous. ha.	% of total area	
Total Sown Area	1625,2	100	1582,4	100	1826,9	100	112,41
Cereals and legumes	754,9	46,45	776,8	49,09	1018,4	55,74	134,91
Technical	327	20,12	545,4	34,47	639,5	35,00	195,57
Root crops	137,6	8,47	111,1	7,02	92,7	5,07	67,37
Fodder	405,7	24,96	149,1	9,42	76	4,16	18,73

industrial crops (primarily for sunflower cultivation). Considering the indicators of structural dynamics of sown areas, which was formed in the period 2000-2020, in Kharkiv region, based on the calculations performed in table 1, we can say that there is a gradual increase in sown areas, increasing the level of plowed land in the region over twenty years arable land amounted to 112.41%, which is a very significant increase for already developed areas. A significant level of plowing has a negative impact on both the natural ecological balance and the conditions of land use.

Researched by the author according to the State Statistics Committee

It is noteworthy that during the study period there were significant shifts in crop areas in favor of cereals and sunflower, the increase in their areas was, respectively, 134.91% and 195.57%, primarily due to the displacement of roots and forage crops, as well as by increasing the plowing of land. This attitude to land resources does not meet the environmental standards of its use, but most entrepreneurs in the region are not responsible for the preservation of land.

In 2020, 55.74% of land was occupied in the structure of sown areas under cereals and legumes, and 35% in technical areas (primarily sunflower). Root crops and fodder crops decreased by almost 33% and 82%, respectively, which indicates a reduction in the livestock industry and, consequently, feed needs, as well as the refusal to grow sugar beets as a technologically complex crop. It should be noted that sugar production, as an industry, in Ukraine during this period has virtually ceased to exist.

A steady trend of changes in sown areas during the study period 2000-2020, was, in the activities of most entrepreneurs, focusing on market benefits, focusing on the production of cereals and sunflower. They sow the bulk of the fields without taking into account the requirements for maintaining soil fertility. With such a structure of sown areas in the Kharkiv region in 2020, the efficiency of crop production is increasingly dependent on a limited number of crops, which not only disrupts environmentally friendly crop rotation, but also reduces the return on land used. Due to the concentration of production on cereals and sunflower, in the cartographic study of crop production is most appropriate to reflect the specifics of these crops.

Forming economic indicators in the cartographic location of the structure of crop production in the Kharkiv region, it should be noted that the distribution of sown areas is uneven. The formation of maps based on economic cartography is

characterized by the complexity of the content, as the coverage of several interrelated indicators, both economic and geographical, such a reflection allows a detailed analysis of natural and economic specifics of crop production in the region. On the maps for assessing the development of crop production in the Kharkiv region, generalizing, typological, synthetic characteristics come to the fore, which we calculated as a result of scientific generalization of economic information. The structure of the location of the studied crops in the districts of the region has significant differences in the share of areas, which is due to the following factors: land relief and specifics, the level of industrialization, climatic conditions, business orientation of producers.

Given that the main crops of the study region were cereals and sunflowers, we performed a cartographic study of the location of their production in the region with an assessment of the structural specifics of distribution and yield by region. Grains, being an important part of crop production in Kharkiv region, have significant volumes of cultivation in all its districts, the total gross grain harvest in the region in 2020 amounted to 18057 tons, but the distribution of production in the region is characterized by heterogeneity. The cartographic representation of the location of sown areas of cereals and legumes in terms of districts of Kharkiv region for 2020, presented in Figure 1, indicates a significant difference in the sown area of this group of crops. Considering the specifics of grain placement in the districts of Kharkiv region, we note that the largest share of them falls on Bohodukhiv and Kharkiv districts - 19.2% and 18.53% of the total sown area of grain in the region. The smallest share of grain crops falls on Chuguiv and Loziv districts - 10.76% and 9.29%. For visualization on the map, the intensity of color reflects the value of the share of cereals and legumes, the darker the background, the greater the share of crops in the area.

Based on the map of grain distribution (Fig. 1) it is clear that the highest yields in the leading areas of placement (in Bohodukhiv-59.5ts-ha, in Kharkiv-54.9ts / ha.), Providing a significant gross harvest, became the main factor in maximizing the share of their areas in these areas. The southern districts of Kharkiv region, due to drier climatic conditions, have slightly lower grain yields, respectively, the share of areas under them is smaller. However, it should be noted that in the overall structure of sown areas, grains occupy the largest share - 55.74%, ie, the focus on their cultivation remains predominant for most producers of crop products, regardless of location. Thus, in the process of allocating grain areas,

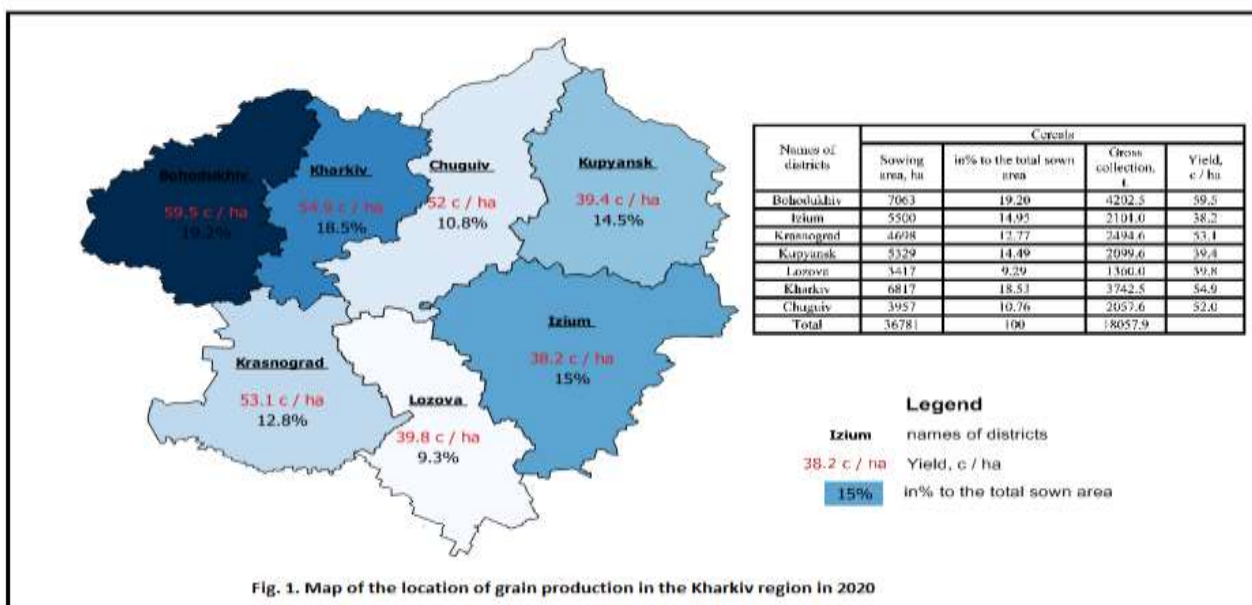


Fig. 1. Map of the location of grain production in the Kharkiv region in 2020

Source: author's research based on cartographic and economic data.

producers give more preference to this group of crops in the northern and central part of Kharkiv region.

Sunflower, being the main technical crop of Kharkiv region, also has significant production volumes, by 2020 its gross harvest in the region reached 2686.8 tons. Its sown area, accounting for 35% of the total arable land of the region, covers 36781 hectares. The specifics of the location of sunflower sown areas, based on the study performed in Fig. (2), is more oriented to the south-east of the region, the largest share of its area falls on the Izium district, with a significant advantage over other administrative units - 19%. Characteristic of this area is that having a low yield of sunflower - 14.4 kg / ha, entrepreneurs are trying to compensate for the shortfall due to the effect of scale, sowing large areas. Thanks to this strategy, the district for 2020 remains the leader in gross sunflower harvesting in the region. From our point of view, this approach, based on extensive methods of production development, does not meet modern requirements for the formation of competitive production and requires change. Taking into account climatic features, these changes should be aimed at increasing the yield of sunflower through the introduction of droughtresistant varieties of crops. The low level of sunflower yield is typical for the eastern part of Kharkiv region, in Kupiansk district it was 16.4%. It is more logical to place sunflower in the second largest share of sown areas – Bohodukhiv, with a share in the region's crops of 16.3%, here significant crops are based on the maximum yield in the region - 29ts/ha.

With the exception of Izium district, in other areas of the region the location of sunflower is characterized by a significant difference in the proportion of sown areas. The smallest share of crops falls on Krasnograd and Loziv districts - 11% each, as due to rather dry weather conditions of recent years, sunflower yields are worse (25 centners per hectare and 19.6 centners per hectare, respectively), than in the northern regions - The leader in terms of yield is Bohodukhiv district, 29 centners per hectare, and the share of crops in this territo-

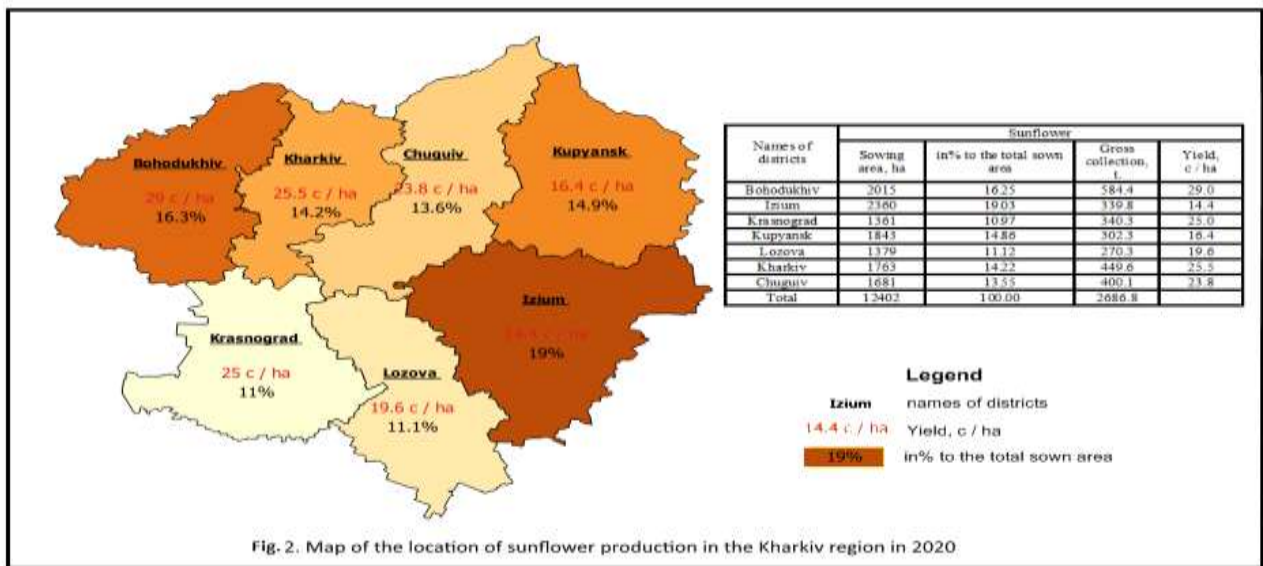
ry is 16.3% of the total in the region. Accordingly, the map of color intensity shows the value of the specific share of sunflower placement, the deeper the color, the greater the share of placement in the area.

Thus, considering the map of sunflower sown areas in Kharkiv region for 2020, we can say that for this crop the main factor in cultivation was the availability of land available for sowing, with smaller scales the growth of gross harvest was higher, and low yields were offset by larger crop areas.

In the long run, it is important for crop producers to focus on increasing crop yields, as sown areas are limited and their fertility needs to be restored. The focus on increasing productivity is associated with additional costs of labor and material resources, but with increasing productivity decreases the amount of labor intensity and material intensity of production, which reduces the cost of growing crops. It is the growth of the yield that has the greatest impact not only on the increase in gross harvest, but also on the overall economic efficiency of crop production, the formation of profits and profitability of production.

Implementation of economic cartography is an important element in the formation of an effective mechanism of economic activity in the field of crop production. Mapping tools can optimize production processes, reduce production costs, increase plant profitability. The category of "profitability" is the main economic indicator of production efficiency, which characterizes from the point of view of most modern scientists, production efficiency, which provides the company with full reimbursement of economic costs, ensuring excess cash proceeds from sales of products (works, services). production and non-production activities.

For Kharkiv region, the high profitability of growing crops in the region is influenced by both organizational and economic factors and favorable geographical location for production, favorable temperate-continental climate, high natu-



Source: author's research based on cartographic and economic data.

Table 2. Dynamics of profitability of agricultural crops of Kharkiv region in 2000- 2020.

Crops	2000	2010	2015	2018	2019	2020	2020 vs 2000 (+,-)
Cereals and legumes,%	72,3	-4,1	37,7	16,7	3	31,1	-41,20
Sunflower,%	74,7	61,1	87,3	32,5	23,8	44,5	-30,20
Sugar beet,%	39,6	-27,5	9,6	-16,8	-2,4	4,7	-34,90
Potato,%	8	69,7	137,3	19,8	57,1	32,7	24,70
Vegetable crops,%	-12	87,6	70,2	7,9	58,8	6,8	18,80

Source: researched by the author according to the State Statistics Committee.

ral soil fertility, which was reflected above in maps of location and yield of major crops. An important factor in high profitability is a significant market for agricultural products, as well as the use of many enterprises of modern production technologies. For 2020, agriculture, according to the Main Department of Statistics in Kharkiv region, belongs to the sectors with high profitability in the region's economy, the level of its profitability was 29.7% against the regional 6.5%. This indicator is much higher and the profitability of the agricultural sector in 2020. in Ukraine as a whole, - 17.4%.

Profitability shows the degree of excess of profits over all types of costs, estimating the return on economic activity of the enterprise. Assessing changes in the dynamics of profitability of crops grown in the Kharkiv region, according to calculations performed in table 2, we note that there is a gradual decrease in the groups of major crops - cereals and legumes - by 41.2%, and sunflower - by 30.2%.

Nevertheless, these types of crop products remain the most profitable, which led to the predominant focus on their cultivation by entrepreneurs in the region. In 2020, the profitability of cereals and legumes was 31.1%, and sunflower - 44.5%. Vegetable crops went from unprofitable to positive profitability, reaching 6.8% in 2020, and the profitability of potatoes increased by 24.7%. The efficiency of production of all types of crops grown in the Kharkiv region is character-

ized by significant instability, as in the study period there are significant fluctuations in their profitability.

Under such conditions, the efficient location of production in areas with the most favorable natural, geographical and economic conditions should be an important factor in stabilizing profitability, reducing production risks and ensuring higher economic results from growing crops.

The main task of economic cartography of crop production is the development, creation, study and use of cartographic research to assess the specifics of the industry in the region. In connection with the developed computerization of cartographic science, the main tasks of economic cartography of crop production include: formation of digital and electronic economic maps of crop production of Kharkiv region, their inclusion in the database of digital cartographic information banks; providing maps of scientific and production processes; creation of new types of economic maps. The maps created by us provide a clearer understanding of the specifics of organizational and economic processes in crop production and allow us to visualize economic activities in accordance with the territorial specifics of the object under study.

4. CONCLUSION

Modern economic cartography is an important factor in ensuring the effective economic activity of entrepreneurs. The

realities of the development of the world economy require changes in its cartographic component in accordance with the informatization of economic processes. The creation of modern cartographic models should, first of all, be oriented towards the assessment of possible economic effects of the studied processes, realizing the practical significance of performing an economic cartographic analysis.

According to the results of the study, we can conclude that crop production in the study area has uneven conditions in ensuring efficient production, due to the specifics of natural and climatic conditions, soil diversity and different conditions of production processes in different areas. The specifics of the location of products produced in crop production is directly dependent on the relief and fertility of land, the possibility of using the area of specific areas for agricultural production, natural and climatic conditions and entrepreneurial orientation of producers. The creation of economic cartographic models of the production of plant products becomes an important element of effective business management under modern conditions.

It is especially important in activities related to the direct use of land resources, such as growing crops. The process of economic cartography of crop production should take into account not only the indicators related to the grant and relief features of the studied areas, but also the specifics of economic factors in accordance with the geographical location of production. The most profitable crops for growing in the region for a considerable period of time remain cereals and sunflowers, which form a special specialization of crop production. The result of the economic mapping was the formation of recommendations, according to which it is more expedient to shift the cultivation of sunflowers in the region to its southern part, while in northern regions it is determined more promising cultivation of grain crops. It is the application of cartographic methods that determines the features and most effective areas of land use and the possibility of ensuring high profitability in specific areas.

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