

Supply Chain Strategy in Modernization of State Support Instruments for Small Farms in Ukraine

Varchenko Olga M.¹, Krysanov Dmytro F.¹, Shubravska Olena V.², Khakhula Larysa P.¹, Gavryk Olecyia Y.¹, Byba Valentyna A.¹, Honcharuk Inna V.³

¹*Bila Tserkva National Agrarian University, BilaTserkva, Ukraine*

²*NASU Institute for Economics and Forecasting, Kyiv, Ukraine*

³*Vinnitsia National Agrarian University, Vinnitsia, Ukraine*

Abstract- Sustainable food value chains can offer important pathways out of poverty for the millions of small farms in developing countries. The need to concentrate state support for the development of small farms is proved in the article. The results of the cluster analysis of small farms show that it is advisable to send state support to the development of farms in which revenues are generated from the sale of crop products, as well as from other crop products - "niche" products and animal husbandry. The necessity to develop regional programs of support for small-scale farms producing "niche" crops, which would provide for compensation of material costs for its production in the amount of 50% of the value of cost standards, is substantiated. The procedure for providing such support was elaborated and the possibilities of financial support were determined according to the principle of co-financing of the united territorial community and state bodies in the ratio of 50:50. The feasibility of state support for beginning farmers on the basis of a grant for the creation of a family livestock farm, the maximum size of which should be: for breeding cattle of meat and dairy areas no more than 60%, pigs and poultry - 50% of regulatory costs is proved. The financial basis for the program for supporting the development of farms for the production of livestock products should be from the funds of the local united territorial communities and the state budget in the ratio of 30:70.

Keywords- *small farms, government support instruments, supply chain strategy, family livestock farms, rural communities*

1. Introduction

Supply chains are principally concerned with the flow of products and information between supply chain member organizations—procurement of materials, transformation of materials into finished products, and distribution of those products to end customers. The formation of a multifaceted economy in Ukraine has facilitated the mass creation of small forms of farming in rural areas. In particular, it has developed such an organizational and legal form as a "farm", whose role is quite significant in solving the problems of reducing unemployment in the countryside, raising the incomes of the population and the production of certain types of agricultural products. However, studies have shown that unmanaged farms in their production activities are

faced with factors that hamper their development, including: uncertain legal status, especially family farms, inadequate information and consultation services, low skills and narrow specialization of most farm managers farms, unresolved land issues, high interest rates on loans from commercial banks, unwillingness of young people to engage in agribusiness, etc.

Individual suppliers, producers and marketers who are associated through a supply chain coordinate their value creating activities with one another and, in the process, create greater value than they can, when they operate independently. The development of small-scale farms requires justification of state support instruments in those areas of production activity that will improve their efficiency and implement the principles of sustainable rural development. We believe that state support for farms is necessary given that agricultural products and food are social and strategic commodities. The state should help to provide the population with food at reasonable prices to ensure social stability and strengthen our position in the world. In addition, in today's environment, small and medium-sized agribusiness is not only the production of agricultural raw materials and food, but also the guarantor of sustainable rural development.

The scientific work of the above scientists is a significant contribution to the study of agricultural development, but today there is a need to justify the instruments of state support for the development of small farms, which, in addition to the formation of agricultural supply and food supply, provide employment for the rural population and socio-economic development of rural territory. *The purpose of the research* is to investigate the particularities of the development of small farms, to identify specific features of the organization of their production activities on the basis of cluster analysis and to justify the instruments of state support in the context of the selected groups.

2. Materials and Methods

In order to develop measures to improve state support for the development of farms, we have excluded medium and large farms from the total array of agricultural enterprises, since they are no different from other organizational and legal forms of

management on a number of features of the organization of production activities.

An algorithm for intragroup averages, that is, a method of clustering, which involves the ordering of a plurality of objects into relatively homogeneous groups, was selected for classification [1],[2]. Supply chain interventions should start and end with the market.

The output is given in the form of a matrix having n columns and t rows, where X_i is a vector column ($i = 1, 2, \dots, n$), U_j is a vector row ($j = 1, 2, \dots, m$). In this case, columns are the name of the metrics, and the rows are their values.

The algorithm, based on the calculation of K intragroup averages, involves 4 steps.

Step 1. Select the initial centers of clusters $Z_1(1), Z_2(1), \dots, Z_K(1)$. This choice is made arbitrarily, usually the first K results of a given set of images are used as the source center.

Step 2. At the k -th step of the iteration, the set of images $\{x\}$ is distributed over K clusters by the following rule: X belongs to $S_j(k)$ if $\|x - z_j(k)\| < \|x - z_i(k)\|$ for all $i = 1, 2, \dots, K, i \neq j$, where $S_j(k)$ is the set of images included in the cluster centered $z_j(k)$. In the case of equality, the decision is made arbitrarily.

Step 3. According to preliminary results (step 2), the new centers of the clusters $z_j(k+1), j = 1, 2, \dots, K$ are determined, given that the sum of the squares of distances between all images belonging to the set $S_j(k)$ and the new cluster center should be minimal. That is, new centers of clusters $z_j(k+1)$ are chosen in such a way as to minimize the quality index:

$$I_j = \sum_{x \in S_j(k)} \|x - x_j(k+1)\|^2, \quad j=1,2,\dots,K. \quad (1)$$

Center

$$z_j(k+1) = \frac{1}{N_j} \sum_{x \in S_j(k)} x, \quad j=1,2,\dots,K, \quad (2)$$

where N_j – is the number of sample images included in the set $S_j(k)$.

It is obvious that the name of the algorithm "K intragroup averages" is determined by the method used to consistently correct the definition of cluster centers.

Step 4. The equality $z_j(k+1) = z_j(k)$ where $j = 1, 2$, is a condition of convergence of the algorithm, and upon its achievement the algorithm ends. Otherwise, the algorithm is repeated from step 2.

The accuracy of algorithms based on the calculation of K intragroup averages depends on the number of cluster centers selected, on the choice of source cluster centers, and, accordingly, on the features of the data. In terms of received groups of small farms, we have justified state support instruments.

3. Results and Discussion

The Supply chain for fruits, vegetable and spices in the state consist of multiple intermediaries and handling, which sometimes leads to high physical wastage and/or value loss of the produce. Although the supply chains may vary from produce to produce but the main

players in most of the horticultural produce supply chain are farmer, post-harvest contractor/aggregator, commission agent, wholesaler, retailer and final consumer. Generalization of results of researches of domestic scientists on organizational and economic conditions of development of farms in Ukraine allowed to systematize the following problems, namely: development of farms occurs in conditions of low economic efficiency of agricultural production; the presence of psychological barriers, lack of proper social status are often the cause of low entrepreneurial activity; because of small investments it is not possible to significantly improve economic results; the underdevelopment of cooperatives impedes the rational utilization of the potential of smallholder farms and rural areas; farmers' lack of educational attainment hinders economic transformation in the agricultural sector; little or no state support, imperfection of state regulation impede the dynamic development of farms [3],[4],[5].

It was found that smallholder farms dominate the structure of farms in Ukraine, which decreased by 21.1% during 2008–2017. The main reasons for this situation according to the survey results (123 polled by Kyiv, Cherkasy and Khmelnytsky regions in 2017) heads of farms are: senior manager's age and absence of heir (41%), high probability of raider capture (23%), loss of production activity during long period of time (32%), 4% - other factors.

It is known that according to the Land Code of Ukraine in 1990, a farmer could obtain from the state ownership and lifetime ownership of up to 50 ha. In fact, during 1990–1992, 0.54 million hectares of land were transferred to farmers. Over the past five years, land use has increased by 12.1% to 4.4 million hectares in 2017 [6]. The main land users are small farms, which account for 62.1% of agricultural land owned by farms as a whole.

Farmers use leased land to carry out production activities. In the structure of land use, the share of leased agricultural land in 2017 was: large and medium-sized farms - 98%, small - 74.4%. It should be noted that there are about 4308.6 thousand hectares of farms in the country, or 12% of the total area of agricultural land. Therefore, the farming sector has no reason to consider itself the leader of Ukrainian agriculture.

In this regard, there is a need for a more in-depth study of small farms by the concentration of agricultural land (Table 1). It is established that, depending on the area of land use, the largest share is occupied by farms that use more than 100 hectares of agricultural land.

Table 1. Grouping of small farms by concentration level farmland, 2017

Groups for area agricultural whatever, ha	Fraction, %	Specific weight in land use, %	Profitability, plant growing, %	Profitability, animal husbandry, %	Fraction products animal husbandry, %	Product rural farms	
						% everything to	profitability, %
by 5	12,1	0,5	14,6	-0,7	67,6	1,3	3,8
5,1-10	9,1	0,9	26,9	15,1	12,4	0,5	25,3
10,1-25	17,6	3,8	38,7	6,5	18,8	2,6	31,3
25,1-50	30,5	14,7	33,8	11,2	3,2	7,1	32,9
50,1-100	12,3	10,5	41,2	9,6	8,0	8,4	38,0
100,1-500	15,0	40,7	47,7	12,7	1,8	44,6	46,9
More 500	3,5	28,9	48,9	27,0	2,7	35,6	48,3
<i>Total</i>	100,0	100,0	46,0	11,0	4,1	100,0	44,2

Source: calculated according to the State Statistics Service of Ukraine.

The results of the grouping show that keeping the supply chain short, the consumer can have access to fresh, seasonal domestic products straight from the producer. Also with the increase in the level of concentration of land resources in farms the level of profitability of agricultural production increases. The area of agricultural land used by small farms is a determining factor that influences the choice of the direction of production activity. Thus, business entities with an area of land use up to 5 hectares specialize mainly in the production of livestock products. As the area of agricultural land increases in the land use of small farms, they reorient themselves to the production of crop products, which is adequately reflected in the increase in the share of agricultural production in the income structure of the entity.

Therefore, during 2000–2017, farmers did not become the leading producers of basic agricultural products for objective and subjective reasons. At the same time, there is a significant increase in the volume of gross agricultural products - almost 7 times, which led to an increase in the share of farms in the structure of total agricultural production. Its rapid increase is explained by the increase in production of crop production, which occupies more than 90% of the gross production of farms. This tendency can be explained by the fact that an agricultural enterprise specializing in the production of crop production requires 3.0–3.5 times less fixed assets for its development than an agricultural enterprise producing livestock products [7],[8].

During the study period, there are positive trends in the production of both crop and livestock products. Thus, in 2017 compared to 2000, the volume of crop production increased by 7 times, animal husbandry - almost 6 times, which led to slight changes in the

structure of agricultural production depending on the organizational and legal forms of agricultural producers. It should be noted that in 95% of small farms in the structure of marketable products, the share of crop production accounts for more than 75%, which provides a high level of profitability.

Such heterogeneity in the development of small farms, on the one hand, as well as the need to find ways of ensuring the employment of rural populations and their effective functioning, on the other, need to examine more deeply their specificities. We conducted a cluster analysis of small farms, on the basis of which 5 clusters of small farms were identified, which are characterized by specific features of the organization of production activities (Table 2).

Table 2. Grouping (clustering) of small farms in Ukraine for 2017

Indicator	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
	6201	1898	2960	1575	15
Area, ha	127	276	75	181	3197
Number of employees	3	5	3	4	132
FG members	1	1	1	1	1
Employees	1,6	3,5	1,7	3,0	131,0
Share of employees	62,0	76,5	62,6	73,9	99,9
Revenue per 1 ha of agricultural land everything, UAH	10798	12803	12280	13294	6621
Profit per 1 ha of farmland everything, UAH	3269	3929	2776	3871	1405
The cost per 1 ha, UAH	8705,0	9635,0	11102,7	10716,7	12849,5
Profitability,%	43,4	44,3	29,2	41,1	26,9
Revenue share,%					
crop production	90,3	97,1	78,6	95,3	60,4
crops	41,0	46,7	18,8	42,1	32,7
sunflower	45,7	34,3	0,7	13,0	21,7
potato	0,0	0,3	1,9	1,0	0,0
vegetables	2,5	1,8	0,1	1,0	0,0
sugar beets	0,0	0,3	1,0	1,0	0,1
fruit, berry crops	0,0	0,1	7,5	0,2	0,1
grape	0,0	0,0	0,7	0,1	0,0
other crop products,	1,0	13,6	48,0	37,0	5,8
not mentioned above	7,3	1,1	21,0	3,4	38,0
Livestock production is everything	1,1	0,9	13,5	1,5	16,4
livestock and poultry (live weight) - everything	0,0	0,1	4,4	0,6	11,7
cattle	0,0	0,3	9,0	0,9	4,0
pigs	0,0	0,0	0,1	0,0	0,0
sheep, goats	1,0	0,5	0,0	0,0	0,0
poultry	0,1	0,0	0,0	0,0	0,7
other livestock	0,0	0,2	7,4	1,6	21,1
milk	6,2	0,1	0,1	0,3	0,6
other livestock products,	2,4	1,7	0,4	1,2	1,6

Source: calculated by the author.

The above data indicate that the fifth cluster has uncharacteristic features that do not correspond to those of small agribusiness entities that are primarily family-owned. At the same time, in the farms of the second and third clusters, incomes from sales of crop production by 37% or more are generated at the expense of other crop production, that is, through the cultivation of so-called "niche" crops.

Despite the dominance in the overall structure of incomes of small farms of crop production, in the third cluster a significant share is occupied by livestock products, mainly cattle breeding and pig breeding. It should be noted that in the first cluster group up to 10% occupies the cultivation of so-called small farm animals and sheep. We believe that this circumstance requires the development of an effective program of support for the aforementioned groups of small farms.

It should be noted that a regional support program for the aforementioned category of agricultural producers should be developed for small-scale farms producing niche crops. This view is also supported by other researchers [9]. Its essence is to stimulate the production of specific agricultural products of particular national importance, only for a particular

region. In our opinion, the proposed regional program should compensate for the material costs of 50% for the production of "niche" crops grown in the territory of a particular region (united territorial community), on the basis of the cost standards of material resources, developed by Research Institute of Ukragroproductivity and their value at the end of the reporting period, which precedes the beginning of the new fiscal year.

The financing is based on the submission of the relevant package of documents to the agro-industrial sector of the integrated territorial community, namely: the documented area of sowing of "niche" culture, the indicative business plan of cultivation, the requisites of the farm. After the harvesting of the "niche" crop and its realization, on the basis of documentary confirmation, the funds are transferred to the current account of the farm. The financial component is based on the principle of co-financing of the united territorial community and state bodies in the ratio of 50:50.

It should be noted that for small farms, the direction of livestock production should be a priority in their production activities. It has been proved that the development of the livestock industry requires much more financial resources, and the payback period is much longer compared to the crop production [10]-

[12]. In this regard, the allocation of funds as state support for the development of the livestock sector by small farms should be competitively funded in the form of grants. In order to receive a grant for the development of a family livestock farm, the head of the farm submits an application to the competition commission, which is created in the executive body of the united territorial community.

The maximum amount of the grant for the development of a family livestock farm should be: for breeding cattle of meat and dairy areas - no more than 60%, pigs and poultry - 50% of the regulatory costs, which are developed by the Research Institute "Ukragropromproductivity".

The grant money for the development of a family livestock farm can be used for the following purposes: development of project documentation for the construction, reconstruction or modernization of family livestock farms; complete the family livestock farms and facilities for processing livestock products with equipment and machinery, as well as their installation; purchase of farm animals; other spending areas.

The grant for a family livestock farm must be 24 months from the date of receipt of the funds to the farm account, and the property purchased at the expense of the grant may be used exclusively for the development and activities of the family farm.

The main criteria to be met by a farm to receive a grant for the development of a family livestock farm are the following: the head and members of the farm are citizens (at least two, including the head of the farm) who are relatives and jointly produce production activities based on their personal involvement ; farming is registered in rural areas; the farm is registered in the territory of the rural settlement where the competition is submitted; the farm provides for the conditions to create its own, or jointly with other agricultural producers, a forage base for farm animals and poultry, or enter into contracts (preliminary contracts) for the supply of the required volume of feed; in the absence of a livestock processing farm in the farm and (or) if the farm is not a member of an agricultural consumer cooperative, then the planned livestock farm for the development of a family livestock farm should not be smaller: the livestock of the main uterus herds of cattle, pigs - 50 heads; the applicant has a business plan for the creation and development of a family cattle farm for the maintenance of highly productive farm animals and poultry using high-tech equipment and agricultural machinery, increasing the volume of livestock products sold; economic justification for the construction, reconstruction or modernization of a family cattle farm with a payback period not exceeding 8 years; the applicant submits an estimate of the costs, indicating the names of the property acquired, the works performed, the services provided, their quantities, prices, sources of financing; the applicant undertakes to pay not less than 40% of the value of the purchased property, works performed, services rendered, specified in the cost plan, including directly from his

own financial resources not less than 10% of the value of the property, works performed, services rendered ; the farm plans to create at least three new permanent jobs a year for the grant; the applicant undertakes to maintain the creation of new permanent jobs for at least 5 years after the grant has been received; the farming undertaking is obliged to carry out the activity for at least 5 years after receiving the grant; the head of the farm is not the founder (participant) of another business structure except for the farm, of which he is the head at the time of applying for the competition; the farm has no overdue debts on taxes, insurance premiums, penalties, fines; the farm of which the applicant is the head is the sole place of employment for at least 5 years from the date of receipt of the grant. The competition for the selection of family livestock farms must be announced in public. The announcement specifies the deadline for accepting applications from farms.

The competition is held in two stages. At the first (correspondence) stage, the selection committee examines the applicants' documents, and at the second stage, a hearing and discussion of the farmer's plans for economic development are conducted.

The financial basis for the program to support the development of farms for the production of livestock products should be the funds of local united territorial communities (UTC) and the state budget in the ratio of 30:70.

In the process of generalizing the experience of using state support methods in economically developed countries, in particular in the USA, a positive result was observed from the implementation of support programs for young farmers [13],[14]. We propose to use a tailored program to support start-up farmers. The criteria for the program for participants are as follows: the age of the head of the farm - not more than 35 years, the average age of the participants of the farm - not more than 40 years, priority is given to applicants with higher education in agricultural profile. Financial assistance is provided on a competitive basis through grants.

We have substantiated the terms of the grant to beginner farmers in Ukraine. Yes, it should be considered a beginning farmer, a farmer who has not been engaged in entrepreneurial activity for the last three years as an sole proprietor and was not the founder or participant of an entrepreneurial structure, with the exception of the farmer whose head he is on the day of submission of the application to the competitive bidding commission selection of grants in the form of small business grants.

An aspiring farmer may apply for participation in the competitive selection if the period of his business activity in the aggregate was no more than six months during the last three years.

Previously, he was not the recipient of a grant for the creation and development of a farm or a grant for the development of family livestock farms.

The farm must be registered in rural areas.

The novice farmer is the head of the farm whose activity does not exceed 24 days from the date of application in the rural territory at the date of application.

He has a secondary specialized or higher agricultural education, or has received additional professional education in agricultural specialties, or has a minimum of three years' agricultural work experience.

A novice farmer submits a cost plan.

The farm has no arrears of taxes, fees and other obligatory payments to the budgets of different levels, the deadline for which has come in accordance with the current legislation.

Grants to novice farmers should be granted for the following purposes: development of project documentation for the construction (reconstruction) of industrial and warehouse buildings, premises intended for the production, storage and processing of agricultural products; purchase, construction, repair and restructuring of production and storage buildings, premises, outbuildings, utilities, barriers and structures necessary for the production, storage and processing of agricultural products, as well as their registration; construction of roads and entrances to production and storage facilities necessary for the production, storage and processing of agricultural products; connection of industrial and warehouse buildings, premises, buildings and structures necessary for production, storage and processing of agricultural products, to the engineering networks of electricity, water, gas and heat supply, road infrastructure; purchase of farm animals; purchase of agricultural machinery and equipment, truck transport, equipment for production and processing of agricultural products.

The main documents required for submission are: a copy of the passport of a citizen of Ukraine; a copy of the document (supplementary) about secondary specialized or higher education, about additional professional education in agricultural specialty, or about at least three years' experience in agriculture, excerpts from a business book; business plan for creation, expansion, modernization of the farm production base; plan of costs proposed for co-financing through a grant for the creation and development of a farm, indicating the names of purchased property, works performed, services provided, their number, prices, sources of financing; copies of documents confirming the availability of own funds of not less than 10% of the expected amount of the grant; copies of previous agreements on sale of agricultural products; documents (or copies) confirming the permanent residence of the novice farmer or the obligation to move to a permanent residence in UTC at the place of residence and registration of the holding of which he is the head and the fact that the holding is the sole place of employment.

The beginning farmer is responsible for the accuracy of the information given in the documents.

One of the effective ways of supporting the development of small farms in Ukraine could be the

introduction of a school nutrition program and the involvement of farmers. It should be noted that in the countries of the world follow different schemes of organization of such relations. In the United States, for example, the Department of Agriculture is helping schools liaise with local farms. A similar system is in place in India where parenting committees, teacher and parent associations take care of supply arrangements [15]. The School Nutrition Program in Brazil is an effective tool for the development of small farms and, ultimately, for improving their material well-being [16],[17].

We believe that such programs should be implemented in rural communities of Ukraine. For this purpose, it is necessary to organize at the legislative level the purchase of food for children of preschool, secondary schools and institutions for citizens who need social assistance and rehabilitation of state and communal property, to which the provisions of the Law on Public Procurement will not apply. At the same time, it is incumbent on the relevant customers, represented by representatives of the executive body of rural communities, to purchase food at prices that do not exceed the current official average prices in the region. At the legislative level, introduce a requirement for mandatory implementation of a HACCP-based food safety management system for all market operators, including food-supplying farmers in schools and pre-schools. According to Art. 20 of the Law on Basic Principles and Requirements for Food Safety and Quality, the market operator is obliged to develop and apply ongoing procedures based on the principles of hazard analysis and critical control systems, and to provide appropriate training for those responsible for such procedures during the production and circulation of food.

In our opinion, the introduction of such cooperation between farms and local authorities will bring some positive points for all interested parties in this agreement, in particular: a rational system of pricing and payment is formed, since trade and intermediary structures are excluded from the relationship, opportunities for increase are created; in the long run, it will increase the standard of living of household members and, globally, increase the standard of living in the country; in rural areas, supplying farmers nicks products mostly are parents of pupils of the local school - receiver products. Thus, they have the opportunity, on an informal basis, to positively influence the quality of nutrition of their children.

The main priorities for the formation of interaction between small farms and local authorities are the tasks of rural development, as well as the social infrastructure of the territory where the farms are located. Among these tasks are the following: creation of favorable conditions for inflow of investments into agriculture of the region; information and consulting support for small businesses; monitoring of entrepreneurial activity of entrepreneurial organizations at the rural community level to evaluate the effectiveness and efficiency of implementation of

state programs and projects, diagnostics of economic, social and innovation situation in rural areas and in the whole region.

State support for socially responsible farmers should include the following: reducing the tax burden or fully exempting taxpayers from entrepreneurs who are actively involved in the socio-economic development of rural areas; grants to socially responsible representatives of the business community, who develop and implement their own projects for developing the social sphere of the village. It is obvious that the development of social partnership, improvement of well-being of rural territories, their socio-economic stability and sustainable development cannot be ensured under the condition of separate, isolated actions of the state, representatives of agrarian entrepreneurship and local self-government bodies. The most relevant area of social partnership is environmental protection, extension of social guarantees for workers, labor protection, creation of appropriate social conditions for living in rural areas, etc. Therefore, it is a matter of overcoming the contradictions and mutual satisfaction of the interests of agrarian entrepreneurship and the state, possibly provided the functioning of a well-established mechanism of interaction as a means of achieving a positive result.

4. Conclusions

Supply chain management of the agriculture is considered in agriculture with its application in small farms. Instruments of state support for the development of farms in leading countries have been systematized, aimed at supporting their interests. The necessity to concentrate state support for the development of small farms is justified, and to exclude medium and large farms from the list of entities that are provided by the state in the framework of financing agriculture.

The results of the cluster analysis of small farms indicate that it is advisable to direct state support to the development of farms in which revenues are generated from the sale of crop products, as well as from other crop products - "niche" products and livestock.

There is a need to develop regional support programs for small-scale "niche" crop farms that would compensate for the material costs of producing it at a rate of 50% of the cost standard. The procedure for providing such support was elaborated and the possibilities of financial support were determined according to the principle of co-financing of the united territorial community and state bodies in the ratio of 50:50. The feasibility of state support for beginning farmers on the basis of a grant for the creation of a family livestock farm, the maximum size of which should be: for breeding cattle of meat and dairy areas no more than 60%, pigs and poultry - 50% of regulatory costs is proved. The financial basis for the program for supporting the development of farms for the production of livestock products should be from the funds of the local united territorial communities and the state budget in the ratio of 30:70.

References

- [1] T. O. Savchuk, and S. I. Petryshyn, "Vykorystannia iierarkhichnykh metodiv klasteryzatsii dlia analizu nadzvychnykh sytuatsii na zaliznychnomu transporti [The Use of Hierarchical Clustering Methods for Railway Emergency Analysis]", Article, International Scientific and Technical Journal "Measuring and Computing Technology in Technological Processes" (Khmelnitsky, no.1, pp.193-198). [in Ukrainian]. 2009.
- [2] P. H. Gitis, "Statystychna klasyfikatsiia ta klasternyi analiz [Statistical classification and cluster analysis]", - Moscow: Moscow State Mining University, 157 p, 2003.
- [3] V. A. Byba, and R. Ya. Korinets, "Ekonomichni aspekty derzhavnoi pidtrymky fermerskykh gospodarstv Ukrainy [Economic aspects of state support for Ukrainian farms]", Agro-world, no. 11, pp. 27–32, 2018 [in Ukrainian].
- [4] I. M. Demchak, and et al. "Zahalni tendentsii rozvytku fermerskykh gospodarstv v Ukraini [General tendencies of development of farms in Ukraine]", - K. Research Institute of Ukragropromproductivity, 56 p, 2016 [in Ukrainian].
- [5] Yu. O. Nesterenko, "Simeini fermerski gospodarstva: tendentsii rozvytku v sviti ta suchasnyi napriam hospodariuvannia v Ukraini [Family Farms: Trends in the World and Modern Business in Ukraine]", Scientific papers of Kirovograd National Technical University. Economic sciences, vol. 28, pp. 59–67, 2015 [in Ukrainian].
- [6] V. A. Byba, K. V. Tkachenko, N. I. Svytnous, "Ekonomichni aspekty zemlevykorystannia fermerskymy gospodarstvamy [Economic aspects of land use by farms]", agro-industrial complex (AIC) Economics and Management: Coll. of sciences. Bila Tserkva Ave., no 1. pp. 113–123, 2018 [in Ukrainian].
- [7] L. B. Gnatyshyn, O. M. Kordoba, and V. V. Lipchuk, "Fermerski gospodarstva: stan, problemy ta stratehii rozvytku: monohrafiia", [Farms: status, problems and development strategies: monograph], 236 p, 2016 [in Ukrainian].
- [8] A. Golubev, "Fermerski gospodarstva Ukrainy: tendentsii rozvytku ta ekonomiko-sotsialna sutnist [Farms of Ukraine: development trends and economic and social essence]", Bulletin of the Academy of Labor, Social Relations and Tourism, no. 1, pp. 58–63, 2017 [in Ukrainian].
- [9] What niche crops can "insure" a farmer? URL: <https://agrodovidka.info/post/10076>
- [10] N. G. Kopitets, "Rynok yalovychny v Ukraini: suchasnyi stan ta perspektyvy", [The Beef Market in Ukraine: Current Status and Prospects] AIC economy and management, no. pp. 59–64, 2015 [in Ukrainian].

- [11] A. Tarasenko, and D. Yablonovsky, “*Yaka model subsydiuvannia ahrarnoho sektora potribna Ukraini [What model of subsidizing the agrarian sector is needed in Ukraine]*”, Electronic resource: Access mode: <https://ces.org.ua/wp-content/uploads/2018/10/> [inUkrainian], 2018.
- [12] O. M. Suprun, “*Derzhavne rehuliuivannia haluzi tvarynyystva. [State regulation of the livestock industry]*”, AGROSVIT, no. 13-14, pp. 3-6, 2016 [inUkrainian].
- [13] O. Varchenko “*Specific features of the new agricultural policy in the United States*”, Economics and management of agribusiness, Bila Tserkva, no 2, pp. 5-10, 2015.
- [14] J. L. Novak, J. W. Pease, and L. D. Sanders. “*Agricultural Policy in the United States: Evolution and Economics (Routing Textbooks in Environmental and Agricultural Economics)*”, 242, pp. ISBN-13: 978-1138809239, 2015.
- [15] S. R. Lozinsky, and O. S. Ruff, “*Comparative assessment of the agricultural sector of the Russian Federation and the USA*”, Education and agrarian science in solving socio-economic problems of agricultural development: international materials. scientific method. conf., ded. 50th anniversary of the economy. fac. NSAU. Novosibirsk: NSAU, pp. 90–95, 2010.
- [16] Schools as a nutrition improvement system. Food and Nutrition in Schools - A New Look: Online Resource: Access Mode: <https://www.unscn.org/uploads/web/news/document/School-Paper-RU-WEB.pdf>
- [17] School nutrition programs contribute to health promotion, education and development: Electronic resource: Access mode: <http://www.fao.org/publications/highlights-detail/en/c/1107079/>