JEL Classification: *O10, O13, O52; Q10, Q15* **DOI**: https://doi.org/10.31521/modecon.V26(2021)-06

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Efficiency of Ukraine Agriculture: a Comparative Analysis by Countries

Abstract. Introduction*. Agriculture plays prominent role to supply people with food and industry with raw. The development of this branch depends on as economic conjuncture as nature conditions. Ukraine agriculture have developed in two directions during the period of 1991-2018. After several years of declining this branch has started reviving since 2009. The question is how successful this process is flowing. Various investigations cover analysis of dynamics, structure, correlations between indicators, forecasting and juxtaposing with other economic branches. Studying experience of other economies that had downs, but then accumulated their strengths and made economical leap, is the example for own start in development. What caused the growth and what made countries prosperous? This experience must be studied and implemented by scientists, government, and farmers. Most nowadays successful countries started from revision of existing styles of agricultural management and farm holding. They initiated reforms and adopted laws that had to support development of farms. Some of countries, that have been under influence of Soviet Union's style of management, being independent now are in the category of countries with middle or high world level of income. In contrary, Ukraine during almost thirty years of independence is fighting problems in economic development caused by negative factors including crises. To study features of countries' growth and eliminate influence of inflation or incomparable indicators on results of analysis it is reasonable to investigate the same indicators for the similar period in determined currency. This article presents comparison results made for Ukraine Poland, Belarus, Moldova, Estonia, Lithuania, Latvia despite their size and political preferences. Information for analysis used in this exploration is on the World Bank official site. Data cover the period of 1995-2019 years.*

Purpose*. The main aim of this article is to compare indicators of agriculture development in Ukraine with other countries in order to find how successful and sufficient economic efforts of Ukraine are to raise agriculture sector on the higher level of development.*

Results. *Conducted analysis revealed that other countries compared with Ukraine get bigger value added per worker or per unit of agriculture land. Moreover, they not only feed own country, but also sell their production abroad.*

Conclusions. *Ukraine has the biggest soils squares to plant crops, vegetable, fruit, but it gets the least amount of profit from land usage. Ukraine has positive tendency in agriculture development, but as comparison with other countries proved the existing way of land using or cultivation, farm holding, and agriculture management is insufficient to become a prosperous country. Crop and livestock production need to be investigated deeper.*

Keywords*: value added; productivity; land; fertilizer consumption; dynamics; tendency.*

УДК 339.9

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Ефективність сільського господарства України: порівняльний аналіз в розрізі країн

Анотація. *Сільське господарство відіграє визначну роль у забезпеченні населення продуктами харчування та промисловості сировинними матеріалами. Розвиток цієї галузі залежить як від економічної кон'юнктури, так і від природних умов. Протягом 1991-2018 років сільське господарство в Україні розвивалося в двох протилежних напрямах. Численні дослідження охоплюють аналіз динаміки показників, структури, взаємозв'язків, прогнозу та зіставлення розвитку галузі з іншими сферами економіки. Вивчення досвіду економік інших країн, які теж мали занепад, однак акумулювали свої зусилля та зробили стрибок у напряму росту, – це основа і приклад для України. Що спричинило зростання та зробило країни процвітаючими? Такий досвід має бути досліджений та використаним у майбутньому науковцями, державним керівництвом та, власне, фермерами. З'ясовано, що більшість успішних країн розпочали з дослідження існуючих форм та стилів господарювання, з реформування галузі та розробки законів, які мали на меті підтримати розвиток фермерства. Деякі країни після отримання незалежності за кілька років перейшли до категорії країн із середнім, а деякі – з високим світовим рівнем доходу. Україна після майже 30 років незалежності потерпає від проблем, спричинених різними факторами, у тому числі і кризами.*

Для вивчення особливостей в розвитку країн та виключення впливу коливання інфляції або інших непорівнюваних показників на результати аналізу, необхідно дослідити показники, виміряні за однією шкалою за один і той самий час, в одній і тій самій валюті. У роботі виконано порівняння розвитку України з Польщею, Білоруссю, Молдовою, Естонією, Литвою та Латвією. Для аналізу використано інформацію офіційного сайту Світового Банку. Дані охоплюють період з 1995 по 2019 роки.

Стаття надійшла до редакції: 10.03.2021
Received: 10 March 2021

Метою статті є зіставлення розвитку сільського господарства в Україні з розвитком інших країн для того, щоб з'ясувати, наскільки успішними та достатніми є економічні зусилля України в напрямі розвитку власної аграрної галузі.

Проведений аналіз виявив, що в порівнюваних з Україною країнах віддача від одиниці земельної площі сільськогосподарського використання більше, при цьому обсяги придатних земель у рази менші, ніж у нашій країні. Доведено, що Україна має найбільші обсяги земель сільськогосподарського призначення, придатні для вирощування зернових культур, овочів та фруктів, однак порівняння з іншими країнами надає підстави стверджувати, що існуючий спосіб господарювання та управління є недостатньо ефективним для того, щоб стати процвітаючою країною.

***Ключові слова**: додана вартість; продуктивність; земля; споживання добрив; динаміка; тенденція.*

Formulation of the problem. Agriculture development specifies on the level of food safety of country and helps to reveal reserves for its future prosperity. Each country chooses own style of farm management and type to growth certain crops, livestock, or fishering. The question of suitable type of agriculture activity in rural settlements or even in some territories of urban area depends on type of lands, geographic and climatic zones, temperature regimes and volume of precipitation. The way how citizens use country nature assets determines the future stability of its development. Wrong decisions or harmful way in use of land, forests and water pools lead to the disastrous consequences. Gaining of high income from harvested crops or cattle breeding or fishering is the bases for food security. The problems in agriculture sector can cause shortage of nutrition, famine, and illnesses among kids and adults. Another aspect, the effectiveness of agriculture activity in country indicates the level of food provision, access to foreign markets, existence of raw and resources for other industry branches.

As it was proved by researchers [1], during the period of 1996-2018 Ukraine agriculture have developed in two directions. The first of them lasted from 1996 to 2008 and has been characterised with features of decline and stagnation with decrease of this economy sector value added. The second proceeded from 2009 up to 2018 and marked as enlargement of the branch productivity. According to the results of earlier conducted analysis, it has increased in two times since 2009. Thus, development of agriculture in Ukraine changed trend into positive direction in 2009 year.

The current stage of investigation is expected to be answered the question: "Is it enough for Ukraine to have such pace of development and use existing types of activity in agriculture in order to become leader among other neighbouring countries, or, at least, to be equal to their rate of growth?" Consequently, this investigation covers the period of 1995-2019 and compares data of several countries.

Analysis of recent research and publications. Different approaches in agricultural development studies can be divided in several groups. The first is dedicated to the effectiveness as agriculture output at a whole. This group includes the work by S. Nadvynychnyy who studied approaches in determining of terms of "agriculture effectiveness" [2]. It is clearly seen from his observing that the most scientists generally understand agriculture effectiveness as a rise of agriculture products or income with minimised material and financial expenditures, but with multiple usage of land, labor, material, and technical resources [2, p. 117]. Author studies such indicators as square of agriculture lands and productivity of various kinds of crops, vegetables, outcomes from activity of dairy and poultry farms, dynamics of their profitability.

The second group contains work by L. Smolii who conducted comparative analysis of effectiveness of government management of agriculture in Ukraine and European Union (EU) [3]. Researcher investigated tendencies in financial support, sources of transfers entering in Ukraine and EU, growth rates of public services, structure of costs on public services, trends in customer support. Author pointed on differences in agriculture afforecement that exist between Ukraine and EU.

The third group consists of presentatives of quantitative analysis. For example, some of foreign researchers explored how farmer willingness, preferences, their specific of activity, farmland size, distance from urban settlements and even farmer's family members quantity influence on effectiveness of cooperation and income rise in agriculture [4]. Others [5] used econometrics models to study small and medium enterprises profitability for the long period. They analysed accounts receivable and payable, inventories, cash conversion cycle, firm profitability, then built multi dimensional regression model. They presented result of correlation analysis between working capital and profitability of numerous Spanish manufacturing firms.

The distinguish approach is demonstrated by forth group of other scientists [6] who rais problem of lack of technologies that can provide both ecology safety and agriculture growth simultaneously. Some researchers [7] conceive that depressions in agriculture lead to the threats for the country economy sustainability and food security. Thus, they pointed in different scientific findings on the necessity to transform "conventional agriculture towards agroecology" that can prevent not only lack of food or economic crisis but provide ecological sustainability of environment [7, p. 156]. Such approach changes understanding of agriculture purpose. Term "agroecology" means that agriculture must be not only for consumption of financial transfers, or usage of its products by other industries, but also must be not harmful for ecology. It is the mainstream in the latest explorations abroad.

Formulation of research goals. The main purpose of this article is to compare the agriculture development of Ukraine with development of this branch in Poland, Belarus, Moldova, Lithuania, Latvia, and Estonia as nearest

countries that have been influenced by economy of former Soviet Union for a long time until 1990th. To gain main goal and understand how Ukraine agriculture is effective it can be possible not only with analysing of internal dynamics but in comparison with abroad economies. Conducted analysis covers the period of 1995-2019.

Outline of the main research material. Value added by agriculture that includes livestock production, crop cultivation, forestry, and fishing (in current US$) is the first among indicators to compare agriculture effectiveness in different countries. The volume of value added as the summarised output of agricultural branches with subtracting intermediate consumering depends on size of certain country and it should be used in relation with another indicator in order to have results of analysis valid and representative. This indicator can help to measure the value added per one employee or find employee productivity.

The next way to investigate value added is to calculate volume of outcome (yield, income) from one hectare or one square metres of agricultural land. The correlation helps to analyse the profitability of lands that are arable, under temporary and permanent crops, pastures, gardens, and lands that are used for a long period (including lands under fruit trees and vines). According to the definition by Food and Agriculture Organisation (FAO) the agricultural lands do not include abandoned fields because of shifting cultivation.

It is known that certain kind and amount of fertilisers facilitate land quality that helps to the growth of culture. This indicator can be applied to see how fertilising is used by countries and what the results of this they gain. As FAO determined "Fertilizer consumption measures the quantity of plant nutrients used per unit of arable land" [8]. It includes components of nitrogenous, potash, and phosphate fertilizers excluding animal and plant manures.

Analysis of agriculture development in Ukraine and comparison with its effectiveness in Poland, Belarus, Estonia, Lithuania, Latvia, and Moldova has revealed that size of Ukrainian lands for agriculture needs is the biggest among mentioned countries and equales to 413290 sq.km. Simultaneously, in 2019 year the size of value added by agriculture sector from the land unit (in current US$) in Ukraine was the lowest (the results are presented in Figure 1).

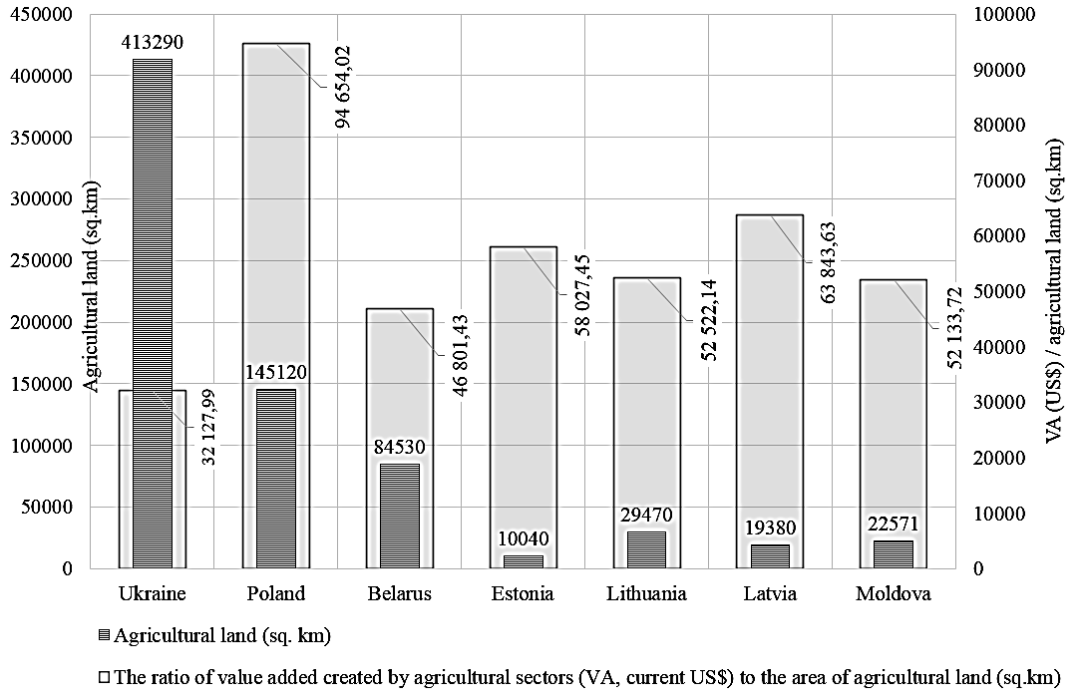

Figure 1 – **The ratio of the value added created by agricultural sectors (VA, current US$) to the square of agricultural land (sq.km), 2019 year**

Source: calculated and constructed by author based on data [9-15]

As it is seen, in 2019 Poland gained the biggest size of value added by this economic branch and that size was more than 94654 US$ from land unit (it is shown by marker in the form of transparent bar). Comparing with Ukraine the land square under crops, fruit trees, pastures or gardens in Poland was more than in twice less (marker in the form of dark bar). It does matter to notice that other countries demonstrated considerable excess of value added over their land size. Ukraine is the single among the investigated countries has huge soils potential and low income from them. This fact proves that Ukraine uses its lands ineffectively.

Supposing the size of value added depends on productivity of farmers or workers who employed in

agriculture. Studying the official statistical data led to the conclusion that the highest productivity per worker (in constant 2010 US$) has observed in Estonia where it exceeded the level of 29610 US$ in 2019. In contrary, in Ukraine it has reached at least 5733,37 US$ (Figure 2).

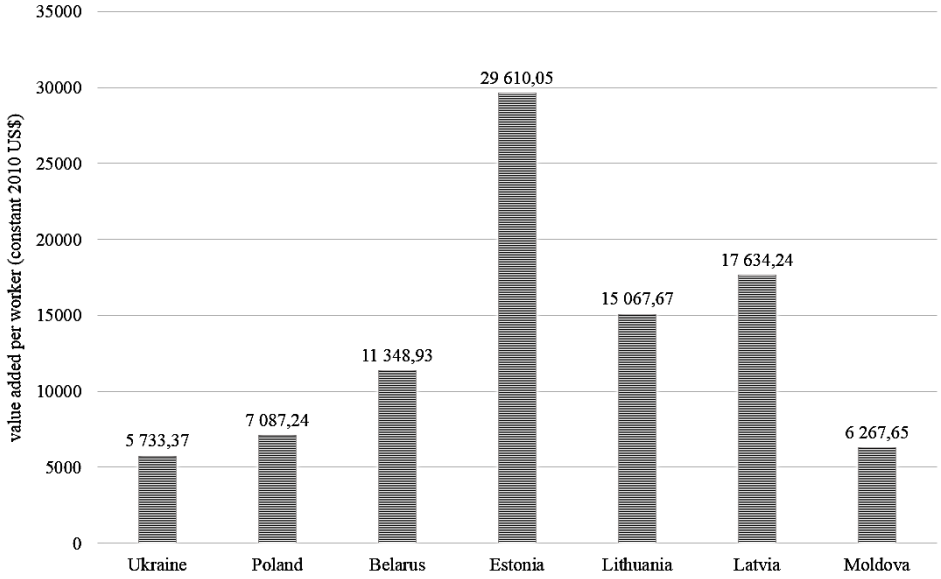

Figure 2 – **Agriculture, forestry, and fishing, value added per worker (constant 2010 US$), 2019 year**

Source: calculated and constructed by author based on data [9-15]

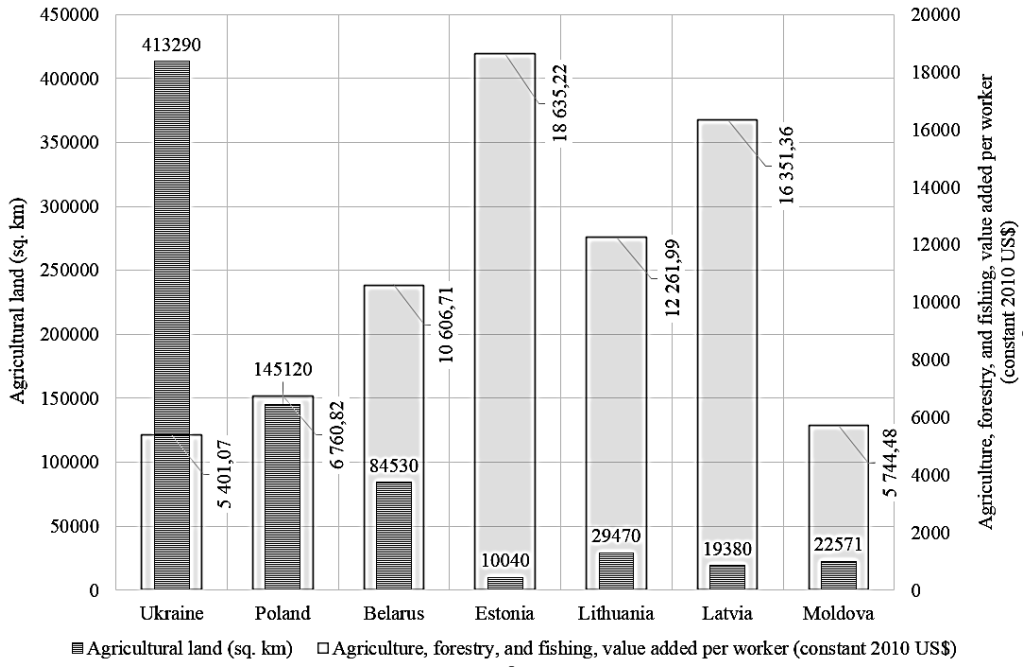

Figure 3 – **Agriculture, forestry, and fishing, value added per worker (constant 2010 US$) and agricultural land (sq. km), 2019 year**

Source: calculated and constructed by author based on data [9-15]

Considerable contrast between Ukraine and Estonia becomes evident if juxtapose the value created by one agriculture employee and soils sizes in countries. It is clearly seen the high productivity of Estonian workers (Figure 3). It leads to the thought that Ukraine needs to learn which kind of activity helps this country to be successful. It is necessary to study their styles and forms of farm holding, use experience of management, raising of production quality, waste utilisation, approaches to improve quality of soils without their depletion. Tendencies of the ratio of the value added created by agricultural sectors (current US$) to the square of

agricultural land (sq.km) are different in countries in 1995-2018 (Figure 4). Ukraine had light growth in agriculture development since 2009 up to 2013, inconsiderable decline until 2015 and then the soft rising of the branch. As a contrast, notable fluctuations can be seen in the trends of Estonia and Poland. Both had ups (in 2007-2008, 2011, 2014) and downs (in 2009 and 2015). The common reduction in development of each country is observed in 2009, when world financial crisis impacted each economy. After crisis the economies went on their growth in own speed and directions, but Ukraine position of explored indicator left on the lowest level (the uneven solid line is in the Figure 4).

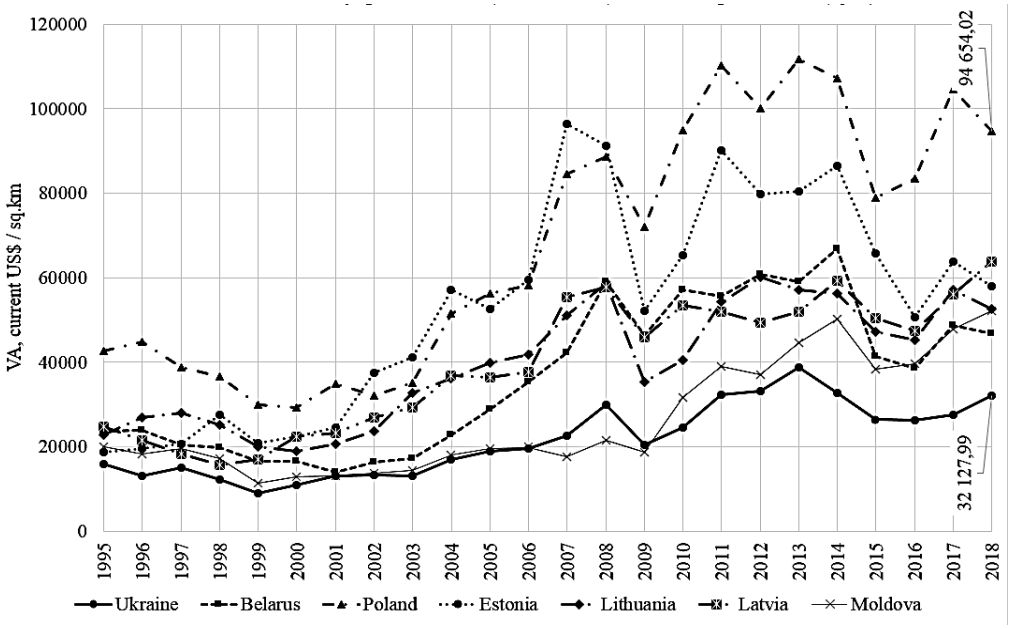

Figure 4 – **The ratio of the value added created by agricultural sectors (VA, current US$) to the area of agricultural land (sq.km)**

Source: calculated and constructed by author based on data [9-15]

Certain fertilisers that were contributed into land facilitate its quality and activate growth of crops in dependence on soils structure and saturation with useful nutrients. As dynamics show, Belarus and Poland are leaders in fertilising (in Figure 5). Moreover, Belarus has been raising fertilisers amounts from year to year up to 2011 year (303,89 kilograms per hectare) and then has started decreasing of the soil enrichment with nutritions.

The juxtaposition of results of fertilizer contributions in kilograms per hectare of arable land and value added created by worker employed in agriculture sectors in 2018 year presented in Figure 6. As it seen, Estonia consumed components of nitrogenous, potash, and phosphate fertilizers (87,8 kilograms per hectare) in twice less than Belarus (156,2 kilograms per hectare), but productivity per worker was the highest (18635,2 US$) among other countries. Ukraine agriculture appeared not such effective and productive. The value added created by employee was the only 5401 US$.

Human activity has always additional outcomes that are solid waste and air pollution. Contemporary agriculture growth is connected to the risks of air pollution and soil depletion. The position when agriculture should be friendly to the nature becomes essential in our world. This scientific direction is called as “agroecology”. It is important to investigate this question in Ukraine and other countries, but it is faced with difficulties in getting of relevant data. Some recources present information about methane and nitrous oxide emissions that are produced in the first case by animals, including animal waste or waste burning, and in the second it is related to fertiliser usage. Such data are presented by the World Bank and EDGAR (Emissions Database for Global Atmospheric Research) and cover the period only up to 2015 year [16]. In Ukraine found data about methane or nitrous oxide emissions cover the period 1995-2008 years. This is the obstacle in exploration of agriculture impact on environment.

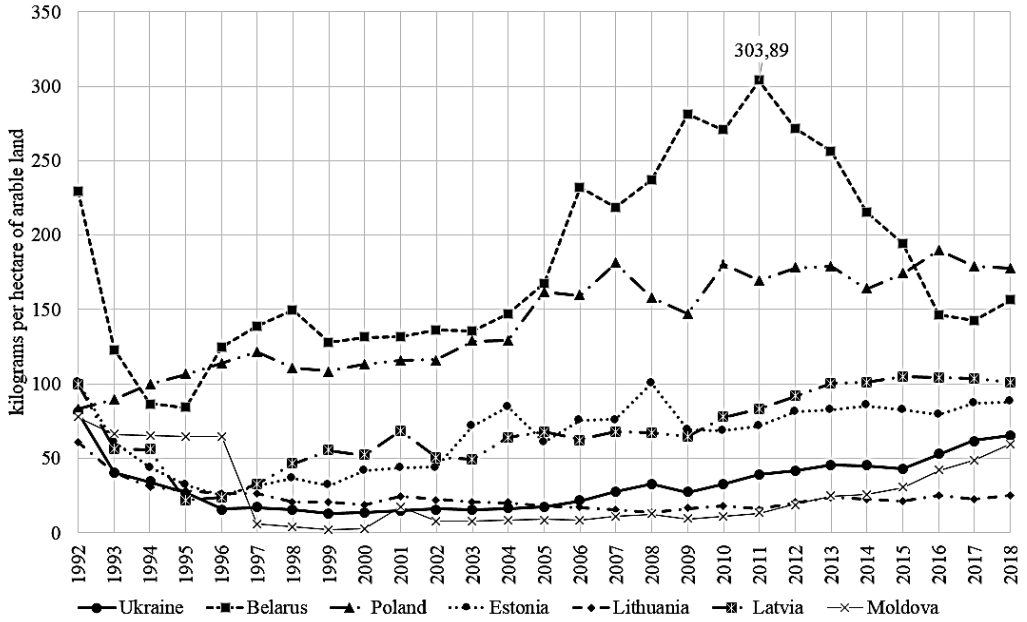

Figure 5 – **Fertilizer consumption (kilograms per hectare of arable land)**

Source: calculated and constructed by author based on data [9-15]

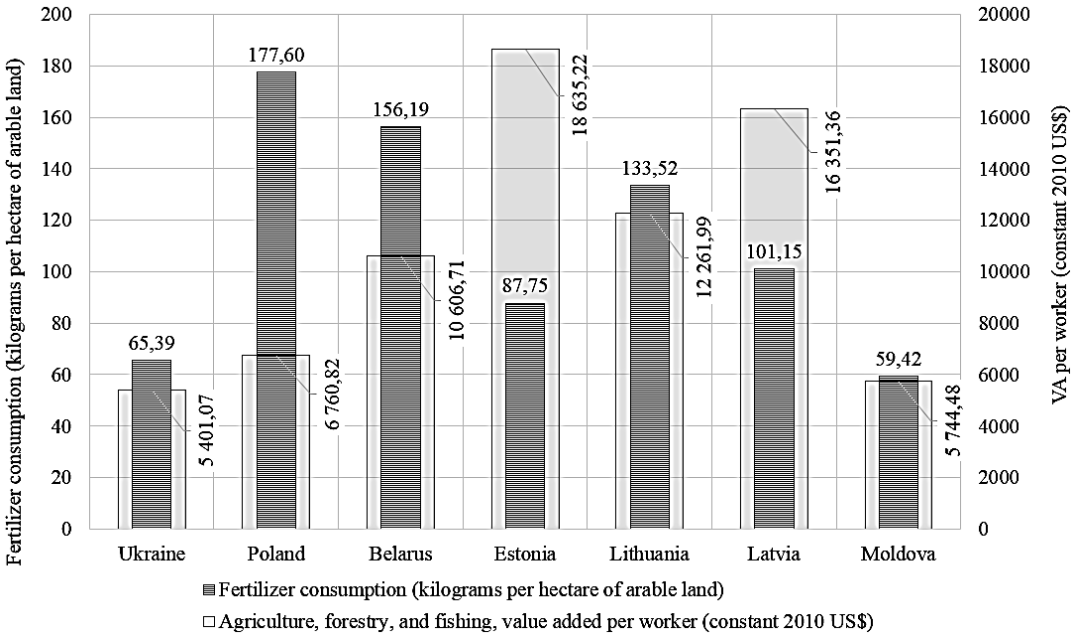

Figure 6 – **Value added per worker employeed in agriculture (constant 2010 US$) and fertilizer consumption (kilograms per hectare of arable land), 2018 year**

Source: calculated and constructed by author based on data [9-15]

To sum up our comparison, Poland is one of the post Soviet influenced countries that has reformed own agriculture since 1991 and now it is one of the famous suppliers of vegetables and fruits for European Union [17]. 80% of land in the country are in private possession. Economical development of this country is not such unambiguous as it can be seemed, but agrarian sector influences on economy at whole. Poland agriculture dynamics is on the growth stage of food export and due to that country has positive trade balance [18].

It does matter to learn experience of other successful European country. Estonia gives the most prominent example. It has the only 45230 km2 lands that give the highest value added. They started reforms in agriculture

in 1989 with adopting the Law on Private Farming to stimulate production activity with land use for crops growing. Today Estonia plants vegetables, cereal crops, potatoes and develops livestock that includes milk cattle, pigs, and poultry. There are fishering that plays considerable role in economy. Estonian farmers were given grants for modernization of own farm holds. As a result, now they supply with food not only own country, but others. The opportunity to sell their food products to other European economies appeared because of joining the European Union. Certain reforms supported Estonian agriculture farmers. Some of specialists today raise problem of concentration of lands in hands of big corporations, and as it is suspected, it can be an obstacle in Estonia future prosperity [19]. Nonetheless, it can be seen notable difference between Estonia and Ukraine productivity. Just, for comparing, Ukraine has 413290 km2 lands for agriculture purposes that is in 41 times bigger than the same indicator in Estonia. Simultaneously, the usage of agriculture lands in Estonia gives 58072 US$ and in Ukraine the only 32128 US$ from one land unit. It is worth to think about described contrast.

Conclusion. Nowadays Ukraine has positive tendency in agriculture development, but as results of conducted analysis proved the existing way of agriculture activity is insufficient and it is ineffective to become a prosperous country. Ukraine is the one among the mentioned countries has the biggest soil squares to plant various crops, cereals, vegetable, fruit, but it gets the least amount of profit from land usage. This fact should be considered to study experience of other successful economies and reform Ukraine agriculture to make it productive and effective.

The problems can be related to the style and type of farming, weak financial and law support, unreasonable taxation, harmful way of land cultivation, poor processing, transportation, and storage of main and by-products, unacceptable use of fertilisers and lack of technologies of waste recycling. Besides, crop and livestock production need to be investigated deeper. The exploration may be headed on studying of agriculture development and it impact on the indicators of balance of payments. It should be cleared the taxation principles and affect on agriculture in Ukraine and abroad. It is worth to compare styles of farm holding. After investigation of mentioned points in juxtaposition with other countries' development it is reasonable to choose or elaborate the most appropriate model for Ukraine agriculture.

References:

1. Dmytriieva, V. and Sviatets, Yu. (2021). Turning points in agriculture development in Ukraine: results of analysis on the base of purified data. *Agricultural and Resource Economics*, 7(1), 5-21. DOI: https://doi.org/10.51599/are.2021.07.01.01.
2. Nadvynychnyy, S. (2016). The methodology of the study of economic efficiency of agricultural production. *Ekonomichnyj analiz*, 25(2), 115-121 [in Ukrainian].
3. Smolii, L.V. (2016). Comparative estimation of state support efficiency of agricultural sector of Ukraine and the EU countries. *Innovative economics,* 1-2 (61), 26-34 [in Ukrainian].
4. Wardhana, D., Ihle, R., Heijman, W. (2020). Farmer cooperation in agro-clusters: Evidence from Indonesia. *Agribusiness*, 36(4), 725–750. DOI: https://doi.org/10.1002/agr.21637.
5. Fernández-López, S., Rodeiro-Pazos, D., Rey-Ares L. (2020). Effects of working capital management on firms' profitability: evidence from cheese-producing companies. *Agribusiness*, 36(4), 770–791. DOI: https://doi.org/10.1002/agr.21666.
6. Loures, L., Chamizo, A., Ferreira, P., Loures, A., Castanho, R. and Panagopoulos, T. (2020). Assessing the Effectiveness of Precision Agriculture Management Systems in Mediterranean Small Farms. *Sustainability*, 12, 9. DOI: https://doi.org/10.3390/su12093765.
7. Salazar, O., Rojas, C., Baginsky, C., Boza, S., Lankin, G., Muñoz-Sáez, A., Pérez-Quezada, J., Pertuzé, R., Renwick, L.L.R., Székács, A., and Altieri, M. (2020). Challenges for agroecology development for the building of sustainable agri-food systems. *Int. J. Agric. Nat. Resour*, 47(3), 152-158. DOI: http://dx.doi.org/10.7764/ijanr.v47i3.2308.
8. The World Bank (2021). World Development Indicators: Agricultural inputs. *Official website*. Retrieved from http://wdi.worldbank.org/table/3.2
9. The World Bank (2021). Ukraine. Data. Retrieved from https://api.worldbank.org/v2/ru/country/UKR?downloadformat=excel.
10. The World Bank (2021). Poland. Data. Retrieved from https://api.worldbank.org/v2/en/country/POL?downloadformat=excel.
11. The World Bank (2021). Belarus. Data. Retrieved from https://api.worldbank.org/v2/en/country/BLR?downloadformat=excel.
12. The World Bank (2021). Estonia. Data. Retrieved from https://api.worldbank.org/v2/en/country/EST?downloadformat=excel.
13. The World Bank (2021). Lithuania. Data. Retrieved from https://api.worldbank.org/v2/en/country/LTU?downloadformat=excel.
14. The World Bank (2021). Latvia. Data. Retrieved from https://api.worldbank.org/v2/en/country/LVA?downloadformat=excel.
15. The World Bank (2021). Moldova. Data. Retrieved from https://api.worldbank.org/v2/en/country/MDA?downloadformat=excel.
16. EDGAR - Emissions Database for Global Atmospheric Research (2019). Country Fact Sheet. Ukraine. *Official website*. Retrieved from https://edgar.jrc.ec.europa.eu/country_profile/UKR
17. Dabrowski, P., Lipski, A. (2002). Poland: Agrarian reforms and family farming. *Online Knowledge Base. Natural Resource. Governance around the World*. Retrieved from http://www.agter.org/bdf/en/corpus_chemin/fiche-chemin-73.html.
18. Kowalczyki, S., Kwasek, M. (2020). Agricultural sector in economy of Poland in 1950-2020. *Western Balkan Journal of Agricultural Economics and Rural Development*, 2(2), 77-98. DOI: https://doi.org/10.5937/WBJAE2002077K.
19. Jürgenson, E. and Rasva, M. (2020). The Changing Structure and Concentration of Agricultural Land Holdings in Estonia and PossibleThreat for Rural Areas. *Land*, 9(2). DOI: http://dx.doi.org/10.3390/land9020041.