Assessing organic production efficiency

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Abstract

A significant number of agricultural producers, in order to get the maximum benefits from their activities, neglect important resources for mankind, i.e. natural. That is why every year the issue of increasing the efficiency of agricultural production with the obligatory reduction of anthropogenic pressure on the environment through the development of organic production becomes more acute.

The purpose of the study is to determine the payback period of the introduction of organic production by typical for Ukraine agricultural enterprise.

Although organic agriculture is a production system that has lower productivity, which leads to a decrease in the commodity mass of production, increases production costs. If we analyze the structure of the cost of organic production compared to traditional, it can be noted that it has much higher material costs, even though in organic production in general there is a decrease due to the abandonment of pesticides and fertilizers.

High profits in the organic technologies management is achieved due to the possibility of selling products at a price higher than traditional, both in domestic and foreign markets.

Thus, to stimulate the transition of agricultural enterprises of Ukraine to organic production is possible through the formation of methods for determining the payback period of organic production.

According to the results of the forecast, it is established that the payback of organic livestock introduced in 2020 in SLC (superadded liability company) "Terezine" will be observed from mid-2026 and by the end of the year will reach 2,000 euros. In the transition to organic production, efficiency increases mainly due to the higher selling price of organic products compared to traditional. Thus, in the first years of transition to organic production there is a significant decrease in production efficiency, which on average after 6 years begins to pay off, while the social and environmental effects of such production are formed immediately.

The modern paradigm of entrepreneurship is formed in such a way that a well-structured strategy for the transition to organic production, environmental and social responsibility of doing business become not only an indicator of image and prestige, but also the main source of potential profit as well as competitive status.

It is possible to stimulate the transition of Ukrainian agricultural enterprises to organic production through the established method of determining the payback period of organic production, which allows to predict in the development strategy of agricultural enterprises the possibility of obtaining the required level of efficiency through parallel traditional and organic production during the period until organic production becomes efficient.

Keywords:*organic production, efficiency, net discounted income*

JEL: *M41, M49, Q23.*

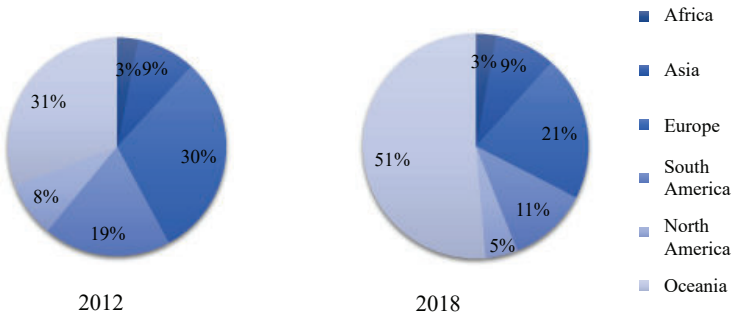
1. **Introduction**

A significant number of agricultural producers, in order to get the maximum benefits from their activities, neglect important resources for mankind, i.e. natural. The use of chemical fertilizers and other synthetic substances in the production process, non-compliance with crop rotation, high mechanical impact on the soil, etc. negatively affect the quality of products. That is why every year the issue of increasing the efficiency of agricultural production with the obligatory reduction of anthropogenic pressure on the environment through the organic production development becomes more acute.

According to FiBL Statistics, it is possible to detail the areas of organic agriculture, as well as to analyze what changes have occurred in 5 years period (2012-2018) (Fig. 1).

Territorial structure of organic production in 2012 and 2018, %*

Fig. 1



* developed according to [1]

Having analyzed the data for 2012 and 2018, we can conclude that in 5 years the number of agricultural areas where organic products are produced in Oceania has increased significantly, if in 2012 their number was almost the same as in Europe and amounted to 31 %, in 2018 they expanded more than 2 times and occupy 51 % (35,894,365.04 ha).

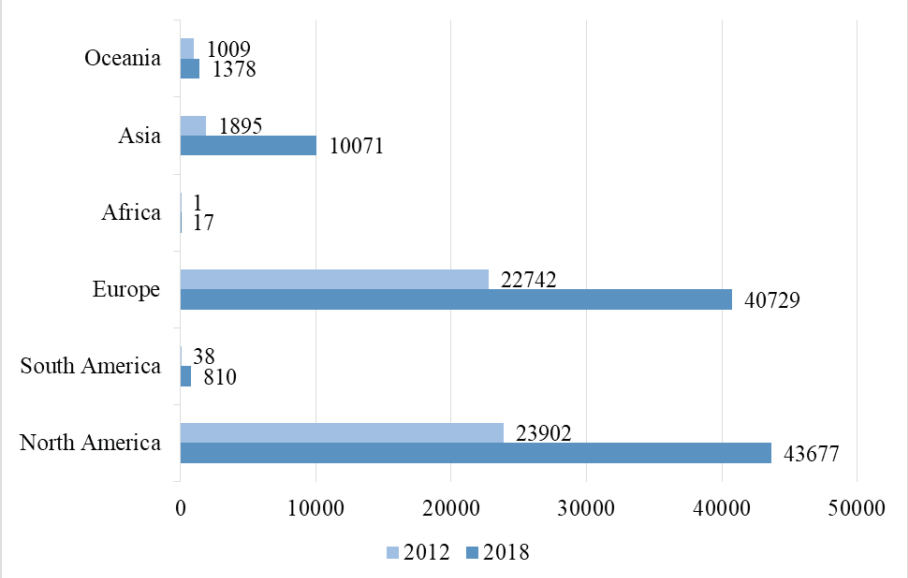
The second largest area for organic production was Europe, which occupies 21 % (14,563,030.64 ha) of the total area of organic land. In percentage terms, in 2018, compared to 2012, there is a decrease in the share of European organic lands of agricultural purposes, but in full-scale their area increased by 3408,05 ha.

Along with this in Fig. 1 for 100% is taken the total area of all agricultural land intended for organic production, and it in turn is only 1.5% of the area of all agricultural land. That is, 98.6% of the land is still exposed to fertilizers harmful to the environment and human health or other factors that negatively affect the environment. In total, according to FiBL Statistics, only in 14 countries 10 or more percents of agricultural land are organic.

Sales of organic products and beverages reached 96.7 billion euros in 2018, which is 47.1 billion more than in 2012 (Fig. 2).

Data on retail sales of organic products in the world, million euros*

Fig. 2



* developed according to [1]

In both 2012 and 2018, the largest markets for organic products were in the United States, i.e. 23.9 billion euros and 43.7 billion euros, respectively, and in Europe, i.e. 22.7 billion euros and 40.7 billion euros, respectively. All other continents have very small sales of organic products. An obstacle to the introduction of organic production by enterprises is the low efficiency of such production in the first years of its introduction.

In the previous researches of scientists the system of indicators of organic production development is revealed [2, 3]. The authors propose indicators for assessing the efficiency of organic production at the micro and macro levels of the economy.

Scientists also pay attention to the study of the following issues: demand for organic products and ways to stimulate it [4, 5], the problem of assessing the economic efficiency of agricultural production in general [6]; ecological and economic assessment of agricultural production [7, 8, 9]; efficiency of environmental protection [10].

The purpose of the study is to determine the payback period of the introduction of organic production by typical for Ukraine agricultural enterprise.

2. Methodology

In Ukraine, the development of the organic food market began in the late 20th century (1990s), first of all, such products were manufactured for resale abroad, i.e. exports, but today we can see that the level of awareness of the population is gradually increasing, and the number of people who can afford to buy organic products is increasing as well.

In book "The New System of Agriculture" (1898) the Ukrainian scientist and farmer Ivan Ovsynskyi was the first to express the opinion that mineral fertilizers are harmful to the soil. Developing Ovsynskyi's methods and using modern principles of organic agriculture, Semen Antonets founded the first organic farm in Ukraine in the Poltava region with an area of 7,000 ha in 1977. As part of a joint project involving a farm, Ukragrofin and Swiss partners, in 2000 the farm received a certificate of organic farming [11].

Europe ranks second in sales of organic products, and two of the three leading countries are in Europe (France and Germany have the largest area for organic production and sell the most organic products) (Table 1), so Ukrainian producers of organic products have strong competitors and should focus on effective organic production strategies.

Data on organic production in some European countries*

Table 1

Index	*Year*	*Austria*	*Germany*	*Poland*	*Romania*	*Slovakia*	*Slovenia*	*Hungary*	*Ukraine*	*France*	*Czech Republic*
Territory of organic production, ha	2012	561 611	1 034 355	661 956	288 261	166 700	35 101	130 609	272 850	1 032 941	468 670
	2013	558 623	1 044 955	669 863	301 148	157 848	38 665	131 018	393 400	1 060 756	474 231
	2014	551 062	1 047 633	657 902	289 252	180 307	41 237	124 841	400 764	1 118 844	472 663
	2015	553 570	1 088 838	580 731	245 924	181 882	42 188	129 735	410 550	1 322 202	478 033
	2016	571 584	1 251 321	536 579	226 309	187 024	43 579	186 347	381 173	1 538 047	488 591
	2017	620 763	1 373 158	494 979	258 471	189 148	46 222	199 684	289 000	1 744 420	520 032
	2018	637 805	1 521 314	484676	326260	188986	47848	209382	309100	2035024	538894
Percentage of organic production in the total amount of agricultural land, %	2012	20,75	6,21	4,28	0,89	8,79	7,27	2,79	0,66	3,71	11,03
	2013	21,12	6,26	4,65	0,89	8,33	7,96	2,81	0,95	3,82	11,16
	2014	20,99	6,26	4,57	0,90	9,51	8,49	2,68	0,97	4,03	11,12
	2015	21,25	6,51	4,03	1,17	9,60	8,68	2,79	0,99	4,77	11,25
	2016	21,94	7,48	3,72	1,23	9,87	8,97	4,00	0,89	5,54	11,50
	2017	24,00	8,21	3,43	1,23	9,98	9,52	4,29	0,68	6,29	12,24
	2018	24,70	9,10	3,40	2,50	10,0	9,90	4,50	0,70	7,30	12,40
Producers of organic products, units	2012	21 768	23 032	25 944	15 315	365	2 682	1 560	164	24 425	3 907
	2013	21 737	23 271	25 944	14 901	365	3 049	1 673	175	25 467	3 910
	2014	20 880	23 398	24 829	14 159	403	3 293	1 672	182	26 466	3 866
	2015	20 976	24 736	22 277	11 869	420	3 412	1 971	210	28 884	4 121
	2016	24 213	27 132	22 435	10 083	431	3 513	3 414	294	32 264	4 271
	2017	24 998	29 764	20 257	7 908	439	3 627	3 642	304	36 691	5 275
	2018	25795	31713	19224	7908	439	3738	3929	501	41632	4601
Sales of organic products, million €	2012	1 065	6 970	120	12	...	44	25	8	4 020	70
	2013	1 065	7 420	120	14	...	49	25	12	4 383	77
	2014	1 260	7 760	120	25	...	...	30	15	4 830	74
	2015	1 360	8 620	167	25	...	...	30	18	5 534	79
	2016	1 541	9 478	167	41	...	...	...	21	6 736	94
	2017	1 723	10 340	235	...	...	...	...	29	7 921	127
	2018	1810	10910	250	...	...	...	...	33	9139	...

* developed based on materials [1]

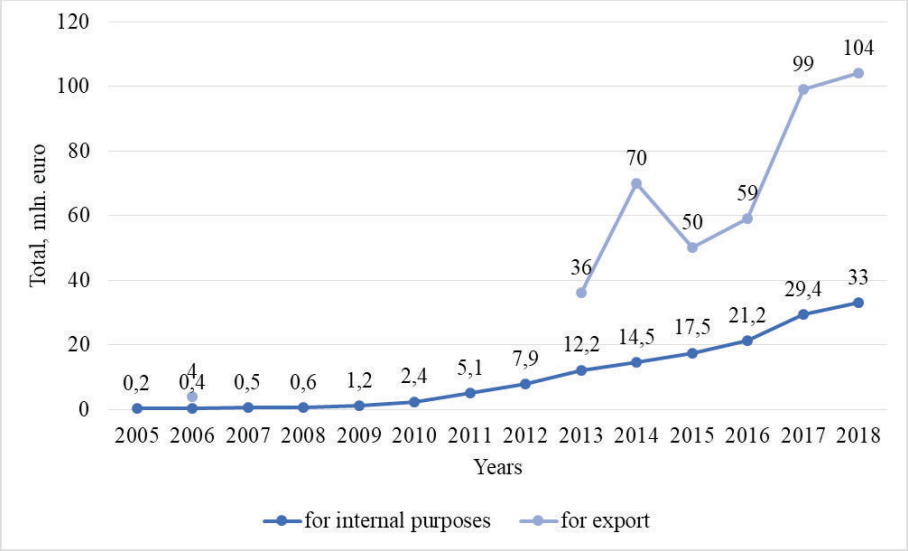
Central and Eastern European countries, such as Poland, Hungary and Romania, have traditionally been important producers and exporters of organic crops. However, domestic markets are slowly developing in these countries. In Ukraine, a decrease in organic production has been observed since 2016, which may be due to the entry into force of new legislation recognizing that in a certain agricultural area just organic products are produced, but compared to 2012, the number of such areas has increased. Ukraine ranks 24th in the

world ranking and 13th in the ranking among European countries in the area of territory intended for organic production.

In 2018, organic products were sold for 33 million euros, which is 68 million euros more than in 2013 (Fig. 3). Export potential in Ukraine is also significant, as sales abroad are more than 3 times higher than domestic indicators.

Data on sales of organic products produced in Ukraine*

Fig. 3



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However, despite the prospects for the development of export potential and the preservation and restoration of soil quality characteristics, the constraining factors for the development of organic farming in Ukraine is the lack of legislation. The transition to organic farming lasts from 2 to 5 years, during which the entrepreneur incurs losses from reduced yields and weed and pest control; low level of awareness, ecological culture, education and innovative activity of agricultural producers [12, p. 50-52]. Thus, for the introduction of large-scale organic production in Ukraine, it is advisable to include in the development strategy of the agricultural enterprise the possibility of obtaining the required level of efficiency through parallel traditional and organic production during the period until organic production becomes efficient. An important issue for this is the formation of a methods for determining the payback period of organic production.

3. Results

Most scientists believe that the essence of the concept of "efficiency" is to obtain the maximum number of products at minimum cost. Ecological and economic assessment of agricultural production includes five groups of indicators that can be used to assess the ecological and economic level of efficiency of agricultural enterprises [7]:

- ecological and economic level of use of production and material resources (fixed assets, working capital, planting materials, feed, fertilizers, chemicals, etc.);
- ecological and economic level of products, expressed in value and full-scale (the impact of environmental factor on the cost and amount of production, profits and profitability, compliance of crop and livestock products with environmental standards, food competitiveness);
- ecological and economic level of production impact on the environment and payback of production costs (unprofitability of certain types of products, economic efficiency of environmental and core activities);
- characteristics of the organizational and technical level of environmental activities of the land user (safety of machinery and technology of agricultural production, availability of equipment with environmental and resource-saving funds, organizational and managerial level of environmental activities);
- the level of financial security of environmental activities and environmental solvency of the land user (financial security of environmental programs, the level of investment development, liabilities in th part of environmental fees and charges).

However, the efficiency of business activity of agricultural enterprises, in view of their contribution to social development, is reduced due to environmental pollution within traditional production [8].

Organic agricultural production involves the use of a technological approach within the production process, which is based on certain standards, namely, is carried out on the basis of appropriate organic standards, which prohibit the use of chemicals and industrialized methods. Within its limits, the achievement of economic efficiency should be based on the use of internal resources of the economy, taking into account the social and environmental component of production.

The traditional agricultural system of production seeks to increase labor productivity and yield, reduce the number of possible risk events inherent in agriculture, as well as reduce production costs. This condition also

applies to organic agriculture, the study of economic efficiency of which is usually carried out by comparing it with traditional (conventional) agriculture.

Due to significant differences in the technological process of agricultural production, they use different methods and tools. However, organic production makes it much easier to harmonize the economic, social and environmental objectives of agricultural entrepreneurship, which is in line with the concept of sustainable development.

Although organic agriculture is a production system that has lower productivity, which leads to a decrease in the commodity mass of production, increases production costs. If we analyze the structure of the cost of organic production compared to traditional, it can be noted that it has much higher material costs, even though in organic production in general there is a decrease of these costs due to the abandonment of pesticides and fertilizers.

High profits in the management of organic technologies is achieved due to the possibility of selling products at a price higher than traditional, both in domestic and foreign markets.

Thus, to stimulate the transition of agricultural enterprises of Ukraine to organic production is possible through the formation of methods for determining the payback period of organic production.

Let's build a model for assessing the effectiveness of the transition to organic production at the enterprise level based on the indicator of net discounted income:

$$NDI = \sum_{t=0}^{T} [NIop - Cop] * \frac{1}{(1+r)^t} \rightarrow max$$

After mathematical transformations:

$$NDI = \sum_{t=1}^{T} \frac{NIop}{(1+r)} + \sum_{t=1}^{T} \frac{Cop}{(1+r)} \rightarrow max$$

where *NIop* – net income from organic production;

Cop – the cost of organic production;

r – discount rate, which for measures of social and environmental orientation is taken at the level of 0.5 of bank interest rate;

t – the period of time.

If for a given period of time T NDI > 0, then the introduction of organic production is economically justified, and if NDI < 0, the introduction is not economically justified.

The payback period of the introduction of organic production is calculated on the example of a typical for Ukraine agricultural enterprise of medium size of the collective form of ownership – SLC "Terezine". The main activity of the studied enterprise is the breeding of farm animals. The company is currently engaged in traditional production.

With the transition of SLC "Terezine" to organic livestock, it may have the following indicators of management (Table 2, columns 1 and 2). The real bank refinancing rate is 10 %. Since social and environmental measures involve a subsidy assessment, a discount rate equals to 0.5 of the bank rate, i.e. 5%, must be taken as the discount rate. The calculation of net discounted income (NDI) is made in Table 2.

Determining the amount of net discounted income for organic production

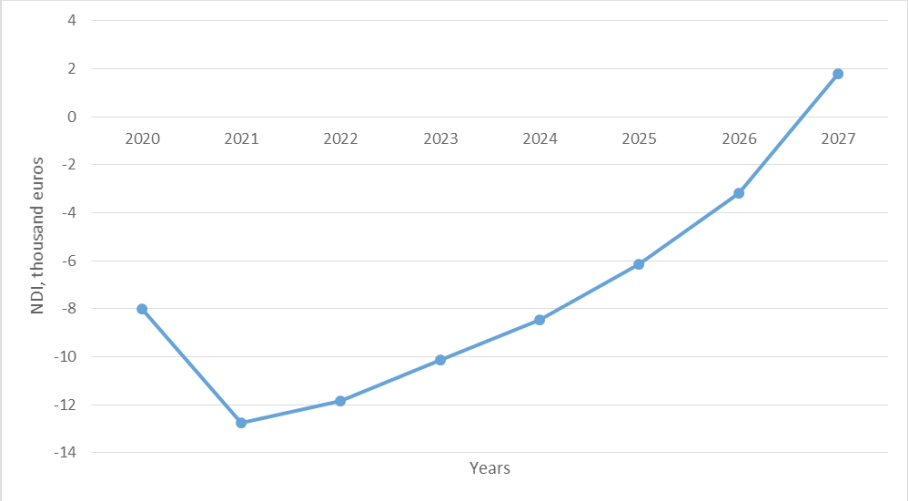
Table 2

Year	*Net income from sales of organic products, thousand euros*	*Costs of production and sale of organic products (including losses from abandonment of traditional production), thousand euros*	*Gross profit / loss, thousand euros*	*Discount rate*	*Gross profit including discounting*	*Net discounted income, thousand euros*
2020	10	18	-8	1	-8	-8
2021	12	17	-5	0,95	-4,75	-12,75
2022	15	14	1	0,91	0,91	-11,84
2023	17	15	2	0,86	1,72	-10,12
2024	19	17	2	0,82	1,64	-8,48
2025	22	19	3	0,78	2,34	-6,14
2026	25	20	4	0,74	2,96	-3,18
2027	27	20	7	0,71	4,97	1,79

A graphical representation of the dynamics of net discounted income is shown in Fig. 4.

Dynamics of predicted net discounted income from the introduction of organic production*

Fig. 4



*developed by the authors

According to the results of the forecast, it is established that the payback of organic livestock introduced in 2020 in SLC "Terezine" will be observed from mid-2026 and by the end of the year will reach 2,000 euros.

In the transition to organic production, the efficiency increases mainly due to the higher selling price of organic products compared to traditional.

Thus, in the first years of transition to organic production there is a significant decrease in production efficiency, which on average after 6 years begins to pay off, while the social and environmental effects of such production are formed immediately.

4. CONCLUSIONS

The modern paradigm of entrepreneurship is formed in such a way that a well-structured strategy for the transition to organic production, environmental and social responsibility of doing business become not only an indicator of image and prestige, but also the main source of potential profit and competitive status of the enterprise.

It is possible to stimulate the transition of Ukrainian agricultural enterprises to organic production through the established method of determining the payback period of organic production, which allows to include in the development strategy of agricultural enterprises the possibility

of obtaining the required level of efficiency through parallel traditional and organic production.

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