

## PECULIARITIES AND RESULTS OF INNOVATIVE ACTIVITY OF AGRICULTURAL ENTERPRISES IN UKRAINE

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### ABSTRACT

The article considers the essence of innovative activity and presents results of the study of innovative processes, conducted by agricultural enterprises of Ukraine. To detect peculiarities of those processes, the researchers used results of examination of the innovative activity of agricultural enterprises in the Lviv region. The work confirms a rather high level of innovative activity of agricultural enterprises, compared to the enterprises of other branches of the economy of Ukraine. It secures positive transformations in the system of agrarian production of the country. The work demonstrates expansion of some kinds of innovations (in product, process, organization, and marketing) by agricultural enterprises of the Lviv region. The authors of the research have analyzed changes in the expenditures of agricultural enterprises, arguing the dependence of innovative activity on resource attraction. The article suggests perspective directions of some kinds of product innovations at agricultural enterprises.

**Key words:** agriculture, innovative activity, kinds of innovations, technological efficiency, expenditures, organic production

**JEL codes:** O13, O31, Q16

### INTRODUCTION

Innovative activity is the principal means to improve the competitive capacity of agricultural enterprises in both the domestic and foreign markets. To reach the adequate level of efficiency, they need permanent upgrading of production technologies to support a high quality of products and optimization of costs. The source of extra revenues is supplied by expansion of the range of products and new ways of selling.

Many agricultural enterprises in Ukraine are focused on the innovative way of development. Their innovative activity has resulted in significant trans-

formations of the system of agrarian production in the country. However, the scale of implementation of some kinds of innovations by agricultural enterprises is unequal, causing imbalance in the development of the agrarian sector of the country's economy. Thus, it is necessary to study the issues concerning conformity of some innovations to the principles of innovative development.

Considering the peculiarities of innovative processes in agriculture, researchers often use a specific concept, i.e. agrarian innovations (agroinnovations). Except for the simplified approach to innovations in a definite branch, the authors point to its principal

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particularity, namely, the application of natural factors and living organisms (animals, plants) in the innovative process [Shubravska 2012, Lupenko et al. 2014, Mohylina 2017]. Taking into account the close relation of agrarian innovations with biological factors of production, Sus [2016] considers agrarian innovations from the position of implementing the tasks of sustainable development in agriculture.

In scientific publications, great attention is paid to peculiarities of the innovative processes in agriculture, which determine their expansion [Yatsiv 2013, Lupenko et al. 2014]. According to Shubravska [2012], the peculiarity of agrarian innovations is that introducing them is not an absolute guarantee for the rise of the competitive capacity of produced commodities or for an increase of their share in the market. The scientists propose different variants of classification of innovations, specifying how their introduction is manifested in agriculture [Sirenko 2010, Yatsiv 2013, Dzhoshar 2015, Karamushka et al. 2018].

Barrientos-Fuentes and Berg [2013] point out the differences of introducing agrarian innovations in different countries. Developing countries are focused on the support for higher quality and diversity of agricultural products, increasing the efficiency of production and distribution processes, improvement of working conditions, and reduction of the burden on the environment. Developed countries are more interested in proposing innovations for satisfying market demand, as well as in the fields related to the generation of alternative energy on the basis of agricultural production. Having studied numerous literary sources, Ogundari and Bolarinwa [2015] suggest that in the scientific publications, innovations in agriculture are primarily associated with technologies, neglecting other innovative effects.

Studying innovative processes in the agriculture of Ukraine, the researchers mark the difficulties occurring while introducing agrarian innovations, including problems of financing, reduction of the number and deterioration of the quality of scientific and research works, lack of qualified personnel [Lupenko et al. 2014, Sus 2016], no integrated state policy, inconsistency of the institutional environment, and needs of innovations transfer [Naymova et al. 2016, Klochan and Klochan 2018]. Having identified the problems,

the scientists outline several means for their solution. Moreover, the dynamic nature of the processes occurring in the environment of agricultural enterprises of Ukraine, requires an extended investigation of their innovative activity.

## **MATERIAL AND METHODS**

The authors of the article set out to characterize the results of expansion of the main kinds of innovations in the operation of agricultural enterprises in Ukraine, and to demonstrate the relation between the innovative activity of those enterprises and the results of their economic activity.

To determine the expansion of some kinds of innovations, the researchers used results of observations for the agricultural enterprises of the Lviv region and in Ukraine. Using a specifically developed form of examination, they obtained information about the innovative activity of those enterprises in 2016–2018. The study concerned 86% of medium-size and large (according to the classification by the State Statistics Service of Ukraine) agricultural enterprises of the Lviv region, confirming high representation in the obtained results.

Having studied the data of the State Statistics Service of Ukraine with application of statistical methods, the researchers established the principal tendencies of agricultural enterprise development in Ukraine and the Lviv region which can be connected with the innovative activity of those enterprises.

## **RESULTS AND DISCUSSION**

To define the essence of innovations, the authors used interpretation of the concept in the Law of Ukraine about innovative activity. The Law states that innovations are considered as new-formed (applied) and (or) improved competitive technologies, products or services, as well as organizational-technical solutions of productive, administrative, commercial, and other character that significantly improve the structure and quality of production and (or) social sphere [2002 Law of Ukraine about innovation activity]. That Law stresses the specific relation between innovative activity and scientific research, as it is focused on the use and commercialization of research findings.

At agricultural enterprises, innovative activity is primarily related to application of new techniques, new technologies, and the introduction of organizational-economic and marketing innovations that are capable of securing growth of the enterprises' revenues, and providing solutions to some social and ecological problems. The researchers note that innovative activity in agriculture is associated with new varieties of crops and new breeds of animals [Lupenko et al. 2014]. However, it is worth noting that only a few enterprises are engaged in selective and breeding work. Their activity is mainly funded by the state. Introduction of new varieties of plants and breeds of animals can be considered as one of the directions to improve the technology of production of agricultural products.

The principle question is what change can be considered as an innovation in economic activity. The State Statistics Service of Ukraine explains that innovations are concerned with the degree of “new for the enterprise (organization)”. The product might already be used or produced by other enterprises, but when it is new or absolutely improved for the present enterprise, such transformation is considered as an innovation for it [State Statistics Service of Ukraine 2018]. Thus, innovations can include products, processes and methods, which are borrowed by an enterprise from other enterprises and are introduced into its operation. It is worth noting that a new or ungraded product can be considered as an introduced one after it is sold on

the market. New production processes, methods of marketing or organization are marked as introduced, when they are actually used in the enterprise operation [State Statistics Service of Ukraine 2015].

In the scientific literature, there are numerous classifications of innovations. The authors of the work suggest that it is reasonable to focus on the approaches which are used by the State Statistics Service of Ukraine. It distinguishes technological and non-technological innovations. However, technological innovations are divided into product (introduction of a technologically new and significantly technologically upgraded product) and process (introduction of a new or significantly improved method of production, or the method of product delivery). Non-technological innovations include marketing and organizational innovations [State Statistics Service of Ukraine 2015]. Other classifications proposed by scientists can serve as specifications for the mentioned list of innovations, being not of principal importance for description of the character of innovative development in a certain branch.

The presented classification is used for determining some kinds of innovations at agricultural enterprises in the Lviv region while observing their expansion. Since the institutional environment for the performance of an innovative activity at agricultural enterprises of the Lviv region does not principally differ from other regions of Ukraine, the obtained results (Table 1) can be

**Table 1.** Introduction of some kinds of innovations at agricultural enterprises in the Lviv region in 2016–2018\*

Kind of innovation	Number of enterprises	Share of enterprises in the total (%)
Product	49	29.0
Including those connected with:		
production of crop products	41	24.3
products of animal breeding	9	5.3
products of agricultural products processing	3	1.8
supply of services in the field of agricultural production	6	3.6
Process	52	30.8
Organization	40	23.7
Marketing	31	18.3
No innovation introduced	82	48.5

\*According to the results of observations of agricultural enterprises in the region.

used for presentation of the peculiarities of innovative activity of such enterprises in the country generally.

Referring to the obtained materials, 51.5% of the studied enterprises note that they have recently carried out some activity which can be defined as innovative. It is a rather high figure because, according to the data of the State Statistics Service of Ukraine, the share of innovatively active industrial enterprises accounted for 29.5% in 2016–2018, including enterprises of the processing industry, i.e. 31.8% [State Statistics Service of Ukraine 2019]. In the dynamics, the share of innovatively active industrial enterprises increases (in 2014–2016, it reached 20.3%). Thus, the country stimulates innovative development of the economy.

A rather high share of agricultural enterprises introducing product innovations (29%), has been established due to initiation of production for crop products which are new for the business entity. It primarily deals with the growing of industrial crops for export. In Ukraine, the total cropping area of sunflower increased by 40% in 2018, compared to the area in 2010, while the area of soybean increased by 56%. However, initiation of the production of new kinds of animal breeding products is seen less often. And one can hardly find product innovations related to the processing of agricultural products and supply of services.

In the practice of innovative activity of agricultural enterprises, process innovations are the most often implemented. They primarily expect upgrading of the

technologies of production of agricultural products or products of their processing. Almost a quarter of the studied agricultural enterprises in the Lviv region stress that they have recently introduced innovations concerning organization of their operation. To some extent, agricultural enterprises attempted to improve the system of sale of their products.

It is worth noting that expansion of some kinds of innovations among agricultural enterprises differs from the same phenomenon for industrial enterprises. In 2016–2018, non-technological (organizational and/or marketing) innovations were introduced by 15.1% of industrial enterprises of Ukraine, whereas technological (product and/or process innovations) – by 14.4 % [State Statistics Service of Ukraine 2019].

Process innovations and upgrading of the technologies of agricultural production, have resulted in a growth of the crop yield and animal productivity. The data presented in Table 2 confirm that the technological efficiency of production for the main kinds of agricultural products by agricultural enterprises of Ukraine has significantly increased in recent years.

Considerable positive changes have been achieved over a relatively short period. One should note that a rapid increase of technological efficiency of production of the majority of principal kinds of agricultural products has occurred not only at export-attractive enterprises. Thus, process innovations get a complex character, and their expansion is forced

**Table 2.** Dynamics of yield capacity of the main crops and productivity of animals at agricultural enterprises in Ukraine in 2010 and 2015–2018\*

Factor	2010	2015	2016	2017	2018	2018, as compared to 2010 (%)
Yield capacity (hwt·ha <sup>-1</sup> )						
cereals	27.6	43.8	50.0	45.6	52.2	189.1
sugar beet	281.5	448.2	494.0	484.1	518.8	184.3
sunflower	15.4	23.0	23.5	21.3	24.1	156.5
soy bean	16.2	18.6	23.4	20.0	26.4	163.0
rape and colza rape	17.0	26.1	25.8	28.0	26.5	155.9
potato	171.0	198.6	212.1	238.4	252.0	147.4
vegetables	207.0	363.4	382.7	435.3	427.4	206.5
fruits and berries	38.2	70.8	72.5	64.9	106.2	278.0
Milk yield per one cow (kg)	3 975	5 352	5 643	6 025	6 190	155.7

\*Calculated according to the data of the State Statistics Service of Ukraine.

by strengthening of the competition on the domestic agro-food market.

A rapid growth of exports of some kinds of agro-food products is both a stimulus and an important effect of the innovative activity of agricultural enterprises. In particular, in 2018, export of Ukrainian meat and meat products increased 8.3 times (mainly poultry meat) compared to 2010, whereas export of eggs increased 2.5 times, sugar – 3.6 times, oil and oil products – 1.8 times, grain – 1.5 times.

Such significant growth of exports and other changes in the system of agrarian production in Ukraine cannot be associated only with technological innovations. Development of agricultural enterprises is also supported by organizational and marketing innovations.

Organizational innovations concern improvement of the system of management of an enterprise, material incentive of personnel, relations of the enterprise with other enterprises and organizations. Some positive movement is observed in the system of labor payment. Thus, in 2010, the average salary at agricultural enterprises in Ukraine accounted for 64% of the average salary in the economy, while in 2018, the figure increased to 81% [State Statistics Service of Ukraine 2019].

Implementation of organizational innovations is partially connected with the process of establishing large agrarian companies in Ukraine. In 2019, there were 35 companies in the country, holding more than 50 thousand ha of agricultural land, and their total land bank constituted above 4.5 million ha [State Statistics Service of Ukraine 2018]. This deals with vertically integrated structures, in which production of agricultural raw materials is done along with their primary processing and sale, including export. Performance of such large structures differentiates the kinds of innovations which they introduce integrally to strengthen their competitive capacity.

Marketing innovations are sometimes introduced by agricultural enterprises. They suggest new channels or methods of product sales. Agricultural producers make transformations in the stimulation of sales less often. But marketing innovations also provide a considerable positive effect. They force rather high rates of growth in the sale price of agricultural products. Particularly, in 2019, they increased 2.05 times compared to 2014, while the index of the price of material

and technical resources of industrial origin for agricultural enterprises constituted 188% for the mentioned period [State Statistics Service of Ukraine 2019].

Upgrading of production technologies, which contributes to a growth of crop yield and animal productivity, and shapes the essence of the process innovations in agriculture, requires great funds. Recently, there has been a rapid growth of the nominal indices of production costs at agricultural enterprises in Ukraine. However, it is worth noting that their formation is considerably influenced by inflation processes, forced by increases in the price of material resources and services, rising salary levels, etc. To neutralize the inflation factor in the calculations, it is necessary to make deflation of the corresponding indices.

Table 3 demonstrates the indices of expenditures per 1 ha of the main agricultural crops, deflated to the level of 2010, at agricultural enterprises in the Lviv region, where the nominal indices are divided by the inflation ratio for the corresponding period. The last one is a product of the chain (referring to the previous year) factors of total expenditures and production of agricultural products by the enterprises of Ukraine.

The data in Table 3 characterizes changes in the physical quantity of resources used for the production of agricultural products. It confirms that the increase in volume mainly happened in the period until 2014. Afterwards, the deflated expenditures per 1 ha of crops did not demonstrate growth and were often reduced. This suggests that agricultural enterprises have lately increased their output not by means of more intensive use of resources, but due to more efficient use.

Product innovations can be also introduced by domestic producers in the form of increased output of organic products. Ukraine improved its position in terms of the area of agricultural lands certified as organic, taking 11<sup>th</sup> place among European countries and the 20<sup>th</sup> position globally in 2017. In that year, the area of agricultural lands certified as organic took 421.5 thousand ha, and there were 375 registered certified organic enterprises [Agropolit.com 2018].

Organic agricultural production is undergoing transformation into a prospective direction for agrarian business. However, in Ukraine, it is mainly oriented on exports. In our country, consumption of organic products per a person accounted for only

**Table 3.** Deflated (to the level of 2010) production expenditures per 1 ha of agricultural crops at the enterprises in the Lviv region in 2010, 2014–2018\*

Factor	2010	2014	2015	2016	2017	2018	2018, as compared to 2010 (%)
Crops expenditures (UAH·ha <sup>-1</sup> )							
cereals	3 322	5 222	5 041	5 417	4 870	5 062	152.4
including wheat	3 197	4 980	4 876	5 443	4 772	4 904	153.4
grain maize	5 043	6 578	6 629	6 789	6 748	6 746	133.8
sugar beet	11 024	12 101	12 511	13 060	11 153	11 396	103.4
sunflower	3 154	4 306	4 987	4 525	4 412	4 659	147.7
soy bean	2 927	4 901	4 449	5 445	5 121	5 233	178.8
rape and colza rape	5 794	6 202	5 449	6 401	6 357	6 192	106.9
potato	28 084	32 534	29 551	23 528	19 501	20 084	71.5
Crops expenditures (UAH·ha <sup>-1</sup> )							
fruit	2 183	23 839	10 596	14 134	15 756	5 644	258.5
berries	25 425	36 690	32 342	23 322	13 234	10 756	42.3

\*Calculated according to the data of the Main Department of Statistics in Lviv region and the sources [State Statistics Service of Ukraine 2019].

EUR 3 in 2017, while a common resident of Europe spent EUR 36.4 for such kinds of products, and a resident of the EU – EUR 53.7. The principal products of organic production which are exported by agricultural producers of Ukraine include cereals, oil seeds, legumes, berries, fruits and wild plants [Dykalenko 2018].

Nowadays, niche crops are getting more popular among the small and medium-size producers of Ukraine. Those crops are little-known and labor intensive, but their cultivation can secure a high profit per unit of area [Cherevko 2018]. In Ukraine, such crops include lentil, chickpea, Chickasano pea, sorgo, nuts, sugar maize, mustard, berries, medical plants, and some vegetables.

Introduction of product innovations related to the production of organic products, and the growing of niche crops, is characterized by high risks. Lower risks are associated with innovations which secure a rise in the quality of produced products, and where organization of its processing is under the brand of a regional product. Such activity is particularly promising for small agricultural producers, and such examples are observed in other regions of Ukraine. Creation of servicing cooperatives by small farmers is an organizational innovation as a solution to the corresponding problems.

## CONCLUSIONS

The concept of innovation has a relative character. Innovative can be a product, technology or method of organizing production or commercial solutions that is already being used by other entities but is being used for the first time or substantially improved for a particular enterprise.

Ukrainian agricultural enterprises are characterized by relatively high innovation activity. In 2016–2018 the share of innovatively active enterprises (about 50% according to the survey in the Lviv region) significantly exceeds the share of innovatively active industrial enterprises (29.5% over the same period in Ukraine).

Among the various types of innovations in the surveyed agricultural enterprises, process innovations dominate (51% of enterprises implemented them). The introduction of process innovations has led to a marked increase in technological efficiency and an increase in agricultural production in recent years. The share of agricultural producers introducing product innovations in the “first time for enterprise” category is quite high. Particularly, medium and large agricultural enterprises expand the assortment of cultivated industrial crops. Small agricultural producers show some interest in the production of fruits and berries, as well as some little-known (niche) crops.

Process and product innovations in agricultural enterprises over the last decade have caused significant changes in the agricultural production system of Ukraine. In their turn, they made it necessary to introduce organizational and marketing innovations. In 2016–2018 organizational innovations were implemented by 24% of surveyed companies, marketing – 18%. Many agricultural enterprises also introduced different kinds of innovations, confirming the complex character of their innovative activity. There are strong incentives in Ukraine to continue innovation processes in agriculture that are linked to the prospects of exporting certain types of agricultural food products. Agricultural enterprises' innovation activity is expected to increase due to increased investment in the sector after the agricultural land market is set to start functioning in 2020.

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## CECHY I WYNIKI DZIAŁALNOŚCI INNOWACYJNEJ PRZEDSIĘBIORSTW ROLNICZYCH UKRAINY

### STRESZCZENIE

W artykule omówiono istotę działalności innowacyjnej i przedstawiono wyniki badań procesów innowacyjnych w przedsiębiorstwach rolniczych Ukrainy. Aby poznać specyfikę tych procesów, wykorzystano wyniki badania działalności innowacyjnej w przedsiębiorstwach rolniczych regionu lwowskiego. Stosunkowo wysoki poziom innowacyjności wymienionych przedsiębiorstw został ustalony w porównaniu z przedsiębiorstwami innych gałęzi ukraińskiej gospodarki, co zapewniło zauważalne pozytywne zmiany w systemie produkcji rolnej w kraju. Pokazano rozprzestrzenianie się niektórych rodzajów innowacji (produktowych, procesowych, organizacyjnych, marketingowych) w przedsiębiorstwach rolniczych badanego regionu. Przeanalizowane zostały zmiany kosztów przedsiębiorstw rolniczych, które odzwierciedlają zależność innowacji od intensywności przyciągania zasobów. Rozważono perspektywy niektórych rodzajów innowacji produkcyjnych w przedsiębiorstwach rolnych.

**Słowa kluczowe:** rolnictwo, działalność innowacyjna, rodzaje innowacji, efektywność technologiczna, koszty, produkcja organiczna