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OPPORTUNITIES AND BARRIERS ON THE WAY OF INTRODUCING INNOVATIONS IN AGRICULTURAL ENTERPRISES

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Abstract

This paper studied the opportunities and barriers on the way of introducing of innovations and innovative projects in the area of land use in agricultural enterprises in the context of agribusiness 4.0 in Ukraine. For ease of analysis and political and managerial decision making, all of identified barriers were conventionally grouped into five groups (ranked in order of importance based on average expert estimates): (i) insufficient financing of innovation activity (average assessment – 3.502); (ii) lack of competence of the subjects of innovation activity (3.412); (iii) imperfection of innovative management (3.400); (iv) imperfection of the normative-legal base of innovation activity (3.261); (v) lack of effective innovation infrastructure (3.256). In general, among the 31 analyzed barriers, the TOP-5 most important, according to experts, include the following: lack of established contacts of scientists in the business environment (average assessment – 4.100); insufficient stimulation of subjects of innovative activity, in particular, authors of developments (3.900); low level of scientific and technical base of scientific organizations (3.850); the vast majority of researchers have not realized the importance of commercialization and are not able to commercialize the results of their research (3.850); there is no state support of innovation business (3.737). Obviously, overcoming these barriers forms key opportunities for introducing innovations in Ukrainian agricultural enterprises.

Key words**:** *barriers, innovations, innovative projects, expert assessments, agriculture, Ukraine*

INTRODUCTION

A lot of studies have been carried out on main barriers in a way of innovations development in various industries and countries. For example, Chesbrough, Laukkanen and Patala examine the issues related to opportunities and barriers to sustainable business model innovation [2; 15]. Various studies and scholars have evaluated barriers, drivers, factors and opportunities for implementation of innovations in different industries [4; 5; 17; 24], and barriers hindering innovations in small and medium enterprises [6; 10]. An important contribution to the development of these issues in agriculture of different countries has been done by Kudová, Chládková, Latushko, Radko, Tomich et al., Wigboldus et al. [13; 14; 19; 22]. Björklund, like Sivertsson and Tell, [1; 18] identified three main types of barriers to sustainable business model innovation in Swedish agriculture: external, internal, and contextual. They believe that cognitive abilities affect intentions, behaviors and actions; some barriers are caused by human factors (individuals' attitudes, social norms, and traditions; some barriers relate to a particular industry or enterprises; other barriers, such as government regulations, and weather, are more abstract [1; 18]. The paper by Harizanova-Bartos and Dimitrova concludes that the barriers to barriers in the implementation of innovations in Bulgarian agriculture are the cost of investment for innovation and the lack of information on possible innovations, as well as the traditional way thinking of the Bulgarian farmer [8]. Simultaneously, «the factors influencing the acceptance of innovation the most are the size of the farm, the willingness of the farmer to take risks, and the financing by bank and non-bank institutions» [8]. Ukrainian researchers have studied main barriers on the way of innovations development and commercialization of research results in economy of Ukraine [7; 9; 16; 20; 21; 23], and problematic aspects of innovative

development of agriculture [3; 11; 12; 25]. However, none of these studies examine the barriers to introducing innovations in Ukrainian agriculture. Based on this, it is important to determine the critical barriers in the implementation of innovations in the agriculture of each country, taking into account national specificities. This study aims to determine the opportunities and barriers on the way of introducing of innovations and innovative projects in the area of land use in agricultural enterprises in the context of agribusiness 4.0 in Ukraine.

MATERIALS AND METHODS

Relatively high scientific potential, on the one hand, and relatively low innovation activity of agricultural enterprises – on the other hand, testifies to the existence of barriers between science and production. Therefore, identifying these barriers and establishing their rating is an urgent task, on which the decision was directed our work. The barriers that prevent the transformation of research results into innovative products have different nature-economic, legal, and organizational, etc. Therefore, the causal relationships between the barriers are so complex that they cannot be determined mathematically. In addition, the data necessary for extrapolation are absent. With this in mind, we have chosen an expert evaluation method for research, namely the simplified Delphi method [21]. In this study, we used the methodological approach of Tsybulov and Korsun [20; 21] as a starting point that allowed us to examine the on the way of introducing innovations and innovative projects in agricultural enterprises.
At the first stage of the study we, taking into acount the research of Tsybulov and Korsun [21], formed a list of barriers that hinder the commercial transfer of innovations in the field of land use in agricultural production in the context of agribusiness 4.0 in Ukraine. This list includes 31 barriers. At the second stage, experts were invited to carry out an independent expert assessment of the weight of each barrier on a five-point scale. If the barrier is the most important, it is estimated at 5 points, if the barrier is insignificant then 1 point. In addition, experts were invited to supplement these barriers, answering the question: «Which, in your opinion, are there barriers between the results of scientific research and innovative products that is what prevents commercialization of scientific research results in the field of land use?». Specialists were selected as the experts who have experience and knowledge in the field of innovation activity and represent different scientific areas: economics, agricultural chemistry, soil science, law, and management. Mostly they were PhDs and Doctors of Sciences, their number – 18 people. In the third stage, the data received from experts were processed by methods of mathematical statistics and an analysis of the obtained results was carried out.

RESULTS AND DISCUSSIONS

As a result of statistical processing of the obtained expert assessments the rating of barriers hindering the commercialization of scientific research in the field of land use in agricultural production was determined (Table 1). According to the obtained data, the most significant were the following barriers: lack of established contacts of scientists in the business environment (average assessment – 4.100); insufficient stimulation of subjects of innovative activity, in particular, authors of developments (3.900); low level of scientific and technical base of scientific organizations (3.850); the vast majority of researchers have not realized the importance of commercialization and are not able to commercialize the results of their research (3.850); there is no state support of innovation business (3.737) and others. The identified barriers are difficult to compare with each other, because they are different in nature and belong to different spheres: economic, legal, administrative, etc. For ease of analysis, all these barriers were conventionally grouped into five groups:
- insufficient financing of innovation activity;
- lack of competence of the subjects of innovation activity;
- imperfection of innovative management;
- imperfection of the normative-legal base of innovation activity;
- lack of effective innovation infrastructure.

Table 1. The rating of barriers hindering the commercialization of the results of scientific research in the field of land use in the context of agribusiness 4.0 in Ukraine

No	The content of the barrier	Average assessment	
		point	%
1	Lack of established contacts of scientists in the business environment	4.100	82.0
2	Insufficient stimulation subjects of innovative activity, in particular, authors of developments	3.900	78.0
3	Low level of scientific and technical base of scientific organizations	3.850	77.0
4	The vast majority of researchers have not realized the importance of commercialization and are not able to commercialize the results of their research	3.850	77.0
5	There is no state support innovation business	3.737	74.7
6	The state does not sufficiently stimulate innovation activity both in financial and organizational terms	3.700	74.0
7	Low motivation of scientists	3.650	73.0
8	Lack in the domestic market demand for innovative products	3.632	72.6
9	Insufficient distribution of state financing of innovation projects by volume and irrational in directions	3.579	71.6
10	Scientists, as a rule, first get the results of the research, then look for ways to use them, and not vice versa	3.550	71.0
11	Scientists are not market oriented	3.526	70.5
12	Incomprehension of a determining role of intellectual property in the development of the economy by the first persons (government officials, heads of scientific organizations and agricultural and agro-industrial enterprises)	3.500	70.0
13	The vast majority of executed work ends with the writing of reports that are not suitable for further development	3.500	70.0
14	Lack of interest of public officials in the implementation of innovation policies	3.450	69.0
15	Most academic institutions have the status of a non-profit organization, which significantly reduces the possibility of their establishment of innovative enterprises	3.450	69.0
16	National Academy of Agrarian Sciences of Ukraine is planning directions of scientific research, not focusing on the market	3.333	66.7
17	Lack of state innovation policy and strategic programs of development for the branches of the economy	3.300	66.0
18	Not favorable production area for innovation	3.300	66.0
19	Low effectiveness of competitions for funding research works	3.250	65.0
20	More than half of the scientists focused on fundamental research	3.250	65.0
21	Overly complex mechanism of creation of technoparks	3.222	64.4
22	Insignificant contribution of foreign capital to the innovation sphere of Ukraine	3.211	64.2
23	The lack of readiness of small and medium enterprises to perceive innovations	3.200	64.0
24	Laws in the field of innovation provide some preferences to technoparks that are not actually implemented and practically do not provide preferences to small innovative enterprises	3.200	64.0
25	A large number of talented scientists was redirected to the orders of foreign scientific centers and companies	3.111	62.2
26	Scientists do not have sufficient knowledge and skills to design and implement innovative projects	3.050	61.0
27	Simplified access to Western technology, therefore it is often more profitable to buy a new technology abroad than to develop it on its own	3.000	60.0
28	Inconsistency of the legislative and normative base, which regulates legal relations in the field of innovation activity	2.842	56.8
29	The reluctance of civil servants to take risks by taking managerial decisions in the field of innovation activity	2.789	55.8
30	National Academy of Agrarian Sciences of Ukraine has insufficient funds for the legal protection of the results of scientific research	2.737	54.7
31	There are contradictions between the relatively long period of implementation of the innovation project (several years) and the short term of government officials in power (one year)	2.737	54.7

Source: list of barriers compiled by the author based on the source [20], estimates formed by the author based on a survey of experts.

Let`s consider these groups of barriers in more detail (Table 2–6). As we expected by rating the first place had a group of barriers (Table 2), which characterizes insufficient financing of innovation activity (average assessment – 3.502). It should be noted that

this group of barriers is decisive, since without overcoming them other barriers cannot be eliminated for effective commercialization of innovations in the field of land use in the context of agribusiness 4.0.

Table 2. The rating of barriers characterizing insufficient financing of innovation activity

No	The content of the barrier	Average assessment	
		point	%
1	Insufficient stimulation subjects of innovative activity, in particular, authors of developments	3.900	78.0
2	Low level of scientific and technical base of scientific organizations	3.850	77.0
3	There is no state support innovation business	3.737	74.7
4	Insufficient distribution of state financing of innovation projects by volume and irrational in directions	3.579	71.6
5	Insignificant contribution of foreign capital to the innovation sphere of Ukraine	3.211	64.2
6	National Academy of Agrarian Sciences of Ukraine has insufficient funds for the legal protection of the results of scientific research	2.737	54.7
Average assessment		3.502	70.0

Source: formed by the author based on a survey of experts.

With regard to this barrier group, we have already noted in the previous works of scarcity of funds, which allocate to the financing of scientific and scientific-technical works from the state budget, which is usually not enough to ensure the effective start of innovation [12]. But even these financial resources, in the opinion of Tsybulov and Korsun, are used not in the best way. So, the distribution of funding between fundamental, applied research and development is 25 : 19 : 56 %, that is, the ratio between the amount of financing for science and development is 1.27, when in the world – 1 : 10 [21]. Deformed, in their opinion, is the ratio between the amount of funding for fundamental and applied sciences 1.32 : 1.0, although the cost of applied research is usually larger than the fundamental one. World experience shows that correlation financing of the stages of the life cycle of innovative products – research and development work: development: production is equal 1 : 10 : 100 [20].

In second place on rating a group of barriers came (Table 3), which characterizes the lack of competence of the subjects of innovation activity (average assessment – 3.412).

Table 3. The rating of barriers characterizing the lack of competence of the subjects of innovation activity

No	The content of the barrier	Average assessment	
		point	%
1	The vast majority of researchers have not realized the importance of commercialization and are not able to commercialize the results of their research	3.850	77.0
2	Scientists, as a rule, first get the results of the research, then look for ways to use them, and not vice versa	3.550	71.0
3	Incomprehension of a determining role of intellectual property in the development of the economy by the first persons (government officials, heads of scientific organizations and agricultural and agro-industrial enterprises)	3.500	70.0
4	A large number of talented scientists was redirected to the orders of foreign scientific centers and companies	3.111	62.2
5	Scientists do not have sufficient knowledge and skills to design and implement innovative projects	3.050	61.0
Average assessment		3.412	68.2

Source: formed by the author based on a survey of experts.

It should be noted, that according to the provisions of the institutional theory, this group of barriers is reflected in the socio-cultural psychotype of the subject of innovation activity, so one should agree with the fact that, which is a fundamental prerequisite overcoming all barriers is a rethinking of the place and role of intellectual property and innovations in the development of the economy by the first persons

(government officials, heads of scientific organizations and agricultural and agro-industrial enterprises), increase of competence and psychological readiness of subjects of innovative activity before commercialization of research results, an important role in what motivation plays in particular, material incentives.

The next group of barriers is closely linked to the previous one (Table 4), characterizing the imperfection of innovation management (average assessment – 3.400).

Table 4. The rating of barriers characterizing the imperfection of innovative management

No	The content of the barrier	Average assessment	
		point	%
1	Lack of established contacts of scientists in the business environment	4.100	82.0
2	Low motivation of scientists	3.650	73.0
3	Scientists are not market oriented	3.526	70.5
4	The vast majority of executed work ends with the writing of reports that are not suitable for further development	3.500	70.0
5	Lack of interest of public officials in the implementation of innovation policies	3.450	69.0
6	National Academy of Agrarian Sciences of Ukraine is planning directions of scientific research, not focusing on the market	3.333	66.7
7	Low effectiveness of competitions for funding research works	3.250	65.0
8	Simplified access to Western technology, therefore it is often more profitable to buy a new technology abroad than to develop it on its own	3.000	60.0
9	The reluctance of civil servants to take risks by taking managerial decisions in the field of innovation activity	2.789	55.8
Average assessment		3.400	68.0

Source: formed by the author based on a survey of experts.

In this group of barriers, the first priority is the lack of established contacts between scientists in the business environment (4.100), low motivation of scientists (3.650), scientists are not market oriented (3.526), which to some extent confirms the preliminary conclusions. Thus, the improvement of innovation management is closely linked with the increase of the competence of the subjects of innovation activity and the improvement of their motivation and reorientation to the market.

Obviously, effective innovation management is difficult in the conditions of the imperfect regulatory framework of innovation activity, therefore, of course, the next ranking is a group of barriers (Table 5), which characterizes the imperfection of the regulatory framework of innovation activity (average assessment – 3.261). Among the significant barriers are: the state does not sufficiently stimulate innovation activity both in financial and organizational terms (3.700), lack of state innovation policy and strategic development programs for the branches of the economy (3.300), laws in the field of innovation provide some preferences to technoparks, which are actually not implemented, and practically do not give preferences to small innovative enterprises (3.200).

Table 5. The rating of barriers characterizing the imperfection of the normative-legal base of innovation activity

No	The content of the barrier	Average assessment	
		point	%
1	The state does not sufficiently stimulate innovation activity both in financial and organizational terms	3.700	74.0
2	Lack of state innovation policy and strategic programs of development for the branches of the economy	3.300	66.0
3	Laws in the field of innovation provide some preferences to technoparks that are not actually implemented and practically do not provide preferences to small innovative enterprises	3.200	64.0
4	Inconsistency of the legislative and normative base, which regulates legal relations in the field of innovation activity	2.842	56.8
Average assessment		3.261	65.2

Source: formed by the author based on a survey of experts.

Overcoming these barriers is in the legal plane, which falls within the competence of the legislative and executive authorities.

Describing this group of barriers, we note that, according to studies of Tsybulov and Korsun, the innovation activity in Ukraine is regulated by more than 80 laws and resolutions of the Cabinet of Ministers of Ukraine. Particularly important among them are the laws of Ukraine: «On Innovation Activity», «On Priority Areas of Innovation Activity in Ukraine»; «On the special regime of innovation activity of technological parks», «On investment activity». An analysis of these laws shows that in some cases they not only do not promote innovation activity, but even create additional barriers to the commercialization of research results. So, the Law of Ukraine «On Innovation» provides for an overly complicated procedure for approving and financing innovative projects, monopolizes this procedure. In order to register an innovation project for the technopark, it is necessary to obtain from the ministries 17 conclusions and this does not guarantee the receipt of financing of the project. The Law of Ukraine «On Priority Areas of Innovation Activity in Ukraine» is oriented to maintain and development III and IV technological way instead of V and VI, that is orientated on yesterday. It is believed that technoparks in Ukraine are most adapted for commercialization of scientific research results. At the same time, the mechanism for creating such parks is extremely complicated «On the special regime of innovation activity of technological parks», that is, decisions are taken at the level of the Verkhovna Rada of Ukraine, which is a rather complex and long-lasting procedure. Innovative projects require investment. At the same time, according to the Law of Ukraine «On Investment Activity», the investor is required to obtain numerous permits and approvals, positive a comprehensive conclusion state expertise of regarding compliance in investment programs and projects current norms. This law only declares, and does not provide real guarantees on the protection of investments that deter potential investors [20].

As known, the strategic direction of economic development of Ukraine is the transition from the doctrine of «development to the fore» to the doctrine of «development to advance», the basis of which should be laid the innovative technological model, based on the maximum use of powerful human potential [25]. In implementing the strategy of transition to the model of «development to advance» should be borne in mind that the key factor VI technological way (chronological limits 2010–2050) is nano and cellular technology, its nucleus is nanoelectronics, molecular and nanophotonics, nanomaterials and coatings, nanobiotechnology, nanosystem technology, the main advantages are a sharp decrease in the material and energy intensity of production, creation of materials and organisms with predetermined properties [16]. Consequently, we are deeply convinced that if we apply in practice an innovative forward-looking model of a qualitatively new development of agro-industrial production, then one of the strategic directions of scientific research in the field of land use should be nano- and nanobiotechnologies, digital and climate-smart technologies and practices for reproduction of soil fertility and increase of land productivity.

The final ranking has been a group of barriers (Table 6), which characterize the lack of effective innovation infrastructure (average assessment – 3.256).

In this group, the defining and primary barrier, in our opinion, is the lack of demand for innovative products on the domestic market (3.632). If this barrier had been overcome, then, in our opinion, it would be possible to significantly improve the situation with the transfer of innovations in the field of land use.

One of the ways of creating such demand is to stimulate agricultural enterprises to the use of innovations through the creation of a real incentive mechanism for lending and taxation for the implementation of innovation projects by these entities.

With the specified barrier two more directly linked: the unfavorable production sector to innovation (3.300) and the unpreparedness of small and medium enterprises to perceive innovations (3.200).

Table 6. The rating of barriers characterizing the lack of effective innovation infrastructure

No	The content of the barrier	Average assessment	
		point	%
1	Lack in the domestic market demand for innovative products	3.632	72.6
2	Most academic institutions have the status of a non-profit organization, which significantly reduces the possibility of their establishment of innovative enterprises	3.450	69.0
3	Not favorable production area for innovation	3.300	66.0
4	More than half of the scientists focused on fundamental research	3.250	65.0
5	Overly complex mechanism of creation of technoparks	3.222	64.4
6	The lack of readiness of small and medium enterprises to perceive innovations	3.200	64.0
7	There are contradictions between the relatively long period of implementation of the innovation project (several years) and the short term of government officials in power (one year)	2.737	54.7
Average assessment		3.256	65.1

Source: formed by the author based on a survey of experts.

Another problem is that most academic institutions have the status of a non-profit organization, which significantly reduces the possibility of their establishment of innovative enterprises. Maybe this issue in legal aspects will be resolved after the full implementation of the new Law of Ukraine «On scientific and scientific-and-technical activities», however, there remain a lot of financial-economic, organizational aspects and geopolitical problems that need to be resolved to attract relevant investments.

Summarizing the results of the study, we give an integrated rating of groups of barriers that interfere with commercialization of the results of scientific research in the field of land use in the context of agribusiness 4.0 (Fig. 1).

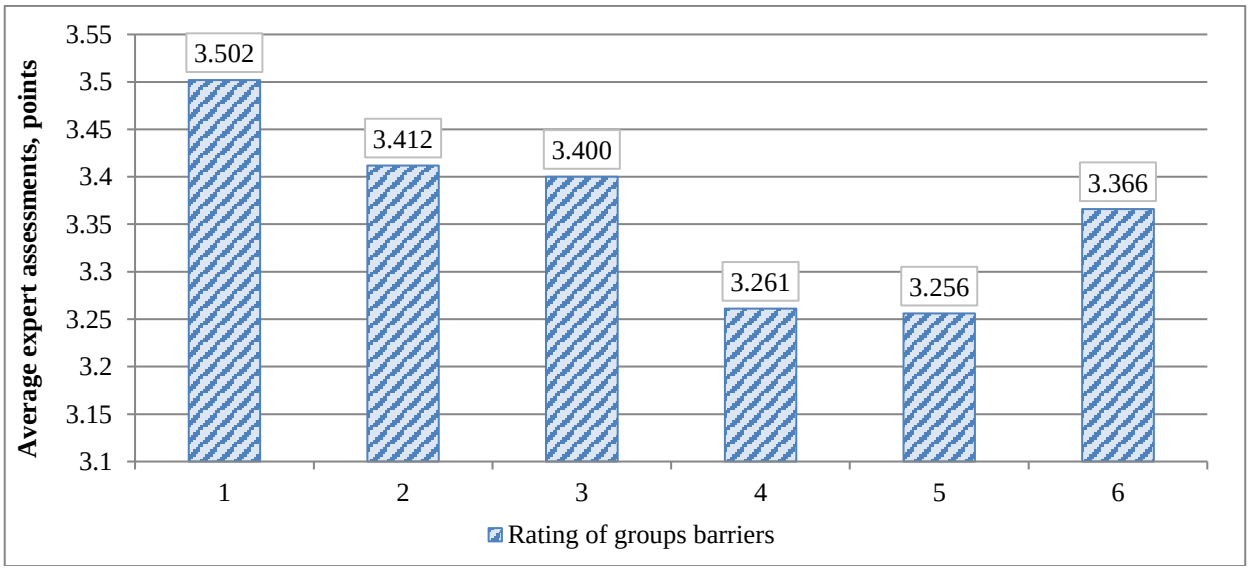

Fig. 1. Rating of groups barriers, which interfere to commercialization results of scientific research in the sphere of land use in the context of agribusiness 4.0

Note. 1 – insufficient financing of innovation activity; 2 – lack of competence of the subjects of innovation activity; 3 – imperfection of innovative management; 4 – imperfection of the normative-legal base of innovation activity; 5 – lack of effective innovation infrastructure; 6 – average assessment.

Source: built by the author based on a survey of experts.

In a separate group there are the barriers that were added by the experts to the ones proposed for evaluation, namely: progressive increase in non-scientific tasks; uncertainty about the position of employers in paying royalties and their amount (Law of Ukraine «On Copyright and Related Rights») given the opportunity to record it in separate civil law contracts); ignoring the possibility of paying royalties and paying additional wages both authors and other specialists who create documents for the commercialization of

scientific research; underfunding of the sector as a whole; the lack of targeted budget financing for preparation of innovations for commercialization in the system of National Academy of Agrarian Sciences of Ukraine; the absence in the budget scientific institutions of a clear algorithm for transforming a new scientific result the articles in the report, etc. and which even received a patent to fit for the commercialization of an innovative product. Each of these barriers, of course, has received the highest evaluation of the relevant expert.

Thus, in order to ensure the effective commercialization of the results of scientific research in the field of land use in the context of agribusiness 4.0, it is necessary to overcome the identified barriers both at the level of academic institutions and at the state level.

CONCLUSIONS

As a result of the study it was determined the opportunities and barriers on the way of introducing of innovations and innovative projects in the area of land use in agricultural enterprises in the context of agribusiness 4.0 in Ukraine. In general, among the 31 analyzed barriers, the TOP-5 most important, according to experts, include the following: lack of established contacts of scientists in the business environment (average assessment – 4.100); insufficient stimulation of subjects of innovative activity, in particular, authors of developments (3.900); low level of scientific and technical base of scientific organizations (3.850); the vast majority of researchers have not realized the importance of commercialization and are not able to commercialize the results of their research (3.850); there is no state support of innovation business (3.737). All barriers, however, merit attention when Ukrainian legislators and decision makers develop a new agricultural and innovation policy.

The analysis results made it possible to group all identified barriers into five thematic groups (ranked in order of importance based on average expert estimates): (i) insufficient financing of innovation activity (average assessment – 3.502); (ii) lack of competence of the subjects of innovation activity (3.412); (iii) imperfection of innovative management (3.400); (iv) imperfection of the normative-legal base of innovation activity (3.261); (v) lack of effective innovation infrastructure (3.256). Obviously, overcoming these barriers forms key opportunities for introducing innovations in Ukrainian agricultural enterprises. The main research results can be used for political and managerial decision making on introducing innovations and innovative projects in the context of ensuring formation of agribusiness 4.0 in Ukraine and its sustainable development.

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