The European Proceedings of
Social & Behavioural Sciences
EpSBS

Future Academy

ISSN: 2357-1330

https://dx.doi.org/10.15405/epsbs.2019.03.02.211

SCTCMG 2018
International Scientific Conference «Social and Cultural Transformations in the Context of Modern Globalism»

A METHODICAL APPROACH TO ASSESSMENT OF INNOVATION POTENTIAL OF AGRICULTURAL ENTERPRISES

Tyapkina Maria F. (a) *, Vlasova Irina O. (b), Ilina Elena A. (c)
*Corresponding author

(a) Irkutsk State Agrarian University, named after A.A. Ezhevsky, Irkutsk region, Russia,
(b) Irkutsk State Agrarian University, named after A.A. Ezhevsky, Apt. 1, Molodezhny village, Irkutsk region, Russia
(c) Irkutsk State Agrarian University, named after A.A. Ezhevsky, Apt. 1, Molodezhny village, Irkutsk region, Russia,

Abstract

For the purpose of comprehensive assessment of innovative potential of agricultural enterprises, the authors propose dividing it into six components characterized by a system of indicators: staff (five indicators), material and technical (six indicators), production technologies (four indicators), market (two indicators), financial (six indicators), organizational and managerial (five indicators). Assessment of each of them is a sum of products of the relevant indicators and their weighting coefficients. The selected indicators are either quantitative or qualitative, thus allowing not only taking into account the specifics of the sector, but also using both objective data and indicators important for hard-to-quantify possibility evaluation. An advantage of the proposed methodology is the mandatory comparison of the value of each indicator with a normative or ideal value, thus allowing not only obtaining a certain value of the innovative potential, but revealing the problem zones, which in its turn will allow developing a program of measure aimed at increasing the role that innovations play in functioning of the enterprise. Integral indicator of of innovation potential assessment of agricultural enterprises is a sum of values of six weighted components and has a value in a range from 0 to 1, thus allowing interpretation of the indicator by assigning an enterprise to a group according to its innovation potential status: very good, good, satisfactory, unsatisfactory, absolutely unsatisfactory. The paper also presents testing of the proposed methodology of innovation potential assessment of agricultural enterprises as exampled by assessment of PAO Belorechenskoye, Irkutsk oblast, Russia.

Keywords: Innovation potential, agricultural enterprises, assessment method.

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

In conditions of unstable political and economic situation, all countries, including Russia, are interested in complete food security by means of domestic resources. Despite the fact that Russia has colossal land resources, the issue of ensuring food security is quite critical. One of the causes of underdevelopment of agriculture is location of a large number of enterprises in the area of risk farming. It should be noted, that scientific developments allow reducing the influence of natural and climatic conditions to a certain degree. That is why it is important to not just determine enterprise's capability to implement and use innovations, but to reveal the causes limiting this process as well. Due to this, issues in assessment of innovation potential get special criticality.

2. Problem Statement

Currently, the question of enterprise innovation potential assessment is controversial. This topic attracted attention of such scholars as Anastase, (2013); Muzaev, (2013); Novikova & Pashina, (2015); Paradeeva, (2013); Ryahovskij, (2011); Sashchenkova, (2009); Vasilcov, (2012); Zhuravlev & Kuksova, (2012) among others. However, in most of the existing methods, the presented groups of indicators do not allow for comprehensive evaluation of capabilities of an enterprise and characteristic of all the components of its innovation potential; alternatively, the indicators selected by authors of some papers more pertain to a cumulative economic potential of enterprise, rather than its innovation potential. Besides, a unified approach to assessment of the innovation potential of agricultural enterprises has not been developed yet.

3. Research Questions

The subject of the research is a process of assessment of agricultural enterprises innovation potential achieved by revealing influencing factors and interpretation of results obtained

4. Purpose of the Study

Thus, the research objective is to develop a methodological approach to assessment of agricultural enterprises innovation potential that takes into account features of the sector, includes a system of quantitative and qualitative indicators, allowing revealing problems and assuming justified criteria for the final integral indicator.

5. Research Methods

A system of indicators for assessment of innovation potential shall include largely the indicators that characterize a capability for innovation, and not those characterizing the enterprise as a whole.

Efficiency and the very possibility of innovation depends on presence of employees; this will characterize the staff-related component of the innovation potential of an enterprise. At that, it is important to assess, what percentage of employees completed training and further training courses that may serve as a prerequisite for innovative activity. In addition, capabilities of an enterprise to innovation will be higher, if more employees have tertiary education or an advanced degree. A group of indicators that characterize the staff component is shown in Table 1.

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Table 01. Calculation method for indicators of the staff component of the agricultural enterprise innovation potential

Indicator	Calculation method	Weighting factor	Standard value
A share of employees involved in innovation activity	Employees headcount Involved in innovation activity (1) Average employees headcount	0.238	0.18
Further training coefficient	Number of employees having completed Training and further training courses (2) Average employees headcount	0.253	0.26
Education coefficient	Headcount of Employees having completed tertiary education (3) Average employees headcount	0.267	0.54
Top qualification employees availability coefficient	Headcount of employees holding an advanced degree (4) Average employees headcount	0.117	0.03
Proportion of expenses to training and preparation of personnel linked to innovation in the total expenses	Expenses for training and preparation of personnel, linked to innovation over the period, kRUB. Total expenses, kRUB (5)	0.125	0.03
Staff component of the innovation potential		0.217	-

Production and technological component of the agricultural enterprise innovation potential presumes financing of own R&D, production design or acquisition of third-party technologies. Besides, it is necessary to determine availability of intellectual property to the enterprise. A group of indicators that characterize the production and technological component is shown in Table 3.

Table 02. Calculation method for indicators of the material and technical component of the agricultural enterprise innovation potential

Indicator	Calculation method	Weighting factor	Standard value
Proportion of land used for innovation activity	Lands used for innovation activity, ha Total area of lands available to the enterprise, ha (6)	0.182	0.05
Share of production stocks in the current assets	Value of the production stocks, kRUB. Current assets value, kRUB (7)	0.138	0.67
Fixed assets renovation coefficient	Value of newly introduced fixed assets during the period, kRUB (8) Fixed assets value at the end of the period, kRUB	0.221	0.08
Fixed assets suitability coefficient	Residue (underpreciated) Cost of the fixed assets, kRUB (9) Initial cost of the fixed assets, kRUB	0.150	0.58
Proportion of the fixed assets put into operation under 10 years	Value of the fixed assets put into operation less than 10 years ago, kRUB (10) Value of the fixed assets, kRUB	0.142	0.18
Share of innovation expenses in investments	Costs for acquiring fixed assets, Linked to innovation over the period, kRUB (11) Investments, kRUB	0.167	0.12
Material and technical component of the innovation potential		0.179	-

Production and technological component of the agricultural enterprise innovation potential presumes financing of own R&D, production design or acquisition of third-party technologies. Besides, it is necessary to determine availability of intellectual property to the enterprise. A group of indicators that characterize the production and technological component is shown in Table 3.

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Table 03. Calculation method for indicators of the production and technological component of the agricultural enterprise innovation potential

Indicator	Calculation method	Weighting factor	Standard value
Presence and assessment of experimental production linked to innovations (including stock breeding)	According to enterprise assessment, from 0 to 1	0.371	1.00
A share of expenses spent for R&D and production design	Expenses spent for R&D and production design over the period, kRUB. / Total expenses, kRUB (12)	0.292	0.04
A share of expenses spent for acquisition of results of third-party R&D and third party technologies	Expenses for acquisition of results of third-party R&D and third party technologies, kRUB. / Total expenses, kRUB (13)	0.129	0.05
Intellectual property availability coefficient	Intangible assets value, kRUB / Capital assets value, kRUB (14)	0.208	0.04
Material and technical component of the innovation potential		0.146	-

Assessment of the market component of the innovation potential would require assessing both capability of the enterprise to product innovation and an ability to sell products using marketing innovations. A group of indicators that characterize the market component is shown in Table 4.

Table 04. Calculation method for indicators of the market component of the agricultural enterprise innovation potential

Indicator	Calculation method	Weighting factor	Standard value
Presence and assessment of marketing innovations	According to enterprise own assessment, from 0 to 1	0.378	1.00
Evaluation of demand for innovative products	According to enterprise own assessment, from 0 to 1	0.622	1.00
Market component of the innovation potential		0.121	-

To assess the financial component of the innovation potential, it is important to evaluate the financial capabilities of the enterprise as a whole, availability and proportion of sources of financing and the enterprise's ability to settle obligations. The value of the financial component of the innovation potential also grows when there is budgetary financing available or drawdowns from investment foundation, etc. A group of indicators that characterize the financial component is shown in Table 5.

Table 05. Calculation method for indicators of the financial component of the agricultural enterprise innovation potential

Indicator	Calculation method	Weighting factor	Standard value
Coefficient of day-to-day liquidity	Current assets, kRUB / Short-term liabilities, kRUB (15)	0.142	2.00
Coefficient of absolute liquidity	Monetary assets and financial contributions, kRUB. / Short-term liabilities, kRUB (16)	0.204	0.20
Coefficient of autonomy	Net worth, kRUB / Total balance, kRUB (17)	0.250	0.50
Working capital to current assets ratio	Working capital, kRUB / Current assets, kRUB (18)	0.200	0.10

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Ratio between the budgetary financing of the innovation activity and the total amount of raised funds of the enterprise	Budgetary funds, received for the purpose of financing the innovation activity, kRUB / Borrowed funds, kRUB	(19)	0.108	0.09
Ratio between the investment foundation financing of the innovation activity and the total amount of raised funds of the enterprise	Investment foundation funds received for the purpose of financing the innovation activity, kRUB / Borrowed funds, kRUB	(20)	0.096	0.10
Financial component of the innovation potential			0.179	-

Assessment of organizational and managerial component of the innovation potential mainly follows the qualitative indicators. This characteristic allows assessing a level of interaction between the enterprise and scientific organizations or tertiary education institutions, presence of innovation subdivision within the enterprise. Besides, the results of the innovation activity largely depends on the swiftness of decision-making, which is determined by availability of strategic communication of the innovation activity. Within this component of the innovation potential, it is desirable to assess the level of application of organizational innovation (introduction of new organizational structures, innovations in shift work, application of modern quality control systems, specifications, logistics, etc). A group of indicators that characterize the organizational and managerial component is shown in Table 6.

Table 06. Calculation method for indicators of the organizational and managerial component of the agricultural enterprise innovation potential

Indicator	Calculation method	Weighting factor	Standard value
Presence and assessment of the system of interaction between the enterprise and sectoral science organizations	According to enterprise own assessment, from 0 to 1	0.291	1.00
Presence and evaluation of innovation divisions at the enterprise	According to enterprise assessment, from 0 to 1	0.188	1.00
Presence and assessment of innovation strategy	According to enterprise own assessment, from 0 to 1	0.225	1.00
Presence and assessment of organizational innovations	According to enterprise assessment, from 0 to 1	0.154	1.00
Presence and assessment of a strategic communications system to support innovation activity	According to enterprise assessment, from 0 to 1	0.142	1.00
Organizational and managerial component		0.158	-

Thus, some of the described indicators have a quantifiable form and appear as coefficients. The rest comprises of indicators that have a qualitative nature and is determined by experts and enterprise management. The enterprise management is asked to give their assessment of the qualitative indicators in a range from 0 to 1 basing on the scale of values that allows assigning the indicator a corresponding value on the Harrington desirability scale depending on the indicator's status : "Very good" (this assessment corresponds to the indicators values 0.80 - 1.00), "Good" (0.63 - 0.80), "Satisfactory" (0.37 - 0.63), "Bad" (0.20 - 0.37), "Very bad" (0.00 - 0.20).

Combining both quantitative and qualitative indicators allows using both objective data and indicators important for possibility evaluation which are hard to quantify.

When assessing the agricultural enterprise innovation potential, we assume that it is appropriate to compare the value of each indicator to its nominal value, because in comparison with numerical score there is no need for individual expert evaluation of each enterprise, as the nominal values are universal and allow

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

the person researching the enterprise to complete the assessment without surveying experts. When assessing all the enterprises of the sector, maximum values of the collection may be used as the nominal values.

Maximum value of the coefficient is equal to one and reflects equality of the actual value to the nominal value. The formula for integrated evaluation of each component of the innovation potential has the following form:

$$Pi = \sum_{j=1}^{n} q_j k_j \quad (1)$$

where Pi is an integral indicator of the agricultural enterprise innovation potential; kj is a coefficient of concordance of the j-th indicator actual value to the nominal value; qj is a weighting factor of the j-th indicator for its corresponding component of the innovation potential; n is the number of indicators comprising this component of the innovation potential.

Each weighting factor qj is in a range between 0 and 1, the sum of the values of indicators' weighting factors for each component of the innovation potential is equal to one.

The coefficient of concordance (Kj) is determined as a relation between the actual value of the indicator to the nominal value of that indicator. Expert evaluations were used to determine the nominal values and weighting factors for each indicator. The expert commission included representatives of top management of various enterprises, heads of divisions related to innovation activity and experienced in innovation management, specialist from the Ministry of Agriculture of the Ikrutsk oblast, as well as experts experienced in enterprise innovation activity in Russia and abroad under current conditions. Variability coefficient was used to evaluate the coherence of expert opinions; this coefficient was within the allowable limits.

As the qualitative indicators take the values from 0 to 1 depending on evaluation by the management of the enterprise, the nominal values of the qualitative indicators are assumed being equal to one. Weighting factors and nominal values for some indicators in the components of the agricultural enterprise innovation potential assessment are given in Tables 1-6.

The final stage of the assessment is calculating the integral indicator of the agricultural enterprise innovation indicator and interpretation of the results obtained.

The Integral indicator of the agricultural enterprise innovation potential (IP) is calculated with the formula

$$IP = Q_1 Pi_K + Q_2 Pi_{MT} + Q_3 Pi_{PT} + Q_4 Pi_P + Q_5 Pi_F + Q_6 Pi_{OУ}, \quad (2)$$

where IP is the integral indicator of the agricultural enterprise innovation potential; ПиК is an integral evaluation of the staff component; PiMT is an integral evaluation of the material and technical component; PiPT is an integral evaluation of the production and technological component; PiP is an integral evaluation of the market component; PiF is an integral evaluation of the financial component; PiOY is an integral evaluation of the organizational and managerial component; Q1...Q6 are the weighting factors of the corresponding components of the agricultural enterprise innovation potential (in a range from 0 to 1).

As the maximum value of a coefficient of concordance in the proposed assessment method for the agricultural enterprise innovation potential is equal to one, and the total of the weighting factors in each

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

indicator is also equal to one, the integral values of each component of the innovation potential and the integral indicator of the agricultural enterprise innovation potential itself are also in the range from 0 to 1. In this case we assume, that the optimal method for interpretation of the obtained integrated indicator is a scale proposed by E. Harrington.

Thus, depending of the status of the innovation potential and assignment of its integral potential to one of the groups, a possibility arises for developments aimed at increasing the innovation potential level in enterprises of each group.

The proposed methodology of assessment allows assessment of all the components of the agricultural enterprise innovation potential separately or in the integrated form.

6. Findings

The proposed method has been tested on the materials from one of the largest agricultural enterprises of the Irkutsk oblast, PAO Belorechenskoye. (Table 7).

Table 07. Integral assessment of innovation potential of PAO Belorechenskoye for the period of 2013-2017.

Indicator	Qi	2013	2014	2015	2016	2017	(+/-)
Staff component (ПиК)	0.217	0.25	0.39	0.41	0.42	0.43	0.18
Material and technical component (ПиМТ)	0.179	0.79	0.78	0.78	0.78	0.78	-0.01
Production and technology component (ПиПТ)	0.146	0.42	0.41	0.41	0.41	0.41	-0.01
Market component (ПиР)	0.121	1.00	1.00	1.00	1.00	1.00	0.00
Financial component (ПиФ)	0.179	0.80	0.80	0.80	0.80	0.80	0.00
Organizational and managerial component (ПиОУ)	0.158	0.85	0.91	1.00	1.00	1.00	0.15
Integral indicator of the agricultural enterprise innovation potential (IP)	-	0.66	0.69	0.71	0.71	0.71	0.06

A high level of innovation potential of this enterprise is determined by the high level of its material and technical, market, financial, organizational and managerial components. Growth of the value of the indicator is due to increased level of staff and organizational and managerial components. PAO Belorechenskoye has necessary material and technical facilities for innovation activities, possibilities for its financing, sales of produced products and management of its innovation activity.

It should be noted, that the level of the staff component has a massive impact on the integral level of the agricultural enterprise innovation potential due to a high importance of this component. If the level of the staff component is low, then, when new technologies and technical means are introduced, employees of the enterprise do not have the adequate qualifications to unlock the full potential of the innovation in other components. Thus, a low level in this component may limit the capabilities of an enterprise to innovation activity. A high level of the staff component of the innovation potential is a prerequisite for increasing the innovation capabilities of the enterprise as a whole and for their efficient fulfillment.

https://dx.doi.org/10.15405/epsbs.2019.03.02.211
Corresponding Author: Maria F. Tyapkina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

7. Conclusion

Thus, the proposed system of indicators allows for a complete and comprehensive assessment of the components of the agricultural enterprise innovation potential while taking into account the specifics of the sector. Application of expert-opinion-based weighting factors to reflect relative importance of separate internal factors for forming the enterprise innovation potential allowed getting more accurate and reliable assessment of the agricultural enterprise innovation potential under the current economic conditions.

Comparison between the obtained values of the indicators and the nominal values allows withdrawing from individual expert evaluation of each individual enterprise, as the nominal values are universal and allow a researcher or enterprise management to conduct the assessment independently, thus increasing the objectivity of the results.

The integral indicator allows combining the components of the agricultural enterprise innovation potential and interpreting the value of the indicator by assigning the enterprise to one of the predefined groups.

The methods takes into account the specifics of the sector, allowing identifying capabilities to innovation activity in agriculture and activating innovation processes. Being easy to apply, it allows for a complete and comprehensive assessment of the enterprise innovation potential and its individual components. Assignment of the enterprise to one of the predefined groups according to the level of its innovation potential allows developing measures aimed at increasing the innovation potential for each group separately.

References

Anastase, I. (2013). Factors affecting the productive potential of the enterprise, *SEA - Practical Application of Science, 2013, I, 1 (1),* 7-15.

Muzaev, M.K. (2013). Evaluation of the innovation potential of economic systems, *Economy and society: modern models of development, 6,* 90-98

Novikova, Y.I., Pashina, N.B. (2015). Research of existing models of an estimation of innovative potential of the industrial enterprises, Actual problems of the humanities and natural sciences, 5, 117-125

Paradeeva, I.N. (2013). Development of a methodology for assessing the innovative potential of enterprises, Modern problems of science and education, 6. Retrieved from: http://elibrary.ru/item.asp?id=21162957

Ryahovskij, P.I. (2011). Methodical approach to the assessment of innovative potential of small business entities", *Business in law, 2011, 6,* 332-334.

Sashchenkova, E.N. (2009). The problem of assessing the innovative potential of modern enterprises", *Bulletin of the Saratov State Social and Economic University, 3,* 133-135.

Vasilcov, V.S. (2012). Theoretical aspects of the evaluation of innovation potential development, *Bulletin of Cherepovets State University, 4, 1(42),* 42-45

Zhuravlev, U.V., Kuksova, I.V. (2012). Characteristics of the method for assessing the innovation potential of an industrial enterprise, *Bulletin of Voronezh State University of Engineering Technologies, 4(54),* 148-151.