System for economic efficiency evaluation of process innovations in poultry farming enterprises

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Abstract. Poultry farming is one of the most important sectors in the agricultural industry that participates in import substitution and has the highest innovation potential. To increase competitiveness of enterprises it is necessary to implement process innovations in poultry raising, maintenance and feeding. In order to increase the level of new technologies in business entities, there is a need to develop a complex system for evaluation of economic efficiency of innovative technologies with considerations for sector-specific requirements. Such system will allow getting extended vision of influence from innovations onto competitiveness of business entities involved in poultry farming.

1. Introduction
Poultry farming is one of the most developed sector of agriculture. Further intensification of the sector requires implementing resource and energy-saving technologies that may facilitate increasing competitiveness level of the economic entities and strengthening their position in the market.

In order to implement a certain process innovation into the production process, management of economic entities needs to make a number of managerial decisions on the basis of evaluation of economic efficiency of the process innovations. However, the current system of efficiency evaluation used with innovative projects is incomplete and does not take into consideration peculiarities of the sector. This fact determines the relevancy of this article.

The purpose of this article is to develop a system of indicators to be used in evaluation of economic efficiency of innovations with accounts for peculiarities of the sector. The following tasks were involved in attaining the set goal:

1) reflect the system of indicators used for evaluation of economic efficiency of innovations;
2) consider sector-specific indicators that reflects specifics of egg and poultry meat production;
3) describe stage-by-stage approach in application of this system at enterprises of the sector.

2. Methods
This research used the methods of analysis and synthesis of available data, as well as graphic method for information representation.
3. Research Results

The issues of evaluating economic efficiency of innovation is similar to investment efficiency evaluation. In order to evaluate efficiency of the innovations being implemented, a number of indicators shall be calculated that reflect the effect of the innovation onto the production process.

This topic has been analyzed by various authors, both Russian and foreign. Some of them are of the opinion that all the indicators included into the innovation evaluation system may be divided into static and dynamic [1, 2]. Some other authors divide the whole system into two subgroups: integral and particular indicators [3]. Yet some others also include a group of sector-specific indicators, however, proposed indicators are not reflective of the sector as a whole, but rather egg farming or poultry meat farming, or they include only a very limited set of indicators [4-6].

In our opinion, this system may be divided into the following groups of indicators:

1) general, including static and dynamic indicators, as well as ranking scores of innovative projects (Figure 1).

![Figure 1. General indicators of economic efficiency evaluation](image)

2) particular – based on indicators of risk evaluation, financial component, as well as other economic indicators, which are also influenced by introduction of the innovative technology into the production process (Figure 2).

3) sector-specific indicators – they characterize efficiency from introduction of the innovative technology into processes of raising, maintaining and feeding in both meat poultry and egg poultry farming. These indicators are shown in Figure 3.

It is evident that complex evaluation of efficiency from introduction of new technologies into processes of raising, maintaining and feeding of poultry would require a complex calculation of efficiency of a given innovation for all the indicators.
Figure 2. Particular indicators of innovation economic efficiency evaluation

This toolkit will allow managers of economic entities to obtain complete information on the influence that the innovation exert over the production process, as well as general economic state of the enterprise and thus its competitiveness.

For example, the general indicators may be calculated during the preliminary stage of innovation project evaluation with the aim of determining economic, process, commercial and financial practicability of introducing the given technology. After the study, experts approach the management with a proposal to conduct subsequent complex analysis.

During such analysis, the particular indicators of efficiency of a given project are calculated, expected efficiency is predicted for introducing the new technology into processes of raising, maintaining and feeding of poultry, as well as total material and labor costs necessary for implementation of the project and its practicability. After the innovation is implemented, a possibility arises to compare the results of poultry raising before the new technology was introduced with the newly-obtained results, thus tracing which of the most important production indicators were influenced to the largest degree as per sector-specific evaluation system.

As the complete complex evaluation of economic efficiency is quite cumbersome, the authors propose creating a software solution that will allow calculating automatically a certain group of indicators or presenting the required groups of indicators graphically. Work time expenditure for the analysis will be reduced, as the calculation will be performed by means of computerized data
processing, as well as due to availability and visibility of all the information. At that, there will be an opportunity to correct the information depending on changes in the environment. Such software will also contain a separate list of evaluation methods depending on indicators selected. Different methods for evaluation of economic efficiency will constitute the subject of authors’ further research. However, it is undoubted that such software product will allow for comparative evaluation of different variants of new technologies and selection of the best one for subsequent implementation.

Thus, a conclusion shall be made that the proposed system of indicators will improve quality and speed of managerial decision-making considering introduction of the newest technologies into the processes of raising, maintaining and feeding poultry, as well as amount of innovations being implemented in economic entities.

**4. Conclusion**

As a result of the research, a complex system of indicators has been developed for evaluation of economic efficiency with considerations for sectoral specifics of poultry farming. This system consists of general, particular and sector-specific indicator, each of which is very important for managerial decision-making involving adoption of new technologies in the processes of raising, maintaining and

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**Figure 3.** Sector-specific indicators of economic efficiency of innovations for poultry farming

| Meat poultry farming                          | Egg farming                           |
|----------------------------------------------|---------------------------------------|
| Gross live weight gain                       | Eggs per hen housed                   |
| Average and gross live weight                | Average egg weight                    |
| Daily average and absolute live weight gain  | Hatchable egg output                  |
| Prime cost of 1 kg of live weight gain       | Egg fertility and hatchability         |
| Total production costs, including losses     | Feed consumption                      |
| Economic effect per 1000 animals             | Prime cost per 1000 eggs              |
|                                              | Total eggs sales revenue               |
|                                              | Economic effect per 1 hen and resulting |
feeding of poultry. Each group of indicators corresponds to their own stage of analysis of practicality of adopting the innovation, providing management of the economic entities with a complex understanding of influence that the innovation would have on the economic status of the enterprise, thus facilitating the level of adoption of the new technologies and procedures in enterprises of the sector.

It is also proposed to develop a software solution capable of analyzing all the required groups of indicators. Such a solution will allow getting a vivid representation of relative efficiency from application of a new technological procedure, selecting the best variant, as well as improving quality and speed of managerial decision-making.

References

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