Strategies for effective agricultural staff training: regional insights

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Abstract. The article presents the results of a regional study of the training of engineering staff for the agricultural complex of Stavropol Krai (expert assessments of the professional community). The scientific publications' review of the science-intensive Scopus database confirms the relevance of the study not only for Russia, but also for many other regions of the world. 69 people took part in the expert survey – representatives of enterprises and organizations of the agro-industrial complex of the region (holding engineering management positions). We made the theoretical substantiation of approaches in the expert assessment of training processes. Thereafter, we implemented survey procedures in the engineering professional environment of Stavropol Krai in the empirical part of the study. On this basis we substantiated the conclusions: the high interest of the engineering professional community in organizing strategic cooperation with higher education organizations in the region for graduate training; willingness to participate in the educational process of the university, the organization of practical training of engineering staff, evaluation procedures of an independent qualification examination, professional and public accreditation.

1 Introduction

The training of engineering staff plays an important strategic role for the development of the country's economy. Recently, much attention has been paid to this issue at the level of decisions of the President, the government and the Ministry of Science and Higher Education of Russia.

The discussion about the training process of engineering staff is also characteristic of the scientific community. Engineering activity involves the search for optimal solutions for certain objects, situations and customers. In turn, we see the need for communication with customers of engineering solutions. The customer's correctly formulated requirements for the finished product help to effectively organize the production process. The study of Ph. Korn et al. shows how the influence of internal training of engineers in communication with

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customers helps to increase the efficiency of engineering activities in the future [1]. Thus, in the process of reproduction of engineering staff, it is necessary to take into account the communicative training of a specialist for effective interactions with the customer [2].

The increasing complexity of technological innovations in production leads to the need to establish work requirements for engineering staff in the field of occupational safety and ergonomics [3]. To achieve this goal in the training of engineering staff, the authors of the article suggest using project-oriented training. This is a methodology of active learning through the development of engineering solutions projects in study groups, which is an effective means of forming professional knowledge and skills. Based on the analysis of reporting documents on the work of project teams (taking into account the quality of the developed projects) and the results of a survey of students, teachers, and employers, the authors of the study conclude that this approach to engineering training effectively develops the technical and intersectoral skills of future engineers [4, 5]. For our study, important conclusions are that in order to ensure the quality of engineering staff training for the agro-industrial complex industry, project-oriented training should be applied and a system for monitoring the quality of graduate training should be created, taking into account feedback from students, teachers, and employers.

The work of specialists in agriculture is complex and multifaceted, often affecting fundamental knowledge in related fields (chemistry, physics, biology, etc.). Thus, the article by authors B. García-Fayos, J.M. Arnal, M. Sancho, B. Ruvira notes the need for increased attention to safety training, which was introduced into the university curriculum for chemical engineers [6]. The relevance of high-quality safety training for engineering staff in the agro-industrial complex is obvious.

The issues of reproduction of engineering staff are acute even in such technologically advanced economies as Japan. Researchers note the lack of engineering staff in a number of industries – from IT specialists to process engineers and propose to overcome this gap through a new system of engineering education – the Institute of Advanced Industrial Technologies [7]. The main idea is to develop the competencies of engineers that are in demand by production through project training. The competence profile of a future engineer is determined by the production needs and prospects for the technological development of industries. This approach to the training of engineering staff is interesting for the Russian system of higher engineering education as a whole and for the training of engineering staff in the agro-industrial complex.

Another point of view on this issue is that in conditions of rapid change of technological engineering processes, technology development, new approaches to the design of the professional profile of engineers are needed [8]. According to the authors, systematic research in this area is needed in order to obtain a well-founded automated version of the archetype of an engineer – a generalized competence profile for the training of a modern engineer. General automated algorithms will help to update and update the competence profile in a timely manner. In our view, systemic changes are needed in the theoretical and applied justification of the competence profile of an engineer to standardize the process of training modern engineering staff, including for the agro-industrial complex of Russia.

The development of information technology is also making changes in professional engineering activities. The group of researchers proposes to use the methodology of information modeling in solving design problems using the example of the construction industry [9]. At the same time, we see a high potential for the application of this approach in the design of engineering tasks in agriculture. To implement this approach, it is necessary to make appropriate changes to the educational programs for training engineers for the agro-industrial complex.

In engineering developments and projects, a certain proportion of work processes are actions related to economic justification, estimated documentation and other financial and

economic calculations. The authors of the article propose to use artificial intelligence more widely in automating these processes [10]. The preparation of digital solutions for the economic justification of the cost of projects will ensure a more efficient work of the engineer. The availability of such software products requires from an engineer not only economic, but also digital user competencies, which should be presented in educational programs for training engineering staff.

In general, a brief analysis of publications related to the issues of training of engineering staff for the agricultural sector shows a number of urgent tasks:

1. In the process of reproduction of engineering staff, it is necessary to take into account the communicative training of a specialist to ensure effective interactions with the customer, considering the fact that engineering involves the search for optimal solutions for certain objects, specific situations and the specifics of customers;
2. The increasing complexity of technological innovations in production leads to the need to establish work requirements for engineering staff in the field of occupational safety and ergonomics. A number of studies have highlighted the need for increased attention to safety training;
3. To ensure the quality of engineering staff training in the agro-industrial complex, project-oriented training should be applied and a system for monitoring the quality of graduate training should be built, taking into account feedback from students, teachers, and employers.
4. The preparation of digital solutions for the economic justification of the cost of engineering projects has received a certain impetus for development, which will ensure more efficient work of an engineer. The availability of such software products requires from an engineer not only economic, but also digital user competencies, which should be reflected in educational programs for training engineering staff.

2 Materials and methods

Strategic partnership with business in solving the problems of high-quality training of engineering staff for the agricultural sector of Russia is important. Ensuring the country's food sovereignty affects the issues of technological improvement of the industry and the training of staff (capable of carrying out the tasks set, in terms of the engineering process). 69 people took part in the expert survey – representatives of enterprises and organizations of the agro-industrial complex of the region (holding engineering management positions). The electronic format of the expert survey was organized in June 2023. Experts, representatives of the professional engineering community, assessed the quality of cooperation with Stavropol State Agrarian University in the field of training of engineering staff for agricultural enterprises in the region. The survey results are processed in the program SPSS Statistics program (version 27).

3 Results and discussion

Stavropol State Agrarian University conducts systematic long-term work to monitor employers' satisfaction with the quality of graduate training and coordinates the process of improving educational programs with the professional community.

Among the experts in the sample population, every second person interacts on an ongoing basis with teachers and students of Stavropol State Agrarian University. 28.4% have interacted previously and 21.6% of respondents noted that their acquaintances have graduates of Stavropol State Agrarian University who are excellent employees. When asked about the quality of training for engineering specialists, 84.9% of experts replied that Stavropol State

Agrarian University trains excellent specialists and another 10.9% rather agree with this statement than not. 4.2% did not answer definitively. According to experts, 86.5% of graduates of Stavropol State Agrarian University have the necessary competencies (skills) to successfully integrate into the current work processes of the enterprise (organization), 13.5% – rather possess than not. In addition, 86.5% of experts note that graduates of Stavropol State Agrarian University are trained on advanced equipment for the industry, taking into account modern technological processes of the industry. 76.7% of the survey participants indicated that graduates of Stavropol State Agrarian University have full knowledge of digital technologies for the successful completion of work production tasks, 19.1% are more likely to own than not. According to 91.6% of experts, graduates of Stavropol State Agrarian University can carry out constructive interaction with colleagues and subordinates, 4.2% are more likely to be able than not. Thus, we see a generally positive assessment of the quality of training graduates of the engineering profile at Stavropol State Agrarian University. This assessment is given by the regional engineering community, which is actively involved in the processes of interaction with the system of higher agrarian education.

The development of strategic partnership with large agricultural producers allows us to solve a number of interrelated tasks relevant for the qualitative reproduction of engineering staff in the agro-industrial complex of the region:

- to update educational programs in accordance with the requests of the professional engineering community;
- to provide practical training bases for conducting all types of practices provided for in engineering educational programs;
- to monitor the quality of the implementation of educational programs through participation in their examination at the development stage and in the procedures for the final certification of engineering graduates;
- to participate in solving current production problems through engineering research and development of the subject area.

All these areas are reflected in the specific interactions between enterprises and the agricultural education system. Thus, a third of the experts who took part in the survey indicated the need for cooperation in the field of scientific research of an engineering orientation. About 40.0% of experts, together with employees of Stavropol State Agrarian University, took part in joint career guidance work with schoolchildren and another 29.3% believe that such practices need to be developed. Thus, we see the direct interest of the professional community of the region in the qualitative reproduction of engineering staff.

Experts take an active part in the educational process. 72.6% of respondents noted that they conduct workshops, open classes, lectures, etc. on a regular basis.

The overwhelming majority of survey participants (83.3%) from the professional engineering community expressed the opinion that it is necessary to develop a strategic partnership with Stavropol State Agrarian University not only in educational, scientific, but also cultural and leisure, sports and other fields of activity.

Half of the enterprises (53.5%) are already training their future engineering workers on a targeted basis under an agreement with a guarantee of replenishment of the staff by young graduates of the engineering school of Stavropol State Agrarian University.

A new and very important trend is developing in the strategic partnership of agricultural enterprises and the system of higher agrarian education – the organization of an internship platform for teachers. 64.4% of the survey participants stated that they are ready to work with the university in this direction. For the university, this is an opportunity to obtain relevant cases of future projects and startups, improve the professional skills of the scientific and pedagogical staff (SPS) in teaching special engineering disciplines, ensure the involvement of students in solving practical production tasks, and make timely changes to the content and

structure of educational programs. Data on promising types of strategic partnerships are presented in the Table 1.

Table 1. Readiness of the professional engineering community to develop types of strategic partnerships

Types of cooperation	Yes	No	Cannot say definitely
1. Creation of an internship platform for teachers	64.4	7.7	27.9
2. Creation of a practical training class for students of SSAU on the basis of the enterprise	57.5	13.5	29.0
3. Creation, modernization by the enterprise of a specialized laboratory class at the university	57.5	21.8	20.7
4. Research of fuel and lubricants and power systems for automotive engines	45.8	16.3	37.9
5. Conducting electrical tests	66.7	4.2	29.1

Compiled by the authors

Among the relevant types of partnerships are conducting electrical tests (66.7%), creating a practical training class for students of SSAU on the basis of the enterprise (57.5%), modernization by the enterprise of the profile class (laboratory) at the university (57.5%).

There is a request for engineers with secondary specialized education – 64.3% of agricultural enterprises are ready to hire such specialists. In addition, there is a need for professional retraining or advanced training of employees of the enterprise (organization) – 72.4% of respondents. This area is also relevant for the training processes of engineering staff in the agro-industrial complex.

Thus, the conducted research shows the current directions of strategic partnership between the system of higher engineering education and industrial enterprises and organizations of the agro-industrial complex in ensuring high-quality reproduction of engineering staff.

4 Conclusion

The theoretical substantiation of approaches in the expert assessment of reproductive processes and the implementation of survey procedures in the engineering professional environment of Stavropol Krai in the empirical part of the study allowed us to substantiate the conclusions:

- the high interest of the engineering professional community in organizing strategic cooperation with higher education organizations in the region for graduate training;
- willingness to participate in the educational process of the university, the organization of practical training of engineering staff, evaluation procedures of an independent qualification exam, professional and public accreditation.

The obtained research results will help to improve the quality of reproduction of agricultural engineering staff in the system of higher agricultural education.1

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