

Professional and Public Accreditation as An Assessment of Agricultural Educational Program Quality in Russia

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Abstract: The aim of the study is to substantiate methodological approaches to the agricultural educational program development on the basis of a modular-competence-based approach, which provides training for the experts of the agricultural industry, capable of implementing a federal scientific and technical program in the future for the development of agriculture in Russia, taking into account the requirements of professional standards. Professional and public accreditation of agricultural educational programs will allow for an external examination of the educational program implementation level and quality in accordance with approved professional standards and develop recommendations aimed at student training level improvement. The study defines the role of professional and public accreditation provision in the interaction between the labor market and the vocational education system. The authors substantiated the modular-competence-based approach to the development of educational programs that contributes to human capital quality improvement in agriculture. In this paper, an algorithm has been developed to expert training quality improvement. In general, the result of the work will contribute to the training of personnel for the industry and will ensure the achievement of a balance of qualifications between the labor market and agricultural education.

Keywords: Accreditation, Agriculture, Education quality, Educational programs, Professional qualifications.

1. Introduction

The agro-industrial complex of Russia includes more than 30 sectors of the economy, which are grouped into three main areas of professional activity: agriculture, fish farming, and fishing, food, and processing industries. At present, the labor market in the agro-industrial complex (hereinafter referred to as AIC) is characterized by a significant professional and qualification imbalance between the demand for workers' qualifications from the labor market and the supply of qualifications from the education system. This lead, on the one hand, to the emergence of a significant number of unclaimed workers, and it causes a personnel shortage of workers and experts in certain areas of the agrarian profile on the other.

Thus, labor productivity in agriculture, for example, is 7-10 times lower than labor productivity in relevant sectors of developed European countries and the United States. The main problem of interaction between the labor market and the educational services market is the lack of balance between the demand of workers from the labor market and the supply of workers with the necessary qualifications and the required number from the market of educational services (Engler & Kretzer, 2014; Kamruzzaman, Islam, Rana & Rashid, 2015; Akter, 2020).

The implementation of the Food Security Doctrine of the Russian Federation, the Strategy for the socio-economic development of the agro-industrial complex of the Russian Federation, the Scientific and Technical Program for the Development of Agriculture requires the development of new approaches to the formation of the labor market in the agro-industrial complex and its staffing with highly qualified personnel.

The aim of the study is to substantiate methodological approaches to the formation of educational programs of an agricultural profile on the basis of a modular-competence-based approach, which provides training for agricultural industry experts, capable of implementing a federal scientific and technical program in the future for the development of agriculture in Russia, taking into account the requirements of professional standards. The scientific novelty of the study is the substantiation of the methodology for the development of educational programs on the basis of a modular-competence-based approach that promotes the training of experts taking into account the requirements of professional standards and the Union of Employers "All-Russian agro-industrial association of employers Agro-industrial union of Russia."

The practical significance of the study is the development of methodological recommendations for the preparation and conduct of professional and public accreditation of agricultural educational programs, which make it possible to improve the quality of expert training for the agro-industrial complex, capable to adapt quickly to the requirements of scientific and technological progress and implement the priority trends of scientific and technological development strategy in the agrarian industry. The work was prepared within the framework of scientific research on the following topic: "Development of guidelines for the preparation and conduct of professional and public accreditation of agricultural educational programs by educational institutions of higher education and secondary vocational education, carried out at the expense of the federal budget at the Federal State Budgetary Educational Institution of Higher Education "Vologda State Agricultural Academy" in 2020.

One of the most effective mechanisms for elimination the qualitative and quantitative gap between the demand of the employer and the supply of the education system is the System of Professional Qualifications, which is currently being created in Russia.

The Union of Employers "All-Russian Agro-Industrial Association of Employers Agro-Industrial Union of Russia" (Rosagropromsoyuz) is empowered by the Council for Professional Qualifications of the RF Agro-Industrial Complex to conduct an independent assessment of qualifications in agricultural areas. Rosagropromsoyuz represents the protection of agricultural producer interests in the field of social and labor relations and vocational education.

The main participants in the formation of a professional qualification system within the agro-industrial complex are shown in Figure 1.



Fig. 1 The participants of professional qualification system development in the agro-industrial complex of Russia

Having analyzed the works of domestic and foreign scientists-economists, legislative and regulatory documents, economic and sociological works on the development of labor market and the market of educational services, it can be concluded that the issues of expert training improvement for the agro-industrial complex remain problematic and relevant (Zavyalova & Kucherov, 2010; Civera, Lehmann, Paleari & Stockinger, 2020; Fleşeriu, Duma, Nistor & Păun, 2020; Nicli, Elsen & Bernhard, 2020).

Scientists identify the following reasons for the inconsistency of the labor market and the market of educational services:

- 1) constantly changing dynamics of production volumes and economic restructuring (Buraeva, 2017; Pouladi, Afshar, Molajou & Afshar, 2020).
- 2) the orientation of universities on the structure of demand for educational services to a greater extent on the part of applicants, and insufficient consideration in the structure change sector planning at the labor market of graduates (Farooq et al., 2019; Pouladi, Afshar, Afshar, Molajou & Farahmand, 2019; Belousova, Dyachenko, Karabanova, Khalimova & Kalyagina, 2020).
- 3) insufficiently effective work of universities in the labor market in terms of selling their graduates to firms, enterprises, and organizations (supply in this market is formed by graduates directly (Anafinova, 2020; Jeong & Choi, 2020).
- 4) a quick reaction on the part of universities to the demand of applicants, which is often supported not by the real needs of the economy, but by their ideas about the specialty "interestingness," some advice from friends and parents, the presence of a military department at a university, study terms, and the proximity of an educational institution to home (Bondarenko, 2014; Gurtov, Garifullina & Sigova, 2016).

Taking into account the increasing requirements of the labor market for the professional and qualification level of employees, it becomes necessary not only to know office equipment but also to be able to apply information technologies in work, and to introduce innovations into the production process. This is possible only with a significant transformation of educational services that will contribute to the formation of an innovative employee type (Putivzeva, Zaitseva, Udovenko, Pusnaya, Gakhova & Kaliuzhnaya, 2019).

It is also necessary to introduce an expert assessment of an expert training quality, which should be carried out both by the educational institutions and by employers.

To ensure the demand for graduates in the agricultural areas, it is necessary to harmonize educational programs with the requirements of professional standards, which also does not contradict the requirements of federal educational standards and allows to take into account the current and future requirements that employers impose on the competencies formed in the learning process.

2. Materials and Method

When the relevant agencies develop and implement the educational programs of higher education, it is necessary to include professional competencies and indicators of their achievement, taking into account the labor market demand. The development of requirements for the results of graduate training in professional competencies is carried out, and taking into account professional standards. The areas and spheres of professional activity predetermine possible professional trajectories of university graduates (Vaganova, Smirnova, Gruzdeva, Chaykina & Ilyashenko, 2019).

The definition of professional competencies is based on professional standards, which are posted on the specialized website of the RF Ministry of Labor and Social Protection "Professional Standards" (Dowling-Hetherington, 2020). Professional and public accreditation is the recognition of graduate training quality and level concerning the graduates who have mastered the main professional educational programs. This accreditation is carried out on the basis of an accreditation examination of educational programs by professional activity type in accordance with the powers of the Council for Professional Qualifications of the Agro-Industrial Complex.

In the process of professional and public accreditation conduct concerning educational organizations, it was revealed that educational programs of an agricultural profile are not matched with professional standards, which leads to a low level of practice-oriented training required for professional qualification mastering. Taking into account the requirements of professional standards and employers, it is advisable to include 11 stages in the organizational mechanism to develop agricultural educational programs (Figure 2).

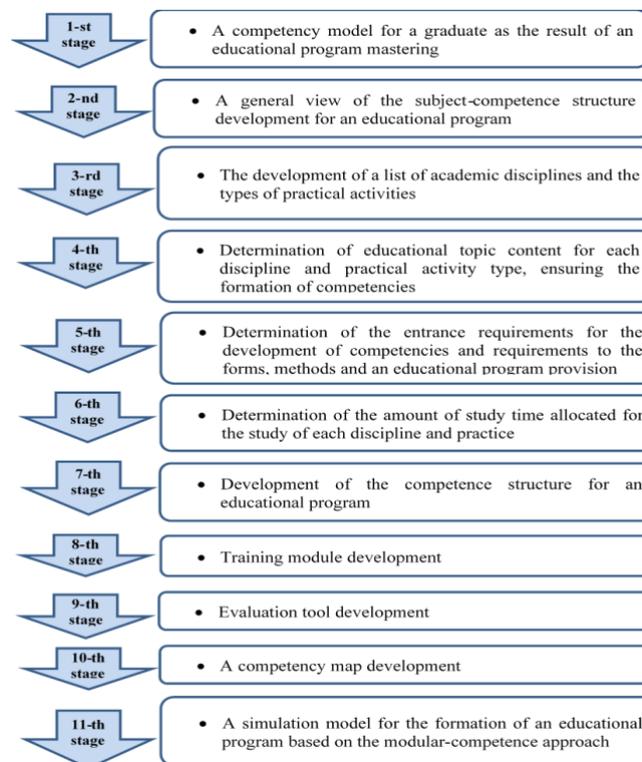


Fig. 2 The organizational mechanism for the development of agricultural education programs based on the modular-competence approach

As mentioned earlier, in this paper, as a novel strategy, it was tried to develop and test an algorithm for passing professional-public accreditation, which contributes to expert training quality improvement who are able to adapt quickly to the requirements of scientific and technological progress in agricultural production. As can be seen in Figure 2, the main steps of this novel algorithm have been listed. Each of these steps is explained below.

3. Results and Discussion

1- st stage. The Development of a Competency Model of a Graduate as The Result of Mastering.

The development of an educational program begins with the definition of requirements for the results of its development. The approximate educational program of higher education, approved by the letter of RF Ministry of Education and Science No. 05-735 (03.23.2017), states the forms of the planned development results in the form of mandatory (MPC) and recommended (RPC) professional competencies (PC). Part 7 of Article 11 of the Law on Education establishes that the formation of the requirements for federal state educational standards to the results of program mastering is carried out on the basis of the relevant professional standards (Engler & Kretzer, 2014). When they develop competencies, it is methodologically important to compare the structure of these competencies with the professional standard, in which labor actions are formed consistently within the framework of the technological process. This approach seems appropriate also in connection with the issue of comparing the funds of the program evaluation means in an educational organization, and the evaluation means used for the independent assessment of qualifications, in which the necessary skills and knowledge are used as the subjects of evaluation in the theoretical part of an exam, and labor actions and functions are used in the practical part of the exam. The result of this stage is the graduate's competence model after mastering the educational program, which is presented in the form of a set of professional competencies with the indicators of their achievement in the context of professional activity tasks (Table 1).

The competence model of a graduate is the basis for modular-competence structuring of an educational program in relation to the development of mandatory professional competencies.

2-nd stage. Formation of A General View of The Educational Program Subject-Competence Structure.

The achievement of program mastering results, formulated in the form of universal, general professional and professional competencies and the indicators of their achievement, should be supported by the formation of an adequate structure and content (Zavyalova & Kucherov, 2010).

As the practice of professional and public accreditation has shown, the educational program is structured by the areas of knowledge. This principle of structuring consists in the development of disciplines that are poorly integrated with each other. This leads to a separate existence of the knowledge and skills being mastered in a graduate's mind, with the help of which only relatively simple tasks can be solved in practice. The solution to complex problems requires the integration of knowledge and skills of individual disciplines, subjects, and practices into complex integrated education in the form of professional competencies. This leads to the need to select modules in the curriculum structure that allow students to form certain professional competencies (modular-competence principle). For the purposes of this section, it is assumed that professional competencies and the indicators of their achievement are formulated on the basis of the corresponding units of professional standards in the form of the educational program mastering results (Putivzeva et al., 2019).

On the one hand, the traditional subject-matter structuring of the program content contradicts the competency-based definition of their goals. On the other hand, this division reflects the real structure of scientific knowledge. Structuring the program according to the subject and modular-competence principle at the same time, will allow resolving these contradictions. The formation of competencies should be associated with the study of various disciplines and the forms of practical and independent work. On the other hand, the units of different competencies can be formed within a separate discipline of practice. The division of the program content by disciplines and practices corresponds to its subject structure. The division by competencies corresponds to its competence structuring.

The modular structure of an educational program allows you to determine the goals, content, results of education, forms of teaching and educational activities of students, taking into account the requirements of professional standards.

Table 1. Competence model of a graduate with a bachelor's degree within the field 35.03.04 Agronomy (fragment)

Professional activity task	Professional code and name	competence	Code and name of professional competence achievement indicator	Substantiation
Type of tasks of professional activity: production and technological				
Collection of necessary information for the development of a farming system and the technologies for the cultivation of agricultural crops.	MPC*-1.	Able to collect information necessary for the development of a farming system and technologies for the cultivation of agricultural crops.	AI** - 1 _{MPC-1} Proficient in methods of searching and analyzing information about farming systems and technologies for crop growing. AI-2 _{MPC-1} Critically analyzes the information and highlights the most promising farming systems and technologies of crop cultivation for specific economic conditions. AI-3 _{MPC-1} Uses special programs and databases when they develop the technologies for the cultivation of agricultural crops.	The professional standard "Agronomist," approved by order of the RF Ministry of Labor and Social Protection No. 454n on 09.07.18 (registered by the RF Ministry of Justice on 27.07.18, registration No. 51709).
Organization of crop rotation system, their placement on the territory of land use and cutting of fields, taking into account the agricultural landscape characteristics of an agricultural enterprise.	MPC-3.	Able to develop a crop rotation system.	AI-1 _{MPC-2} Establishes the compliance of agro landscape conditions with the requirements of agricultural crops. AI-2 _{MPC-2} Draws up crop rotation schemes in compliance with scientifically based principles of crop rotation. AI-3 _{MPC-2} Draws up plans for the introduction of crop rotation and rotation tables. AI-4 _{MPC-2} Determines the optimal sizes and contours of fields, taking into account the zonal features.	
Acquisition of tillage, sowing, and harvesting units, the units for fertilizing and combating pests and diseases of agricultural plants, determining the patterns of their movement in the fields, carrying out technological adjustments.	MPC-3.	It is capable of completing tillage, seeding, and harvesting units, the units for fertilizing and combating pests and diseases of agricultural plants, to determine the patterns of their movement in the fields, and to carry out technological adjustments.	AI-1 _{MPC-3} Completes units for tillage in crop rotation. AI-2 _{MPC-3} Completes units performing technological operations of sowing (planting) crops and caring for them. AI-3 _{MPC-3} Completes units performing technological operations for fertilization. AI-4 _{MPC-3} Completes units performing technological operations for plant protection. AI-5 _{MPC-3} Completes units performing technological	

operations for harvesting, post-harvest handling, and storage of agricultural products.

AI-6_{MPC-3} Defines the patterns of unit movement in the fields.

AI-7_{MPC-3} Organizes technological adjustments.

3-rd stage. Formation of A List of Academic Disciplines and Practical Activity Types.

Designing an educational program based on a modular competence approach consists of compiling a list of academic disciplines, practices, and other forms of educational activities that ensure the formation of competencies. The content of the competencies that are planned to be formed in the learning process determines the composition of the disciplines and the content of their programs, but not automatically. It is necessary to determine within the framework of the study of which disciplines and practices the units of each competition will be mastered. To establish the links between the target and implementation parts throughout the program, it is necessary to compare the target competency model of a graduate (stage 1) with the model of the subject-competence matrix structure (stage 2), which results in a comparison matrix of the target and implementation parts. The list of professional competencies and the indicators of their achievement predetermine the list of disciplines and practices. After compiling a list of disciplines/practices, it is necessary to determine within which of them the components of the competencies that are planned to be formed in the learning process will be mastered. Assessment of the content focus degree of an educational program allows you to coordinate the goals of studying the discipline with the desired results of the educational program as a whole. At the final stage, the list of disciplines and types of practice, as well as educational topics, should be formed, within which the development of professional competencies will take place (Bondarenko, 2014).

4-th stage. Determination of Educational Topic Content for Each Discipline and Type of Practical Activity, Ensuring the Formation of Competencies.

For each item of competence achievement indicators, disciplines, and academic topics are determined in which the relevant knowledge will be mastered (Table 2).

Table 2. The list of disciplines and practices for the development of professional competencies for a bachelor training in the field of 35.03.04 Agronomy (fragment)

Professional activity task	Professional competency code	Professional competency indicator code	Educational program in the field of 35.03.04 Agronomy	
			List of disciplines	Types of practices
research	MPC-1	AI-1 _{MPC-1} AI-2 _{MPC-1} AI-3 _{MPC-1}	Innovation in agronomy Seed growing Fertilizer system	Research practice
production and technological	MPC-3	AI-1 _{MPC-3} AI-2 _{MPC-3} AI-3 _{MPC-3}	Experimental methodology Agriculture Plant growing	technology practice undergraduate practice

When formulating topics and determining their content, it is advisable to proceed from the following conditions:

- any indicator of competence achievement can be formed only within the framework of one academic topic of a discipline;
- different professional competencies cannot be formed on the basis of the same indicators of competence achievement.

5-th stage. Determination of The Entrance Requirements for The Development of Competencies and Requirements to Educational Program Forms, Methods, and Provision.

Determination of knowledge and skill content by disciplines makes it possible to form the composition of the acquired competence and the indicators of its achievement. The forms of organization of classes, the methods of their conduct, and the necessary support are determined on the basis of the program requirements. For effective implementation, an educational program must meet the following requirements (Fleşeriu et al., 2020):

- the content of the program must meet the requirements of completeness, coherence, and coordination concerning the content of individual academic disciplines and practices;
- structuring should be carried out according to the areas of knowledge, according to the educational standard structure and according to those activities, the subject of which is the graduate must become;
- the content of the program at all stages of training should ensure that students understand the final goals and intermediate goals of their education;
- the sequence of discipline study should be coordinated with the development of professional tasks and ensure the consolidation of the actions mastered during the previous task solution;
- the program must identify information, organizational, personnel, motivational, material and technical, scientific and methodological, financial resources used for its implementation.

6-th stage. Determination of The Amount of Study Time Allocated for The Study of Each Discipline and Practice.

It is advisable to take into account the following two features when determining the volume of the labor intensity of a discipline and practice (Pouladi et al., 2020). The first feature is associated with the process of competence development, and the second is predetermined by regulatory legal acts in the field of education. The complexity of the discipline should ensure the possibility of professional competence mastering. The development of competence within the framework of the development of various disciplines can help to increase the labor intensity of its development. The effectiveness of competence development can be increased through integrated classes aimed at specific issue solutions in the field of the professional activity of a graduate.

7-th stage. Competence-Based Structure Development for An Educational Program.

After all the initial elements of the educational program are fully determined, it is necessary to form its competence structure in the form of an interconnected set of competence modules distributed over time. There are the following main stages in competence structure development:

- the sequence and timing of competence development;
- time and place of practical skill acquiring during relevant problem solution;
- indicators of competence achievement.

Particular attention should be paid to the following question: where and in what forms the experience of special and general task solution will be acquired since in this process, the components

of competence are integrated into an integrated functional system of activity. After all the logical chains have been identified, it is necessary, moving "from the end" to determine the timing of the development completion for each of the competencies/indicators of competence achievement.

The result of this work is the competency-based structure OOP, which determines the sequence and timing of competencies and their achievement indicator development in the form of a table, in which all planned competencies are recorded vertically and horizontally - the deadlines for their development completion.

8-th stage. Development of Training Modules.

At the next stage, on the basis of the competence model, the training modules of the program are formed, corresponding to the competence modules and providing the temporal structuring of all disciplines and practices included in it and necessary to achieve the ultimate goals. The formation of educational modules for OOP is implemented by distributing the relevant disciplines and practices into educational modules, within which professional competencies are mastered. Training modules include interrelated disciplines, practices in the format of network schedules, and fixed milestones in the form of intermediate and final attestation of qualifications and competence component development assessment. In practice, training modules may include several competency modules, depending on the proximity of their content and the time required for mastering. The presence of a list of disciplines, their content, and labor intensity allows you to move on to disciplines and practice content development within the curriculum.

9-th stage. Evaluation of Means Development.

The introduction of a modular-competence-based approach in the formation of an educational program determines the improvement of control forms over the implementation of the educational process (monitoring the education quality), which includes the means of assessing the competencies acquired by a student (Pouladi et al., 2019).

To control the quality of competence development, the designed diagnostic tools must meet the requirement of the educational material structure included in them, and also of its coherence or integrability. Assessment of the discipline study quality should take into account all types of connections between the knowledge, skills, and abilities included in them, which makes it possible to establish the level of competencies formed in a student in accordance with professional activities.

The technologies of independent assessment of qualifications (IAQ) meet these requirements. The competency model of a graduate contains a complete map of competencies with the indication of the disciplines and practices that form it at different levels of its achievement and the indicators of competence achievement. The indicator of competence achievement is a measuring tool that reflects the activity structure of competence. The assessment is focused on specific actions performed by a graduate who has acquired a competency. This achievement is verifiable throughout the entire period of competence formation:

- current and intermediate control (mastering of skills and knowledge);
- during the final certification (mastering of qualifications, i.e., readiness to perform the labor function of its components).

This allows the formation of end-to-end assessment tools that will lead to its full interface with the assessment tools of the qualification exam used in the independent assessment of qualifications when they use IAQ technology. It is the necessary knowledge and necessary skills, in accordance with the indicators of competence achievement, that are used as assessment subjects in the theoretical part of the exam and as labor actions and labor functions in the practical part of the exam.

International experience shows the advisability of combining the final certification procedures for professional retraining programs with IAQ. If for one reason or another it is impossible to carry out the combined procedure (the infrastructure of IAQ is just being formed), it is recommended to develop assessment tools and conduct the assessment in conditions as close as possible to the professional

examination conditions in the form of which the IAQ is held. Up-to-date information about the IAQ in Russia is posted in the register <https://nok-nark.ru/pk/list/>.

Intermediate certification also requires the development of assessment tools and the use of a procedure that allows you to assess the results of mastering the corresponding part of the program reliably. This will require an assessment toolkit used in an independent qualification assessment. It is recommended to develop assessment tools on the basis of already available examples posted in the register of information on the IAQ (<https://noknark.ru/os/list/>) and in accordance with the methodology used in the independent qualification assessment system. The IAQ professional exam includes a theoretical and practical stage. For the development of assessment tools, it is convenient to use the digital resource "Assessment of Qualifications": <https://kos-nark.ru/>.

10-th stage. Competency Map Development.

A prerequisite for a qualitative assessment of the extent to which the content of disciplines and practices corresponds to the content of competencies is good knowledge of its target part by the educational program designers, as well as the knowledge of the competencies that are formed within the module by the teachers teaching individual disciplines. The competency map is the final document for the implementation of stages 1-9 based on the modular-competence approach, and it includes the following main positions:

- code and name of a competence;
- code and name of a training module within which the competence is mastered;
- the indicators of competence achievement;
- type of competence (professional);
- professional competence category: (mandatory, recommended);
- correlation with the type of tasks of professional activity;
- competencies and indicators of their achievement, on the basis of which this competence is formed (previous competencies);
- the threshold input level of knowledge, skills, experience required for the formation of a competence;
- the disciplines that have formed the input level of knowledge, abilities, and skills that are necessary for competence development;
- the disciplines and topics that form this competence;
- evaluation tools used to assess the achievement of competence.

11-th stage. The simulation model of an educational program development is based on a modular-competence approach.

Each professional educational program can be called a project since its development is a purposeful activity, the result of which is the development of an effective solution for a particular system design. "Design" means the activities aimed at a thoughtful educational process creation as the system that leads to one or another qualification result (Fig. 3).

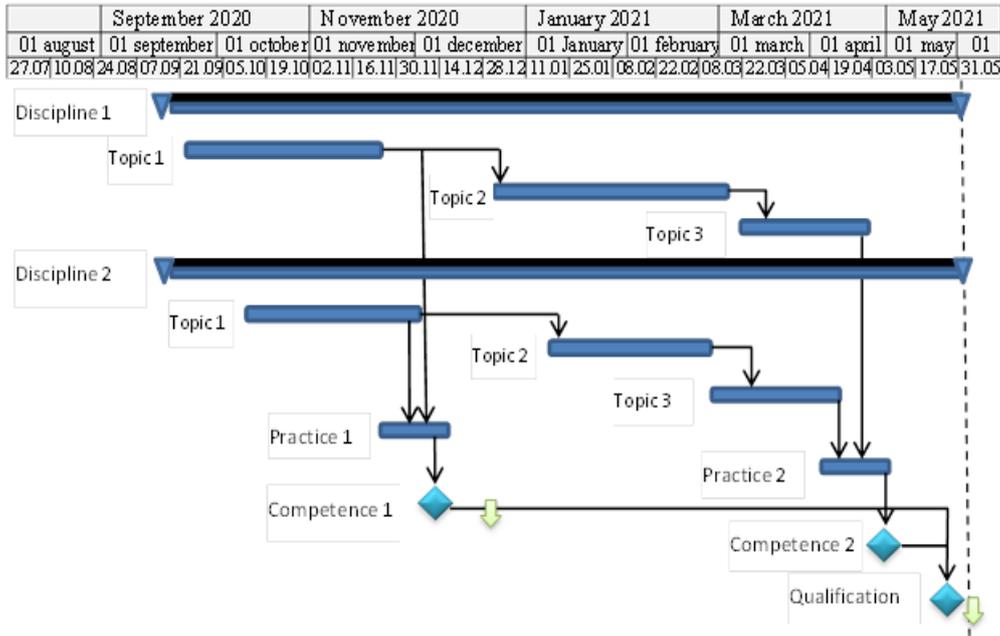


Fig. 3 Formation of relationships and control points for intermediate and final certification

4. Conclusions

Today, high requirements are imposed on the graduates of agricultural universities: they must know modern production and solve the problems at a professional level. The introduction of professional standards requires new approaches to the educational process organization, the use of methods, and teaching methods in accordance with the requests of employers. As mentioned earlier, the main target of the current paper was to substantiate methodological approaches to the agricultural educational program development on the basis of a modular-competence-based approach, which provides training for the experts of the agricultural industry, capable of implementing a federal scientific and technical program in the future for the development of agriculture in Russia, taking into account the requirements of professional standards.

The proposed mechanism for educational program development, taking into account professional standards, allows to consider the needs of the labor market of the agro-industrial complex and ensure a prompt response of the agricultural education system to its dynamic requirements, planning various educational paths leading to a specific qualification obtaining and the qualification level increase, to career growth in the areas demanded on the market labor. In the current study, as a novel strategy, an algorithm has been developed and tested for passing professional-public accreditation, which contributes to expert training quality improvement who are able to adapt quickly to the requirements of scientific and technological progress in agricultural production. In general, the result of the work will contribute to the training of personnel for the industry and will ensure the achievement of a balance of qualifications between the labor market and agricultural education.

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