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INFORMATION MODELS OF "COMPLEX-ANALYTICAL INFORMATION SYSTEM OF SCIENTIFIC DEGREES" IN THE FIELD OF ATTESTATION OF HIGHER QUALIFIED SCIENTIFIC AND SCIENTIFIC-PEDAGOGICAL PERSONNEL

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Abstract: In our country, comprehensive systemic measures are being taken to develop the digital economy and improve the widespread introduction of modern information and communication technologies in all sectors and industries, including education and science. This strategy requires improving the quality and efficiency of the system of training and attestation of highly qualified scientific and scientific-pedagogical personnel, further development of the industry through digitalization and adaptation to advanced world practice. This paper presents models and descriptions of scenarios for the use of "Complex-analytical information system of scientific degrees" developed for the exchange of electronic documents and the digitization of their attestation in the field of attestation of highly qualified scientific and scientific-pedagogical personnel. The study deals with the general IDEF model of the software modules that make up the system, the IDEF model for submitting the attestation documents by the applicants for scientific degrees, the IDEF model for verification the attestation process documents, the IDEF program model for awarding the scientific degrees.

Keywords: information system, digitization, scientific degree, user interface, attestation process, PhD, DSc, algorithm, IDEF model, usage scenario.

Аннотация: Мамлакатимизда рақамли иқтисодий ва фан ривожлантириши, барча тармоқлар ва соҳаларда, жумладан, таълим ва илм-фан соҳаларида замонавий ахборот-коммуникация технологияларини кенг жорий этиши бўйича комплекс тизимли чора-тадбирлар амалга оширилмоқда. Бу эса ўз навбатида олий малакали илмий ва илмий-педагог кадрлар тайёрлаш ва аттестациядан ўтказиши тизимининг сифати ва самарадорлигини ошириши, соҳани рақамлаштириши орқали янада ривожлантириши ва илгор жаҳон амалиётига мослаштириб боришини тақозо этмоқда. Ушбу мақолада олий малакали илмий ва илмий педагог кадрлар аттестацияси соҳасидаги илмий даражаларга оид электрон ҳужжат алмашинуви ва уларнинг аттестация жараёнини рақамлаштириши бўйича ишлаб чиқилган «Илмий даражалар комплекс-таҳлилий ахборот тизими» фойдаланиши сценарийларининг моделлари ва тавсифи келтириб ўтилган. Бунда тизимни таъкил этувчи дастурий модулларининг умумий IDEF модели, талабгорларнинг диссертация ҳимояси тўғрисида веб-сайтта эълон қилиши бўйича аттестация ҳужжатларини тақдим қилиши жараёнининг IDEF модели, илмий даража бўйича аттестация иши ҳужжатларини кўриб чиқиши жараёнининг IDEF модели, илмий даражаларда тасдиқлаш жараёнининг IDEF моделлари келтирилиб, улардаги жараёнлардаги бажариладиган амаллар, тизим иштирокчиларининг вазифалари фойдаланиши сценарийлари орқали батафсил ёритиб берилган.

Таянч сўзлар: ахборот тизими, рақамлаштириши, илмий даража, фалсафа доктори, фан доктори, IDEF модел, фойдаланиши сценарийси.

Аннотация: В нашей стране принимаются комплексные системные меры по развитию цифровой экономики и совершенствованию повсеместного внедрения современных информационных и коммуникационных технологий во всех секторах и отраслях, включая образование и науку. Данная стратегия требует повышения качества и эффективности системы подготовки и аттестации высококвалифицированных научных и научно-педагогических кадров, дальнейшего развития отрасли за счет цифровизации и адаптации к передовой мировой практике. В статье представлены модели и описания сценариев использования «Комплексно-аналитической информационной системы ученых степеней», разработанной для обмена электронными документами и оцифровки их аттестации в области аттестации высококвалифицированных научных и научно-педагогических кадров. В исследовании рассматривается общая модель IDEF программных модулей, составляющих систему, модель IDEF для подачи документов об аттестации соискателями ученых степеней, модель IDEF для проверки документов процесса аттестации, модель программы IDEF для присуждения ученых степеней.

Ключевые слова: информационная система, оцифровка, научная степень, пользовательский интерфейс, процесс аттестации, доктор философии, доктор наук, алгоритм, модель IDEF, сценарий использования.

Applying modern information and communication technologies significantly influences the attestation field of highly qualified scientific and scientific-pedagogical personnel. Major obligations concerning digitization the attestation field were defined in the Resolution of the President of the Republic of Uzbekistan PP-4699 "On measures for the widespread introduction of the digital economy and electronic government" from 28 April 2020 on improving the digital economy and implementing electronic government, the Decree of the President PD-6079 "On approval of the strategy "Digital Uzbekistan-2030" and measures for its effective implementation". By broadly implementing information technologies in the attestation process we will achieve full digitization and provide the openness and transparency of the process [1, 2, 16, 17].

In this regard, the creation of "Complex analytical information systems of scientific degrees" within "Electronic Supreme Attestation Commission (SAC)" by digitizing the attestation process and submission of attestation case on scientific degrees (Ph.D., DSc), which are an important part of the attestation of highly qualified scientific and scientific-pedagogical personnel are topical issues. specifications needed for preparing electronic versions of their papers [3, 4, 18].

Oz DSt 1987: 2018 – (Technical directions for developing of information system) Terms of Reference for the creation of an information system in the form of scenarios for the use of the information system in accordance with the state standard, the requirement to describe business processes and key user behaviors that allow to achieve the objectives of the system. Scenarios of use - in an information system, the main action in this scenario is a sequence of actions performed by the person to achieve the desired result [8].

Effective introduction the modern information and communication technologies to the procedure of scientific degree attestation serves for the progressive reduction of interaction the human factor with the attestation process and further advancement of science by providing it's objective effect to the attestation process; acceleration of the quality, pace, and effectiveness, as well as increase the responsibilities of the people who are engaged in it.

Taking this into consideration, the whole attestation process, including the submission/acceptance of attestation documents for scientific degrees, as well as the process of normative-technical and scientific expertise of attestation works, review of procedures, and introduction a "Complex-analytical information system of scientific degrees" that will serve the future digitization of scientific degree attestation process. The following features of the information system can be acclaimed, including: first, the information system is considered to be a completely new system in the organization of attestation at the national level; second, an electronic folder of attestation works of scientifically certified persons will be created; third, in addition to regulating the flow of information on scientific degrees, this system can systematize analytical and informational data in predetermined areas (characters) and automate the formation of generalized reports; fourth, there is an opportunity to organize real-time monitoring of the activities of scientific councils [9, 10, 11].

The system involves the following software modules:

- "Module of publication of dissertations on the SAC website" [5].
- "The submission of post-dissertation documents module" [5].
- "Module of acceptance/distribution of attestation of scientific degrees" [6].
- "Module for approval of attestation cases on scientific degrees".

- "Normative and technical expertise of attestation cases on scientific degrees, submission to the disciplinary commission and expert council" [6, 7].
- "Module for organizing the work of the disciplinary commission for attestation of scientific degrees" [6].
- "Module of formation of conclusions of the expert council on attestation work on scientific degrees" [7].
- "Module of the meeting of the expert council on attestation work on scientific degrees" [7].
- System Administrator module, Settings and Additional Modules.

Methods that provide system users with options to help them make decisions, to use search engines based on intelligent analysis of data have been launched in the development of system modules [12, 13, 14].

Figure 1 shows the scheme of operation of the module "Publication of dissertation defense of applicants on the SAC" in the form of the IDEF model.

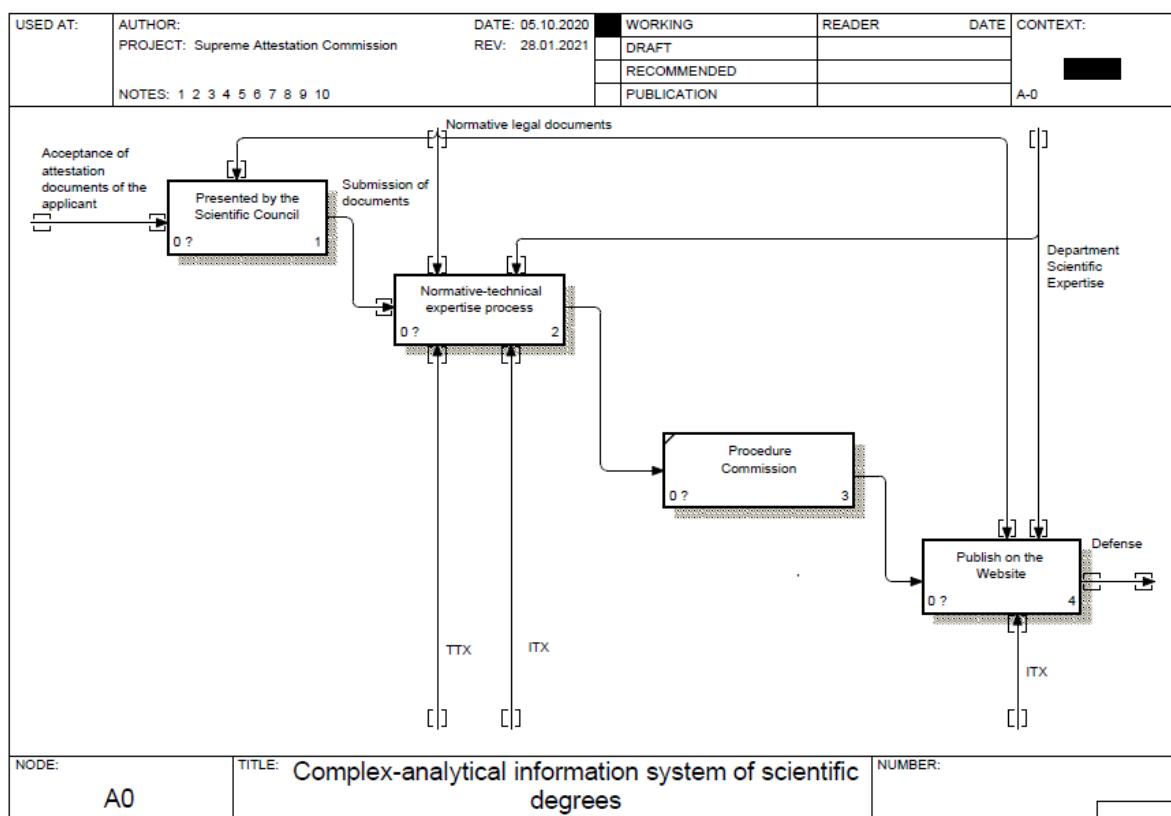


Fig. 1. Process of publication the applicants' defense of dissertation on the SAC website.

Internal processes of the "Publication of dissertation defense of applicants on the SAC website" module (submission of attestation documents, regulatory and technical expertise, disciplinary commission, publication on the website of the SAC), their functions and description, list of scenarios are given in Table I below.

Table 1.

List of scenarios for the operation of the "publication of dissertation defense on the SAC website" module

ID Number	Title of Operational Scenario	The User
A1	Providing attestation documents	Scientific Secretary of the Scientific Council
A2	Regulatory and technical expertise	Department of Scientific Expertise
A3	Conducting the disciplinary commission	Department of Scientific Expertise
A4	Publication on the SAC website	Department of Scientific Expertise, information-analytical department

Scenario Development

The scenario for practicing A1: Submission of attestation documents.

Conditions for activation: The Scientific Secretary of the Scientific Council submits the attestation documents for the scientific degree.

Main operating person: Scientific Secretary of the Scientific Council.

Execution procedure of scenario:

- 1) The Scientific Council decides on the defense of the dissertation;
- 2) the attestation documents are submitted to the SAC for publication of the dissertation defense on the SAC website.

Input information: Attestation documents for publication on the website of the SAC.

Output information: Inquiry on submission of attestation documents for publication on the website of the SAC.

The scenario for practicing A2: Regulatory and technical expertise.

Conditions for activation: Certain specialist of the department of scientific expertise of the SAC conducts a normative and technical expertise of the attestation documents to a scientific degree.

Main operating person: Department of Scientific Expertise.

Execution procedure of scenario:

The announcement about the defense of the dissertation is subject to normative and technical expertise of the appropriate documents in the SAC within a certain period from the date of submission of the relevant documents.

Input information: relevant attestation documents on scientific degrees

Output information: Inquiry for the Procedural Commission to publish the dissertation defense on the SAC website.

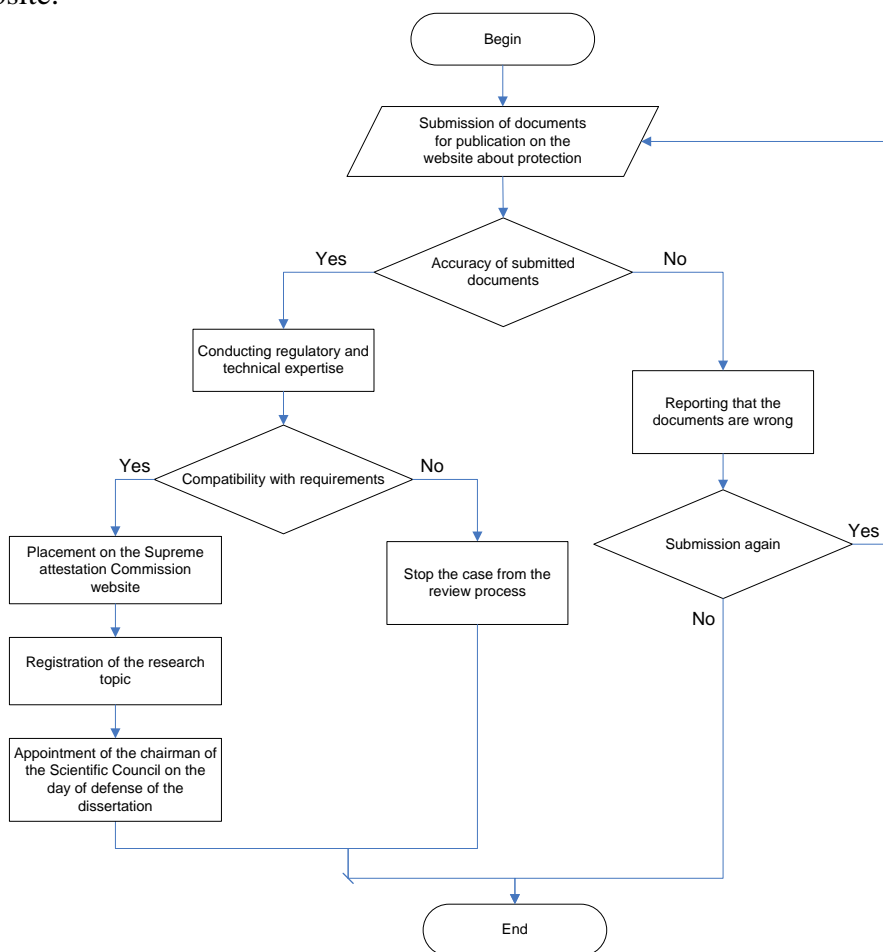


Fig. 2. Algorithm of operation of the announcement module on the website of the dissertation defence of applicants.

The scenario for practicing A3: Conducting the disciplinary commission.

Conditions for activation: The staff that consists of relevant specialists of the department of scientific expertise of the SAC, delivers the documents of the attestation on the scientific degree through the disciplinary commission.

Main operating person: Department of Scientific Expertise

Execution procedure of scenario:

The announcement about the defense of the dissertation is sent to the disciplinary commission after being subject to normative and technical expertise of the appropriate documents in the SAC within a certain period from the date of submission of the relevant documents.

Input information: relevant attestation case documents on scientific degrees.

Output information: conclusion about being recommended for announcing the defense of the dissertation on the SAC website.

The scenario for practicing A4: Announcing on the SAC website.

Conditions for activation: The dissertation defense will be posted on the SAC website in conformity with the conclusion on the recommendation for publication on the website.

Input information: the announcement text on the SAC website

Output information: The website of the SAC publishes the defense of the dissertation.

The algorithm of operation of the announcement module on the website of the applicant's dissertation defense is shown in Figure 2.

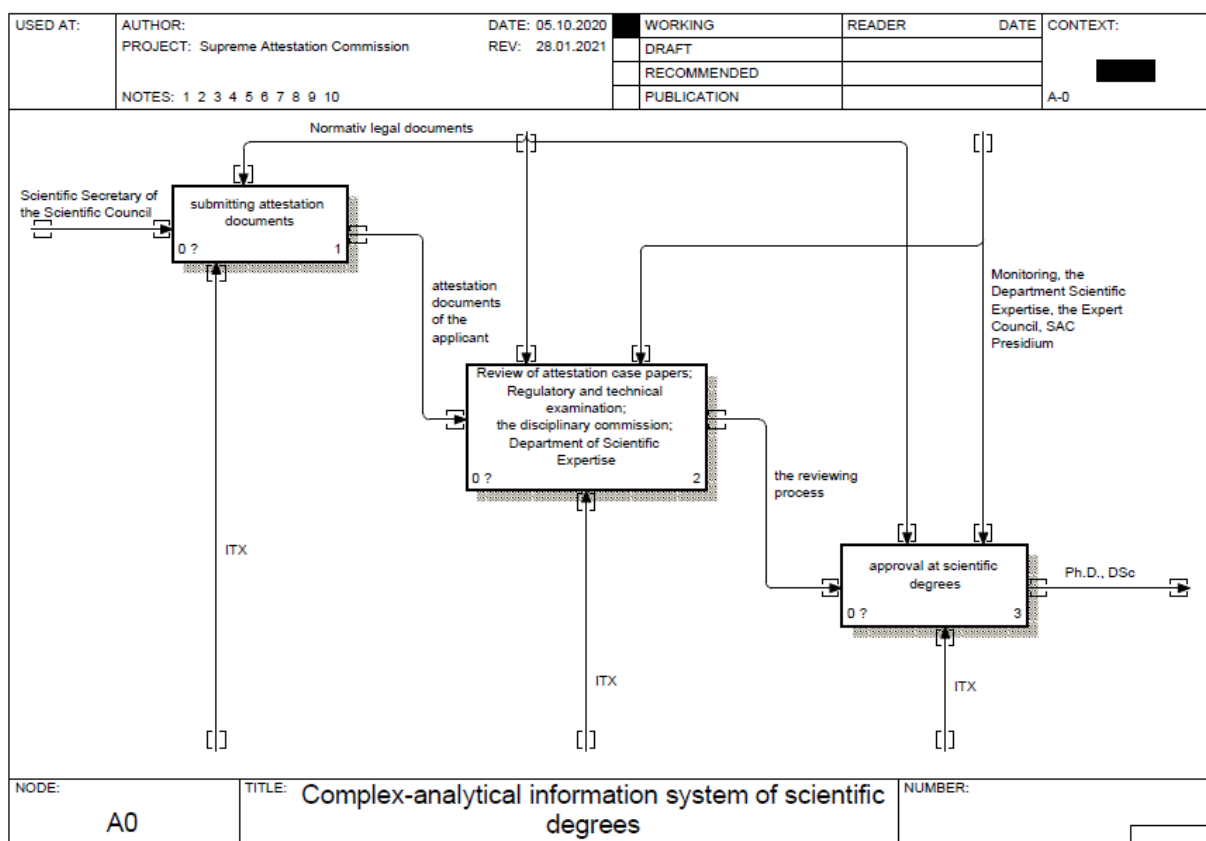


Fig. 3. Submission of post-defense dissertation documents and review process.

Figure 3 shows the operational scheme of the "Submission of post-defense documents of the dissertation" module as the IDEF model.

Internal processes of the module given in Fig. 3 (submission of attestation case documents, normative and technical expertise, an expertise by the disciplinary commission, preview by the expert commission, approval at the scientific degree), their functions and description, list of scenarios are given in Table 2 below [5, 6, 7, 15].

Table 2

List of scenarios for operating the module "submission and review of post-defense dissertation documents"

ID Number	Title of Operational Scenario	The User
D1	Submitting the Attestation Case Documents	Scientific Secretary of the Scientific Council
D2	Regulatory and Technical expertise	Department of Scientific Expertise
D3	Expertise by the disciplinary Commission	Department of Scientific Expertise
D4	Review by an Expert council	Expert Council

The scenario for practicing D1: Submitting the attestation case documents.

Conditions for activation: Scientific secretary of the Scientific council submits the post-defense documents.

Main operating person: Scientific Secretary of the Scientific Council.

Execution procedure of scenario:

1) The defense of the dissertation is held at the Scientific Council, which awards scientific degrees;

2) In case of a positive decision of the Scientific Council on the defense of the dissertation, the documents of the attestation case are submitted to the SAC through this system.

The scenario for practicing D2: Regulatory and technical expertise.

Conditions for activation: The relevant specialist of the department of scientific expertise of the SAC conducts a normative and technical expertise of the documents of the attestation case after the defense of the dissertation.

Main operating person: Department of Scientific Expertise

Execution procedure of scenario:

Within a certain period from the date of submission of the relevant documents after the defense of the dissertation, the relevant documents are subject to normative and technical expertise in the SAC.

Input information: post-defense dissertation documents of attestation case.

Output information: Questionnaire for the procedural commission for the post-dissertation attestation case.

The scenario for practicing D3: Expertise by the disciplinary commission.

Conditions for activation: The scientific expertise department staff the SAC, which consists of relevant specialists, to expertise the documents of the attestation case after the defense of the dissertation by the disciplinary commission.

Main operating person: Department of Scientific Expertise.

Execution procedure of scenario:

Within a certain period from the date of submission of the relevant documents after the defense of the dissertation, the relevant documents are the first subject to regulatory and technical expertise in the SAC and then passed through the disciplinary commission.

Input information: post-defense dissertation documents of attestation case.

Output information: The conclusion about the recommendation of the post-dissertation attestation case to the expert council.

The scenario for practicing D4: Review by an expert council

Conditions for activation: After the conduct of the procedural commission of the post-defense attestation work, the attestation work is submitted to the expert council in the case of a positive conclusion of the procedure.

Main operating person: Department of Scientific Expertise.

Execution procedure of scenario:

The expert council conducts scientific expertise on post-dissertation attestation work, including dissertation, and makes a relevant decision, which is reviewed at the next meeting of the Presidium of the SAC.

Input information: Post-dissertation attestation case, the conclusion of normative and technical expertise, the conclusion of the procedure commission.

Output information: An appropriate decision is made on the attestation case after the defense of the dissertation, which is reviewed at the next meeting of the Presidium of the SAC.

The scenario for practicing D5: Approval at scientific degrees.

Conditions for activation: the SAC Presidium confirms or declines the decree of the Scientific Council on awarding an scientific degree following the conclusion of the expert council.

Main operating person: Department of Scientific Expertise, the SAC Presidium.

Execution procedure of scenario:

1) The Presidium of the SAC considers the decision of the Scientific Council on awarding a degree based on the conclusion of the expert council.

2) The decision of the Presidium of the SAC on the approval of the Scientific Council's decision on the award of scientific degrees comes into force from the date of its adoption.

3) The Presidium of the SAC returns the issue to the expert council for reconsideration if it does not find the decision of the expert council on the attestation justified.

Input information: Conclusions of the expert council on the post-dissertation attestation work.

Output information: Awarding the candidates in relevant scientific degrees (Ph.D., DSc).

The algorithm of the module for the submission of post-dissertation attestation works is shown in Figure 4.

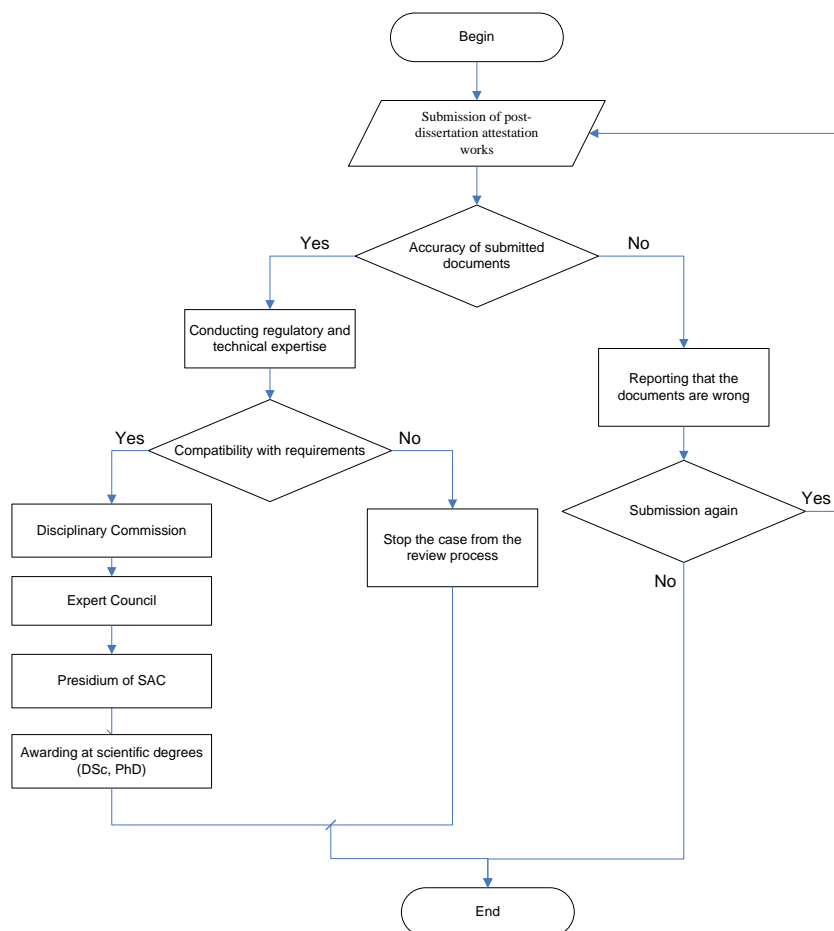


Fig. 4. Algorithm of the module for the submission of post-dissertation attestation work of applicants.

Consisting of 15 functional modules, the information system operates based on client-server architecture, in a multiuser regime. The system database is a MySQL database management system. The user interface is developed in a Yii framework environment based on MVC technology using HTML, PHP, AJAX, JQUERY web technologies. The system provides information security via using HTTPS, SQL injection, XSS scripting, reCaptcha, and RBAC technologies.

Models and descriptions of scenarios to use the "Complex-analytical Information System of Scientific Degrees" for the digitization of attestation documents for the Doctor of Philosophy (Ph.D.) and Doctor of Science (DSc) degrees were presented. The copyright certificate number DGU 07657 for the information system was obtained from the Intellectual Property Agency on 31.01.2020. By implementing this system within the "Electronic SAC" framework via digitizing the process of attestation of highly qualified scientific and scientific-pedagogical personnel we will ensure the unity of attestation requirements, increase the scientific potential of educational institutions and scientific organizations, guarantees openness and transparency in the field.

This information system was developed and put into practice within the framework of the system "Electronic SAC", designed to digitize the process of attestation of highly qualified scientific and scientific-pedagogical personnel. Also, this information system has been integrated into the departmental information systems of the SAC and the software and hardware complex "Single electronic information analysis system of the State Civil Service".

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