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SECTORIAL QUALIFICATION FRAMEWORK OF RUz ON INFORMATION AND COMMUNICATION TECHNOLOGY

СЕКТОРИАЛЬНАЯ КВАЛИФИКАЦИОННАЯ РАМКА РУз ПО ИНФОРМАЦИОННО-КОММУНИКАЦИОННЫМ ТЕХНОЛОГИЯМ

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SECTORIAL QUALIFICATION FRAMEWORK OF RUz ON INFORMATION AND COMMUNICATION TECHNOLOGY

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Chapter 1. Methodology and principles for the development of sectorial qualification framework of RUz on ICTt

Introduction

Decree of the Cabinet of Ministers of the Republic of Uzbekistan dated January 10, 2015 No. 3 introduced some changes and additions to Resolution of the Cabinet of Ministers of August 16, 2001 No. 343 “State Educational Standard of Uzbekistan”, according to which the new Classifier of areas and specialties of higher education was approved.

Classifier - a systematic list of areas and specialties of personnel training with higher education

The Classifier includes 6 areas of knowledge, which in turn contain 26 areas of education and 180 areas of undergraduate program.

COMPOSITION				
Classifier of undergraduate program and specialties of higher education				
6 areas of knowledge	↔	26 areas of education	↔	180 areas of undergraduate program.
AKn	↔	AE	↔	UP

ICT Specializations - Information and Communication Technologies		
AKn: 300 000 - "Production and technical sphere"	AE: 330 000 - "Computer technology and informatics" and 350 000 - "Communication, information and telecommunication technologies"	6 undergraduate program: from 5330100 to 5330600 11 undergraduate program: from 5350100 to 5351100

The undergraduate program is a set of basic and fundamental knowledge and skills acquired by a graduate of a higher educational institution in terms of curricula and undergraduate programs (equivalent to “Learning Outcomes” from the EQF), and ensuring that they perform a certain type of professional activity (equivalent to “Competences” from the EQF) in the

framework of the academic degree **"bachelor"**
Master's specialty is a set of knowledge, skills and abilities in a particular specialty, acquired by a graduate of a higher educational institution in master's curriculum and discipline programs (similar to the "Learning Outcomes" from the EQF), and ensuring that they perform a certain type of professional activity (similar to "Competences" from the EQF) within the framework of the academic degree **"master"**

12+17=29 master program

1. The main principles for the development of sectorial qualifications frameworks

As a generalized description of qualification levels, the National Qualifications Framework for the System of Continuing Education of the Republic of Uzbekistan (NQF SCE RUz) is determined by the characteristics or descriptors of each level and serves as the basis for creating sectorial qualifications frameworks, ensuring inter-sectoral comparability of qualifications.

Under the sectorial qualification framework (SQF) for the Classifier refers to the definition of descriptors, covering the characteristics of each of the 26 fields of education, and each of the 180 of undergraduate program.

NQF SCE RUz includes the development of SQF for ICT specialties - information and communication technologies. These specializations in the Classifier are located in two areas of education, that is, it is necessary to develop general descriptors for ICT covering the following two areas of education:

330 000 - Computer technology and computer science,

350 000 - Communication, information and telecommunication technologies.

These areas combine 6+11=17 areas of undergraduate program (Appendix 1-1).

2. Legal principles at the heart of the sectorial qualifications framework

- Sectorial qualifications frameworks at the national and international levels provide for the accumulation and recognition of qualifications (knowledge) common for all levels of higher education.

- For each specialization, unity is provided by the corresponding six qualification descriptors. It:

1. - Knowledge and understanding

2. - Application of knowledge and understanding

3. - Ability to express judgment and ability to learn

4. - Communication skills and abilities

5. - Ability to further learning

6. - Professional communication skills.

- Each of the marked descriptors is considered in two perspectives: what are the "learning outcomes" of a graduate and what "competencies" he has developed.

- sectorial qualifications framework is a systematic and structured by level description of the qualifications of a specific educational program recognized by society, industry, specialists. They are used to measure and determine the relationship of learning outcomes and establish the ratio of documents on education and training (diplomas, certificates, certificates).

- The sectorial framework of qualifications of a specific educational program within the country itself and abroad is the basis for building quality education, expanding its accessibility, establishing relationships and recognizing qualifications, both in society and in the labor market.

- The sectorial qualifications framework for educational programs is approved in agreement with the relevant state governing body of higher education and the sectoral ministry.

- Separate sectorial qualifications frameworks (on initiative educational and vocational and educational programs) are drawn up on the basis of consensus reached between the social partners.

- Qualification is always the result of mastering a certain educational program or practical experience. However, anyone who wants to improve their qualifications or change the profile of their professional activity is ensured by the possibility of

studying additional educational programs (this possibility could be realized in institutions of the system of advanced training or retraining).

- The skill level may also increase as you gain practical work experience, self-education and self-study. The sectoral qualifications frameworks provide for such educational opportunities to increment the personality qualifications, that is, the sectorial qualifications framework contains the individual's right to build an individual educational trajectory.

3. Purpose of sectorial qualifications framework

Dublin descriptors in the form of "Learning Outcomes" and "Competences" of a graduate of an educational institution of higher and postgraduate education will be used as basic provisions in the development of SQF on ICT.

Dublin descriptors describe what the trainee should know, understand and be able to complete at the end of the program in accordance with the program of a particular level of higher or postgraduate education (or course, module, or period of study).

"Learning outcomes" and "Competences" imply the development of a graduate's knowledge and their respective understandings, abilities to apply knowledge and understanding, to be able to form judgments, develop communication skills and learning skills (or learning ability).

The development of SQFon ICT will provide an opportunity to determine the place of SQFon ICT in the overall structure of the NQF RUz, and, if necessary, a comparison, with the structure of the EQF. Using them, you can also carry out the so-called "self-certification" procedure. This is the so-called process by which the competent authorities of the relevant country of enrollment of our citizens for study confirm that the NQF of Uzbekistan (and with it the SQF on IT) is compatible with the comprehensive framework of the European higher education area.

4. Distinctive features of sectorial qualifications framework

The development of qualification frameworks, as well as sectoral requirements for personnel, along with educational institutions of higher education, involved

interested representatives of companies, industrial chambers, organizations, professional and regulatory bodies.

The competence parameters of a specialist are formed, first of all, in accordance with the requirements of employers, opinions of interested industries (personnel users), conclusions of developers of industry requirements for personnel and functional maps of specific positions. And only then, by the possibilities of educational institutions of higher education.

In the modern higher educational space, the university is obliged to do everything possible in order, first of all, to meet the needs of production and the labor market. The content of the educational process is also adjusted to these requirements.

If earlier production adjusted to the possibilities of a professional higher educational institution, now, on the contrary, the university fulfills applications and orders of a specific production.

Cadre users along with educational institutions are interested in the development of industry requirements.

Particularly strongly, all that has been said relates to the development of competences and learning outcomes across a sectorial framework of entities. They are developed in accordance with the requirements of employers and functional maps of specific positions.

Structural sectorial qualifications are being introduced by order of the relevant departmental ministry, and introduced into the educational process by a decree of the minister responsible for education.

There are many benefits of jointly developing industry-wide qualifications frameworks. First of all, the structure is the result of a dialogue between industry representatives who work together to establish a common vision of their business and competence. Such cooperation allows us to develop many universal solutions.

Dublin descriptors of the sectorial qualification framework (SQF) of a graduate of a higher educational institution are practically analogous to the requirements for a graduate of a higher educational institution in the state educational standard (SES), but only in a slightly modified amended form.

Analysis and comparison [1-6] of NQF SCE RUz and EQF shows that SQF on ICT needs to be developed only for four levels of NQF:

- 4a-SQF for NQF-4a -dovuzovskogo secondary special education,

- 5-SQF for NQF-5 - a bachelor of higher education,

- 6-SQF for NQF-6 - the master's of higher education,

-5a-SQF for the NQF-5a system of personnel retraining and improvement of their skills.

SQF on ICT for the level of postgraduate education (NQF-7 and NQF-8) are not considered at this stage, since the training of specialists in the highest category of ICT is mainly focused on the foreign educational system.

The system of retraining and advanced training also covers the educational process for adults (SQF-5a). The program (the training in them has much in common with the corresponding undergraduate program) and its consideration will be postponed until a later time.

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Appendix 1-1

12- Computer technology and informatics-330 000			
№	**Undergraduate program and master courses**	**master courses**	**Bachelor program**
1	*Mathematical and software information systems*		5330100
	Computer systems and their software (by industry and sector)	5A330101	
2	*Informatics and information technologies (by application area)*		5330200
	Computer science and information technology (by industry and industry)	5A330201	
	Information and multimedia technologies (by application area)	5A330202	
	Applied Informatics	5A330203	
	Информационные системы (по отраслям)	5A330204	
3	*Information security (by spheres)*		5330300
	Cryptography and cryptanalysis (by directions)	5A330301	
	Information security (by directions)	5A330302	
4	*Computer graphics and design*		5330400
	Computer graphics and design	5A330401	
5	*Computer engineering ("Computer engineering", "IT service", "Information security", "Multimedia technologies")*		5330500
	Computer engineering ("Designing computer systems", "Designing application software", "Information and multimedia technologies", "Information security, cryptography and cryptanalysis")	5A330501	
	E-Government System Management	5A330502	
6	*Software engineering*		5330600
	Software engineering	5A330601	
	Mathematical and software information systems (by type of application)	5A330101	
14 - Communication, information and telecommunication technologies - - 350 000			
№	**Undergraduate program and master courses**	**master courses**	**Bachelor program**
1	*Telecommunication technologies ("Telecommunications",*		5350100

	"Broadcasting", "Mobile Systems") Telecommunication engineering ("Information Transmission Systems", "Telecommunication Networks", "Broadcasting") Information transfer devices and systems Telecommunications software Information security systems and telecommunications networks	 5A350101 5A350102 5A350103 5A350104	
2	*Television technologies ("Audiovisual technologies", "Systems and applications of television studios")*		5350200
3	*Economics and management in the field of information and communication technologies* Economics and management in the field of information and communication technologies	 5A350301	5350300
4	*Professional education in the field of information and communication technologies*		5350400
5	*Postal technology* Organization and technology of the postal service	 5A350501	5350500
6	*Informatization and Library Science* Informatization and Library Science Electronic library and archives	 5A350601 5A350602	5350600
7	*Electronic equipment and systems (by industry)* Electronic equipment and systems (by type and industry) Antennas and microwave devices Radio engineering and communication devices	 5A350701 5A350702 5A350703	5350700
8	*Television, radio and broadcasting* Devices and systems of television, radio communications and broadcasting (by type) Security of television, radio and broadcasting systems	 5A350801 5A350802	5350800
9	*Mobile communication systems* Mobile communication systems	 5A350901	5350900
10	*Audio-video technology* Audio technology Video technology	 5A351001 5A351002	5351000
11	*Technology special lighting*Technology special lighting	 5A351101	5351100

Chapter 2. Stages and methodology of development of the sectorial qualification framework in the field of information technologies in the Republic of Uzbekistan

The purpose of the sectoral qualification framework in the field of information technologies is to develop a document containing a classification of the types of labor activity of the information technology sector at the qualification levels and sublevels of the NQF of the Republic of Uzbekistan. The classification criteria are the qualification frameworks and other indicators relevant for the sector.

The purpose of this document is to provide a "roadmap" for the realization of the activities.

The process of developing a sectoral qualification framework in the Republic of Uzbekistan consists of the following stages:

1. **Introduction of members of the consortium of the Republic of Uzbekistan for conducting functional analysis and development of the functional map of the employer in the sphere of information technologies**
2. **Creation of the database of employers**
3. **Conducting an employer's questionnaire and analysis of answers**
4. **Carrying out the round table on the development of the functional map of the employee in the field of information technologies**
5. **Determination of knowledge and skills for each labor function**
6. **Definition of the level of education for each labor function**
7. **Development of a draft sectorial qualification framework project (SQF)**
8. **Discussion of the project of the sectorial qualification framework with employers and the academic community**

1. Introduction of members of the consortium of the Republic of Uzbekistan for conducting functional analysis and development of the functional map of the employer in the sphere of information technologies

The purpose of acquaintance and training of members of the consortium of the Republic of Uzbekistan is familiarization with the principles of conducting functional analysis and developing a functional map of the employee in the field of information technology.

The knowledge gained from the training is used directly in discussions with employers and the academic community in developing a functional map of an employee in the field of information technology.

Conducting a functional analysis is intended to describe the work activity through specific labor functions

The result of the functional analysis is the functional map of the employee in the field of IT.

The development of the functional map of an employee in the IT sphere consists of the following stages:

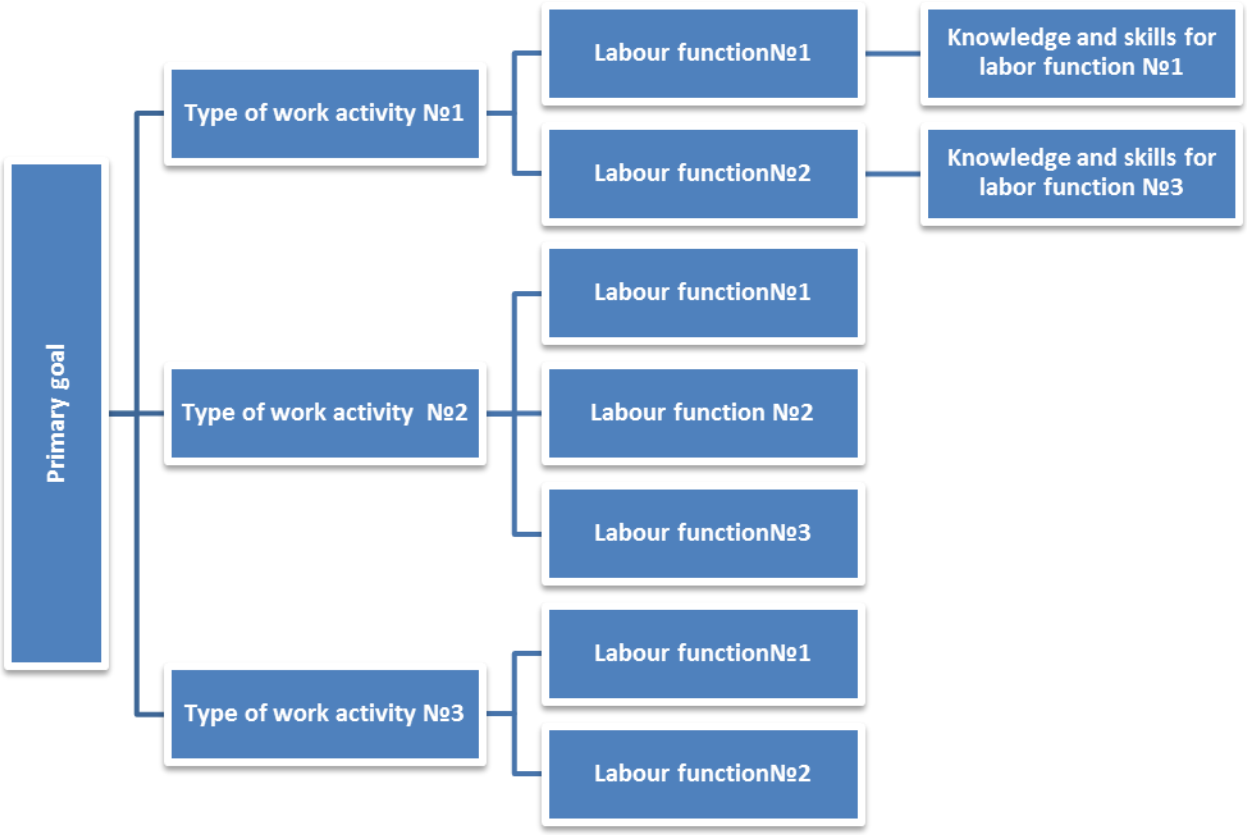
1. Formulation of the main aim. At this stage, define the main aim, which pursued by the organization in which there are specialists in the field of IT, is determined.

2. Formulation types of work activity. Types of work activity are the processes that are necessary to achieve the main goal (see the previous paragraph).

3. Formulation of specific labor functions. Each type of work activity is divided into a list of specific labor functions.

4. Formulation of knowledge, skills and abilities. At this stage, the knowledge and skills are formulated, to necessary to fulfill a specific labor function.

The relationship between the stages of developing a functional map is shown in the diagram below.



Further, a functional map of the employee is prepared with the following structure:

Goal	Type of work activity	Labor functions	Actions that are part of the labor function (what should I do?)	The object of labor (what ?)	Means of work (with what to work?)	The degree of importance of the function		
						High	Avera ge	Low

For each specific labor function, knowledge and skills are formulated (see table below)

Work function	List of knowledge required to perform	List of skills required to perform	Behavior Models

2. Creation of the database of employers

The purpose of creating a database of employers is to determine the list of organizations in which specialists in the field of information technology work in the Republic of Uzbekistan, including distribution by region.

№	Name of organization	FULL NAME of the manager	Contact details		FULL NAME of the contact persone	Contact details	
			address	tel., fax		tel.	e-mail
1							
2							
3							

A list of employers is given in Appendix 3-4.

3. Conducting an employer's questionnaire and analysis of answers

The objective of the questionnaire is to determine the interest of employees in developing a functional map in the field of IT, professional standards and a sectoral qualification framework.

The questionnaire consists of two sections:

- **information about organization and**
- **questionnaire questions.**

Information about the organization consists of the following items:

1. Name of organization	
2. Mailing address: 3. e-mail: 4. Phone:	
5. The head of the enterprise (full name, position)	
6. Year of foundation of the organization:	

The following objectives are defined in the questionnaire:

1. To find out whether the employer is interested in participating in the development of the functional map of an employee in the field of IT.
2. To find out whether the organizations have job descriptions of employees.

3. To find out whether IT staff are sufficient in their organization and what level of education they have.

There were five questions for polling employers with multiple answers.

1. Are there sufficient IT specialists in your organization and do they meet the requirements of today?

- ☐ Sufficient and meet the requirements
- ☐ IT-specialists do not meet the requirements
- ☐ There is not enough IT-specialists

2. Indicate the number of employees by levels of education:

- ☐ Primary professional (after the trade union)
- ☐ Secondary vocational (after college, technical school)
- ☐ Specialty (5 years)
- ☐ Undergraduate(4 years)
- ☐ Master (2 years)
- ☐ Retraining - Short-term courses
- ☐ Second higher education

3. Does your company have a functional employee card?

- ☐ Yes
- ☐ No

4. What competencies, in your opinion, should be available to the specialist you employ? Prioritize competencies.

- ☐ Knowledge
- ☐ Application of knowledge
- ☐ Expression of judgments
- ☐ Communicative abilities
- ☐ Ability to study

5. Are you interested in working out a functional map of an employee, professional standards and a sectoral IT framework?

- ☐ Yes
- ☐ No

The results of the survey will analyze the responses of employers and form a list of employers interested in further cooperation. Also, for each answer to the question, the proportion of the total number of respondents is determined.

The results of the analysis of the questionnaire survey of employers in the field of information and communication technologies are presented in Chapter 3 of this document.

4. HOLDING THE ROUND TABLE FOR DEVELOPING THE FUNCTIONAL MAP OF THE EMPLOYEE IN THE SPHERE OF IT

The purpose of the round table is to attract the attention of employers in the development of a functional map of an employee in the IT field,

Participants of the round table:

1. Ministries

2. Employers

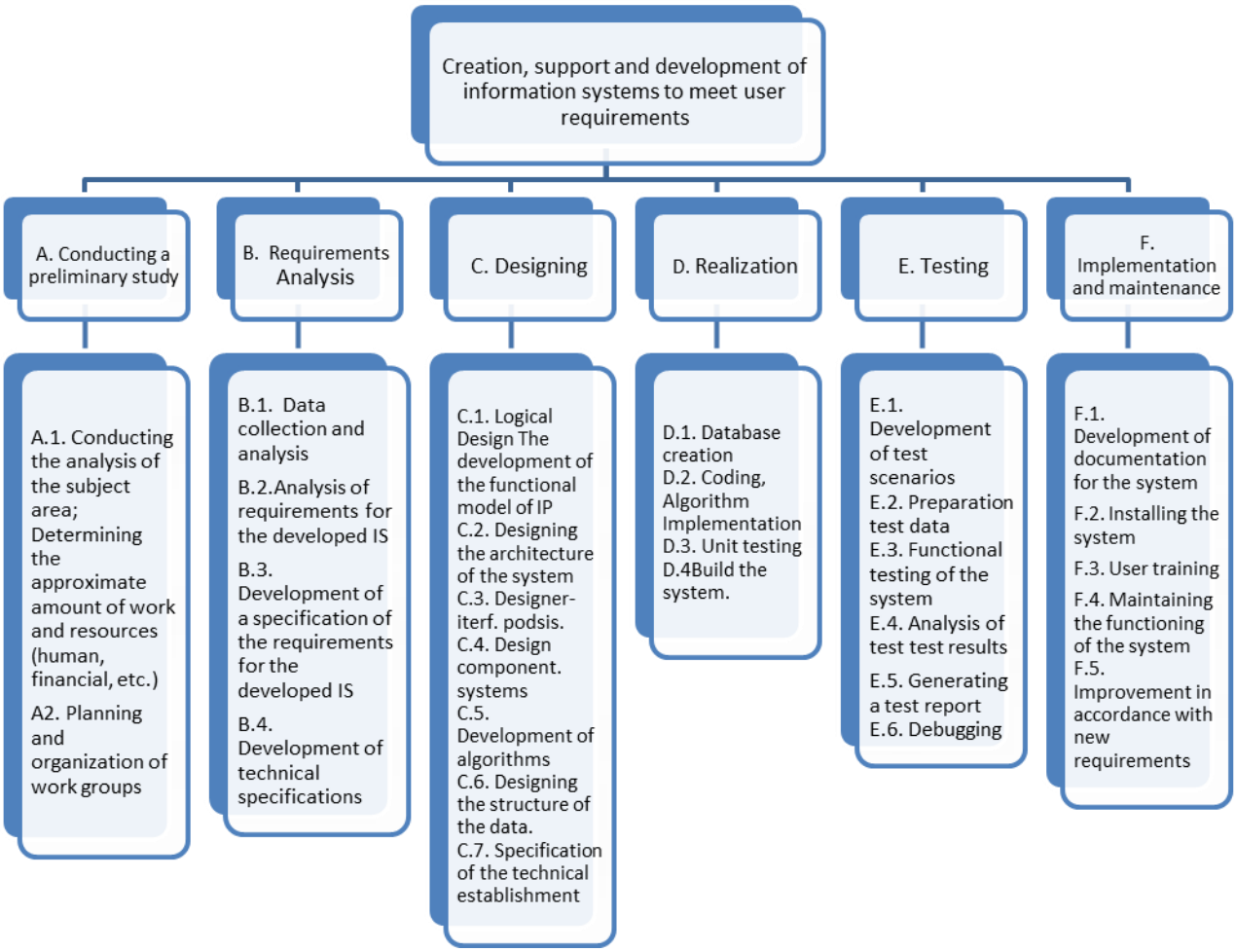
3. Academic community

When discussing with the participants of the functional map, the following will be formulated:

1. The main goal of IT professionals

2. Types of labor activity

3. Specific labor functions


Creation, support and development of information systems to meet user requirements
A. Conducting a preliminary study
B. Requirements Analysis
C. Designing
D. Realization
E. Testing
F. Implementation and maintenance
A.1. Conducting the analysis of the subject area; Determining the approximate amount of work and resources (human, financial, etc.)
A2. Planning and organization of work groups
B.1. Data collection and analysis
B.2.Analysis of requirements for the developed IS
B.3. Development of a specification of the requirements for the developed IS
B.4. Development of technical specifications
C.1. Logical Design The development of the functional model of IP
C.2. Designing the architecture of the system
C.3. Designer-iterf. podsis.
C.4. Design component. systems
C.5. Development of algorithms
C.6. Designing the structure of the data.
C.7. Specification of the technical establishment
D.1. Database creation
D.2. Coding, Algorithm Implementation
D.3. Unit testing
D.4Build the system.
E.1. Development of test scenarios
E.2. Preparation test data
E.3. Functional testing of the system
E.4. Analysis of test test results
E.5. Generating a test report
E.6. Debugging
F.1. Development of documentation for the system
F.2. Installing the system
F.3. User training
F.4. Maintaining the functioning of the system
F.5. Improvement in accordance with new requirements

Further, the functional map of the employee in the IT field is filled.

The draft functional map of an IT worker is presented below

Goal	Type of work	Labor functions	Actions that are part of the labor function	The object of labor	Means of work	The degree of importance of the function		
			what should I do?	(what?)	(with what to work?)	High	Average	Low
СОЗДАНИЕ, ПОДДЕРЖКА И РАЗВИТИЕ ИНФОРМАЦИОННЫХ СИСТЕМ С ЦЕЛЬЮ УДОВЛЕТВОРЕНИЯ ТРЕБОВАНИЙ ПОЛЬЗОВАТЕЛЕЙ	A. Conduct prior research.	A.1. Conducting the analysis of the subject area; determining the approximate amount of work and resources	Definition, description of the problem; Definition of goals;	Development of alternative solutions;	Documents about the object of research; Interview with customers	+		
		A.2. Planning and organization of work groups	Plan; Divide professionals into groups	Project objectives and resources	Standards and norms of project management	+		
	B. Requirements Analysis	B.1. Data collection and analysis	Collection of requirements (questionnaire, survey)	Developed system	Computer, CASE-technologies	+		
		B.2. Analysis of the requirements for the developed IS	Construction of functional models in the form of diagrams; Preliminary requirements analysis	Subject area	Computer, CASE-technologies	+		
		B.3. Development of a specification	Describe the technical requirements for facilities,	Sources of information: Product	Rules of documentation Standards for the development	+		

		of the requirements for the developed IS	materials or operations; Describe and prioritize functional blocks;	parameters; technical requirements for facilities, materials or operations; cost-effective ways to achieve technical requirements;	of specifications CASE-technology Standards and requirements for IP			
		B.4. Development of technical specifications	Documenting all requirements, Reporting	Requirements for the developed IS	Documentation Rules	+		
	C. Designing	C.1. Logical design. Development of the functional model of IP	Development and evaluation of alternative projects; Project selection; Development of detailed functional models of IP.	Logical model of IP	Principles of supporting the integrity of the configuration during the life cycle of the development of information systems; CASE-tools, and the principles of their use;	+		
		C.2. Physical Design. Designing the architecture of the system.	Definition of the specification of input and output data; Definition of input and output devices, Definition of system architecture; Formation of the requirements for the system software and technical devices (memory, processor, etc.) Drawing up requirements for the protection of information, data accuracy.	Physical model of IP; IP Requirements	Architectural styles, tactics and patterns; Methods of designing and analyzing the architecture of systems; Principles of architectural design of integrated circuits; Principles of revaluation and redesign of project components in accordance with changing requirements; Specification and modeling languages; CASE-tools; Fundamentals of network technologies; OS	+		
		C.3. Designing the Subsystem	Design information display tools, formats;	Information sources Required input and	Aspects of design that affect the interaction of the user and			

		Interface	Design devices and technologies for data entry; Design dialogs, interactions and transactions between subsystems, user and computer, feedback from the user; Develop the procedure for using the program and the documentation for it..	output parameters for the user; Subsystems, subsystem interface A set of tasks for the user; Elements, properties and features of the selected environment.	the system; Tools, methods and rules for designing interfaces; CASE-tools;			
		C.4.Designing system components	To carry out the selection and formation of technical, information, mathematical, software and organizational and legal support. Optimum combination of the above-mentioned components for processing information and generating the required outputs; Organize the complete set of methods and algorithms for solving functional problems требуемых выходов;	Necessary procedures, methodological support Methods and algorithms for solving problems.	CASE-tools;			
		C.5. Designing algorithms	Design variants of algorithms; Selection of optimal algorithms among the designed; Ensuring the compatibility of the designed algorithms;	The algorithm of functioning of the integrated circuit	Methods of designing algorithms:			
		C.6. Designing a Data Structure	Design data structures; Identify the structure and flow of data, as well as the operations that create this flow	Data; data structure models	CASE tools Methods for designing data structures:			

		C.7. Specification of the technical assignment	To define, specify additional requirements to form the final technical assignment for the development of information systems	Requirements for TK	Techniques and technologies for information search and analysis;			
	D. Realization	D.1. Database creation	Development of a database; Administration and programming of stored procedures, functions, representations) Organization of control over observance of regulations on information protection in the database management system; Control levels of access to data objects, as well as user credentials;	DB, Program Codes	DBMS Tools for developing client-server applications Software development technology Database protection technologies Object-oriented programming			
		D.2. Coding. Implementation of the algorithm.	Implementation of the algorithm using the necessary tools; Optimization of code using specialized tools;	Designed system, terms of reference; Software code	CASE-technology. Programming languages; Tools for developing IP on appropriate means; Basic methods and means of effective development; Methodologies for the development of IP; Internal norms and development regulations; Standard algorithms and areas of their application;			
		D.3. Unit testing.	Implementation of unit testing and debugging of IP;	Programs; codes	Programming languages and software development tools in		+	

					appropriate languages; Methods for debugging autonomous applications, Methods for debugging distributed applications,			
		D.4. Assembling the system	Integration of system components	System Components	Programming languages and software development tools in appropriate languages;	+		
	E. Testing	E.1. Development of test scenarios	Determining the amount of testing (functions, subsystems, the system as a whole) Selection of test methods, Selection of testing tools (hardware and software, users, etc.) Defining a script and a test schedule	Requirements specifications Hardware and software	Standards for testing; Methods of testing			
		E.2. Preparation of test data	Determine the amount of testing (functions, subsystems, the system as a whole) Preparation of input data for testing	Requirements specifications Hardware and software Algorithms for the operation of components, modules, subsystems, the system as a whole The algorithms of the components of the system	Standards for conducting testing Test methods Test scenarios			
		E.3. Functional testing of the	Assembly. Testing the system (the "black box" method, testing	Hardware and	Test data Test methods Test			

		system	the assembly, performance, security, etc.);	software Test data	scenarios			
		E.4. Analysis of test test results	Comparison of test results with data defined in test scenarios and test data. Decision on sufficiency of testing or its continuation.	Test results; Test scenarios; Test data	Requirements specifications; Standards for testing Test data; Methods of testing			
		E.5. Generating a test report	Issue a report on the results of testing and recommendations for further actions (debugging or commissioning)	Requirements specifications Test scenarios Test data Test results	Test results Test data Testing standards; Documentation Rules			
		E.6. Debugging	Implementation of IS debugging;	Programs; codes	Programming languages and software development tools in appropriate languages; Methods for debugging stand-alone applications; Methods for debugging distributed applications;			
	F. Implementation and maintenance of the system	F.1. Development of documentation for the system	Determine the necessary amount of documentation and described system components. Develop documentation for the system (user, programmer, installation (hardware and software), security,	Requirements Specifications Hardware and software systems	Standards and Regulatory Requirements for Documentation			
		F.2. Installing the system	Deploy hardware and software Configure hardware and software	The developed IS (hardware and software)	System documentation Hardware and software systems			

		F.3. User training	Conducting group or individual training for different groups of users	Users; IP, Documentation,	Multimedia devices; Hardware and software; Documentation for the system			
		F.4. Maintaining the functioning of the system Auditing and evaluating the information system;	Control and operation of the IC in specified functional characteristics and in accordance with the quality criteria	Hardware and software of the information system	Documentation to the system; System state indicators			
		F.5. Improvement in accordance with new requirements	Track and apply modern achievements of science and technology in the system Identification of new system requirements	New achievements in science and technology Hardware and software of the information system New requirements for the system	Documentation to the system; The source of information			

5. DETERMINATION OF KNOWLEDGE AND SKILLS FOR EACH LABOR FUNCTION

After the development and completion of the functional map of the employee in the IT field, the knowledge and skills necessary to perform specific labor functions are determined.

A project of the description of knowledge and skills for each labor function is presented below.

Type of work	Labor functions	Knowledge and understanding	Skills and abilities
A. Carry out a preliminary study.	A.1. Conducting the analysis of the subject area; determining the approximate amount of work and resources	Fundamentals of Project Management, Project Management Standards, Information Systems Cost Metrics, Methodology of Systems Analysis	Systematically and structurally consider information, Make informed decisions
	A.2. Planning and organization of work groups	Fundamentals of Management, Project Management Standards, Fundamentals of Personnel Management, Principles of Command Development of Information Systems	Effectively organize work, Effectively manage personnel, Ability to work in a team, Ability to rationally plan and allocate your time
B. Requirements Analysis	B.1. Data collection and analysis	Main approaches and means of system analysis, Basics of communication, Principles of using CASE-tools, Internal norms and regulations of document flow of subject domain, Software development methodologies, Development and maintenance of project documentation in accordance with standards	Systematically and structurally approach to the study of the subject area, Abstract thinking, Productively use the means of system analysis
	B.2. Analysis of the requirements for the developed IS	Methods and means of gathering requirements, Methods and technologies for developing formalized requirements and specifications, Fundamentals of CASE-tools and principles of their use, Software development methodologies, Methods for estimating the time and cost of development	Skillfully develop software requirements, Productively use tools and methods to develop requirements and specifications, Clearly assess requirements, Develop scenarios for the use of products
	B.3. Development of a specification of the requirements	Tools and methods for developing requirements and specifications, Development and maintenance of project documentation in accordance with	Substantially develop software requirements, Productively use tools and methods to develop requirements and specifications,

	for the developed IS	standards	Skillfully work in a team
	B.4. Development of technical specifications	Development and maintenance of project documentation in accordance with standards, Basic principles of the software development process, Methods and technologies for the development of formalized requirements and specifications	Substantially develop software requirements, Productively use tools and methods to develop requirements and specifications, Skillfully work in a team
C. Designing	C.1. Logical design. Development of the functional model of IP	Principles of maintaining configuration integrity during the life cycle of software development, Designing multi-threaded applications, Fundamentals of CASE tools and principles of their use, Methods of structural and object-oriented approaches to design	Systematically and structurally approach the design of the functional model of IP, Holistically represent the future system
	C.2. Physical Design. Designing the system architecture	Fundamentals of CASE-tools and principles of their use, Object-oriented analysis, Principles of architectural software design, Fundamentals of distributed systems design, Software design strategies and methods	Skillfully and optimally use the tools of object-oriented design and principles of architectural design
	C.3. Designing the Subsystem Interface	Specification languages (BNF, UML, ERD, DFD, etc.), Specification methods; Methods of standardization and unification of IP documentation; required system characteristics; Required input and output parameters; technical requirements for facilities, materials or operations; cost-effective ways to achieve technical requirements; accurate representation of the solution to the problem; mathematical or program conditions; stakeholder assessments; knowledge of methods for implementing a function using the selected software environment; Standards for the development of specifications (IEEE 830 for describing software requirements, Multiboot for multicasting, etc.)	Systematically analyze, Logically formalize the ways to solve the problem, Choose effective methods for implementing subsystems, Optimally combine the competencies and preferences of the group's developers, Argumented to state their thoughts

	C.4. Designing system components	Required input and output parameters of subsystems; aspects of design that affect the interaction of the user and the system; a set of user tasks that he solves with the help of the system; system control elements; navigation between system blocks; elements, properties and features of the selected environment, tools, methods and rules for designing interfaces;	Coordinated interaction with end users; Adequate to perceive the opinion of users; Be attentive to every detail of the request; Designers approach the solution of the problem, Maximize the convenience of entering, storing and accessing information.
	C.5. Designing algorithms	Element base of computational means, Numerical methods, bases of algorithmization, Principles of construction of databases, Principles of construction of information models.	Effectively choose technical, mathematical, software, information support; Optimal to combine the above-named components in order to process information and generate the required outputs;
	C.6. Designing a Data Structure	Methods for designing algorithms, Structural and object-oriented approaches to program design, Fundamentals of algorithmization, CASE tools	Effectively apply design methods when designing algorithms, Effectively determine the optimality of the designed algorithms
	C.7. Specification of the technical assignment	Methods for designing data structures, Data structure design with CASE tools	Effectively apply design methods when designing data structures, Effectively determine the structure and flow of data, and the operations that create this flow, Effectively use CASE tools
D. Realization	D.1. Database creation	Technologies of search and analysis of information, principles of construction of technical assignment;	search and analyze information, verify the correctness of TK, create technical tasks for the development of technical systems and software; be able to work in a team
	D.2. Coding. Implementation of the algorithm.	Fundamentals of Algorithmization and Programming, Methods and Technologies of Algorithm Programming, Programming Languages	Analytically implement the algorithm, Productively implement the algorithm

	D.3. Unit testing.	Fundamentals of DBMS, Tools for developing client-server applications, Software development technology, Object-oriented programming, Database protection technologies	Develop with various databases, perform their administration and programming (write stored procedures, functions, representations), Organize control over observance of regulations on data protection in a database management system, manage access levels to data objects, and also user credentials
	D. Assembling the system	Principles of assembling system components, principles of identifying and eliminating integration problems	The use of specialized tools for assembling systems, early detection and elimination of integration problems
E. Testing	E.1. Development of test scenarios	Basics of the programming language, Modules, parts of programs, Debugging and testing tools	Review each team, Check each project module to find out the errors.
	E.2. Preparation of test data	Basics of testing, Test methods, System analysis of IP requirements	Effectively apply testing techniques
	E.3. Functional testing of the system	Determining test situations, Defining the data format	Effectively analyze problematic and critical situations
	E.4. Analysis of test test results	Principle of operation of IS components, Test methods, Principles of information protection, Principles of IP administration	Effectively identify and systematize errors
	E.5. Generating a test report	Programming languages and tools for developing software in appropriate languages, Methods and tools for developing test scenarios and test code, Methods for testing software Effectively use methods and tools for developing test scenarios and test code,	Effectively use methods and technologies for testing and reviewing code and project documentation to control the achievement of specified functionality and quality
	E.6.Discussion	Principles of debugging, detection, localization and error elimination	Effectively use specialized software (debuggers) to detect, localize and fix errors
F. Implementation and maintenance	F.1. Development of documentation for the system	Principles of the system approach, Rules of drawing up the report.	Ability to work with tools and a testing library.

of the system	F.2. Installing the system	knowledge of the hardware of the PC, knowledge of the operating system (OS), settings of user OS and office programs, knowledge of technical English	PC maintenance, Software installation and tuning, System maintenance
	F.3. User training	Know and understand your subject area, Speak foreign languages	Ability to apply knowledge in practice, Ability to explain their subject area to non-professionals, Ability to self-education, Ability to positive and tolerant interpersonal communication
	F.4. Maintaining the functioning of the system	Types of information system architectures, Features of operation and maintenance of information systems of various architectures, Operating systems, Network technologies, Administration of information systems	Effectively maintain the operability of information systems and technologies in specified functional characteristics and in accordance with the quality criteria
	F.5. Improvement in accordance with new requirements	mastering knowledge of the achievements of science and technology on the information system; mastering knowledge on the introduction of automated systems to reduce the amount of manual labor; mastering of special knowledge on the use of modern Internet technologies in the information system.	the ability to apply modern achievements of science and technology in their system; the ability to implement automated systems; the ability to use modern Internet technologies in the system.

6. DEFINITION OF LEVEL OF EDUCATION FOR EACH LABOR FUNCTION

Based on the functional map of an IT worker and the knowledge and skills for specific labor functions, labor functions are related to a certain level of education in accordance with the NKR (educational levels 6 to 8). The methodology of the European e-Competence Framework http://www.ecompetences.eu/ is taken as the basis for the distribution of labor functions.

Below is a table with certain levels of education for each work function of an IT worker.

Type of work	Labor functions	Professional competency levels (4-6 levels of NQF RUz)		
		4/4a	**5/5a**	**6**
A. Carry out a preliminary study.	A.1. Carrying out an analysis before field of tasks; define scope of works and results.			
	A.2. Planning and organization of activities of work groups			

B. Requirements Analysis	B.1. Data collection and analysis			
	B.2. Analysis of the requirements for the developed IS			
	B.3. Development of a specification of requirements for the development. IS			
	B.4. Development of technical specifications			
C. Designing	C.1. Logical Designing. Development of functions. IS models			
	C.2. Physical Designing. Designing of the architects of systems			
	C.3. Designing the Subsystem Interface			
	C.4. Designing system components			
	C.5. Designing algorithms			
	C.6. Designing a Data Structure			
	C.7. Specification of the technical assignment			
D. Realization	D.1. Database creation			
	D.2. Coding. Implementation of the algorithm.			
	D.3. Unit testing.			
	D. Assembling the system			
E. Testing	E.1. Development of test scenarios			
	E.2. Preparation of test data			
	E.3. Functional testing of the system			
	E.4. Analysis of test test results			
	E.5. Generating a test report			
	E.6.Discussion			
F. Implementation and maintenance of the system	F.1. Development of documentation for the system			
	F.2. Installing the system			
	F.3. User training			
	F.4. Maintaining the functioning of the system			

	F.5. Improvement in accordance with new requirements			

7. DEVELOPMENT OF THE SQF PROJECT

After determining the level of education, a sectoral framework for the qualification of an employee in the field of information technology is developed for each labor function. Each level is described in accordance with the accepted descriptors. The consortium of the Republic of Uzbekistan has identified 6(3) descriptors for describing the levels of education: Knowledge and understanding, Skills and abilities, Ability to learn, Level of responsibility, Communicative abilities, Ability to express judgments.

In this example, the SQF is presented for level 5 (bachelor) with descriptors: Knowledge and Understanding, Skills and Abilities. This part of the SQF was formed from a previously developed knowledge and skills table required to perform specific labor functions. This table will be supplemented by three more descriptors.

5th level (bachelor)		
Knowledge and understanding	Skills and abilities	List of possible professions
K1 Fundamentals of Programming K2 Programming Languages K3 IP Design Methods and Tools K4 Information Systems Administration K5 Network technologies K6 Architecture of information systems K7 Features of operation and maintenance of information systems K8 Operating systems K9 Fundamentals of DBMS K10 Testing techniques for IP K11 Standards in IT (SWEBOK, Agile, etc.)	S1 Process and analyze information S2 Design and develop, hardware architecture, user interfaces, software components and embedded software modules S3 Use object-oriented design tools and principles of architectural design S4 Creation of databases, administration and programming, organization of data protection in DBMS S5 Application of programming languages and applications for the development of PP Identify and systematize testing errors S6 Maintain the operability of information systems and technologies in specified functional characteristics and in accordance with the quality criteria S7 Create technical documentation (manuals, reports, reference books, etc.)	Programmer Information Systems Specialist System Administration Specialist Database Administrator

8. DISCUSSION OF THE DRAFT PROJECT WITH EMPLOYERS AND THE ACADEMIC COMMUNITY

After the completion of the SQF for all levels of education, a second discussion with representatives of the IT and academic community is necessary.

Unfortunately, due to the refusal to extend the project for a year, there was not enough time for a wider dialogue with employers and a National Conference with IT employers.

Chapter 3. Results of analysis of the questionnaire poll of employers in the sphere of information and communication technologies

Statement of a question

The purpose of the study: "Development, selection of a study method and generalization of the results of an expert survey to determine the interest of employers in the field of information and communication technologies to the development of a functional map of ICT workers, industry and sector qualifications framework."

To carry out research to determine the interest of employers in the field of information and communication technologies to the development of a functional map of ICT workers in the sphere, sectoral and sectoral qualifications framework, a questionnaire survey method has been applied.

The developed “Survey Questionnaire” (see Appendix 3-1) consists of three parts. The first part indicates the purpose of the questionnaire: “determining the interest of employers in the development of a functional map of ICT workers in the sphere, sectoral and sectoral qualification frameworks”. It is indicated that according to the survey results, an analysis of the employers' answers will be conducted and a possible list of employers interested in further cooperation will be formed.

In the second part - reference data of the questioned (postal address, e-mail, telephone number, name, name, name of the organization, which he represents).

The third part is the questionnaire itself from 5 test questions.

The development of the questionnaire was carried out taking into account the analysis of the methodological literature [2-6], the main provisions of which are discussed in Appendix 3-2. For conducting detailed studies, a combined method was chosen, which allows to obtain more objective information on the survey results.

The questionnaire survey was conducted among those responsible for the implementation of ICT units in government and economic management, as well as in government bodies (ministries, agency committees, etc.). Respondents (participants in specialized surveys) are competent individuals whose professional and theoretical knowledge, life experience allow an authoritative conclusion to be made that this is an expert opinion. Respondents are able to give a balanced assessment of issues of interest to the researcher.

The results of the survey

In total, the survey covered more than 100 respondents (organizations and their leading experts, Appendix No. 4) from 7 major sectors of the republic's economy and sectors involved in the ICT sector, namely:

1. Information and Analytical Department on youth policy, culture, information systems and telecommunications (7 experts);
2. Complex on issues of integrated development of territories and communal sphere, transport, capital construction, construction industry (11 experts);
3. Information and Analytical Department for the integrated socio-economic development of territories (13 experts);

4. Complex on the issues of macroeconomic development, structural transformations and attraction of foreign investments (13 experts);
5. Complex on the issues of agriculture and water management, processing of agricultural products and consumer goods (21 experts);
6. Complex on issues of geology, fuel and energy complex, chemical, petrochemical and metallurgical industries (15 experts);
7. Complex on health care, ecology, environmental protection, physical culture and sports (19 experts).

As can be seen from the list, the main areas of industry and the economy of the republic participate in the survey.

The majority of respondents noted the lack of specialists in general, as well as the weakness of practical skills in working with the latest ICT systems prepared by specialists in the field of information technology.

The survey on education levels showed the following results:

• in the field of resource management and ICT development policies, individuals with a bachelor's level and above are required;
• in the sphere of production and management of telecommunications, persons with a secondary professional and higher level of education are necessary.

These results show that in the field of management specialists are needed with experience in introducing ICT to the economy, in other words, ICT design architects.

In the manufacturing sector, there is a need for specialists with an initial level of vocational education, as well as specialists with work experience even without higher education.

In fact, all respondents noted that their organizations have a functional employee card (meaning job description), which is developed mainly based on the responsibilities in this area assigned to these organizations. These functional maps are not standardized and are not tied to specialist training programs. Therefore, for many specialists in the course of their work, it is necessary to organize the passage of additional specialized vocational courses, which is reflected in the answers about the appropriateness of the "Ability to learn" descriptor.

The divergence of opinions turned out in the point of inquiry of the level of competence. Some respondents noted the need to develop the application of knowledge and expression of judgment, and some noted the ability to learn and communication skills (teamwork). Virtually everyone noted the importance of learning ability.

Most respondents expressed a desire to participate in the development of professional standards and sectoral qualifications frameworks in the chosen field.

Responses to the survey were received from 25 survey participants and the results are given below:

• to the first question "Do your organizations have enough ICT specialists and do these specialists meet today's requirements?" 15 respondents answered that there was a shortage of ICT specialists, 5 respondents answered that ICT specialists do not meet the requirements, 5 respondents answered there are enough specialists and meet the requirements;

• to the second question “Specify the number of employees by level of education?” 17 participants noted that they have bachelor and master degrees, 6 participants said that they have graduates of colleges, lyceums, bachelor and masters, two participants said that they have graduates of colleges, lyceums, bachelors, masters and specialists, even with a second higher education;
• to the third question, “Does your company have a functional employee card?” All 25 participants noted that they have “job descriptions, official duties”, which replace, in part, functional cards. They are drawn up on the basis of the tasks assigned to the ICT unit, but are not brought under a single standard;
• to the fourth question: “What competences, in your opinion, should be available to the specialist you hire?” Answers vary greatly: 9 participants noted the priority in the following order: “Knowledge”, “Application of knowledge”, “Ability to study ”,“ Expression of judgments ”,“ Communication skills ”, 11 participants noted the priority in the following order:“ Knowledge ”,“ Application of knowledge ”,“ Expression of judgments ”,“ Ability to learn ”,“ Communication skills ”, 5 participants noted the priority in the following order: "Knowledge", "Com communicative abilities "," Application of knowledge "," Expression of judgment "," Ability to learn ";
• to the fifth question, “Are you interested in developing a functional employee card, professional standards and sectoral ICT qualification framework?” 23 participants indicated a desire for what needs to be developed, and they are interested in participating in the development, and only 2 participants refused to participate in the development.

Conclusion

- In order to study the methods of conducting a survey of experts to determine the interest in the introduction of new professional standards in the field of education, the existing methodologies for conducting a study of public opinion were reviewed.
- For the formation of the survey questionnaire was selected a combined survey method. For questions of the standard type, questions of a closed type questionnaire with answers “Yes” or “No” are used. And for questions that have a more detailed study, the polar profiles method was used, which made the survey more informative.
- The survey showed that there is an acute shortage of personnel in the ICT field and there is an inconsistency of requirements between educational institutions and consumers in the training of specialists. This discrepancy was due to:
- lack of a functional map of ICT workers,
- weak reflection in state educational standards of regularly updated professional requirements,
-No sectoral and sectoral qualifications framework with corresponding Dublin descriptors.

Based on the above, it follows that there is a need to develop a functional map of ICT workers, professional standards and a sectoral qualification framework, taking into account the experience of world practice.

The survey was conducted in accordance with the action plan of the project “National Qualifications Framework: Guidelines for the Development and Recognition of

Qualifications" (NURSLING) of the ERASMUS + program with the assistance of the Ministry of Information and Communication Technologies of the Republic of Uzbekistan and the Rector of Tashkent University of Information Technologies named after Muhammad al Khorammiy (Appendix No. 3).

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Appendix3- 1

THE QUESTIONNAIRE
for the survey of employers and their subsequent analysis

The purpose of the survey is to determine the interest of employers in the development of a functional map of workers in the IT sphere, professional standards and sectoral qualification framework.

Information about the interviewee and his organization
(Filled when sending back):

1. Name of organization	
2. Mailing address:	
3. e-mail:	
4. Phone:	
5. The head of the company (name, position)	
6. Year of establishment of the organization:	

Questionnaire questions
(Select the appropriate answer and tick it off)

1. Does your organization have enough IT specialists and do these specialists meet the requirements of today?
   - ☐ Adequate and meet the requirements
   - ☐ Available IT-specialists do not meet the requirements
   - ☐ Lack of IT-specialists
2. Indicate the number of employees by education level:
   - ☐ Initial professional (after profliceum)
   - ☐ Secondary Vocational (after college, technical school)
   - ☐ Specialty (5 years)
   - ☐ Undergraduate (4 years)
   - ☐ Master (2 years)
   - ☐ Retraining - Short Courses
   - ☐ Second higher education
3. Does your company have employers functional cards?
   - ☐ Yes
   - ☐ No
4. What competences, in your opinion, should be available to the specialist you hire? Prioritize competencies.
   - ☐ Knowledge
   - ☐ Application of knowledge
   - ☐ Expression of judgment
   - ☐ Communication skills
   - ☐ Learning Abilities
5. Are you interested in the development of a functional employee card, professional standards and a sectoral qualification framework for IT?

☐ Yes
☐ No

According to the survey results, an analysis of employers' answers will be conducted and a list of employers interested in further cooperation will be formed.

Appendix 3-2.

Questionnaire Methodology

To solve the problem, science uses certain methods. Method is the way of knowing the truth. There are:

- universal method (methodology);
- general (inherent in a number of sciences) and private (specific to this science) methods;
- methods and means of research.

Methods are based on theories and methodologies. Each specific science, using general methods (methodology), specifies, specifies and transforms methods in relation to the conditions and objectives of their research areas.

The main methods of collecting information are observation and experiment. Observation is the study of the external manifestations of feelings, actions, actions and behavior of people and groups in various conditions of their life and activity, and the experiment is the active intervention of the researcher in the process being studied.

Observation and experiment are complemented by individual, mass methods, methods of generalization of independent characteristics by others. Individuals include conversations, and mass interviews are in the form of questionnaires, tests, and interviews.

A survey is, on the one hand, a method for studying the opinions, attitudes or behaviors of individuals, and on the other, a method for collecting primary information in the socio-psychological interaction between the researcher and the respondent. The interaction itself (verbal or written judgment of a person) can be either directly through a conversation or an interview, or indirectly through a questionnaire.

The widespread use of this method is due to its versatility, the relative ease of application and data processing. A researcher in a short time can get information about real activities, actions, moods, intentions and assessments of the surrounding reality of the person being surveyed.

One of the difficulties of the survey method is to ensure the reliability and reliability of the data obtained. The information obtained from the survey is subjective and depends on the degree of sincerity of the respondent, his ability to adequately assess his actions and personal qualities. Therefore, there should be a wide coverage of the respondents with the subsequent comparison of many other subjective answers. Ensuring the reliability and reliability of the data obtained is also achieved by conducting among consumers before the survey of public opinion about the existing requirements for personnel in their organizations.

The basis of the survey is a survey or interviewing, or sociometric method. These methods are well developed, which allows you to easily compose the content of the

questionnaires and identify survey questions. The objectivity of the data is greatly improved with a simultaneous combination of different methods and coverage of the opinions of representatives of various related industries.

The survey is the most common method of collecting primary information, when studies are conducted on the substantive characteristics of social, group and interpersonal relationships, hidden from the external eye and make themselves known only in certain conditions and situations. In a questionnaire for a short time, you can simultaneously interview in person or in absentia a significant number of respondents.

Questionnaires may have open and closed questions. The first ones allow the free form of the answer, the second - one of the ones proposed by the experimenter: “Yes”, “No”, “I don't know.”

Participants in mass surveys are called respondents. In specialized surveys, the main source of information is competent persons whose professional or theoretical knowledge and life experience allow making authoritative conclusions. In fact, the participants in such surveys are experts who are able to give a balanced assessment of issues of interest to the researcher. From here one more wide prevalence of such polls - expert polls and estimations.

Appendix 3-3

Министру
по развитию информационных технологий
и коммуникаций Республики Узбекистан
Содикову Ш.

Уважаемый Шухрат Мухамаджанович,

Ташкентский университет информационных технологий имени Мухаммада ал-Хоразмий просит Вас оказать содействие в проведении социалогического опроса (анкетирования) среди ответственных за внедрение ИКТ подразделений в органах государственного и хозяйственного управления, а также в органах государственной власти.

Целью опроса является

а). выяснение мнения потребителей кадров о **качестве подготовки кадров** по информационно-коммуникационным технологиям (ИКТ-ICT),

б). определение интереса работодателей к **разработке функциональной карты** работников ИКТ-ICT сферы с указанием необходимых для них компетенций,

в). привлечение внимания соответствующих организаций к **разработке** профессиональных стандартов и отраслевых (секторальных) **квалификационных требований** по 26 направлениям образования, утвержденных Постановлением Кабинета Министров Республики Узбекистан № 3 от 10 января 2015 года

На основе полученных мнений и с учетом высказанных предложений будет разработан конкретный план мероприятий по коренному преобразованию процесса подготовки профессиональных кадров и совершенствованию всех циклов образовательного процесса университета в свете происходящих в соответствии со «Стратегией действий по развитию Республики Узбекистан на 2017-2021 годы» инновационных преобразований в области высшего и профессионального образования.

Социалогический опрос реализуется краткими ответами ответственного лица подразделения на 5 вопросов анкеты (форма анкеты прилагается). Анкеты можно направить как по обычной, так и по электронной почте на адрес ТУИТ имени Мухаммада ал-Хоразмий.

Ректор **Т.Тешабаев**

Исп.: проф.Э.З.Имамов
Тел.:(71)238-64-50

Appendix3-4

List

mailing the questionnaire through the Ministry for the Development of Information Technologies and Communications of the Republic of Uzbekistan

Information and Analytical Department on youth policy, culture, information systems and telecommunications

1. Центр внедрения электронного образования в образовательных учреждениях МВССО.
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2. Отдел внедрения ИКТ в учебно-воспитательный процесс МНО.
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3. Государственное унитарное предприятие "Научно-техническая информация".
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4. Отдел внедрения и развития информационно-коммуникационных технологий ДТМ.
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6. ВАК центр внедрения и развития. эл.почта: stat@oak.uz
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Complex on issues of integrated development of territories and utilities, transport, capital construction, construction industry

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