

# EUROPEAN AND INTERNATIONAL principles FOR QUALITY MANAGEMENT IN EDUCATION USING INTELLIGENT TECHNOLOGIES

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**Abstract.** The article compares the international and European requirements for institutions of higher education. General international principles of quality management were also considered and adapted to institutions of higher education. The main requirements for the quality management system (QMS) of a higher education institution (HEI) following international and European standards,) as well as the advantages and main requirements for the implementation of the quality management of educational services, as a tool for managing the processes of providing educational services and improving their quality.

**Key words:** Quality QMS are given. It is proposed to integrate the intelligent management system into the general system of Management System, Institution of Higher Education, Educational Services, Intelligent System.

## 1. Introduction

Higher education is considered a factor of strategic importance and priority development of society and state. Ukraine has clearly defined the course for entering the European educational space with sustainable development of educational activities in the context of European requirements. Here, the most acceptable seems to be the model of education quality, the components of which are standards and norms regarding the quality of education at the HEI level, external assurance of the education quality at the state level, and international quality assurance of education.

## 2. Disadvantages

The European Association for Quality Assurance (ENQA) in Higher Education, with the participation of other independent commissions, has developed standards and recommendations for the creation of quality assurance systems [1]. However, European standards and recommendations concern only three levels of higher education and do not relate to the field of scientific research and general management of HEI.

## 3. Purpose of work

Research of European and international standards and norms for quality management in education and formation of proposals for the implementation of best HEI practices in Ukraine, identification of tools for automation and management of higher education processes and their improvement.

## 4. Analysis of standards and principles of quality management

Today, each HEI uses its ways of ensuring and improving the quality of educational services, guided by national and international standards [2-3]. To create an effective QMS of educational services and achieve significant results in the activities of HEI, it is suggested to

jointly comply with the requirements of state education standards, European recommendations, and norms [1] as well as the requirements laid down in the international standards of the ISO 9000 series [4-5]. Together, these standards form a coherent series of standards that promote mutual understanding in the national and international spaces and contain the modern experience of systematic quality management.

Another normative document regarding the management of services in educational institutions from kindergartens to universities is the international standard ISO 21001:2018 [6]. However, this standard was not widely implemented in Ukraine. It is used as extended recommendations for the implementation of the requirements of ISO 9001:2015, according to which the certification of the QMS is carried out. Comparing the international requirements of the main standards for quality management systems ISO 9001:2015 and European norms ESG 2015 [1] as well as for the system of internal quality assurance of education, a certain correspondence is established (Table).

**Table.** Comparison of sections of the ISO 9001:2015 and ESG 2015 standards

Chapters of ISO 9001:2015	Chapters of ESG 2015
4. Context of the organization	I
5. Leadership	1.1
6. Planning	1.2, 1.3
7. Support	1.5, 1.6, 1.7, 1.8
8. Operation	1.4
9-10. Performance evaluation, Improvement	1.7, 1.9, 1.10

An analysis of the principles on which the above-mentioned documents are based demonstrates that they not only do not contradict but also complement each other. We adapt the general principles of quality management, which are the basis of standards [4-6], to HEI:

1. Orientation to the consumer. Internal consumers of HEI are students, teachers, and employees of the

educational institution. External consumers of educational services are parents, employers, state or regulatory bodies, accreditation bodies, public organizations, organizations that have agreed to training, research, or consulting, and society in general. As a rule, HEI considers students and employers as the main consumers of their services.

An educational institution is dependent on its consumers, and therefore the managers of HEI must first identify the main consumers of services, permanently monitor their requirements, needs, and expectations (through questionnaires, interviews, focus group surveys, and personal meetings), trying to satisfy them, and in some cases exceed. Adherence to this principle leads to the satisfaction of all interested parties.

Sustainable contact with consumers and assessment of their level of satisfaction with the activities of HEI is decisive for the success of an educational institution in the market of educational services. Therefore, it is necessary to ensure the monitoring of the fulfillment of the accepted obligations to consumers (control of the effectiveness of training and success of graduates' careers, response to information from consumers, etc.). HEI should involve consumers in the development of educational programs, the process of strategic planning, and the improvement of their activities.

2. The principle of leadership. The management of HEI should ensure an understanding of the tasks and directions of development at all levels and direct the efforts of the staff to their achievement and prompt response to changes in the educational space.

3. Involvement of personnel. Maximum involvement of employees in improving the quality of educational services and processes benefits the employees themselves and the educational institution in general. This principle provides:

- staff delegation of powers by the management of the HEI;
- extensive discussion with the staff of the HEI of aspects of the institution's activities;
- encouragement, recognition, and awarding of the best employees;
- staff training.

This is the most effective way in which an educational institution can achieve its goals, promote the involvement of personnel and make the most of the competence, life experience, professional skills, and creative abilities of staff [1].

4. The process approach guarantees the effective achievement of the result if the management of resources and activities is carried out as a process. Any activity, using resources and managed to enable the transformation of inputs into outputs, can be considered a process.

5. To function effectively, HEI must identify the order in which each work process creates value for the learner.

For example, the process of providing educational services includes recruitment of students, educational process, scientific activity, employment of graduates, and postgraduate studies. Each of the processes is characterized by several parameters that must be under permanent control and management.

For each of the processes that function in HEI, it is necessary to define:

- order of execution, which includes the interaction of various structural units;
- process monitoring scheme, gathering information about it;
- process manager with authority to coordinate the work of involved structural units (not managing people, but regularly analyzing the adequacy and effectiveness of the process, searching for opportunities for its improvement);
- considered inputs and outputs and their interaction with other processes;
- process improvement tasks and measures to achieve them.

An example of the work of the process manager includes the collection, summarization, and analysis of reporting on process execution in involved structural subdivisions; holding regular meetings with representatives of units involved in the operation of the process (consideration of problems related to the execution, interaction between units, decision-making regarding changes to the order of process execution).

Identification, understanding, and management of interrelated processes as a system contributes to the HEI in achieving its goals more efficiently.

6. Continuous improvement. Improvements can be related to the elimination of identified deficiencies (corrective actions) or the prevention of possible problems (preventive actions). Continuous improvement of the activity of the educational institution should be considered an unchangeable goal of HEI.

7. Making decisions based on facts. To implement the principle of continuous improvement, it is necessary to keep reliable quality information. Decisions that are made should be based on facts, not assumptions. For this, information and life experience are combined with analysis, logical thinking, and a scientific approach.

Mutually beneficial relations with interested parties (cooperation with partners). Educational institutions and their suppliers are interdependent, and mutually beneficial relationships increase the ability of both parties to create value, to optimize the resources spent by them. The main values of HEI can include consumers and other interested parties, staff of HEI and scientific schools, the image of HEI at the regional, national, and international levels, openness of HEI to society, material and technical base, modern learning technologies, etc.

Schools, lyceums, colleges, and other HEIs can be considered providers of higher education, in the case of obtaining a second higher education. They are developers of study guides, textbooks, and methodical literature as well as manufacturers and suppliers of equipment, materials, etc.

In general, the work of the educational institution according to the before-mentioned principles is focused on preventing the provision of low-quality educational services, and not on correcting errors.

### 5. Advantages of implementing the QMS in HEI

An effective QMS, which meets the requirements of the standards, enables the university to ensure the stable output of competent specialists, and conscientious members of society, ensure improvements in the structure and management, increase productivity, optimize costs, strengthen the image and strengthen the position of HEI in the market of educational services, as well as systematically evaluate the adequacy of its training system to modern requirements, in particular licensing and accreditation, to improve it promptly.

As a result of the implementation of the QMS in the HEI, they should be achieved improvements:

- in the management of the processes that make up the activity of HEI, primarily the educational process, and scientific activity, as a result of which the level of quality of graduates, their competitiveness in the labor market, the level of satisfaction and commitment of employers increases;
- in the organization of staff work and student education, including scientific activities of lecturers and students, independent work of students;
- of the external image of HEI and strengthening of positions in the market of higher education services;
- of competence and satisfaction of personnel;
- of the infrastructure of HEI, as a result of which costs for ensuring its activities could be optimized;
- of the results of related activities of HEI, in particular, in conducting courses, seminars, pieces of training, etc.

The implementation of the QMS in the HEI would ensure:

- better level of internal organization, fewer errors;
- increasing the efficiency of the development of budget funds;
- improving the quality of educational services (increasing the success of students, improving the quality of scientific research, and educational programs, expanding the involvement of teaching staff and staff of HEI while growing demand for graduates);
- transparency of information for consumers of higher education services;

- interaction between the HEI and organizations that already have a self-management system;

- stable work in conditions of staff turnover.

What does the QMS give management:

- bringing the educational and scientific results of HEI to the level of leading universities, by clearly formulating goals in the field of quality of educational services and developing ways to improve them;

- the opportunity to prove to the staff the requirements for the performance of work;

- the possibility of a clear division of responsibility;

- obtaining information necessary for the analysis of activities;

- ensuring the implementation and control of the decision-making;

- the possibility of regulating activities when changing the strategy, and general tasks.

What does the QMS give to the staff:

- a clear understanding of the management's requirements and how the work of employees is evaluated;

- distribution of responsibility with interacting structural divisions, conflict resolution;

- better interaction with other structural units;

- a mechanism for initiating improvements in work.

### 6. Basic requirements for the QMS of a higher education institutions

For work on the development and implementation of QMS in HEI, it is important to have competent specialists who can plan and organize this process, develop a series of documentation, implement requirements following standards, conduct internal audits, pass certification and continue work on improvement of QMS. The training of standardization and certification specialists is a priority direction that Europe has identified for participation in international competitions, for example, Horizon 2023.

Lviv Polytechnic National University is a leading HEI in Ukraine and Eastern Europe, which is accredited. It trains specialists in quality management, standardization, and certification based on the Department of Information-Measuring Technologies. It also provides significant advantages due to the implementation and improvement of the QMS which is the foundation for the development of educational and scientific activities.

Analyzing the experience with the introduction of the QMS, it is possible to determine the main stages for HEI development under international principles [4, 7]:

- to determine the processes necessary for QMS and their application at all levels of higher education;
- to define the sequence and interaction of these processes;

- to ensure the availability of resources and information necessary for the functioning and monitoring of these processes;
- to consider the criteria and methods necessary to ensure the effectiveness of the functioning of these processes and their management;
- to monitor and analyze these processes;
- to take necessary measures for achieving the planned results and their continuous improvement.

The processes of the QMS of HEI should be defined and properly described, for example, in the form of flowcharts, diagrams or process maps, etc., indicating the persons responsible for the process, the resources and documentation used, the inputs and outputs of the processes, the management tools, and the monitoring and performance process criteria. The level of process detail is determined by each educational institution independently. It depends on the complexity and stability of the performed activities.

The management of the educational institution must determine the documented information necessary for the implementation of the QMS, which may contain:

1. Documented quality policy and goals.
2. The Quality Guide, which describes the QMS according to the announced policy and goals in the field of quality.

The Quality Guide can become the main document of the QMS of the HEI, a kind of "road map" and contain a description of the QMS, documented methods or references to them, the distribution of responsibilities, a description of the interaction between key processes, and the justification of possible exclusions. It should be written in such a way that anyone, not related to the HEI, can easily understand how the institution functions and what documentation is used. However, the instruction should not contain confidential information.

If the current documentation of the HEI is adequate to the requirements of the QMS, then it can be referenced in the instruction (if necessary, pre-adjust following the goals of the QMS of the university).

3. Documented methodologies that describe the interrelated processes and activities required for QMS implementation.
4. Documents necessary for the educational institution to ensure effective planning, operation, and control of processes (working instructions, forms, reports).
5. Protocols for providing information about the work performed at the HEI (for example, about the results obtained at each stage of the learning process) and evidence of compliance with the requirements and effectiveness of the QMS.

To fulfill these requirements, the educational institution should determine:

- documentation which is necessary for the implementation of the QMS;
- type of documentation carrier, considering functionality (for example, speed of processing);
- assessment of activities related to documentation (creation, application, management);
- possibility of access to documentation for employees of the educational institution and other interested parties.

It is necessary to determine the duration and place of storage of each type of documentation and how to dispose of it. No need to pile up outdated documents. Each employee of HEI and, if necessary, third parties (for example, consumers or representatives of the certification body) must have access to the document they need.

To ensure the quality of educational activities of each HEI, it is necessary [1, 7] to:

1. Formulate and document the strategy and tasks for the nearest period and begin their systematic implementation. Inform all interested parties about it (students, their parents, university employees, employers, etc.).
  2. Periodically review and monitor educational programs and diplomas in the interests of students and other beneficiaries of higher education in the European Higher Education Area.
  3. Provide for the participation of students and other interested parties in the process of ensuring the quality of educational services. Ignoring the needs of students and the labor market, inflexibility regarding changes in training programs leads to a decrease in the quality of education.
  4. To improve the quality assessment system of students' learning results.
  5. Develop procedures and criteria that would certify that scientific and pedagogical workers have appropriate qualifications and a high professional level to perform their official duties.
  6. Provide a sufficient number of resources for conducting the educational process at the appropriate level.
  7. Collect, analyze and use relevant information for effective management of educational programs and other activities.
  8. Regularly publish the most up-to-date, unbiased, and objective information, both quantitative and qualitative, about training programs and qualifications offered.
- The presence of a working QMS that meets the requirements of ISO 9001:2015 facilitates the implementation of the system under ISO 21001:2018 [6].

The considered principles and approaches are continuously implemented at the Lviv Polytechnic National University. Thus, in 2021, the university passed international recertification for compliance with the

requirements of [4] and received confirmation of this compliance. Nowadays, HEI does not stop and looks for opportunities to improve processes and activities.

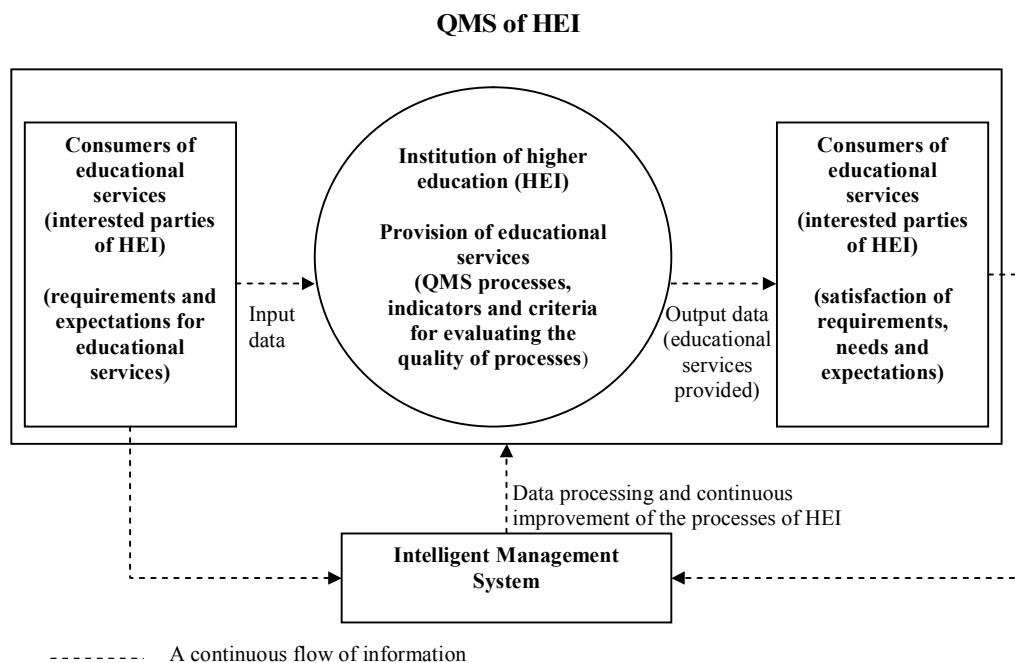
### 7. Intelligent technologies in quality management of educational services

To manage the processes of HEIs, develop and manage data on the quality of educational services, timely elimination, and possible prevention of inconsistencies in the activities, it is proposed to introduce intelligent technologies to the QMS, in particular, expert systems based on fuzzy logic [7-9] (Fig.).

The purpose of such an intelligent system is to analyze information received from consumers of educational services and other interested parties of HEI and

provide feedback for HEI by forecasting the need to improve certain activity indicators. This is necessary to make timely and effective management decisions, improve the quality of the services provided, and increase the rating indicators of the university at the national and international levels.

The use of intelligent technologies and the integration of an intelligent system into the overall QMS of the HEI involves the automated management of the data flow and processes of the institution through systematic quality control and planned influence on the conditions and factors on which the QMS of the HEI depends. Such a system can become a tool for managing the processes of providing educational services and improving their quality.



*Intelligent system of quality management of educational services*

### 8. Conclusions

HEI ignoring issues related to ensuring the quality of educational services may negatively affect their competitiveness. As world practice shows, the implementation of quality services provides to withstand fierce competition in the field of higher education, achieve a high level of trust and stability of consumer commitment to their services, improve and optimize their activities and increase efficiency, sustain high-quality services to meet the demands of consumers, open new opportunities or preserve already won market segments of services in the education field, gain recognition through the certification procedure.

The introduction of intelligent technologies into the quality management system of educational services permits management processes more effectively, to respond to inconsistencies in time and prevent their occurrence, manage risks and identify opportunities for continuous improvement of university operations.

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