

# Evaluation of the integration of systems for quality management in the field of higher education

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*For the purposes of continuous improvement of the quality management system in any organization, and in particular those in the field of higher education, an assessment of the degree of integration (maturity) of the system in the activities of the organization is necessary. In this way, activities aimed at its further improvement can be identified. A quality management system that does not have the necessary integration is ineffective.*

*The main purpose of the current research is to assess the level of some indicators related to the quality of education in higher education institutions, such as: technology and infrastructure, providing timely information about the functioning of the educational system, maintaining high academic standards and professional training programs for all students in every higher education institution, and most importantly developing an institutional culture to ensure the quality of education. In conditions of globalization, digitalization, and the common European educational space, Bulgarian higher schools are placed in a highly competitive environment that requires the maintenance of high quality, including the educational service itself, as well as the satisfaction of the students.*

**Keywords – exploratory factor analysis, ISO 9004, quality management, structural model, technology and infrastructure.**

**Оценка на интеграцията на системите за управление на качество в областта на висшето образование (Павлина Шопова, Мария Тодорова, Лиляна С. Колева, Елена Г. Колева).** За целите на непрекъснатото усъвършенстване на системата за управление на качеството във всяка организация, и по-специално в тези в областта на висшето образование, е необходима оценка на степеня на интеграция (зрялост) на системата в дейностите на организацията. По този начин могат да бъдат идентифицирани дейности, насочени към нейното допълнително усъвършенстване. Система за управление на качеството, която не притежава необходимата интеграция, е неефективна.

Основната цел на текущото изследване е да се оцени нивото на някои показатели, свързани с качеството на образованието в институциите на сектор висше образование, като: технология и инфраструктура, предоставяне на своевременно информация за функционирането на образователната система, поддържане на високи академични стандарти и професионални обучителни програми за всички студенти в сектор висше образование и най-важното развиване на институционална култура, гарантираща качеството на образованието. В условията на глобализация, дигитализация и общоевропейско образователно пространство, българските висши училища са поставени във високо конкурентна среда, която изисква поддържането на високо качество, както на самата образователната услуга, така и на удовлетвореността на студентите.

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## Introduction

The Quality in the context of ISO 9001:2015 is defined as "the extent to which a set of internal characteristics of a particular product, service, solution, document, information or process result satisfies a need or expectation that is generally accepted or obligatory"

[1]. Quality management in an educational organization needs development and integration of a quality management system [1] – [3]. Quality indicators, strategies of quality, Road map of quality management should be elaborated [4]. In transferring the methods from industry to academia, however, there are some differences, which need to be kept in mind [4] – [6]:

1. The university is not a factory.
2. The students are not the product.
3. Their education is the product.
4. The customers for the product are several:
  - a) The students themselves;
  - b) Their parents;
  - c) Their future employers;
  - d) Society at large.

Indicators of quality in education can vary depending on the specific context and goals of an educational system. However, here are some commonly recognized indicators of quality in education:

*Student Achievement:* This refers to the academic performance and learning outcomes of students. It can be measured through standardized tests, assessments, grades, and graduation rates.

*Learning Outcomes:* Quality education focuses on ensuring that students acquire the necessary knowledge, skills, and competencies. Assessments and evaluations of students' abilities to apply what they have learned in real-world situations are indicators of educational quality.

*Teacher Quality:* The qualifications, expertise, and effectiveness of teachers significantly influence the quality of education. Indicators of teacher quality include their qualifications, certifications, ongoing professional development, teaching methods, and student feedback.

*Curriculum and Instruction:* A well-designed curriculum aligned with educational goals and standards, as well as effective instructional practices, contribute to quality education. Indicators of quality curriculum and instruction include relevance, coherence, depth, and engagement of learning experiences.

*Equity and Inclusion:* Quality education should be accessible and inclusive to all learners, irrespective of their socio-economic status, gender, ethnicity, or disability. Indicators of equity and inclusion include measures such as enrollment rates, retention rates, and provision of support for marginalized groups.

*Stakeholder Engagement:* Involvement and collaboration among various stakeholders, including parents, communities, and educational institutions, can contribute to educational quality. Indicators of stakeholder engagement include parental involvement, community partnerships, and participation in decision-making processes.

*Post-Graduation Outcomes:* The ability of education to prepare students for future success, such as higher education or employment, is an important indicator of quality. Tracking post-graduation

outcomes, such as college enrollment rates, employment rates, and career advancement, can provide insights into the effectiveness of education.

*Student Engagement and Well-being:* Quality education promotes active student engagement, well-being, and socio-emotional development. Indicators may include attendance rates, student satisfaction surveys, and mental health support services.

*Continuous Improvement:* A commitment to ongoing evaluation, self-assessment, and improvement is a key indicator of quality education. Educational institutions that regularly monitor their performance, implement evidence-based practices, and adapt to changing needs demonstrate a commitment to quality.

*Resources and Infrastructure:* Adequate resources, including textbooks, learning materials, technology, and well-maintained infrastructure, are crucial for quality education. Indicators of resource availability and adequacy include student-to-teacher ratios, library facilities, computer labs, and classroom infrastructure. The new electronic information reality shows the expectations of students and staff and they are obviously in the direction of binding the conventional facilities and technical base with innovation and high technological standards.

These indicators, when considered collectively, can provide a comprehensive assessment of the quality of education within a specific context. However, it is important to note that different educational systems and stakeholders may prioritize different indicators based on their specific goals and priorities.

In [7] selected models of quality management implemented at a private university in Slovakia are described, especially the process model ISO 9001 and the common assessment framework (CAF) model. The self-assessment within the CAF model was carried out by a questionnaire survey; the obtained data were assessed by classical CAF scoring. Issues connected with the challenges in the integration of quality and innovation are pointed in [8].

Self-assessment [3] should be used to determine the strengths and weaknesses of the organization as well as best practices, both at an overall level and at the level of individual processes. Self-assessment can assist the organization to prioritize, plan and implement improvements and/or innovations, where necessary. The results of self-assessment support:

- a) improvement of the organization's overall performance;
- b) progress towards achieving and maintaining sustained success for the organization;
- c) innovation in the organization's processes,

- products and services, and the organization's structure, when appropriate;
- d) recognition of best practices;
- e) identification of further opportunities for improvement.

The main purpose of the current research is to assess the level of some indicators related to the quality of education in higher education institutions. The ISO 9004:2018 standard "Quality management - Quality of an organization - Guidance to achieve sustained success" gives the possibility each organization to make a self-assessment of the Quality system maturity level in the organization [3]. The defined indicators correspond to the clauses in ISO 9001 standard and their evaluation gives an overview of the level of integration of the quality system concerning different aspects of the activities of the organization. Current investigation presents the results and the analysis of the performed survey among the academic staff and students (including PhD students) from the estimation of the quality indicator "Technology" in the Resources and Infrastructure Category in a state higher education university.

### Methodology

Factors affecting an organization's success continually emerge, evolve, increase or diminish over the years, and adapting to these changes is important for sustained success. ISO 9004:2018 gives guidelines for enhancing an organization's ability to achieve sustained success. This guidance is consistent with the quality management principles given in ISO 9001:2015. This document promotes self-assessment and provides a self-assessment tool for reviewing the extent to which the organization has adopted the concepts in this document.

ISO 9004:2018 is applicable to any organization, regardless of its size, type and activity.

This standard proposes guidance how to achieve sustainable development by monitoring the elements of various quality indicators [3, 7, 9]. An organization can be at different levels of maturity for different categories. The proposed in ISO 9004:2018 self-assessment tool uses five maturity levels, which can be extended to include additional levels or otherwise customized as needed. Table 1 presents the generic model for self-assessment elements and criteria related to maturity levels [3]. It gives a generic framework for setting out how performance criteria can be related to the levels of maturity in a tabular format. The organization should review its performance against the specified criteria, identify its current maturity levels,

and determine its strengths and weaknesses and the related risks and opportunities for improvement.

**Table 1**  
*Generic model for self-assessment elements and criteria related to maturity levels*

Maturity level towards sustained success					
Key element	Level 1	Level 2	Level 3	Level 4	Level 5
Element 1	Criteria 1 <i>Base level</i>	Criteria 1 <i>Documented level</i>	Criteria 1 <i>Integrated level</i>	Criteria 1 <i>Strategic level</i>	Criteria 1 <i>Best practice</i>
Element 2	Criteria 2 <i>Base level</i>	Criteria 2 <i>Documented level</i>	Criteria 2 <i>Integrated level</i>	Criteria 3 <i>Strategic level</i>	Criteria 2 <i>Best practice</i>
Element 3	Criteria 3 <i>Base level</i>	Criteria 3 <i>Documented level</i>	Criteria 3 <i>Integrated level</i>	Criteria 3 <i>Strategic level</i>	Criteria 3 <i>Best practice</i>

**Table 2**  
*Maturity levels and elements to be monitored.*

Maturity level		
Level	№	Question
1	Q1	Improvements in technology occur occasionally.
2	Q2	Do you think that the benefits and risks of introducing new technologies and developments are assessed?
3	Q3	Do you agree that the latest innovations in technological developments are identified and implemented?
	Q4	Do you agree that the costs and benefits of implementing appropriate innovations and/or emerging technologies are assessed?
	Q5	Do you think that competitiveness of the application of the newly introduced and/or emerging technologies is assessed?
4	Q6	Do you agree that organizational knowledge and resource are available to adapt to innovations and/or technological changes or improvements?
	Q7	Do you think that there is a systematic approach to assess the risks and opportunities when introducing technological changes/improvements and innovations?
5	Q8	Do you think that there is a systematic approach to address students' needs and meet their expectations when innovations are introduced?
	Q9	Do you think that there is a systematic approach to address academic staff's needs and meet their expectations when innovations are introduced?
	Q10	Do you think that academic staff are informed about new technologies and innovations in the university and their possible benefits?
	Q11*	Do you agree that the impact of new technologies and new practices is monitored and assessed regularly, considering all possible risks and consequences?

\* for the academic staff only

A gap review can assist senior management in planning and prioritizing the improvement and/or innovation activities needed to move individual elements to a higher level.

For the current investigation the quality indicator "Technology" in the Resources and Infrastructure Category was chosen. The defined 5 levels of maturity and each level has various number of elements to be monitored (Table 2). On the basis of the suggested in the standard elements, our scientific team has proposed questions relevant for a higher education institution (Table 2). The questions are 10 for students and 11 for the academic staff. The study of the maturity of an organization uses a 5-point Likert scale, where the answer "1" means "Strongly disagree", answer "2" means "Rather disagree", answer "3" means "I cannot judge", answer "4" means "I rather agree" and answer "5" means "I strongly agree".

### Results and Discussion

The proposed questionnaire consists of 10 questions for students and 11 questions for the academic staff, aiming to investigate technology and innovation in a digitalized and highly-competitive environment (Table 2). The initial sample of this study consists of a total of 78 students from the University of Chemical Technology and Metallurgy (UCTM), who were interviewed during the summer semester of the academic 2022 – 2023 and 20 people from the academic staff. The survey participants are representatives from all three faculties of the university and their distribution by faculties is as follows: for the students - 48.7% are from FHSI (Faculty of Chemical and System Engineering), 34.6% are from FCT (Faculty of Chemical Technology) and 16.7% are from FMM (Faculty of Metallurgy and Materials Science) and for the academic staff - 55% are from FHSI, 20% are from FCT and 25% are from FMM. The survey also covers different types of students - 64.1% from the students are bachelor, 11.5% are master and 24.9% are PhD students. The academic staff is distributed by position as follows: 5% are assistants, 25% are assistant professors, 40% are associate professors, and 30% are professors.

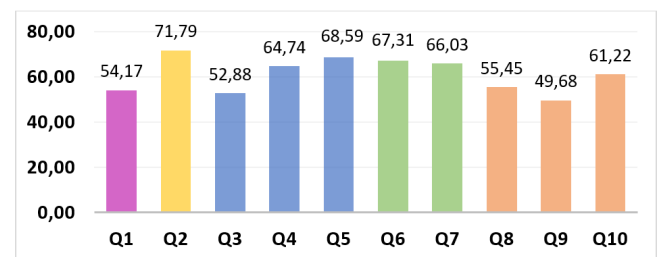
Table 3 shows the precise results of the processed students' questionnaires as well as the fulfilment degree of the investigated issues in percentages. Fig. 1 shows only the fulfilment degree and the bars are in different colors that show the different maturity level. Since our study of the maturity of an organization uses a 5-point Likert scale, where the answer "1" means "Strongly agree" (81 – 100%), answer "2" means "Rather agree" (61 – 80%), answer "3" means "I cannot

judge" (41-60%), answer "4" means "I rather disagree" (21 – 40%) and answer "5" means "I strongly disagree" (0 – 20%), it is clear that questions 4, 5, 6, 7, 10 are in the area where the fulfilment degree is very positive.

**Table 3**

*The total scores and the fulfilment degrees (students)*

	Strongly agree	Rather agree	Cannot judge	Rather disagree	Strongly disagree	Fulfilment degree, %
Q1	11	20	26	13	8	54.17
Q2	25	30	12	10	1	71.79
Q3	10	20	21	23	4	52.88
Q4	17	26	22	12	1	64.74
Q5	15	40	11	12	0	68.59
Q6	22	26	15	14	1	67.31
Q7	18	27	21	11	1	66.03
Q8	14	21	15	24	4	55.45
Q9	13	18	11	27	9	49.68
Q10	18	20	21	17	2	61.22



*Fig.1. Self-assessments for the organizational maturity according to the indicator Technology by the students.*

The fulfilment degree of Question 1, regarding the improvements in technology indicates that students are not convinced if it is implemented on a regular basis. It is a question that belongs to the very first level of the maturity model of the organization which means that serious and immediate efforts should be made to improve its value. When there are gaps in the basic levels and high fulfilment degrees in the higher levels, this means that the maturity of the organization is not stable and the efforts should be directed to quickly upgrade the lower levels. Question 9 discusses the expectations and needs of the academic staff. It has the lowest fulfilment degree. It belongs, however, to the highest level of the organizational maturity as well as question 8. It discusses the expectations and needs of the students themselves. It is implied that students' expectations deserve a more prominent place when designing innovative learning environments. Their expectations can have positive or rather detrimental effects on learning in all stages of the educational process. When their expectations are not met, students can experience difficulties in adjusting to a new

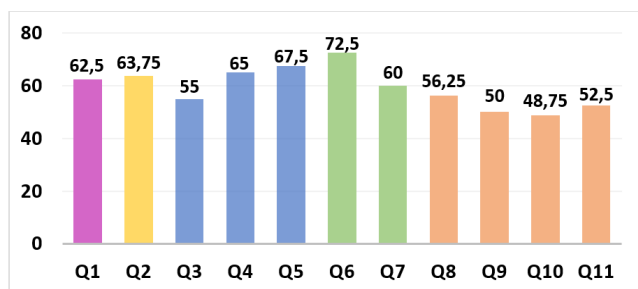
learning environment and have lower levels of satisfaction, engagement, and affective commitment that may lead to lack of motivation, for example.

Table 4 shows the precise results of the processed academic staff questionnaires as well as the fulfillment degree (Fig. 2) of the investigated issues in percentages.

**Table 4**

*The total scores and the fulfillment degrees (academic staff).*

	I strongly agree	I rather agree	I cannot judge	Rather disagree	Strongly disagree	Fulfillment degree, %
Q1	3	12	1	0	4	62.50
Q2	4	9	2	4	1	63.75
Q3	1	9	3	7	0	55.00
Q4	3	10	4	2	1	65.00
Q5	4	9	4	3	0	67.50
Q6	5	10	3	2	0	72.50
Q7	2	8	6	4	0	60.00
Q8	2	8	3	7	0	56.25
Q9	2	4	7	6	1	50.00
Q10	1	9	2	4	4	48.75
Q11	3	6	2	8	1	52.50

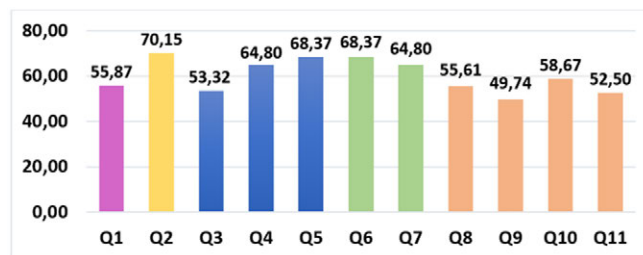


*Fig.2. Self-assessments for the organizational maturity according to the indicator Technology by the academic staff.*

The estimations of the academic staff are less positive. The question that has the highest fulfillment degree is Question 6 which discusses the organizational knowledge and resource available to adapt to innovations and/or technological changes or improvements. Obviously, the academic staff rate highly their competence and the available resources and knowledge. Unfortunately, the questions with the lowest estimation are Question 10 and Question 9. The latter concerns the needs and expectations of the academic staff regarding technological innovations. The role of teachers in the so-called "knowledge society" has changed. They are not only teachers and researchers but also administrators and facilitators. Probably, the workload is more, too. The demands are

various and they are increasing which in turn influences the work-life balance. Question 10 concerns the timely notification of the staff about the introduction and application of new technology.

Fig. 3. shows the cumulative assessment of the two groups. It is obvious that there is some imbalance. Question 1 which corresponds to the first level of the maturity level does not reach 60%. If its indication is improved quickly, then the organization will jump immediately to level 3 and 4 of the maturity model – the assessments there are higher and already attained to a higher degree. The improvement process is how you advance from a level one to a level three. How to do it exactly? The answer is – by having a maturity model and practices to follow. An Organizational Maturity Model is a collection of reliable, proven processes to follow, focused on a specific area. The five-step framework ranges from basic to sophisticated practices (Table 1).



*Fig.3. Self-assessments for the organizational maturity according to the indicator Technology by the two groups: students and academic staff.*

The Exploratory Factor Analysis (EFA) was subsequently applied to reduce and group the variables in the obtained database and to obtain the exact structural model of the performed survey.

The applied rotation method is the Oblimin with Kaiser Normalization. The presented loadings indicate the relative weight of each variable (item) in the factor.

**Table 5**

*The Structure matrix for Students.*

	Component	
	1	2
Q7	0.818	
Q10	0.790	
Q8	0.761	
Q4	0.735	
Q6	0.733	
Q9	0.731	
Q5	0.687	
Q2	0.640	
Q3	0.591	-0.502
Q1		0.882

The obtained inquiry structure model involves 2 factors, regarding the group of students (Table 5). The first includes questions - Q7, Q10, Q8, Q4, Q6, Q9, Q5, Q2, Q3 in descending order. Let's consider them in order of importance - a systematic approach in assessing the risk and opportunities of introducing new technologies, informing the academic staff about the technologies, a systematic approach to the needs and expectations of students, costs and benefits, organizational competence and resource for adaptation to innovation, a systematic approach to the needs and expectations of educators, competitiveness, benefits and risks of new technologies and tracking and implementation of new technologies. This factor clearly shows students' priorities. The second factor is determined by questions Q3 and Q1. It concerns the knowledge and application of new technologies regularly. Here, question Q3 has a negative value of -0.502, which means that since this question examines the extent to which technological innovations are introduced and applied, the higher the score, the more negative it is. Therefore, an increase in the value of the factor will mean a decrease in efficiency.

**Table 6**

*The Structure matrix for Academic staff.*

	Component		
	1	2	3
<b>Q4</b>	0.923		
<b>Q2</b>	0.830		
<b>Q5</b>	0.741		
<b>Q7</b>	0.689		0.495
<b>Q3</b>	0.550		0.538
<b>Q9</b>		-0.867	
<b>Q1</b>		0.840	
<b>Q10</b>		-0.836	
<b>Q11</b>	0.507	-0.779	
<b>Q8</b>	0.460	-0.562	0.491
<b>Q6</b>			0.939

The obtained inquiry structure model involves 3 factors.

The reliability statistics for each factor defined by Cronbach's Alpha (its value should be greater than 0.4) were estimated as follows:

Three components (factors) can be seen with the academic staff. The first includes questions Q4, Q2, Q5, Q7, Q3, Q11, Q8 in descending order, the second factor - Q9, Q1, Q10, Q11, Q8. The third factor - Q7, Q3, Q8, Q6. The first factor is determined by costs and benefits and risks and benefits of implementing new technologies. The pragmatism of the teaching staff stands out. Next comes competitiveness and a systematic approach to assessing risks and

opportunities. Knowledge and application of technology, regular monitoring and evaluation of the impact of new technologies and innovations in the teaching and learning process and a systematic approach to the needs and expectations of students. The second factor is composed of issues concerning academic staff and students, improvements in technological equipment and tracking the impact of new practices, their monitoring and evaluation. In other words, the interaction between teachers, students and technology. Almost all the questions making up the second factor have a high negative value. These are questions Q9 (-0.867), Q10 (-0.836), Q11 (-0.779) and Q8 (-0.562). They concern the familiarization of teachers and students with new technologies and their introduction into the learning process. The negative value indicates that the more the ratings on these factors increase, the more negative the assessment will be and the efficiency will decrease.

With the third factor, it is questioned whether there is a systematic approach to assessing the risk and opportunities when introducing new technologies, whether there are organizational resources and knowledge, and again whether the needs and expectations of students are known.

### Conclusion

The current research is directed toward the investigation and assessment of the level of maturity of the quality management system in education in higher education institutions by implementation of the self-assessment approach and tool provided by the ISO 9004:2018 standard "Quality management - Quality of an organization - Guidance to achieve sustained success". The defined indicators correspond to the clauses in ISO 9001 standard and their evaluation gives an overview of the level of integration of the quality system concerning different aspects of the activities of the organization. The results and the analysis of the performed survey among the academic staff and students (including PhD students) from the estimation of the quality indicator "Technology" in the Resources and Infrastructure Category in a state higher education university are presented in the current study.

Based on the factor analysis, the following conclusions can be drawn:

1. The teaching staff is more pragmatic, bringing to the fore costs and benefits and risks and benefits of implementing new technologies. The expectations and needs of students are also highlighted.

2. There is a concern about whether there is a systematic approach to assessing the risk and opportunities when introducing new technologies,

whether there are organizational resources and knowledge, and again whether the needs and expectations of students are known.

3. Students are concerned about whether new technologies are identified and implemented and whether there is regular updating.

4. Students clearly set their priorities. The systematic approach to assessing the risks and benefits of new technologies, the awareness of the teaching staff about them and knowledge of student needs and expectations stand out among the top positions.

Based on the results obtained from the questionnaire concerning the level of maturity of the university according to "Technology" criteria in the "Resources" category, the following can be highlighted:

1. The general assessment by students and teachers shows that if the indication at level one is improved quickly, then the organization will jump immediately to level 3 and 4 of the maturity model – the assessments there are higher and already attained to a higher degree. Implementing an Organizational Maturity Model sets the stage for greater organizational improvement.

2. An Organizational Maturity Model is a collection of reliable, proven processes focused on a specific area. The five-step framework ranges from basic to sophisticated practices.

3. The presented research is an element of a bigger self-assessment program, which is in the process of realization. Improving quality at any organization is a worthy goal.

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**Received on: 07.08.2023**