

PROSPECTS FOR THE DEVELOPMENT OF AN INTEGRATED SYSTEM OF INDICATORS IN INCREASING THE LEVEL OF COMPETITIVENESS IN THE FIELD OF HIGHER EDUCATION

Yuldashev Feruz Isroil ugli

PhD researcher of Bukhara State University

f.i.yuldashev@buxdu.uz

Abstract: The article forms a comprehensive framework for assessing the activities and competitiveness of higher education institutions. A holistic approach has been proposed according to a system of formulas integrated on the basis of several variables to assess educational effectiveness, research effectiveness, student performance and organizational effectiveness. The normalization techniques and complex mathematical operations used in their formulation provide high accuracy. Also, in addition, the Ishikawa diagram is used to visualize relationships between performance indicators, to help understand causal relationships.

Keywords: *higher education, integrated indicators, competitiveness, performance assessment, educational effectiveness, research productivity, student performance, organizational efficiency, normalization techniques, mathematical operations, logarithms, ratios, Ishikawa diagram, strategic insights, innovation, policy-making, comprehensive development, and institutional performance.*

OLIY TA'LIM SOHASIDA RAQOBATBARDOSHLIK DARAJASINI OSHIRISHDA INTEGRALLASHGAN INDIKATORLAR YAXLIT TIZIMINI RIVOJLANTIRISHNING ISTIQBOLLARI

Yuldashev Feruz Isroil o'g'li

Buxoro Davlat Universiteti tayanch doktoranti

f.i.yuldashev@buxdu.uz

Annotatsiya: Maqolada oliy ta'lim muassasalarining faoliyati va raqobatbardoshligini baholash uchun kompleks asos shakllantirilgan. Ta'lim samaradorligini, tadqiqot samaradorligini, talabalar faoliyatini va tashkiliy samaradorlikni baholash uchun bir nechta o'zgaruvchilar asosida integrallashtirilgan formulalar tizimiga ko'ra yaxlit yondashuv taklif qilingan. Ularni shakllantirishda ishlatilgan normallashtirish texnikasi va murakkab matematik operatsiyalar yuqori aniqlikni ta'minlaydi. Shuningdek, qo'shimcha ravishda Ishikava diagrammasi ishlash

ko'rsatkichlari o'rtasidagi munosabatlarni tasavvur qilish, sabab-oqibat aloqalarni tushunishga yordam berish uchun ishlatiladi.

Kalit so'zlar: oliy ta'lim, integratsiyalashgan ko'rsatkichlar, raqobatbardoshlik, samaradorlikni baholash, ta'lim samaradorligi, tadqiqot samaradorligi, talabalar faoliyati, tashkiliy samaradorlik, normallashtirish texnikasi, matematik operatsiyalar, logarifmlar, nisbatlar, Ishikava diagrammasi, strategik tushunchalar, innovatsiyalar, siyosat ishlab chiqish, kompleks rivojlanish va institutsional ko'rsatkichlar.

ПЕРСПЕКТИВЫ РАЗВИТИЯ ИНТЕГРИРОВАННОЙ СИСТЕМЫ ПОКАЗАТЕЛЕЙ В ПОВЫШЕНИИ УРОВНЯ КОНКУРЕНТОСПОСОБНОСТИ В СФЕРЕ ВЫСШЕГО ОБРАЗОВАНИЯ

Юлдашев Феруз Исроилович

докторант Бухарского государственного университета

f.i.yuldashev@buxdu.uz

Аннотация: В статье сформулирована комплексная основа оценки деятельности и конкурентоспособности высших учебных заведений. Для оценки эффективности обучения, результативности исследований, успеваемости учащихся и организационной эффективности был предложен целостный подход по системе интегрированных формул на основе нескольких переменных. Применяемые при их формировании методы нормализации и сложные математические операции обеспечивают высокую точность. Кроме того, диаграмма Исикавы используется для визуализации взаимосвязей между показателями эффективности, чтобы помочь понять причинно-следственные связи.

Ключевые слова: высшее образование, интегрированные показатели, конкурентоспособность, оценка эффективности, эффективность обучения, эффективность исследований, успеваемость студентов, организационная эффективность, методы нормализации, математические операции, логарифмы, соотношения, диаграмма Исикавы, стратегические концепции, инновации, разработка политики, комплексное развитие и институциональные показатели.

INTRODUCTION

Today, the issue of ensuring the competitiveness of higher education institutions in the rapidly developing field of education and the practice of determining this on the basis of certain criteria are becoming a decisive factor in determining their success and

stability. It is assumed that educational institutions will adopt strict standardization in order to occupy a stable and stable position in the services market, to bring promising personnel to the labor market [3]. This includes the development of a system of ratings that accurately assess the activities of students and teachers and the introduction of solid methods of their assessment.

It is quite natural that in the conditions of a higher education system based on the principles of complex competition, participants of the higher education system aim to get a market share worthy of their potential, taking into account their capabilities, strong aspects [3,6]. In the competitive struggle, their shortcomings, which cause a decrease in the effectiveness of activities and lead to the gradual loss of its place in the market in the future, should also be accurately assessed in the process of scientific analysis of the situation. To what extent HEIs can contribute to the well-being of society when the final results are summed up can be shown in scientifically based accounts. The processes and results that take place in the higher education system show their level of importance with their repeated character in terms of the point of their direct impact on the life of society [8]. It has been proven several times in the experiment that even small results that can be achieved through this in the field of education can cause unprecedented advances in the functioning of an existing complex mechanism [10,11].

LITERATURE REVIEW

To explore the key concepts and recent developments relevant to enhancing the competitiveness of higher education institutions through the development of integrated indicator systems there were necessity to synthesize insights from global trends, the application of social software, the impact of academic autonomy, and the use of innovative mechanisms, drawing on both international perspectives and specific research within Uzbekistan.

Altbach, Reisberg, and Rumbley (2009) provide a comprehensive overview of global higher education trends, highlighting the academic revolution that has transformed universities worldwide. They emphasize the importance of tracking these trends to understand the evolving landscape of higher education and the need for institutions to adapt to maintain competitiveness.

Anderson (2007) discusses the use of social software to reduce the loneliness of distance learners, an important consideration for institutions aiming to enhance student engagement and retention. By integrating social software into their systems, universities can create more interactive and supportive learning environments, thereby improving overall educational quality.

In our previous researches the prospects of using foreign experience to implement innovative mechanisms for improving education quality in universities

were analysed(Yuldashev (2024)). Our findings suggest that adopting best practices from international institutions can significantly enhance the quality and competitiveness of higher education in Uzbekistan. Furthermore, Yuldashev Feruz's work (2024a, 2024b) on academic autonomy highlights its critical role in fostering a democratic academic environment and ensuring high-quality education. We argue that achieving academic independence is essential for enhancing competitiveness, as it allows institutions to tailor their programs and policies to better meet the needs of students and society. Next, in a related study, Yuldashev (2023) analyzes the support for academic autonomy in Uzbekistan, drawing insights from the 2022 AFI study. This research underscores the importance of autonomy in driving innovation and improving educational outcomes.

Ennew and Greenaway (2012) explore the globalization of higher education, providing insights into how institutions can navigate and leverage global trends to enhance their competitiveness. Their edited volume discusses various strategies that universities can adopt to remain relevant and competitive on the global stage. Astin and Antonio (2012) delve into the philosophy and practice of assessment and evaluation in higher education. Their work offers a detailed framework for developing integrated indicators that can help institutions measure and improve their performance systematically.

Rosa and Amaral (2014) present contemporary debates in quality assurance, highlighting the challenges and opportunities faced by higher education institutions in maintaining high standards. Their edited volume is crucial for understanding the dynamic nature of quality assurance and its impact on institutional competitiveness.

Wang (2016) provides a comprehensive handbook on quality assurance and value management in higher education. This resource is invaluable for institutions looking to develop robust quality assurance mechanisms that align with their strategic goals.

Finally, Sarrico, Teixeira, and Rosa (2016) discuss strategic management and institutional practice, focusing on how higher education institutions can improve their performance. Their work emphasizes the importance of strategic planning and the use of integrated indicators to drive continuous improvement and maintain competitiveness.

The literature reviewed highlights the multifaceted nature of enhancing competitiveness in higher education. By integrating insights from global trends, innovative practices, academic autonomy, and robust quality assurance mechanisms, institutions can develop a comprehensive system of indicators that not only measures but also drives their competitiveness and overall educational quality.

METHODOLOGY

In the article various methods have been used such as: Hierarchical Visualization (Ishikawa Diagram), Normalization and Complex Mathematical Operations, Integral Indicator Formulas, Interdisciplinary and Comprehensive Approach. The primary method employed in the article is the development of integrated indicator formulas that combine multiple variables to measure key performance indicators in higher education. This method is supplemented by normalization techniques, complex mathematical operations, and hierarchical visualization to ensure a comprehensive and accurate assessment of institutional performance [9]. The use of these methods allows for a detailed and holistic analysis of the competitiveness of higher education institutions.

DISCUSSION AND RESULTS

One of the effective approaches to measuring institutional performance is the use of integral indicator formulas. Such types of formulations are developed based on comprehensive scales to assess key indicators such as student educational outcomes.

Many deviations can be eliminated by normalizing the factors that affect the competitiveness of HEIs when analyzed [7]. When determining them, formulas of integrated indicators can be used, which are considered one of the methods of rating assessment (Table 1).

Table 1

Primary calculation method of the integrated indicator of the management of the competitiveness of higher education institutions¹¹

Nomi	Formulasi	Mazmuni
Educational effectiveness	$TS = \sqrt[4]{TN * TQ * IS * TO'}$	TN-student learning outcomes TQ-student satisfaction level IS-scientific potential TO'-student-teacher ratio
Research Effectiveness	$RS = \sqrt[4]{ND * IQ * TB * TM}$	ND-number of publications Number of quotes TB-research budget TM-Availability of research centers
Effectiveness of student activities	$TFS = \sqrt[3]{TD * ID * DT}$	TD-The degree of successful completion of training programs ID-employment rate by industry DT - the index of admission to continuing (further) education programs
Effectiveness of	$TI = \sqrt[4]{XF * IF * IB * TR *}$	XF-number of international students IF-level of social activism(outreach

¹¹ Designed by the Author

organizational work		programs, service initiatives, or public lectures IB-availability of startups, technology transfer or business incubator support programs for students TR-availability of modern libraries, technological equipment and well-equipped laboratories
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This primary formula is made up of evaluation processes taking into account the main ones of the parameters of the HEIs, limiting the possibility of ensuring high accuracy of the full characteristics of the existing variables. To carry out a detailed analysis, it is advisable to increase the number of variables. It also uses more complex mathematical operations such as logarithms and ratio (fraction) to better reflect the subtle relationships between extended variables. Below is proposed a system of complex characteristic integralized formulas developed based on the primary formulas (the formula gives an additional explanation to elements that were not previously commented on:

1. Educational effectiveness (TS)

$$TS = \sqrt[4]{(TN * TQ)^{0.5} * (IS * TO')^{0.5} * \left(\frac{PS}{1+TX}\right)}$$

- **PS (pedagogical potential, usually max. 100 points):** this means the scientific degrees, special training, professional qualifications and the overall harmonized efficiency of industrial experience of professors and teachers in an educational institution.

- **TX (education costs, usually in som):** This element, named under the sign of educational expenses, includes a structure of general funds directed by students, parents and institutions in order to organize educational services. For the purpose of normalizing (stabilizing) the denominator and keeping the denominator of the expression from remaining equal to zero, the number 1 is added to the cost of education part.

2. Research efficiency (RS)

$$RS = \sqrt[4]{\left(ND * \frac{IQ}{1+\lg(1+MQ)}\right) * \left(\frac{TB}{1+BT} * TM\right)}$$

- **MQ (average number of articles, PCs):** a conditional indicator set to assess the impact of research publications. The average value of this indicator is determined by the ratio of the number of total quotes to the number of articles published. Through logarithms, data can be normalized in an optimal way, especially when working with

variables with wide values in such a private case, where the number of quotes can vary significantly between publications, using the logarithmic scale and helping to reduce the dispersion of variables arising from extreme values.

- **BT (budget deficit, usually in som):** budget deficit can hinder the distribution, planning and implementation of various functions (operational activities such as research, training, infrastructure development) of HEIs.

3. Student performance efficiency (TFS)

$$TFS = \sqrt[3]{\left(TD * \left(1 + \frac{ID}{1+IJB}\right) * \frac{DT}{1+NDM}\right) * \left(\frac{TT}{1+RM}\right)}$$

- **IJB (unoccupied graduates, in percentage):** The ratio of unoccupied graduates to the total number of graduates (in percentages). The IJB indicator introduced here as an additional element also fulfills the function of the HEIs to evaluate programs for training students for labor market requirements.

- **NDM (availability of non-standard applications, PCs):** The presence of curricula, which is much more complex than the standard requirements of education, is implied. Such programs often include involvement in research and innovation processes, participation in various grant projects, and active job activities in advanced pre-professional activities. Such programs provide the opportunity for faculties to identify talented students in favor and provide a worthy incentive.

- **TT (student researches, PCs):** The presence of innovation projects and research work carried out by students.

- **RM (availability of resources, usually in som):** While it serves to support education, training and research at the HEI, financial and material form resources are used as an important factor to assess the performance of the HEI staff and students.

4. Effectiveness of organizational work (TI)

$$TI = \sqrt[4]{\left(XF * \frac{IF}{1+RCH} * IB * TR\right) * \left(\frac{SM}{1+IC} * \frac{AS}{1+SM}\right)}$$

- **RCH (resource limitation):** Resource constraints have an important influence in determining the effectiveness of organizational work. Inadequately approved budget plans for organizational activities, a shortage of qualified employees, a lack of demand for the state of infrastructure and the lack of support for the integration of modern technologies and IT processes are clear signs of resource limitation.

- **SM (compatibility of strategies):** The merit between the strategic plans and actions of the OSCE is instrumental in the correct assessment of the capabilities of the

OSCE in achieving the higher goals of the organization, including the effective management of the distribution of resources, the implementation of actions in accordance with market requirements and the timely implementation of long-term plans.

- **IC (innovation opportunities):** provides for the capabilities of the OSCE in the implementation of science-based innovations, new goods and services, technologies.

- **AS (practice efficiency):** It is used to analyze the practical dependence of research and assess the effectiveness of the development of mechanisms for parallel development and education of theoretical and Applied Sciences with various industrial and production partners.

- **SM (industrial problems):** through this indicator, difficulties and restrictions are expressed, which can be noted by HEIs and partner industrial enterprises. The various problems associated with the financial, management, technological and supply chain are a component of this indicator.

The proposed integrated indicator method for managing the competitiveness of higher education institutions involves a delicate and complex approach to the assessment, implementation of institutional indicators. Several criteria have been used when using this method, which can be combined into formulas that provide detailed information about educational effectiveness, research effectiveness, student activities, and organizational effectiveness. With a focus on these core areas, HEIs can effectively manage complex character aspects of modern education and maintain competitiveness in a fast-growing trend [1].

Achieving educational effectiveness is considered the basis of the entire HEI mission, and successes in this area are regularly encouraged by the government [2,4]. The integrated formula (TS) developed to explain educational effectiveness covers important aspects such as student educational outcomes (TN), student satisfaction (TQ), scientific capacity (IS) and student-teacher ratio (TO'). Through this holistic approach, it is possible to ensure the participation of students in an educational environment in a satisfied and ambitious mood, not limited to the responsibility of providing high-quality education. By focusing on these metrics, institutions can identify prospective directions for improvement and implement strategies that increase their educational experience. This, in turn, contributes to the overall competitiveness of the HEI, attracting a large number of students and professors who are supportive and looking for a dynamic and modern educational environment.

Research effectiveness is the next important factor in the competitiveness of higher education institutions. The research effectiveness (RS) formula includes the number of publications (ND), the number of citations (IQ), the research budget (TB), and the availability of research centers (TM). This comprehensive approach

emphasizes the importance of research results and implications. By ensuring that institutions have the necessary funds and infrastructure to support modern research, this formula helps institutions measure research opportunities and identify areas of strategic investment. The high productivity of research not only increases the reputation of the OSCE, but also contributes to the development of knowledge and innovation necessary for social progress.

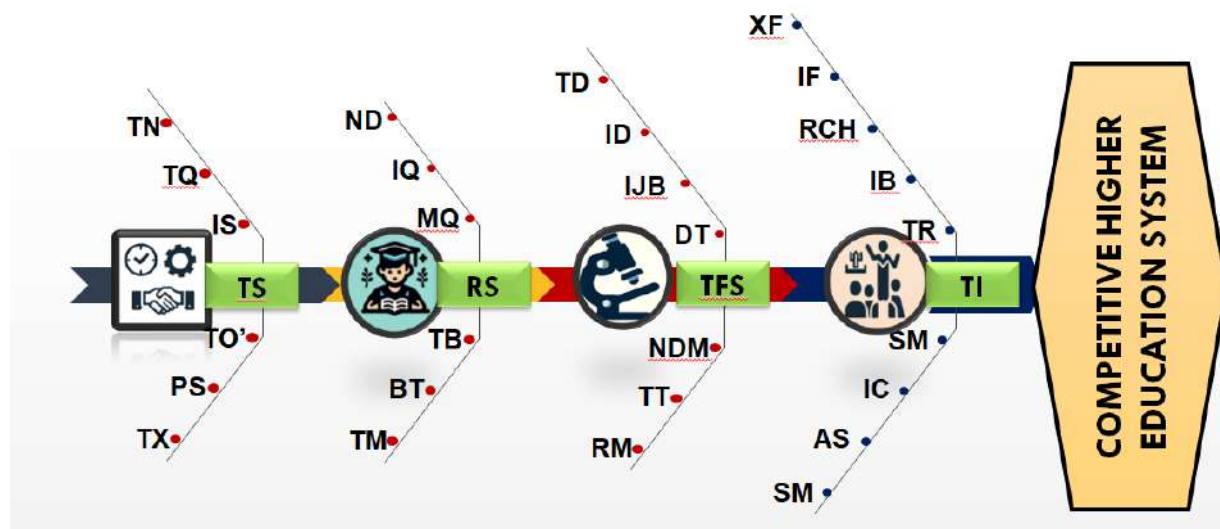
Student activities are a climactic aspect of institutional life, reflecting the activity and success of students beyond audience training [1,5,7]. The student performance effectiveness formula (TFS) includes successful curriculum completion rates (TDs), employment rates (ID) in related fields, and enrollment rates in continuing education programs (DTS). This integration emphasizes the importance of supporting students throughout educational processes and in their upcoming professional activities. By focusing on these indicators, the management of HEIs can ensure that their programs meet the needs of the industry and that graduates are adequately prepared for the demands of the labor market. This, in turn, increases the institution's reputation and appeal to potential students.

The indicator of organizational efficiency is a very important factor for the continuous operation and long-term sustainable development of higher education institutions. The organizational efficiency (TI) formula includes international student quantity (XF), social activity levels (IF), support of student startups and technology transfer programs (IB), and availability of modern libraries and laboratories (TR). This comprehensive approach ensures that HEIs are sufficiently equipped to support their students and faculty, encouraging an environment of innovation and engagement. Relying on strong organizational structures and resources, HEIs can effectively manage their activities, attract international talent, and contribute to the development of the general public.

By implementing the integrated indicator method, it is possible to note the interconnection of various aspects of institutional performance. While educational effectiveness is explained by students' high-quality education and satisfaction with learning processes, research efficiency encourages innovation and contributes to the scientific potential of the institution. The effectiveness of student activities reflects the ability of the HEI to prepare students for a successful career. Through organizational efficiency, the HEI assumes that it has the necessary resources and structures to support its mission.

The integrated indicator method provides an important and valuable guide to managing the competitiveness of HEIs. Focusing on key indicators in education, research, student activities, and organizational effectiveness, HEIs can make decisive decisions that increase their performance and impact. This comprehensive approach

ensures that HEIs are competitive in rapidly changing education market conditions, resulting in benefits for students, faculty, and society in general.



Picture 1. Integrated Formula system¹²

Picture 1 describes an integrated Formula system through the Ishikawa diagram (fish skeleton method), with structural elements of the formulas that annotate the main 4 indicators listed as the basis of the skeleton. When analyzed in terms of the principle of causality, the effectiveness of organizational work (TI), the effectiveness of student activities (TFS), the effectiveness of research (RS) and the effectiveness of Education (TS) serve as necessary components for the organization of a competitive educational system. This hierarchical image, expressed through the Ishikawa diagram, shows the relationship between the factors that contribute to the competitiveness of HEIs, as well as the visual manifestation of them.

The method of calculating integrated indicators emphasizes cohesion and cooperation within the framework of HEIs. Through the use of such techniques, institutions can make extensive use of interdisciplinary research, develop academic programs tailored to industrial needs, and optimize organizational processes for efficiency. This approach is especially relevant when solving complex social problems and taking advantage of emerging opportunities such as the integration of digital technologies into education and research.

In keeping with the fierce dynamics of globalization, the implementation of integrated indicators of higher education institutions into practice has a certain importance for managing the complexities of the modern educational environment[5]. In the context of the disposal of complex processes, the mobilization of limited resources for the implementation of strategic goals and to increase the potential of competitiveness can in turn lead to the foundation of an effective management system.

¹² Designed by the Author

CONCLUSION

In the article we tried to present a sophisticated and comprehensive approach to evaluating the performance and competitiveness of higher education institutions (HEIs). By integrating multiple variables into a cohesive set of formulas, the article provides a robust framework for assessing educational effectiveness, research productivity, student performance, and organizational efficiency.

The development of integral indicator formulas offers a multifaceted evaluation framework that covers essential aspects of HEI performance. This approach ensures that all critical areas, including educational outcomes, research capabilities, student success, and organizational strength, are measured comprehensively.

The use of normalization techniques and complex mathematical operations, such as logarithms and ratios, enhances the precision of the assessment. These methods help manage data variability and ensure that the evaluations are accurate and reflective of true performance.

The article provides a well-structured and methodically sound approach to evaluating and enhancing the performance of higher education institutions. The integrated indicator system, with its emphasis on comprehensive assessment, precision, and strategic insight, serves as a powerful tool for fostering competitiveness and excellence in the field of higher education. By adopting this framework, HEIs can better navigate the complexities of the modern educational environment, ultimately contributing to their long-term success and stability.

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