

Information and Analytical System of Control, Planning, and Management of the Educational Process in Educational Institutions

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Abstract

In the context of the rapid informatization of the economy, the issues of effective information support for the management of higher education institutions (hereinafter HEIs) are of paramount importance. Their complexity and relevance are determined by the intensive development of the multi-vector nature of HEIs' activities, the variety of funding sources, and a large number of types and forms of educational, research, production, and economic activities. This indicates the need to manage higher education institutions at a qualitatively new level, to create appropriate functional and organizational models. These models should envisage a combination of regional and national educational management systems, and the development of a modern concept of information support based on networked computer technologies and modern software tools.

The article aims to define the basic principles and main trends of research in the scientific literature on issues related to the implementation of control, planning, and management systems for the educational process of HEIs in terms of their information and analytical support, and to clarify certain practical aspects of HEIs management.

Methodology. In the course of the study, the analytical and bibliographic method was used to study the scientific literature on information and analytical support for the management of the educational process of HEIs. Induction, deduction, analysis, synthesis of information, system-structural, comparative, logical, and linguistic methods, abstraction, and idealization were used to study and process data. Moreover, the authors of the study conducted an online questionnaire survey to practically clarify the most important issues related to the research topic.

Results. According to the results of the study, the main most important theoretical components of the information and analytical system for managing the educational process in higher education are identified. The perspective of scientists and managers of HEIs on the key aspects of this issue is also studied.

Keywords: management of HEIs, informatization of management in higher education, information space, innovative approaches to management and control, the latest information technologies in education

1. Introduction

Currently, higher education is facing fundamentally new challenges due to the peculiarities of the development of the information society. Their realization is possible only on the condition of rational use of technical achievements, and the creation of conditions for free access of all subjects of the educational process to information resources. In this case, the intensity of socio-economic processes in general increases, and the role and importance of information technology grows. Moreover, there is a constant development of information and communication systems, technologies, and services, the formation of the national scientific and educational information environment, and, accordingly, its integration into the global information space.

The theoretical part of this study substantiates the relevance and analyzes the problems of management of higher education institutions in terms of information and analytical support of this process. It also provides an overview of the structure of management activities in terms of the necessary steps to informatize the management, planning, and control of the work of HEIs.

The practical part of the study includes an assessment of the importance of the factors that are prerequisites for the relevance of high-quality information and analytical support for the management process of HEIs. It includes an assessment of the levels of information support of HEIs that are most in need of optimization of control, planning, and management of the educational process. Moreover, this part considers the main problems of information and analytical support of higher education that need to be addressed to optimize control, planning, and management systems. It also contains an assessment of the importance of unresolved topical information and analytical tasks of restructuring the management processes of higher education in modern conditions.

Based on the results of the study, conclusions have been drawn regarding the issues raised. In particular, the main factors determining the relevance of the issue of high-quality information and analytical support for the management of the HEIs processes have been found. These are the need to adapt HEIs to the changing infrastructure of the world economy and the need to analyze and consider the needs of the educational services market and the labor market (including graduate employment). Moreover, the respondents identified the formation and visualization of consolidated analytics by faculties and analytics by individual teachers as the most important levels of information support for HEIs that require optimization of control, planning, and management of the educational process. The survey has identified the main problems of information and analytical support of higher education that require urgent attention to optimizing the control, planning, and management systems of HEIs. The first of these is the contradiction between the objective need of society to update the educational process management system to improve the quality of training of future specialists with higher education and the insufficient development of its conceptual, scientific, and applied provisions. It is worth noting that there is a mismatch between the high technological capabilities of modern ICTs to support the educational sector, in particular web-based and cloud-based technologies, and the insufficient readiness of participants in the educational process of HEIs to use them in a scientifically sound, pedagogically balanced and effective manner. As it was found out because of the survey, among the unresolved urgent tasks of restructuring the processes of higher education management in modern conditions, one can distinguish the construction of a model of the university educational process management system in the context of informatization and intellectualization of society. It is possible to create on its basis information management systems of higher education institutions using web-oriented and cloud-oriented information and communication technologies, as well as to develop a methodological system for designing and implementing a web-oriented information and analytical management system (IAMS) of HEIs.

2. Literature Review

As a rule, in the process of organizing the current activities of an educational institution, there are a large number of sources and directions of information (Holovaty, 2014). This complicates the process of obtaining answers to key questions about the work of the educational institution, and without a proper system for processing such information; it does not allow the leaders of the HEI to see the overall picture of its development. In this context, there is a need to create a high-quality information space in HEIs. It should fully meet the information needs of students, teachers, and staff and have flexible mechanisms for introducing new technologies into the education process, and meet modern principles of democracy, efficiency, and reliability (Mourato & Patrício, 2019).

To respond promptly to the needs of the labor market and the market conditions in the field of educational services, it is necessary to constantly restructure the internal economy of HEIs, optimize management accounting, and rationalize management processes (Gasevic, Tsai, & Drachsler, 2021).

The practice of other industries, the positive experience of informatization of certain subsystems accumulated in the education system, as well as the potential opportunities inherent in new information technologies show that the latter can be successfully used to improve the efficiency of HEI management (Kleimola & Leppisaari, 2022).

In a market economy, the problems of managing HEIs are of paramount importance (Coman et al., 2020).

We live in a time of global informatization of society and rapid changes (Iatsyshyn et. al., 2020). Thus, the issue of finding optimal ways and innovative approaches that will contribute to the quality training of future qualified specialists is becoming more relevant. One of the ways to solve this issue is to digitalize the educational process and use information technology (Babu & Sridevi, 2018).

Modern information technology in education is a complex of educational and teaching materials, technical and instrumental means for educational purposes, as well as a system of scientific knowledge about the role and place of technological means in the educational process, about the forms and methods of their use to improve the work of educators and students (Sadeghi, 2019).

The analysis of management activities and scientific literature on the informatization of management of educational process planning in an HEI allowed us to identify the main management functions and types of management activities, the functioning of which depends on the use of software and information management technologies. Thus, the following management types and functions should be distinguished - management, analysis, accounting, planning, forecasting, and continuous monitoring (Cacheiro-Gonzalez et al., 2019; Suresh, Priya & Gayathri, 2018).

A positive contribution to the process of informatization of management of planning the educational process in an HEI is that management activities are filled with fundamentally new content (Zinoviev et. al., 2021). Numerous routine operations that are present in management activities rely on computer technology, which saves time for creative activity, and individual work, and contributes to the improvement of professional qualifications. This result justifies even significant material and other costs. However, positive results of informatization of management of planning the educational process in an HEI can be obtained by combining the efforts of the manager as a generator of management decisions, teaching staff and university staff. The staff acts as an organizer of the educational process, teaching and methodological support, regulatory documentation as a source of information and computer tools and technologies as tools for working with information (Odit-Dookhan, 2018; Burac et al., 2019).

3. Aims

The research aims to determine the position of scientists who study the issues of higher education informatization in their works. Moreover, it is equally important to study the opinions of the heads of departments and heads of HEIs on the peculiarities of information and analytical support for control, planning, and management systems in higher education.

4. Materials and Methods

A practical study of the peculiarities of information support of management systems of HEIs was conducted by interviewing 208 scientists and 224 heads of HEIs and departments in 23 educational institutions of Khmelnytsky, Chernivtsi, Ivano-Frankivsk, Lviv, and Kyiv oblasts of Ukraine. The study was held through the Typeform service. Typeform is a popular online survey and form building tool that allows users to create engaging and interactive surveys, quizzes, feedback forms, and other types of online forms. Typeform is a versatile and user-friendly tool that is ideal for creating engaging and interactive surveys and forms that can help businesses, organizations, and individuals collect and analyze data more effectively.

The study used a survey approach, where participants were asked a series of questions related to information support of management systems in their universities. This have included questions about the availability and use of information technology, data management and analysis, communication and collaboration tools, and other relevant topics. By conducting this study, researchers aimed to gain insights into the current state of information support in HEIs, identify potential challenges and opportunities, and develop recommendations for improving information support in management systems. The findings of this study can inform policy and decision-making in higher education institutions and contribute to the overall improvement of the quality of education in Ukraine.

5. Results

In today's highly informatized economy, the problems of resource provision for the management of higher education institutions (HEIs) are of paramount importance. According to the survey participants, their complexity and relevance are determined by several factors: the need to analyze and consider the needs for the educational and labor markets, the need to adapt HEIs to the changing infrastructure of the global economy; many types and forms of educational, research, production and economic activities in higher education diversity of sources of funding for higher education; intensive development of the multidimensional nature of HEI activities (Figure 1).

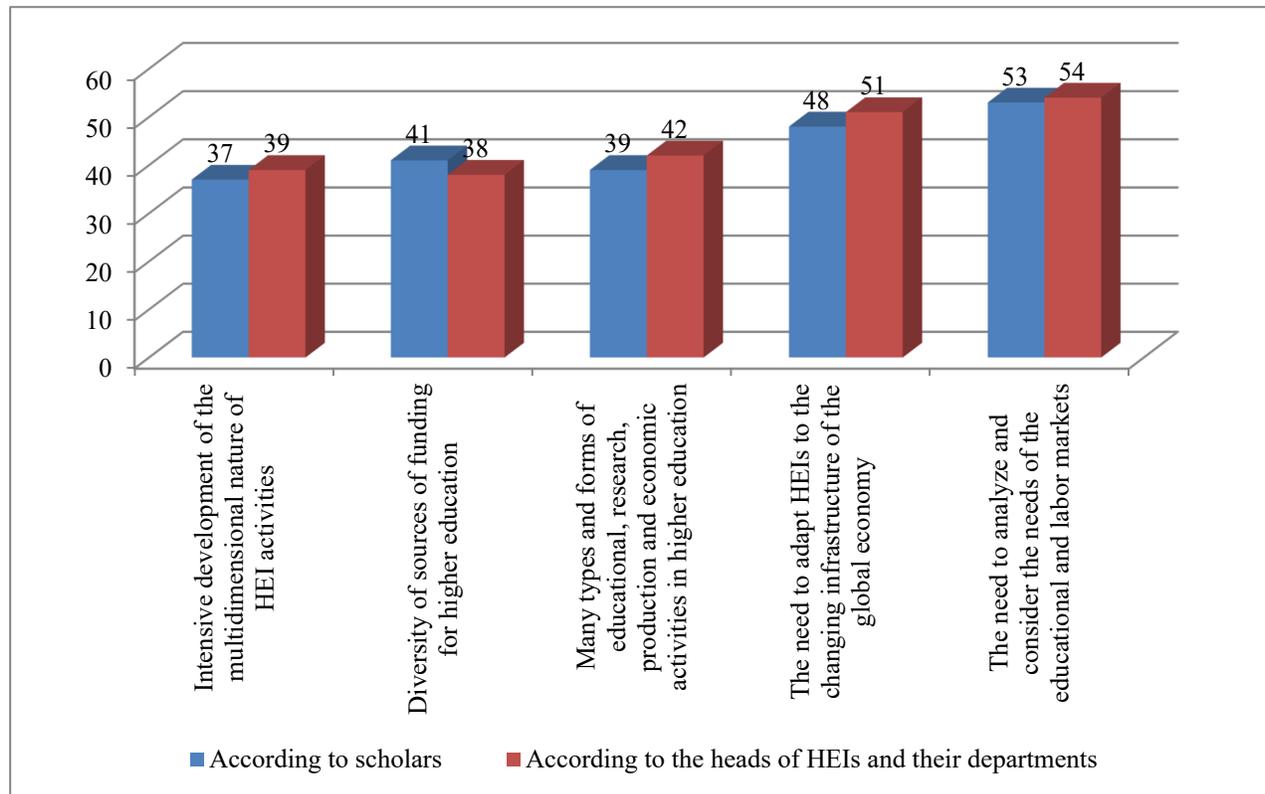


Figure 1. Factors That Are Prerequisites for the Relevance of High-Quality Information and Analytical Support of the HEI Management Process, %

Source: built by the authors.

According to the respondents, the importance of information and analytical development of the HEI management process is primarily driven by the need to adapt HEIs to the changing infrastructure of the global economy and the need to analyze and consider the needs of the education market and the labor market (including graduate employment).

In the course of the survey, respondents identified the following most important levels of information support for higher education institutions that require optimization of control, planning, and management of the educational process (Figure 2):

- analytics in the context of an individual educator;
- formation and visualization of consolidated analytics for the department;
- formation and visualization of consolidated analytics by faculty;
- formation and visualization of consolidated analytics for the university;
- analytics the context of an individual student.

As you can see from Figure 2, the processes that require the most information and analytical optimization today are those related to the formation and visualization of aggregate analytics by faculty and analytics by each pedagogue.

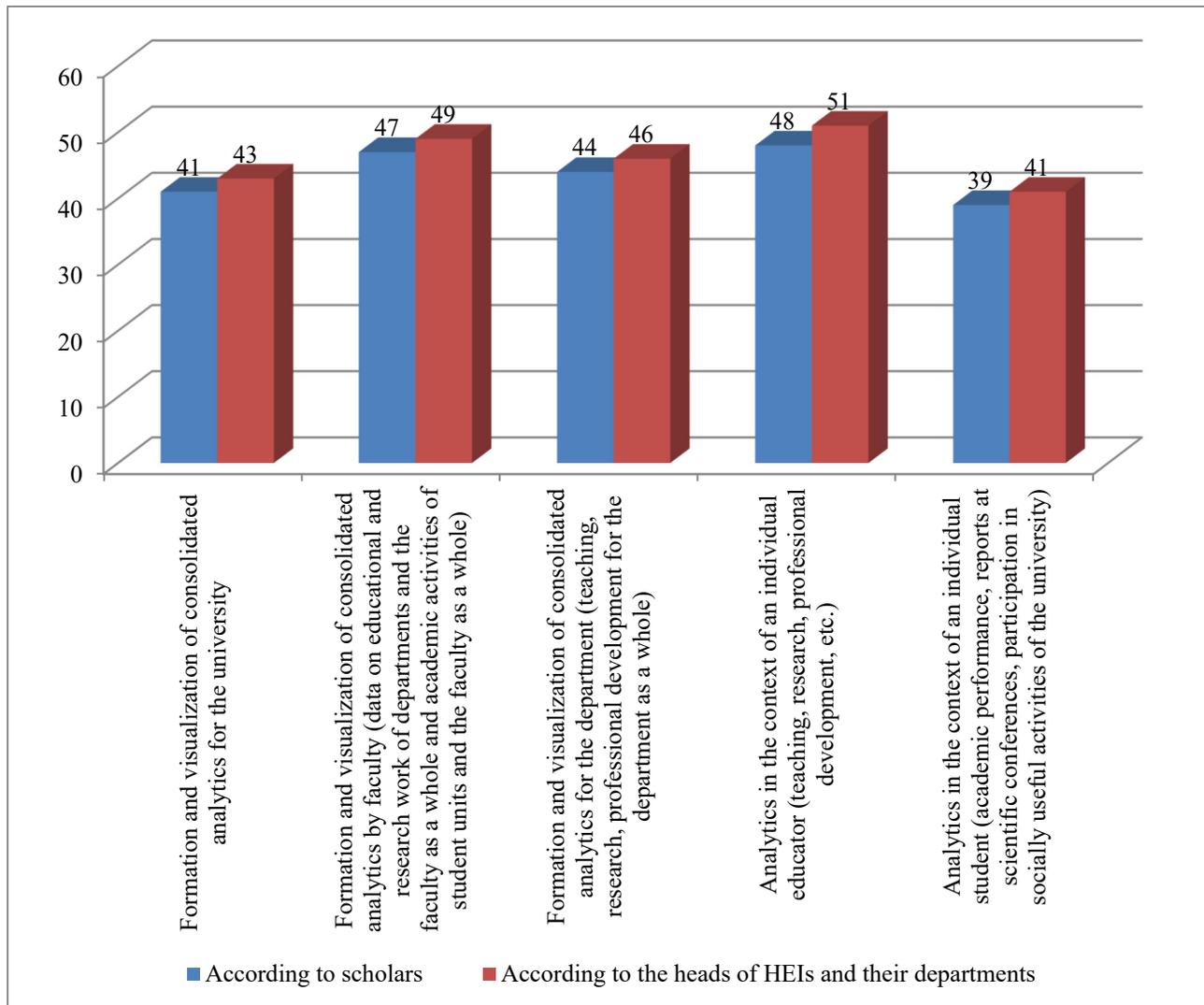


Figure 2. Levels of Information Support of HEIs That Most Need to Optimize Control, Planning, and Management of the Educational Process, %

Source: built by the authors.

The survey has identified the main problems of information and analytical support of higher education that require urgent attention to optimizing the control, planning, and management systems of HEIs (Figure 3):

- the contradiction between the need of society to update the management of the educational process and the lack of development of provisions for such an update;
- high technological capabilities of using modern ICTs to support education;
- the contradiction between the significant didactic potential of using information system in the management of the educational process of higher education institution;
- significant need to overcome fragmentation in the use of ICT tools in the management of the education process;
- mismatches between the growth rate of the impact of information technology and the lagging behind of theoretical and methodological research on the systemic use of UCT tools

As can be seen from Figure 3, the survey of respondents on the current state of research and practical aspects of ICT application for the organization and management of the educational process of HEIs shows the following. First, there are contradictions between the objective need of society to update the educational process management system to

improve the quality of training of future specialists with higher education and insufficiently developed conceptual, scientific, and applied provisions. It can also be seen that there is a mismatch between the high technological capabilities of modern information and communication technologies to support the educational sector, in particular web-based and cloud-based technologies, and the lack of readiness of participants in the educational process of HEIs to use them in a scientifically sound, pedagogically balanced and effective manner.

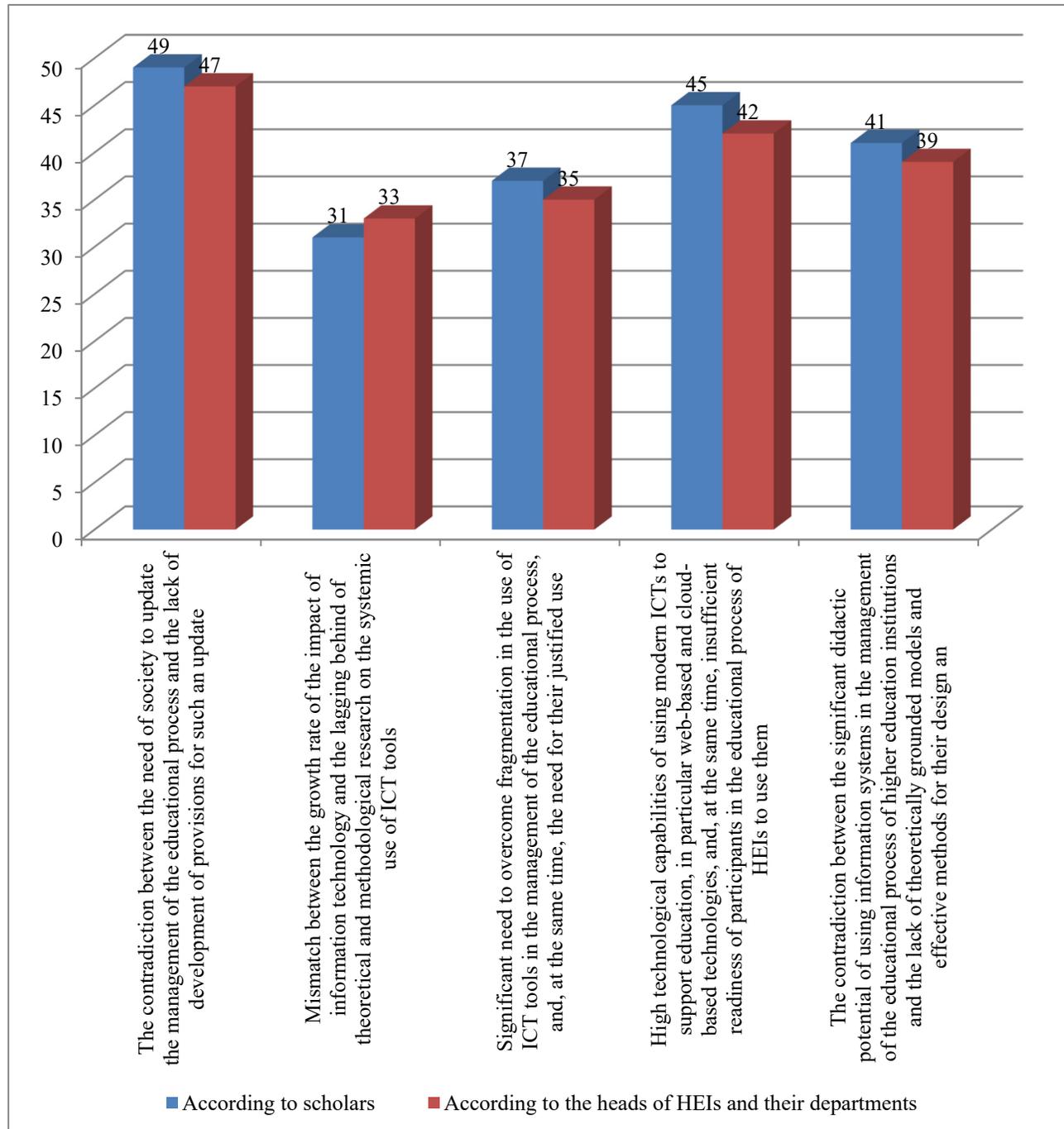


Figure 3. The Main Problems of Information and Analytical Support of Higher Education That Need to Be Solved to Optimize Control, Planning, and Management Systems, %

Source: built by the authors.

Among the unresolved urgent tasks of restructuring the processes of higher education management in modern conditions are the following (Figure 4):

- building a model of the university educational process management system in the context of informatization and intellectualization of society, and creating on its basis information management systems of HEIs using web-based and cloud-based information and communication technologies;
- development of a methodological system for designing and implementing a web-based information and analytical management system (IAMS) of HEIs.

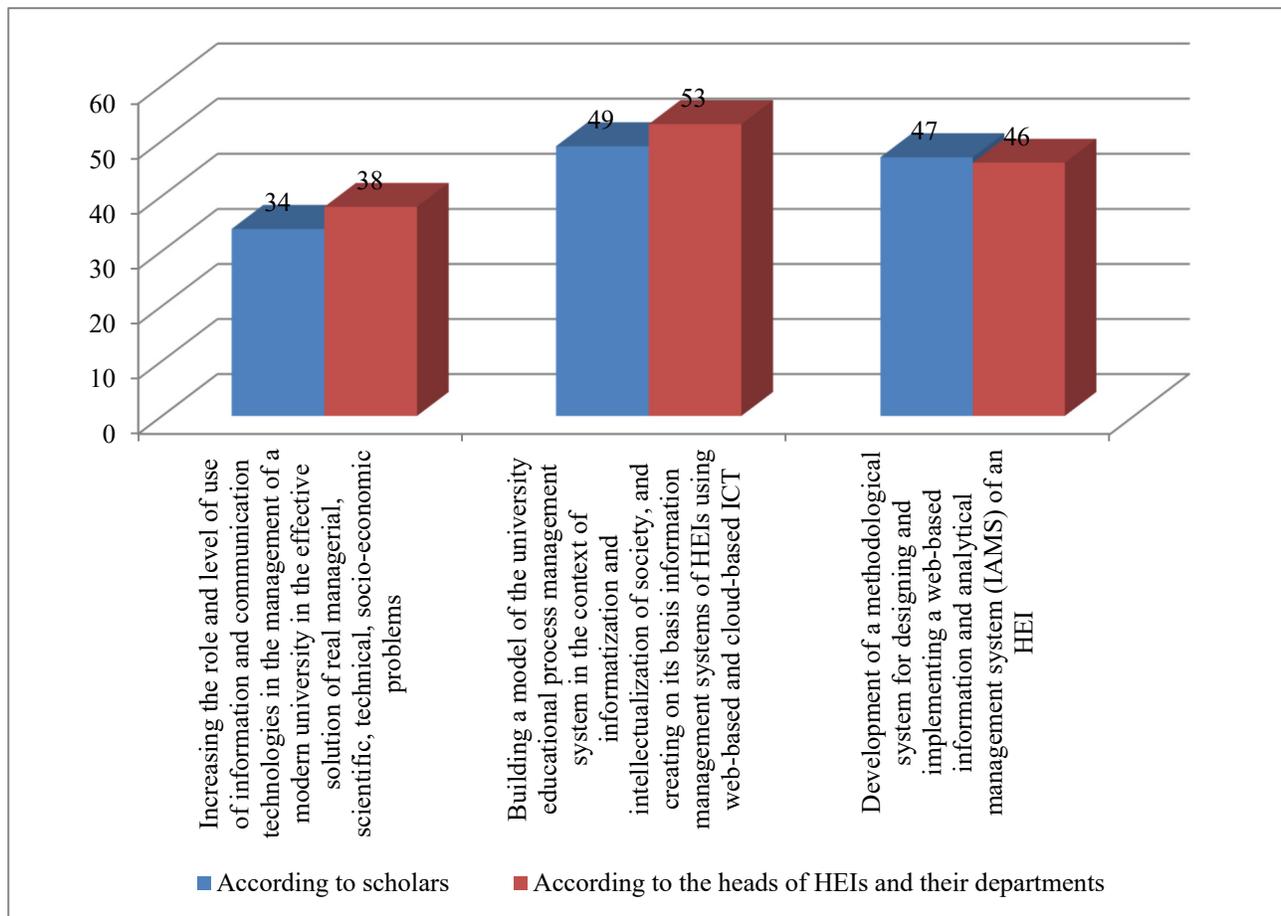


Figure 4. Unresolved Topical Information and Analytical Tasks of Restructuring the Processes of Higher Education Management in Modern Conditions, %

Source: built by the authors.

The survey results have shed light on several unresolved topical information and analytical tasks that need to be addressed to optimize the processes of higher education management in modern conditions. These tasks include:

1. Developing a comprehensive and integrated information and analytical system that can support the diverse needs and objectives of HEIs, while also ensuring data privacy and security.
2. Building capacity and providing professional development opportunities for staff and faculty in the use of information and analytical tools and techniques.
3. Promoting greater collaboration and communication among different stakeholders, including administrators, faculty, students, and external partners, to facilitate the implementation of an IAS and ensure its sustainability.
4. Addressing the challenge of data quality and data governance, by establishing standardized data collection, storage, and analysis procedures, and ensuring compliance with data privacy and security regulations.

5. Developing a scientifically sound and pedagogically balanced conceptual framework for the use of information and communication technologies in the management and planning of the educational process, that takes into account the needs of diverse student populations and aligns with the objectives of HEIs.

Overall, these tasks require a coordinated and strategic approach, with a clear vision, goals, and metrics for success, and a commitment to continuous improvement and innovation in the management of higher education institutions.

6. Discussion

Improving the quality of education and equal access to it is one of the main tasks of modern state policy in the field of education, a national priority and a prerequisite for national security, a condition for the realization of the right to education (Tran & Kuula, 2023; Beerkens, 2018).

Achieving a qualitatively new state of modern society is impossible without a radical improvement in the level of training of highly qualified specialists. This also applies to the education system, which, in turn, has to solve problems related to professional training. The quality of education covers all the main functions and areas of modernization of educational activities in the context of European requirements: the quality of teaching, training, and research, which means the quality of relevant personnel and programs and the quality of learning as a result of education (Cano, Murray, & Kourouklis, 2022; Wright & Wernecke, 2020).

The introduction of the latest information technologies in the educational process is a project in which, in a limited time, using the allocated resources, it is necessary to ensure the launch and operation of a certain information technology to support the activities of the institution (Cui, French, & O'Leary, 2021; Burac et al., 2019).

Implementation and application of modern software tools and information technologies for managing the educational process of an HEI radically change the conditions of activity of all participants in the educational process. Thus, the implementation of management information technology is carried out through the automation of individual stages of information processes. There is an automation of the managerial activities of the head, which leads to the automation of individual stages of the information process of making a managerial decision. Moreover, the requirements for the quality and reliability of information about the state of the educational process, the diversity of programs, the spread of innovation, the democratization of the process of management, education, training, etc. are increasing (Yanqing, Guangming, & Edwards, 2020; Moscardini, Strachan, & Vlasova, 2022; Senoner, Netland, & Feuerriegel, 2022).

Given the requirements of the modern development of society, informatization of management of planning of the educational process of HEIs allows for an increase in the efficiency, quality, and accessibility of management (Germain-Alamartine et al., 2021).

In this regard, scientists are facing a new challenge - to modernize the strategy of professional training. Online education has become accessible to everyone, and the quality assessment of the educational process has moved online. Nowadays, it is not difficult to join a lecture or webinar by any teacher or watch a recording. Employees prefer technological solutions where content is easy to find and the user interface is more like a search engine or a user library than a course catalog (Hazen et al., 2018; Hou et al., 2022).

7. Conclusions

Thus, the analysis of the scientific literature on the research topic and the results of the questionnaire survey showed that informatization of management of planning the educational process of HEIs is a set of measures to implement various types of information systems. This ensures the formation of information resources in HEIs, systems for monitoring the quality of their work, learning management, testing and control, and decision support systems, and requires the use of a single organizational, hardware, software, economic, and other types of software. Functional tasks of informatization of management of planning of the educational process of HEIs are determined with due regard to theoretical foundations. In particular, this concerns the principles of its construction and the characteristics of the object and each specific management entity, as well as the experience of their previous application.

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