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INFORMATION TECHNOLOGIES AS A METHOD FOR SUPPORTING THE QUALITY MANAGEMENT SYSTEM OF LIBRARY AND ARCHIVAL INSTITUTIONS

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ABSTRACT The application of the monitoring procedure is an integral part of the quality management system of archival and library institutions. The purpose of the article is to study the process of quality monitoring of the overall quality management system through the prism of information technologies. A monitoring system of high-quality information support for research in library and archival institutions has been developed, which ensures compliance with the requirements of quality management systems in accordance with ISO 9000 international standards. The degree of stakeholder satisfaction is determined through electronic surveys. An analysis of the factors affecting the quality of activities of library and archival institutions was carried out using the Ishikawa diagram. According to the Ishikawa diagram, it is proposed to distinguish the following components of quality: the process of high-quality information support, the process of reengineering and maximum automation, and the process of direct provision of library and archival services. The most common nonconformities regarding the quality of libraries' and archives' activities have been identified, and a Pareto diagram was constructed, which demonstrates that the greatest contribution to the overall nonconformity is made by the indicator of understanding customer requests. As a result, the advantages and disadvantages of monitoring the quality management system of a library or archival institution were revealed. The data obtained in the monitoring process serve as sources of information for corrective actions and risk analysis, which in turn contributes to the continuous improvement of library and archival institutions.

Keywords: information technologies; library; archive; project; monitoring system model; quality; integrated quality management system.

ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ ЯК МЕТОД ПІДТРИМКИ СИСТЕМИ УПРАВЛІННЯ ЯКІСТЮ БІБЛІОТЕЧНИХ ТА АРХІВНИХ УСТАНОВ

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АНОТАЦІЯ Застосування процедури моніторингу є невід'ємною частиною системи управління якістю архівних і бібліотечних установ. Метою статті є дослідження процесу моніторингу якості загальної системи менеджменту якості через призму інформаційних технологій. Розроблено систему моніторингу якісної інформаційної підтримки досліджень у бібліотечних та архівних установах, яка забезпечує дотримання вимог до систем менеджменту якості відповідно до міжнародних стандартів ISO серії 9000. Визначення ступеня задоволення зацікавлених сторін здійснюється через електронне анкетування. Проведено аналіз факторів, які впливають на якість діяльності бібліотечних та архівних установ з використанням діаграми Ісікави. Відповідно до діаграми Ісікави запропоновано виділяти такі складові якості: процес якісної інформаційної підтримки, процес реінжинірингу та максимальної автоматизації та процес безпосереднього надання бібліотечних та архівних послуг. Визначені найбільш розповсюджені невідповідності щодо якості діяльності бібліотек та архівів та побудована діаграма Парето, яка демонструє, що найбільший внесок у сумарну невідповідність вносить показник розуміння запитів клієнтів. У підсумку були виявлені достоїнства та недоліки моніторингу системи менеджменту якості бібліотечної та архівної установи. Дані, отримані в процесі моніторингу є джерелами інформації для здійснення коригувальних дій та аналізу ризиків, що в свою чергу сприяє постійному поліпшенню бібліотечних та архівних установ.

Ключеві слова: інформаційні технології; бібліотека; архів; проєкт; модель системи моніторингу; якість; інтегрована система управління якістю.

Introduction

In various spheres of human activity, observation has long been used as a distinct method of cognition,

based on prolonged, purposeful, and systematic perception of objects and phenomena in the surrounding world. In a competitive environment, leading positions are held by organizations and institutions that focus on

ensuring high quality and implementing an effective quality management system, which is continuously analyzed and improved. Both qualitative and quantitative performance indicators-particularly those derived from monitoring data are used to provide an unbiased evaluation of their operations.

The term monitoring does not have a precise and universally accepted definition, as it is employed across various domains of practical activity. It can be viewed both as a form of research and as a tool for providing the management sphere with relevant and reliable information [1].

According to the requirements of the ISO 9000 international standards [2], to ensure proper functioning, effective operation, and continuous improvement of an organization's quality management system, it is necessary to carry out measurement, analysis, and evaluation of its performance in the area of quality. Ensuring a high level of quality management in libraries and archives is based on the provision of objective and up-to-date information on the functioning and development of all structural elements, information obtained through systematic monitoring [1]. In this context, monitoring is viewed as a standardized and regular observation of the institution's processes and outcomes, which allows for the construction of a chronological picture of changes, quantitative evaluation of transformations within the system, identification of trends, and forecasting of potential development directions. Monitoring and analytical evaluation should be carried out at all stages of library service provision to ensure their effectiveness and alignment with contemporary standards.

The application of information technologies for the effective monitoring of quality management systems is a key competency in the digital era, where technology evolves rapidly [2].

The issue of quality management in archival and library institutions is explored in both domestic and international scholarly works. In particular, studies [3–5] are devoted to quality management in archival and library practices, examining its role, position, and prospects within the framework of sustainable development. The works [6, 7] investigate quality monitoring in the activities of scientific and technical libraries and archives, based on expert methods for data collection and processing, utilizing multiple hierarchical levels-coordination and optimization.

Trends analysis and the development of libraries in the digital environment are presented in study [8]. The issues of information and communication technologies in modern university libraries are addressed in research papers [9–11]. Notably, study [12] examines the interrelation between monitoring and audit quality, using primary data, where compliance with quality standards serves as a mediating variable.

Relevant and timely are studies [13,14], which consider new intelligent approaches to data quality management through quality monitoring systems, emphasizing the potential of AI-driven tools in the field

of librarianship. The use of artificial intelligence systems to enhance quality control is addressed in studies [15,16]. The authors emphasize the innovativeness of applying AI tools to improve the efficiency of data collection and processing.

Purpose of the work

The purpose of the research is to examine the monitoring process of the overall quality management system through the lens of information technologies. To achieve this goal, a three-level monitoring system for high-quality informational support in research within library and archival institutions has been developed. This system ensures compliance with the requirements of quality management systems in accordance with ISO 9000 series international standards.

Main part

The general methodological requirements for monitoring tools include validity, reliability, usability, alignment with the stated objectives, appropriate application of statistical methods, standardization, and the existence of prior testing (piloting). Achieving these requirements is possible by considering a number of important factors:

1. Level of professional training of specialists: this is a controllable factor during the research process. The measurement procedure typically involves several stages: development of the tools, direct data collection, data analysis, and formulation of recommendations.

2. Change of experts during the study: under certain conditions, this variable can be controlled. It relates to the accumulation of experience and coordination of opinions, where the judgment of a more authoritative expert may influence the evaluations of other participants.

3. Statistical regression: this refers to the potential distortion of research results due to statistical regularities.

4. Cyclical nature of social processes: social phenomena tend to repeat over time, which should be taken into account when conducting measurements.

5. Respondent selection: this is a key factor, as proper selection not only improves the accuracy of the evaluations but also enables extrapolation of the results to a broader target group.

6. Indicator significance and potential bias: when participants are aware of the importance of a certain indicator, they may consciously or unconsciously influence its measurement outcomes.

7. Violation of information exchange: in social systems, measurement assumes that the observed entities have a sufficient level of awareness. However, lack of information or its unequal distribution may significantly affect the results.

8. Participant motivation: in studies conducted in real-life conditions, participants may demonstrate varying behavior depending on personal goals or contextual factors.

9. Repeated measurement effect: performing the same tasks multiple times may alter the results. It is essential to determine the conditions under which this effect is negligible and does not distort the final conclusions.

10. Group dynamics under social context: participants in an experimental setting may adjust their evaluations based on peer reactions, leading to the formation of new evaluative criteria within the group.

11. Collective bias in results: classic experimental methods recognize the possibility of participants aligning their responses or evaluations, especially in the absence of direct personalized interaction between the researcher and the subjects.

12. Natural evolution of participants: during the experiment, internal development of the group or individual members may occur independently of external influences. This factor is particularly significant in educational research, where change dynamics are rapid.

13. Event imbalance between groups: groups involved in an experiment or comparative analysis may be subject to different external events beyond the experimental context. These factors can cause unexpected shifts in evaluation dynamics, complicating the interpretation of results.

14. Differences in intragroup process development rates: the experimental influence may manifest at varying speeds across different groups. In some cases, the effect might be mistakenly deemed absent simply because it had not yet become apparent by the time measurements concluded.

15. Mutual neutralization of influences (compensatory effects): Various internal or external factors may neutralize one another. When multiple influences occur simultaneously, one may completely or partially offset the other, complicating the identification of cause-and-effect relationships [16–18].

In the proposed study, monitoring is conceptualized as an integrated system for collecting, processing, storing, and disseminating information regarding the functioning of a quality management system or its individual components. The primary purpose of monitoring is to provide informational support for managerial activities, enabling the assessment of the current state of an object at any given time and the formulation of well-founded forecasts concerning its further development.

For the monitoring system to function effectively, it is necessary to adhere to a number of requirements, which can be formulated as key principles:

1. Objectivity of information. Monitoring must be based on reliable and verified data obtained through information exchange processes. The requested data should be as standardized and verifiable as possible. The feedback should be specific, practically valuable, and applicable to the management process.

2. Comparability of results. This principle is based on the need not only to record the system's condition but also to track its dynamics. To ensure comparability,

consistent approaches to data collection and identical empirical indicators for the same research object should be used.

3. Adequacy. Monitoring should take into account external factors affecting the performance of the object and include an analysis of the system's compliance with changing conditions. Such assessment is achieved through targeted studies of the external environment's impact on the institution's functioning.

4. Predictability. Monitoring must provide analytical data enabling the modeling of the system's future development and identifying potential changes in strategies to achieve defined goals. This principle is implemented through trend analysis and forecasting of possible development scenarios.

5. Goal orientation. The information collected and analyzed during monitoring should be relevant to the set objectives and aligned with the needs of specific managerial decisions. It is crucial to ensure the sufficiency and appropriateness of data depending on the research or management purpose.

Monitoring system development should be initiated prior to the start of project activities. Monitoring tasks must be integrated into the project's work plan and, more broadly, into the strategic plan.

Thus, the first level of monitoring is carried out by the staff involved in the project. Managers are responsible for monitoring the personnel and their work, while the project manager is responsible for overseeing all aspects of the project.

The second level of monitoring is carried out by donors, whose main function is to visit implementation sites and monitor project progress and performance.

The key distinction between monitoring and evaluation lies in the depth of analysis. Monitoring is conducted to obtain timely information on the current state of affairs. A monitoring system should be "embedded" into the project (or activity) from the outset by implementing the following steps:

1. Definition of measurable indicators.

2. Establishment of information sources for monitoring (organizations, departments, individuals or groups, documents, etc.).

3. Selection and justification of the method for data collection.

4. Determination of the frequency of data collection, taking into account the intensity of the evaluated activities.

5. Appointment of responsible persons for obtaining the necessary data.

6. Specification of techniques for processing and analyzing the collected data.

7. Analysis of monitoring results and planning of corrective actions [19–20].

In accordance with the requirements of DSTU ISO 9001, an organization that has implemented a quality management system must ensure three-level monitoring, which includes measuring indicators of the quality management system, products (services), and processes.

Accordingly, taking into account the specific nature of library and archival institutions, a monitoring model for an Integrated Quality Management System

(IQMS) has been developed, in line with the ISO 9000:2015 standards [2] (fig.1).

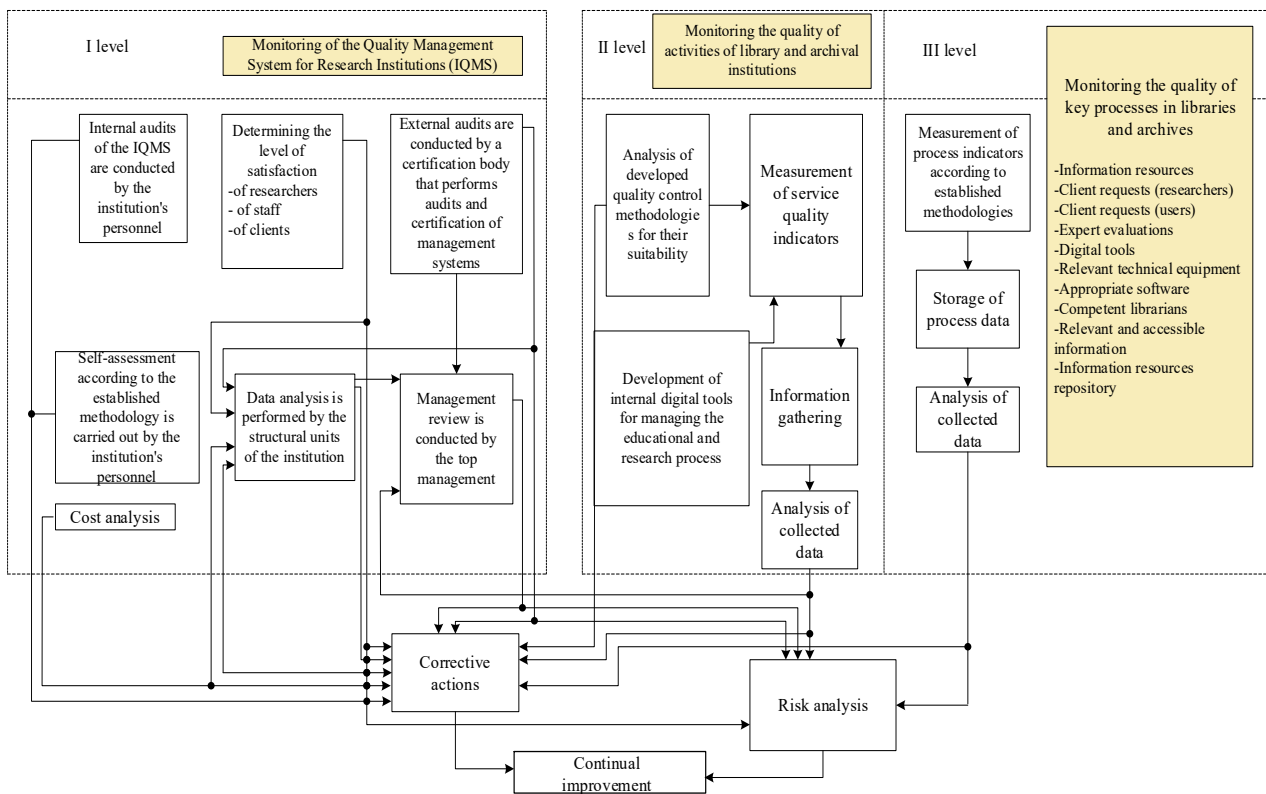


Fig. 1 – Monitoring system for high-quality information support of research in library and archival institutions

The first level of the monitoring system within the IQMS in library and archival institutions includes key components such as internal audits, self-assessment procedures, evaluation of stakeholder satisfaction, external audits conducted by certification bodies, consumer needs assessment, as well as analytical evaluation by top management, data processing, and cost analysis. These elements aim to enhance the effectiveness and efficiency of the monitoring system. Particular attention is given to audits performed at specified intervals: external audits are conducted once every three years, while internal audits and self-assessments are carried out annually. This approach supports continuous improvement and increases the operational efficiency of all organizational units [21].

The second level of the IQMS consists of internal control elements related to assessing the quality of staff training, specifically the development of librarians' competencies, as well as the development and implementation of internal digital tools aimed at managing educational and research processes. An additional component at this level is non-conformity management, which involves monitoring the quality of services provided in libraries and archival institutions and

implementing mechanisms for re-verification of service quality.

The third level comprises internal monitoring elements focused on quality control of key processes. These include managing user requests, utilizing digital tools and appropriate technical support, as well as measures to enhance staff professional competence.

Information collected through monitoring at levels I, II, and III serves as a basis for making corrective decisions and conducting risk analysis, ultimately ensuring continuous improvement of library and archival institutions' operations. The implementation of a continuous improvement system requires setting clear objectives for staff qualification enhancement (including librarians and technical personnel) across all organizational levels. Key components of this process include establishing an effective mechanism for submitting initiatives and timely responding to them, as well as introducing a system of moral and material incentives for employees based on their achievements, such as motivational programs.

The process of collecting, accumulating, and preserving data obtained during the monitoring of the IQMS is advisable to implement through specialized

information support—namely, automated information systems.

The quality of library processes is influenced by the following factors:

The level of professional training of library staff and their communicative competence in interacting with users;

The degree of user satisfaction with library services, particularly regarding the completeness and accuracy of fulfilling user requests;

The promptness of providing information services;

Accessibility of both traditional and additional services;

Creation of a favorable information and communication environment;

Active expansion of communication with users via social networks, library blogs, interactive platforms, and similar channels.

The communicative effectiveness of library activities is primarily ensured by the high quality of library and information resources and services, as well as the convenience and comfort of access to them. Moreover, the efficiency of implementing social and communicative functions largely depends on the quality of the library's interaction with other entities within the information space, the intensity of such contacts, the accessibility level of communication channels, the professional training of personnel, and the degree of the library's integration into broader information and communication networks.

Contemporary theories of quality management in library activities distinguish several approaches to evaluating the efficiency of library institutions. One of the leading approaches is based on analyzing and studying users' information needs, which has gained active development in library science research. Feedback from users is critically important for an objective evaluation of services provided. Conducting surveys, questionnaires, and analyzing satisfaction levels of both users and library staff contribute to the continuous improvement of services and the implementation of new service solutions.

It is proposed to carry out the monitoring procedure of the integrated library and archive system annually. A distinctive feature of the proposed monitoring system is the control of the functioning of key processes and the integrated system as a whole. The determination of stakeholder satisfaction is conducted via electronic questionnaires [22].

We conducted a study aimed at improving the quality of activities in library and archival institutions. The expert method was chosen to determine quality indicators of the products, as traditional methods such as measurement, registration, and calculation methods were not applicable. In expert evaluation practice, various methods are used to determine the weighting coefficients of quality indicators, including the express method, ranking method, paired comparison method, and scoring evaluation.

The essence of the express method lies in the direct assignment of weighting coefficients by the expert

group. In case of disagreement, the final decision is made by a qualified majority – not less than two-thirds of the votes. The ranking method involves assigning each indicator a certain rank according to its significance. The paired comparison method is based on step-by-step comparison of each indicator with all others; experts establish priority using symbols ">" or "<." The scoring evaluation method involves assigning a specific number of points to each indicator according to a predetermined scale, allowing for quantitative assessment of its importance level.

The self-assessment method enables determining the degree to which set goals have been achieved, identifying possible deviations and their causes, applying a systematic approach to improving organizational activities, obtaining assessments based on both factual data and personal perceptions, identifying and analyzing processes that can be improved, and comparing self-assessment results with the best outcomes achieved both within the organization and externally.

Determining key performance indicators is an important stage in the process of evaluating the quality of library activities. The main groups of such indicators include: Indicators of technological and informational processes, reflecting the effectiveness of forming the library's information resource base and organizing library services based on the integration of traditional and modern forms, methods, and communication channels with users; Indicators of functional and content-related activities, which characterize the library's ability to expand its content profile as a multifunctional information and socio-cultural center actively integrated into key areas of social life as an important information and communication element; Indicators of personnel and professional potential, reflecting the staff's competency level and the library's overall ability to function effectively amid external challenges and risks, as well as to assess internal weaknesses that may limit the utilization of available external opportunities; Indicators of regulatory and legal support, confirming the compliance of all types of activities and processes within the library with current standards, regulations, and requirements established in the relevant documentation.

The evaluation of the quality management system's performance is largely determined by the use of a set of indicators that enable comprehensive analysis of the library's activities, as well as the quality of specific processes and operations. Thus, effective management of the entire set of library activity processes as a unified system is a crucial condition for improving the institution's overall performance and efficiency.

Various methods from several scientific disciplines such as marketing, sociology, economics, linear programming, regression and statistical analysis, as well as concepts of Total Quality Management (TQM) are applied to measure the effectiveness of library services. Existing approaches to assessing the quality of library activities – viewed as a system of interconnected

processes – are conventionally divided into two main groups: technological and economic.

The use of economic methods allows quantitative assessment of the economic efficiency of library services. Within economic theory and the marketing approach, this efficiency is defined as the ratio between the obtained results (benefits) and the expended resources. The primary goal of such evaluation is to achieve maximum utility of services provided to the end user.

For an effective understanding of the mechanisms of prompt managerial decision-making, it is advisable to graphically represent the relationship between identified nonconformities and the factors causing them. A classic tool for visualizing such cause-and-effect analysis is the Ishikawa diagram (also known as the “fishbone” diagram), developed by the Japanese quality management expert Kaoru Ishikawa. In this model, the “head” of the fish represents the formalized problem under analysis. A horizontal line – the “spine” – extends from it, with major groups of causes – the “bones” – attached at an angle. Each “bone” represents a category of factors (e.g., personnel, methods, equipment, materials, environment, management) that directly or indirectly influence the emergence of the identified problem. Causes located closer to the “head” of the diagram indicate a more significant impact on the formation or exacerbation of the problem situation [23].

We conducted an analysis of factors influencing the quality of activities in library and archival institutions using the Ishikawa diagram. The indicators for evaluating key processes are presented in Figure 2, which illustrates the cause-and-effect relationships impacting the quality of the organization and provision of library and archival services.

Based on the analysis of the materials from publications [24–27], the key indicators to consider in the process of providing quality library and archival services were summarized. Thus, in organizing information support for education and research—that is, in delivering services to clients—it is necessary to take into account the following:

1. User requests – these are communicative inquiries received by the executors of the relevant processes from the library clients, containing formulations of their informational needs. It is on the basis of the analysis and adequate interpretation of these requests that the library develops proposals for relevant services, offerings, and service models aimed at meeting the current demand.

2. Information resources – systematically organized collections of documents in paper or electronic formats that ensure the fulfillment of the library’s functions as a communication and information center. The library forms, organizes, preserves, and provides access to various categories of information resources: printed and digital, commercial (licensed or subscription-based) and open access (freely available).

3. Information resource providers – entities responsible for creating and distributing informational content in various formats. These include publishers of

printed and electronic products, companies offering multimedia resources (on CD/DVD), providers of full-text and abstract databases, as well as libraries managing electronic journals, archives, repositories, and institutional or university-level digital libraries.

4. Digital tools and services – modern software solutions for searching, storing, processing, and disseminating scientific information. Among these are search engines (Google Scholar, Microsoft Academic), scientometric databases (Scopus, Web of Science), bibliographic managers (Zotero, EndNote, Mendeley), author identification systems (ORCID, ResearcherID), scientific social networks (ResearchGate, Mendeley), collaborative writing platforms (Authorea, AuthorCafé), and open-access repositories (Figshare, Zenodo).

5. Expert support – involvement of highly qualified specialists who possess relevant professional knowledge, experience, and competencies. Both internal and external experts who share the library’s value orientations can participate in information-analytical and research processes.

Their involvement may include consulting, providing expert opinions, participating in monitoring activities, and deploying and supporting internal digital tools in collaboration with other structural units of the institution, such as the research sector or IT department.

6. Comfortable virtual development environment.

7. Comfortable physical development environment.

The reengineering and full automation process includes:

1. Providing relevant and timely information necessary for conducting scientific research, educational processes, teaching, and the development of corresponding activity areas.

2. Offering convenient tools that support scientific activity, learning, teaching, and development.

3. Forming a collection of current information resources aimed at supporting research, education, teaching, development, as well as managing educational and scientific processes.

4. Organizing and preserving an up-to-date collection of information resources that ensures the effective functioning of scientific, educational, and managerial activities.

5. Ensuring quick and convenient access to relevant information required for accomplishing research, educational, teaching, and managerial tasks.

6. Developing and implementing internal digital tools that optimize the management of educational and scientific processes.

7. Utilizing databases of educational and scientific information resources, including both open access resources and subscription-based electronic databases from leading publishers (Elsevier, Springer, Wiley, etc.) and aggregators (EBSCO).

8. Applying automated library and information systems for forming a current collection of information resources on physical media.

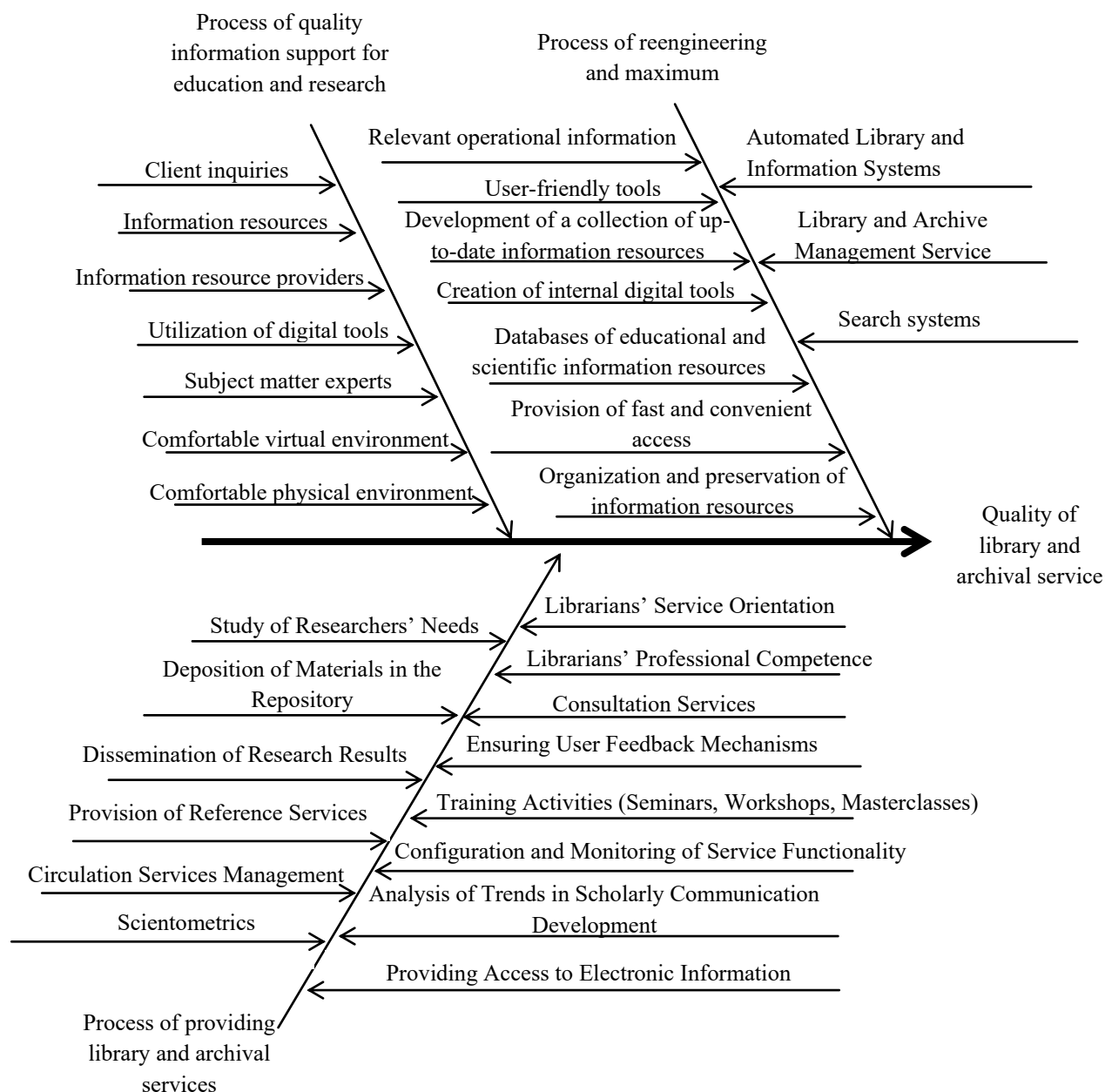


Fig. 2 – Quality indicators of library and archival service delivery

9. Implementing a Library Management Service (LMS) that provides comprehensive management of all types of information resources—print, digital, and electronic—through a unified user interface.

10. Using software solutions for creating digital libraries, institutional repositories, and managing external electronic resources (both open access and subscription-based).

11. Employing discovery systems to efficiently locate necessary information resources.

12. Systematizing relevant information resources to ensure their optimal organization and further utilization.

13. Populating electronic catalogs, digital libraries, and institutional repositories with metadata about available resources.

14. Organizing the placement of information resources on physical media according to established procedures and standards.

15. Ensuring access to external electronic information resources for library users, considering access control via IP addresses or authentication systems.

16. Monitoring university researchers' profiles in scientometric systems (Scopus, Web of Science, Google Scholar) and researcher identification services to track their scientific outputs.

The process of receiving library and archival services includes:

1. Ensuring librarian service orientation, which involves creating psychological comfort during communication with users.

2. Librarian competence encompassing fundamental professional skills, including information and network literacy, digital competence, media literacy, communication competence, and adherence to principles of academic integrity.

3. Providing consultative support for learning, teaching, scientific research, development, and management of educational and scientific processes.

4. Supplying reference information that facilitates effective learning, teaching, research, and management activities.

5. Organizing educational events (seminars, trainings, workshops) on a wide range of topics to enhance the effectiveness of learning, teaching, and research.

6. Studying researchers' needs using methods such as surveys, direct communication, case studies.

7. Analyzing current trends in scientific communication, as well as the latest digital resources, services, and tools utilized in organizing educational and research activities.

8. Ensuring effective feedback from users both within the physical library space and online (via electronic consultation registration forms, email, etc.).

9. Hosting educational and research materials in repositories and providing users with access to these resources.

10. Utilizing scientometric tools to support research activities, promote research outcomes, enhance the scientific reputation of individual researchers and the university as a whole, and conduct monitoring of scientometric indicators using platforms such as Scopus, Web of Science, and Google Scholar.

11. Providing access to electronic information resources within the library environment from library devices as well as users' mobile devices.

12. Organizing the book lending process according to user needs.

13. Offering open access to analytical information for internal and external users, as well as access to analytical tools within the institution's local network.

14. Establishing, monitoring, and maintaining uninterrupted operation of all library services (electronic ordering, renewal of loan periods, online interlibrary loan requests, electronic document delivery, etc.) [24].

A summary of the causes of discrepancies is presented in the table 1.

Analysis of the problem with emphasis on key factors that have the greatest impact is presented in a Pareto diagram (fig. 3).

Table 1 – Causes of Nonconformities

№	List of Causes	Frequency of occurrence, units	Percentage contribution, %	Cumulative contribution, %
1	Understanding of client requests by the library or archive, based on which service offers or service models are developed	326	28,08	28,08
2	Scientometric monitoring of the university's and individual researchers' impact and research capabilities	296	25,50	53,57
3	Use of search systems, search interfaces for proprietary databases, external scientific and educational databases, and the web portal	158	13,61	67,18
4	Insufficient utilization of digital tools and services	89	7,67	74,85
5	Provision of information resources	64	5,51	80,36
6	Insufficient involvement of library staff in quality management	55	4,74	85,10
7	Comfortable physical environment for research managers	43	3,70	88,80
8	Working conditions for personnel	36	3,10	91,90
9	Studying researchers' needs through surveys, direct communication during inquiries, use of case studies, and other methods.	26	2,24	94,14
10	Organization of the current collection of information resources both in online environments and on physical media	19	1,64	95,78
11	Provision of consultations to support the educational process, teaching, scientific research, development, and management of educational and scientific activities	17	1,46	97,24
12	Ensuring effective feedback from users both in the physical and online library space through electronic consultation registration forms and via email	14	1,21	98,45
13	Providing access to relevant library information resources in reading rooms, as well as electronic resources via library devices and users' mobile devices, including book lending services	7	0,60	99,05
14	Insufficient staff qualification	6	0,52	99,57
15	Fast and convenient access to relevant information	5	0,43	100,00
		Σ=1161	Σ=100 %	

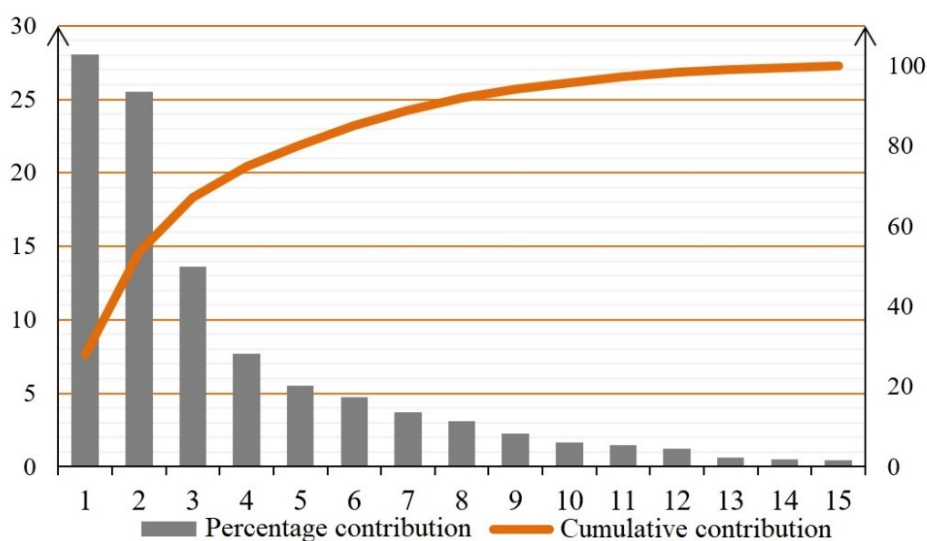


Fig. 3 – Pareto chart of the causes of nonconformities in library service quality indicators

Results

The processing results revealed that the most significant factor among the causes of nonconformities, as identified by research managers, is the library's or archive's misunderstanding of client requests, which serves as the basis for developing service offerings. The next most important factor is scientometric monitoring of the the university's and individual researchers' impact and research potential.

Conclusions

As a result of this study, the following findings can be outlined. The quality monitoring system is an integral part of the overall quality management system; therefore, its enhancement – especially under the conditions of rapid digital transformation – is both relevant and timely. Accordingly, the study proposes a three-level monitoring system, which includes the monitoring of the quality management system, the monitoring of the activities of the library institution, and the monitoring of key processes within libraries and archives as a separate level. The data obtained from monitoring these levels serve as an information base for implementing corrective actions and conducting risk analyses, which in turn supports the continuous improvement of library and archival institutions.

The identification of specific goals for the development of staff (librarians, technical personnel) at all levels of the organizational structure is of paramount importance for implementing continuous improvement. Equally important is the creation of a transparent mechanism for submitting proposals and responding to them promptly, as well as a recognition and reward system for achieved results.

The collection and storage of data obtained during the monitoring of the integrated quality management system is carried out through a specialized information support system.

Список літератури

1. Процес якісної інформаційної підтримки освіти та досліджень у бібліотеці університету: рекомендації для впровадження моделі / роз.: Бруй О., Кулик С., Сербін О.; за заг. ред. Сошинської Я.; ВГО Українська бібліотечна асоціація; Науково-технічна бібліотека КПІ ім. Ігоря Сікорського; Наукова бібліотека ім. М. Максимовича Київського національного університету ім. Т.Шевченка. Київ: УБА, 2020. 25 с.
2. Національний стандарт України ДСТУ ISO 9001:2015 (ISO 9001:2015). Системи управління якістю. Основні положення та словник термінів. Київ, 2016. 51 с.
3. Тверитникова О. Є., Салата Г. В. Менеджмент якості архівної та бібліотечної справи: до проблеми імплементації міжнародних стандартів. *Бібліотекознавство. Документознавство. Інформологія*. 2023. № 2. С. 48–53. doi: 10.32461/2409-9805.2.2023.284657.
4. Бачинська Н., Салата Г., Касьян В. Адаптивний підхід як інструмент бібліотечного менеджменту в умовах турбулентного зовнішнього середовища. *Цифрова платформа: інформаційні технології в соціокультурній сфері*. 2024. № 7(1). С. 9–23. doi: 10.31866/2617-796X.7.1.2024.306995.
5. Kelly E. J. Assessment of Digitized Library and Archives Materials: A Literature Review. *Journal of Web Librarianship*. 2014. № 8 (4). С. 384–403.
6. Bachynska N. A., Tverytnykova E. Ye., Drozdova T. V., Demidova Yu. Ye., Salata H. V. Educational services quality monitoring system as an important component of library and archive management. *Теорія і практика управління соціальними системами. Щоквартальний науково-практичний журнал*. Харків:

- НТУ «ХПІ». 2024. № 2. С. 43–55. doi: 10.20998/2078-7782.2024.2.04.
7. Бачинська Н., Тверитникова О., Дроздова Т., Салата, Г. Менеджмент архівних і бібліотечних установ: експертне оцінювання якості діяльності. *Вісник Національного технічного університету «ХПІ». Серія: Нові рішення у сучасних технологіях.* 2024. № 2(20). С. 17–23. doi: 10.20998/2413-4295.2024.02.03.
 8. Івашкевич О. В. Цифрова трансформація бібліотек України: сьогодення та перспективи. *Бібліотекознавство. Документознавство. Інформологія.* 2021. № 2. С. 50–56. doi: 10.32461/2409-9805.2.2021.238782.
 9. Чумак С. Трансформація інформаційних ресурсів публічних бібліотек України в сучасних умовах. *Український журнал з бібліотекознавства та інформаційних наук.* 2022. № 10. С. 36–48. doi: 10.31866/2616-7654.10.2022.269445.
 10. Maiatina N. V., Salata H. V., Bachynska N. A., Snihur O. M., Haiovych H. V. Information and Communication Technologies as a means of developing global planetary thinking among students of non-humanitarian specialties. *International Journal of Learning, Teaching and Educational Research.* 2021. Vol. 20. No. 4. P. 190–209.
 11. Колоскова Г., Михайлова А. Цифрові комунікації сучасної бібліотеки: ключові аспекти. *Вісник Книжкової палати.* 2024. № 2. С. 15–24. doi: 10.36273/2076-9555.2024.2(331).
 12. Owusu-Afryie R., Gyimah D., Kingsley P. A. Monitoring and audit quality: Does quality standards compliance matter? *Cogent Business & Management.* 2024. doi: 10.1080/23311975.2024.2416095.
 13. Jeanyoung K., Waluyo U., Sudirman S., Asrin A. Digital Service Management at the NTB Provincial Library and Archives Service. *Path of Science.* 2024. № 10. P. 2045–2053. doi:10.22178/pos.102-9.
 14. Shah K., Gami S., Trehan A.. An Intelligent Approach to Data Quality Management AI-Powered Quality Monitoring in Analytics. *International Journal of Advanced Research in Science Communication and Technology.* 2024. Vol. 4. P. 2581–9429. doi: 10.48175/IJARST-22820.
 15. Jana Mr. A., Rout R. From Archives to Insights: Using WARC-GPT to Advance Library Metaliteracy. 2013. *Communications in Information Literacy.* № 7 (2). doi:10.15760/comminfolit.2013.7.2.138.
 16. Маранчак Н. Використання штучного інтелекту в цифровому маркетингу бібліотечної галузі України: зарубіжний досвід і перспективи. *Цифрова платформа: інформаційні технології в соціокультурній сфері.* 2023. № 6(1). С. 172–184. doi: 10.31866/2617-796X.6.1.2023.283986.
 17. Гончаренко Д., Мокін В., Проценко Д. Побудова інформаційної системи моніторингу фізичних показників на основі технології інтернет речей. *Інформаційні технології та комп'ютерна інженерія.* 2023. Вип. 57 (2). С. 99–108. doi: 10.31649/1999-9941-2023-57-2-99-108.
 18. Demir's Taylan et al. Polynomial Regression and Faster R-CNN Models for University Library Decision Implementation Discovery based on Deep Learning. *WSEAS Transactions on Information Science and Applications.* 2025. № 22. P. 83–92. doi: 10.37394/23209.2025.22.9.
 19. Ярмус С. С. Проектування системи моніторингу та оцінювання ефективності інноваційної діяльності промислових підприємств. *Економіка та суспільство.* 2024. № 69. С. 2–7. doi: 10.32782/2524-0072/2024-69-149.
 20. Горлова О. П. Теоретико-методологічні підходи до розвитку інтегрованих систем управління підприємств. *Ефективна економіка. Електронне фахове видання.* 2020. № 8. doi: 10.32702/2307-2105-2020.8.70.
 21. Баєва О. І. Теоретичні основи формування системи управління якістю на підприємстві. *Економічний простір.* 2024. № 190. С. 132–135. doi: 10.32782/2224-6282/190-25.
 22. Світличин І. І. Методичний підхід до оцінювання якості продукції. *Економіка, управління та адміністрування.* 2023. № 1 (103). С. 64–69. doi: 10.26642/jen-2023-1(103)-64-69.
 23. Грудцина Ю. В. Якість та методи її оцінювання. *Економіка та управління національним господарством.* 2017. № 1. С. 30–34.
 24. Рибалко Л. А., Гусаковська Т. О., Кужель Н. Л. Розробка і впровадження системи менеджменту якості на підприємстві: обґрунтування проектного підходу на основі діаграми К. Ісікави. *Науковий вісник Полтавського університету економіки і торгівлі.* 2022. Вип. 1 (105). С. 24–28. doi: 10.37734/2409-6873-2022-1-3.
 25. Думанський Н. О. Робота з бібліотечними та архівними фондами: пошук і збір наукової інформації. *Бібліотекознавство. Документознавство. Інформологія.* 2023. № 4. С. 63–68. doi: 10.32461/2409-9805.4.2023.294075.

References (transliterated)

1. Bruj O., Kulyk Ye., Serbin O.; Soshynska Ya. (ed.). *Protses yakisnoi informatsiinoi pidtrymky osvity ta doslidzhen u bibliotetsi universytetu: rekomendatsii dlia vprovadzhennia modeli [Process of quality information support for education and research in the university library: recommendations for implementation of the model]*. Kyiv. Ukrainian Library Association; Scientific and Technical Library of Igor Sikorsky KPI; Scientific Library of M. Maksymovych, Taras Shevchenko National University of Kyiv, 2020. 25 p.
2. *Natsionalnyi standart Ukrainy DSTU ISO 9001:2015 (ISO 9001:2015). Systemy upravlinnia yakistiu. Osnovni polozhennia ta slovyk terminiv* [National Standard of Ukraine DSTU ISO 9001:2015 (ISO 9001:2015). Quality management systems. Basic provisions and glossary of terms]. Kyiv, 2016. 51 p.
3. Tverytnykova O. Ye., Salata H. V. Menedzhment yakosti arkhivnoi ta bibliotечноi spravy: do problemy implementatsii mizhnarodnykh standartiv [Quality management of archival and library affairs: on the problem of implementing international standards]. *Bibliotekoзнавство. Dokumentoznavstvo. Informolohiia [Library Science. Documentation Science. Informology]*, 2023, no. 2, pp. 48–53, doi: 10.32461/2409-9805.2.2023.284657.
4. Bachynska N., Salata H., Kasian V. Adaptivnyi pidkhid yak instrument bibliotечноho menedzhmentu v umovakh turbulentnoho zovnishnoho seredovyscha [Adaptive approach as a tool of library management in a turbulent external environment]. *Tsyfrova platforma: informatsiini tekhnologii v sotsiokulturnii sferi [Digital Platform: Information Technologies in the Socio-Cultural Sphere]*,

- 2024, no. 7(1), pp. 9–23, doi: 10.31866/2617-796X.7.1.2024.306995.
5. Kelly E. J. Assessment of Digitized Library and Archives Materials: A Literature Review. *Journal of Web Librarianship*, 2014, no. 8(4), pp. 384–403.
 6. Bachynska N. A., Tverynykova E. Ye., Drozdova T. V., Demidova Yu. Ye., Salata H. V. *Educational services quality monitoring system as an important component of library and archive management. Teoriia i praktyka upravlinnia sotsialnyimi systemamy. Shchokvartalni naukovo-praktychnyi zhurnal* [Theory and Practice of Social Systems Management. Quarterly Scientific and Practical Journal], Kharkiv: NTU "KhPI", 2024, no. 2, pp. 43–55, doi: 10.20998/2078-7782.2024.2.04.
 7. Bachynska N., Tverynykova O., Drozdova T., Salata H. Menedzhment arkhivnykh i biblioteknykh ustanov: ekspertne otsiniuvannya yakosti diialnosti [Management of archival and library institutions: expert evaluation of performance quality]. *Bulletin of the National Technical University "KhPI". Series: New Solutions in Modern Technologies*, 2024, no. 2(20), pp. 17–23, doi: 10.20998/2413-4295.2024.02.03.
 8. Ivashkevych O. V. Tsyfrova transformatsiia bibliotek Ukrainy: sohodennia ta perspektyvy [Digital transformation of libraries of Ukraine: present and prospects]. *Bibliotekoznavstvo. Dokumentoznavstvo. Informolohiia [Library Science. Documentation Science. Informology]*, 2021, no. 2, pp. 50–56, doi: 10.32461/2409-9805.2.2021.238782.
 9. Chumak Ye. Transformatsiia informatsiinykh resursiv publichnykh bibliotek Ukrainy v suchasnykh umovakh [Transformation of information resources of public libraries of Ukraine in modern conditions]. *Ukrainskyi zhurnal z bibliotekoznavstva ta informatsiinykh nauk [Ukrainian Journal of Library and Information Science]*, 2022, no. 10, pp. 36–48, doi: 10.31866/2616-7654.10.2022.269445.
 10. Maiatina N. V., Salata H. V., Bachynska N. A., Snihur O. M., Haiovych H. V. Information and Communication Technologies as a means of developing global planetary thinking among students of non-humanitarian specialties. *International Journal of Learning, Teaching and Educational Research*, 2021, vol. 20, no. 4, pp. 190–209.
 11. Koloskova H., Mykhailova A. Tsyfrovi komunikatsii suchasnoi biblioteki: kliuchovi aspekty [Digital communications of the modern library: key aspects]. *Visnyk Knyzhkovoï palaty [Bulletin of the Book Chamber]*, 2024, no. 2, pp. 15–24, doi: 10.36273/2076-9555.2024.2(331).
 12. Owusu-Afriyie R., Gyimah D., Kingsley P. A. Monitoring and audit quality: Does quality standards compliance matter? *Cogent Business & Management*, 2024, doi: 10.1080/23311975.2024.2416095.
 13. Jeanyoung K., Waluyo U., Sudirman S., Asrin A. Digital Service Management at the NTB Provincial Library and Archives Service. *Path of Science*, 2024, no. 10, pp. 2045–2053, doi: 10.22178/pos.102-9.
 14. Shah K., Gami S., Trehan A. An Intelligent Approach to Data Quality Management AI-Powered Quality Monitoring in Analytics. *International Journal of Advanced Research in Science Communication and Technology*, 2024, vol. 4, pp. 2581–9429, doi: 10.48175/IJARSCT-22820.
 15. Jana Mr. A., Rout R. From Archives to Insights: Using WARC-GPT to Advance Library Metaliteracy. *Communications in Information Literacy*, 2013, no. 7(2), doi: 10.15760/comminfolit.2013.7.2.138.
 16. Maranchak N. Vykorystannia shtuchnoho intelektu v tsyfrovomu marketynhu biblioteknoi haluzi Ukrainy: zarubizhnyi dosvid i perspektyvy [Use of artificial intelligence in digital marketing of the library sector of Ukraine: foreign experience and prospects]. *Tsyfrova platforma: informatsiini tehnologii v sotsiokulturnii sferi [Digital Platform: Information Technologies in the Socio-Cultural Sphere]*, 2023, no. 6 (1), doi: 10.31866/2617-796X.6.1.2023.283986.
 17. Goncharenko D., Mokin V., Protsenko D. Pobudova informatsiinoi systemy monitorynhu fizychnykh pokaznykiv na osnovi tehnologii internet rechei [Development of an information system for monitoring physical indicators based on Internet of Things technology]. *Informatsiini tehnologii ta komp'uterna inzheneriia [Information Technologies and Computer Engineering]*, 2023, no. 57(2), doi: 10.31649/1999-9941-2023-57-2-99-108.
 18. Demir's Taylan et al. Polynomial Regression and Faster R-CNN Models for University Library Decision Implementation Discovery based on Deep Learning. *WSEAS Transactions on Information Science and Applications*, 2025, no. 22, doi: 10.37394/23209.2025.22.9.
 19. Yarmus S. S. Proektuvannya systemy monitorynhu ta otsiniuvannya efektyvnosti innovatsiinoi diialnosti promyslovykh pidpriemstv [Designing a system for monitoring and evaluating the effectiveness of innovative activities of industrial enterprises]. *Ekonomika ta suspilstvo [Economy and Society]*, 2024, no. 69, doi: 10.32782/2524-0072/2024-69-149.
 20. Gorlova O. P. Teoretyko-metodolohichni pidkhody do rozvytku intehrovanykh system upravlinnia pidpriemstv [Theoretical and methodological approaches to the development of integrated enterprise management systems]. *Efektivna ekonomika. Elektronne fakhove vydannia [Efficient Economy. Electronic Professional Edition]*, 2020, no. 8, doi: 10.32702/2307-2105-2020.8.70.
 21. Bayeva O. I. Teoretychni osnovy formuvannya systemy upravlinnia yakistiu na pidpriemstvi [Theoretical foundations of forming a quality management system at an enterprise]. *Ekonomichniy prostir [Economic Space]*, 2024, no. 190, doi: 10.32782/2224-6282/190-25.
 22. Svitlyshyn I. I. Metodychnyi pidkhid do otsiniuvannya yakosti produktsii [Methodical approach to assessing product quality]. *Ekonomika, upravlinnia ta administruvannya [Economics, Management and Administration]*, 2023, no. 1(103), doi: 10.26642/jen-2023-1(103)-64-69.
 23. Grudtsyna Yu. V. Yakist ta metody yii otsiniuvannya [Quality and methods of its evaluation]. *Ekonomika ta upravlinnia natsionalnym hospodarstvom [Economics and Management of the National Economy]*, 2017, no. 1.
 24. Rybalko L. A., Husakovska T. O., Kuzhel N. L. Rozrobka i vprovadzhennia systemy menedzhmentu yakosti na pidpriemstvi: obgruntuvannya proektnoho pidkhodu na osnovi diaramy K. Isikavy [Development and implementation of a quality management system at the enterprise: justification of a project approach based on K. Ishikawa's diagram]. *Naukovi visnyk Poltavskoho universytetu ekonomiky i torhivli [Scientific Bulletin of Poltava University of Economics and Trade]*, 2022, no. 1(105), doi: 10.37734/2409-6873-2022-1-3.
 25. Dumanskyi N. O. Robota z biblioteknyimi ta arkhivnymi fondamy: poshuk i zbir naukovoï informatsii [Work with library and archival collections: search and collection of scientific information]. *Bibliotekoznavstvo. Dokumentoznavstvo. Informolohiia [Library Science. Documentation Science. Informology]*, 2023, no. 4, doi: 10.32461/2409-9805.4.2023.29407.

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