The efficiency model of business intelligence systems based on cloud technologies and microservice architecture

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Annotation: This article explores the integration of higher education institution systems through microservice architecture and cloud technologies. It addresses the challenges posed by limited system integration in universities, such as ERP and LMS, and highlights how microservices can improve scalability, operational efficiency, and decision-making capabilities. The article also examines the role of Business Intelligence (BI) systems in organizational data analysis and decision-making, demonstrating how the integration of cloud technologies and microservices enhances BI processes by enabling real-time data analysis and flexibility. Additionally, the potential future developments of BI systems, such as the application of machine learning and artificial intelligence for personalized analysis, are discussed. The paper concludes that adopting microservice architecture and cloud technologies is essential for modernizing higher education institutions, boosting their digital capabilities, and improving the management of resources and data.

Kewyords: Microservice architecture,cloud technologies,business Intelligence systems,efficiency model,real-time data analysis

Annotatsiya: Ushbu maqolada oliy ta'lim muassasalari tizimlarining mikroservis arxitekturasi va bulutli texnologiyalar orqali integratsiyalashuvi ko'rib chiqilgan. U ERP va LMS kabi universitetlarda cheklangan tizim integratsiyasi bilan bog'liq muammolarni hal qiladi va mikroservislarning miqyosi, operatsion samaradorligi va qaror qabul qilish imkoniyatlarini qanday yaxshilashi mumkinligini ta'kidlaydi. Maqolada, shuningdek, bulutli texnologiyalar va mikroservislarning integratsiyasi Real vaqtda ma'lumotlarni tahlil qilish va moslashuvchanlikni ta'minlash orqali BI jarayonlarini qanday kuchaytirishini ko'rsatib, tashkiliy ma'lumotlarni tahlil qilish va qaror qabul qilishda Business Intelligence (BI) tizimlarining roli ko'rib chiqiladi. Bundan tashqari, shaxsiylashtirilgan tahlil uchun mashinani o'rganish va sun'iy intellektni qo'llash kabi bi tizimlarining kelajakdagi potentsial ishlanmalari

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muhokama qilinadi. Hujjat mikroservis arxitekturasi va bulutli texnologiyalarni qabul qilish oliy o'quv yurtlarini modernizatsiya qilish, ularning raqamli imkoniyatlarini oshirish va resurslar va ma'lumotlarni boshqarishni takomillashtirish uchun juda muhimdir degan xulosaga keldi.

Kalit so'zlar: Mikroservis arxitekturasi, bulutli texnologiyalar,biznes intellekt tizimlari,samaradorlik modeli, Real vaqtda ma'lumotlarni tahlil qilish

Аннотация: В этой статье рассматривается интеграция систем высших учебных заведений с помощью микросервисной архитектуры и облачных технологий. Он решает проблемы ограниченной системной интеграции в таких университетах, каксionp и LMS, и подчеркивает, как микросервисы могут улучшить масштабируемость, операционную эффективность и возможности принятия решений. В статье также рассматривается роль систем бизнес-аналитики (BI) в анализе организационных данных и принятии решений, показывая, как интеграция облачных технологий и микросервисов может улучшить процессы BI за счет анализа данных в реальном времени и обеспечения гибкости. Кроме того, обсуждаются будущие потенциальные разработки Би-систем, такие как машинное обучение и применение искусственного интеллекта для персонализированного анализа. В документе сделан вывод о том, что внедрение микросервисной архитектуры и облачных технологий имеет решающее значение для модернизации высших учебных заведений, расширения их цифровых возможностей и улучшения управления ресурсами и данными.

Ключевые слова: архитектура микросервисов, облачные технологии,системы бизнес-аналитики,модель производительности, анализ данных в реальном времени

1. INTRODUCTION

The effectiveness of higher education institutions today is increasingly dependent on their ability to manage, analyze, and leverage data for strategic decision-making. These institutions utilize various systems and platforms, such as ERP (Enterprise Resource Planning), LMS (Learning Management System), security systems, and library systems, among others. However, these systems often operate independently or with limited integration, which hampers seamless data exchange. This lack of integration presents significant challenges to analytical processes, decision-making, and the achievement of strategic goals [1, 2].

The exchange of data and effective integration among interconnected systems in higher education institutions extends beyond internal systems. It involves managing the flow of information between both internal and external

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sources, enabling real-time analysis, and supporting optimal decision-making. However, the complexity and limitations of inter-system interactions often hinder the efficiency of these processes. A promising solution to these challenges is the adoption of an integration approach based on microservice architecture and cloud technologies [3].

Microservice architecture focuses on modularizing systems into independent services, with each microservice handling a specific task and operating autonomously. This approach simplifies system modularization, updates, and scaling. Microservices are particularly well-suited for managing large datasets and conducting rapid analyses. By adopting this architecture, higher education institutions can streamline system integration, enhance interconnectivity, and improve the efficiency of data utilization [4, 5].

Cloud technologies significantly enhance the management and analysis of microservice-based systems on a global scale. Cloud computing enables remote system management, dynamic resource allocation, and cost optimization. Furthermore, cloud technologies facilitate real-time data analysis, which supports strategic decision-making processes [6, 7].

- The primary aim of this article is to develop a model for the effective integration of higher education institution systems based on microservice architecture and cloud technologies. This model is designed to provide the following benefits:
- *Scalability and flexibility:* Microservice architecture provides the ability to quickly and easily integrate new services into systems. This approach simplifies the expansion of system functionality and coverage.
- *Operational efficiency:* By ensuring the efficient organization of real-time data exchange and analysis processes between systems, this model enhances the speed and quality of overall operational processes.
- *Cost optimization:* Cloud technologies enable efficient use of resources, thus offering the potential to reduce infrastructure and technological costs.
- *Improved analysis and decision-making:* Cloud platforms facilitate the rapid processing and analysis of large volumes of data, providing opportunities for data-driven strategic decision-making [8].

This approach is designed to enhance the operational efficiency of universities, optimize decision-making processes, and strengthen the interconnectivity between systems. By integrating microservice architecture with cloud technologies, higher education institutions can achieve modern, efficient, and flexible systems. This integration will play a pivotal role in the digitalization of

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educational processes, ultimately improving their overall effectiveness. Figure 1 presents the creation of multiple systems within higher education institutions based on microservice architecture and cloud technologies, along with their operational schema. The figure illustrates the integration process of the university's core systems with the cloud platform, highlighting the interconnection between each system and the cloud, as well as the data exchange processes between them.

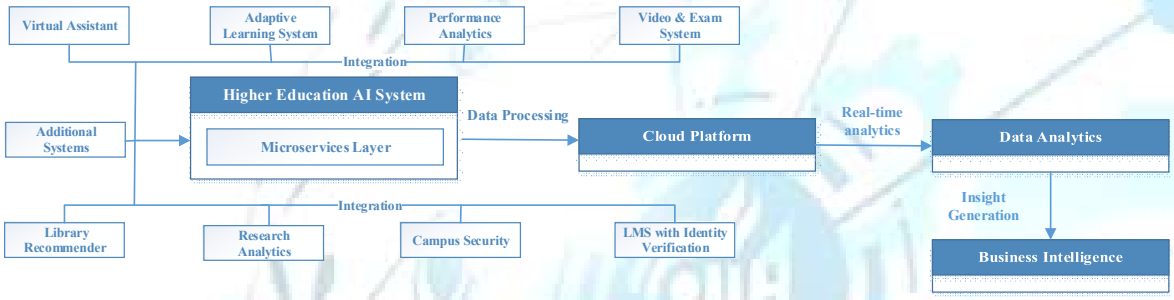


Figure 1. The integration process of the cloud platform based on microservice architecture

2. THE IMPACT OF CLOUD TECHNOLOGIES AND MICROSERVICES ON BUSINESS INTELLIGENCE SYSTEMS

Business Intelligence (BI) systems are a set of modern systems designed to optimize the process of analyzing organizational data and decision-making. BI systems support the processes of data collection, storage, analysis, visualization, and decision-making, which are essential for effectively managing an organization's business operations [9]. These systems primarily enable the improvement of business processes, enhancement of efficiency, and strategic decision-making by analyzing large volumes of data stored in databases [10].

2.1.1 Core elements of a business intelligence (BI) system

Business Intelligence (BI) systems consist of several essential components, each of which contributes to ensuring the system's effective operation [11]. Based on these components, the architecture of BI systems is constructed (Figure 2):

- *Databases:* used for storing data.
- *Data warehouse*: used for organizing and analyzing large volumes of data.
- *ETL (Extract, Transform, Load):* a technology that automates the process of collecting, transforming, and analyzing data.
- *OLAP (online analytical processing):* provides capabilities for analytical data processing.

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- *Visualization tools:* used to present data in a visual format (e.g., dashboards and charts).

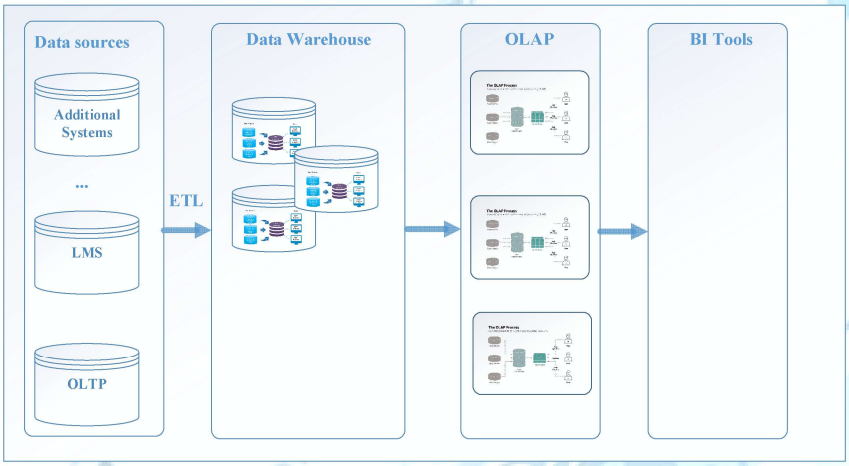


Figure 2. Architecture of BI systems

The fundamental components, such as databases, Data Warehouses, ETL processes, OLAP systems, and visualization tools, collectively facilitate the efficient collection, storage, analysis, and visual representation of data. By leveraging these integrated systems, organizations can optimize operational processes and enhance decision-making accuracy and responsiveness. Today, Business Intelligence (BI) systems serve as effective tools not only for data analysis but also for facilitating real-time decision-making. By leveraging cloud technologies and Big Data, BI systems enable the analysis of massive data volumes. Cloud-based BI systems provide ubiquitous and continuous access to data, allowing organizations to conduct efficient analyses while adapting to rapidly evolving markets. This capability enhances their ability to drive growth and sustain competitive advantages in dynamic environments [12]. BI systems offer organizations advanced, intuitive, and interactive functionalities. Through the use of visualization tools, dashboards, and graphical representations, users are empowered to efficiently analyze data, formulate strategic business plans, and make well-informed, precise decisions. These methodologies significantly contribute to enhancing organizational competitiveness and fostering sustainable growth in the marketplace [13].

2.1.2. Prospects for the development of BI systems

In the future, Business Intelligence (BI) systems are expected to become even more advanced. By leveraging machine learning and artificial intelligence

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technologies, these systems will be able to provide users with personalized analyses. For instance, these systems can analyze a user's previous decisions to help optimize new ones. The further development of real-time analytics capabilities will enhance data access, enabling faster and more informed decision-making [14]. These processes are implemented using the components of modern BI systems (Figure 3). Machine learning and artificial intelligence technologies equip systems with the ability to autonomously learn and improve, which helps make decision-making more accurate and efficient. These approaches not only enhance the quality of decision-making but also contribute to making business processes more innovative and optimized [15].

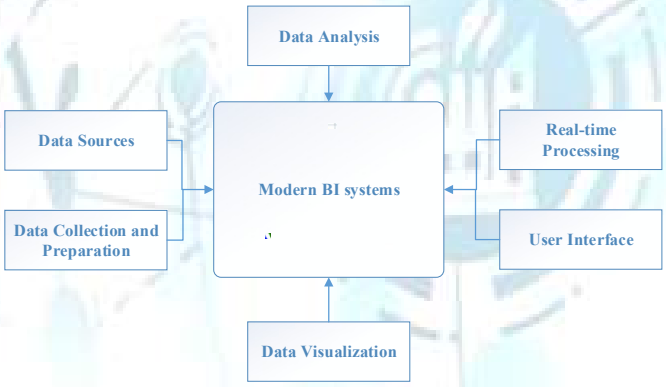


Figure 3: Core components of modern BI systems

2.2. Microservices architecture and its role in business intelligence systems

Microservices architecture ensures that a system is divided into small, independent services, with each microservice performing a specific function and maintaining its own database, resources, and processing capabilities. This approach, in contrast to monolithic architectures, significantly simplifies the scaling, updating, and management of the system. Monolithic systems operate as a single unit, where any modifications or updates necessitate rebuilding the entire system, which may result in errors and a reduction in system performance speed [16, 17]. The main elements of microservices architecture include the following [18]:

- *Independent services:* each microservice is responsible for performing a specific business function and interacts with other microservices, enabling modularization and independent operation within the system.

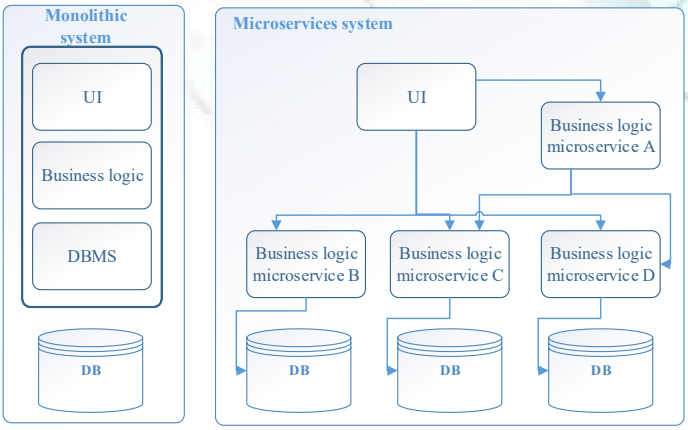
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- *Communication via API:* microservices communicate with one another through an API (Application Programming Interface), which ensures system independence, scalability, and efficient data exchange between services.
- *Autonomy:* each microservice may possess its own database, ensuring operational independence and enhancing security by isolating data and reducing the risk of system-wide failures.
- *Rapid updates:* microservices can be updated individually, allowing for faster and more efficient system modifications and the seamless addition of new services without impacting the entire system.

The interaction between microservices and Business Intelligence (BI) systems: In Business Intelligence (BI) systems, microservice architecture offers effective solutions for the efficient collection, analysis, and visualization of data. BI systems typically require processing large volumes of data and supporting decision-making processes. By implementing microservice architecture, a BI system operates through distinct, independent services, each responsible for specific functions such as data management, analysis, or report generation [19]. This modular approach simplifies the independent updating and development of the system, while also accelerating the interaction and integration of data, ultimately enhancing the overall performance and scalability of the BI system.

As seen from Figure 4, compared to monolithic architecture, microservices offer the following advantages for BI systems:

- *Scalability:* microservices enable easy addition of new services and system scaling, such as integrating new data sources or analysis algorithms.
- *Flexibility:* each microservice functions independently, facilitating quick system updates and modifications.
- *Efficiency:* microservices support parallel data processing, enhancing system performance, particularly when dealing with large datasets.



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Figure 4. Microservice Architecture

The microservice architecture is a pivotal solution for ensuring high performance, flexibility, and scalability in BI systems, especially for those dealing with large and rapidly changing datasets. This approach enhances the system's ability to manage complex data processes and adapt quickly to evolving requirements.

3. CLOUD TECHNOLOGIES AND MICROSERVICES-BASED BI SYSTEMS PERFORMANCE MODEL AND ALGORITHM

In developing a performance model for BI systems based on cloud technologies and microservices, the system's modular structure and resource allocation are defined at the design phase. Data collection and cleaning ensure high-quality analysis, while efficient resource allocation improves system speed and performance. Advanced algorithms and continuous monitoring optimize system operations. Ultimately, user experience is refined to ensure the system's efficiency and support decision-making (Figure 5).

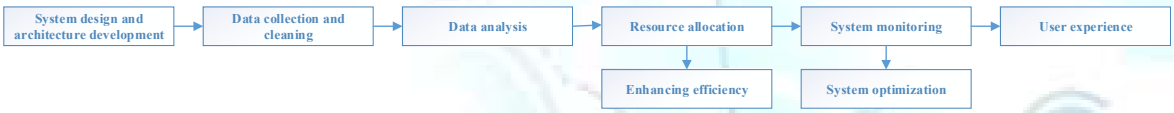


Figure 5. Microservices architecture

3.1. Efficiency model

To maximize the efficiency of Business Intelligence (BI) systems based on cloud technologies and microservices, it is essential to consider several critical parameters. These parameters encompass system optimization, scalability, efficient resource allocation, and continuous performance monitoring. The primary parameters include:

- R- resources (processor power, memory, bandwidth, and other system resources).
- A - algorithms and dystem optimization (data analysis and algorithm efficiency).
- Q - data quality (clean data, databases, and data sources).

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- M - monitoring and optimization (real-time monitoring and continuous system optimization).

- UX- user experience (system usability and responsiveness for the end user).

To create an efficiency function, it is essential to evaluate the impact of each parameter on the system and determine the extent of their influence on overall performance. Scaling and optimization of the system can be achieved through the use of cloud technologies and microservices. The general form of the efficiency function can be expressed as follows:

$$s = \omega_1 \cdot f_R(R) + \omega_2 \cdot f_A(A) + \omega_3 \cdot f_Q(Q) + \omega_4 \cdot f_M(M) + \omega_5 \cdot f_{UX}(UX) \quad (1)$$

Here:

- $\omega_1, \omega_2, \omega_3, \omega_4, \omega_5$ - the weight of each parameter's impact on the system's efficiency. These weights are determined based on the specific conditions and requirements of the system.
- $f_R(R), f_A(A), f_Q(Q), f_M(M), f_{UX}(UX)$ - the functional impact of each parameter on the system's efficiency.

Efficient resource allocation enhances system performance. The change in each resource affects the overall operation of the system. For example, processor power or network bandwidth should be scaled according to demand.

$$\mathrm{f_R(R)} = \frac{\mathrm{R_{total}}}{\mathrm{R_{max}}} \cdot 100 \quad (2)$$

Here:

- R_{total} — total resources.
- R_{max}— maximum available resources.

Efficient algorithms improve system performance. With well-performing algorithms and optimization methods in the system, data can be analyzed quickly and accurately.

$f_A(A)$- the efficiency of algorithms is calculated using the following formula:

$$f_A(A) = \frac{A_{eff}}{A_{max}} \cdot 100 \quad (3)$$

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Here:

- A_{eff} - the number of efficiently functioning algorithms in the system.
- A_{max} — maksimal samarali algoritmlar soni.

High-quality data optimizes the analysis process in BI systems. The purity and relevance of data contribute to improving the system's efficiency. The data quality, $f_Q(Q)$, is evaluated using the following formula:

$$f_Q(Q) = \frac{Q_{clean}}{Q_{total}} \cdot 100 \quad (4)$$

Here:

- Q_{clean} - the number of clean and ready-to-process data.
- Q_{total}- the total amount of data.

Continuous monitoring and optimization of the system enhance efficiency. This process aids in resource conservation and improves the system's operational speed.

The efficiency of the optimization processes is evaluated using the following formula for $f_M(M)$:

$$f_M(M) = \frac{M_{opt}}{M_{max}} \cdot 100 \quad (5)$$

Here:

- M_{opt} -represents the effectiveness of the optimization processes.
- M_{max} - denotes the maximum optimization level.

Improving user experience helps enhance system efficiency. The system's user-friendliness and quick response capability increase its overall performance.

$f_{UX}(UX)$- user experience evaluation is carried out using the following formula:

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$$f_{UX}(UX) = \frac{UX_{eff}}{UX_{max}} \cdot 100 \quad (6)$$

Here:

- UX_{eff} - the effectiveness of the user experience.
- UX_{max}— the maximum level of user experience.

Based on all the formulas provided above, it can be concluded that all parameters influence the effectiveness of the BI system. Therefore, the appearance of formula 1 will change, and efficiency is calculated as follows:

$$S = \omega_1 \cdot \frac{R_{total}}{R_{max}} + \omega_2 \cdot \frac{A_{eff}}{A_{max}} + \omega_3 \cdot \frac{Q_{clean}}{Q_{total}} + \omega_4 \cdot \frac{M_{opt}}{M_{max}} + \omega_5 \cdot \frac{UX_{eff}}{UX_{max}} \quad (7)$$

This formula measures the system's performance by considering the weight (ω) associated with each parameter, ultimately determining the overall system efficiency. The weights represent how each parameter influences the system's various aspects, and this allows for an accurate evaluation of its efficiency. In the evaluation process, each parameter should be analyzed separately to identify which aspects are most crucial for the system. This approach helps to improve and optimize efficiency further.

3.2. Efficiency evaluation and optimization algorithm

In paragraph 4.1, an efficiency evaluation and optimization algorithm was developed. The algorithm determines the overall efficiency based on system resources, algorithm efficiency, data quality, monitoring processes, and user experience, using the efficiency model from formula 7. Input data for the algorithm:

- R_{total} - total resources available in the system.
- R_{max} - maximum available resources in the system.
- A_{eff} - number of effective algorithms in operation
- A_{max} - maximum number of effective algorithms.
- Q_{clean} - number of clean and ready-to-process data.
- Q_{total} - total amount of data.
- M_{opt} - efficiency of optimization processes.
- M_{max} - maximum optimization level.

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- UX_{eff} - user experience efficiency
- UX_{max} - maximum user experience level

The sequence of operations for the algorithm:

Step 1: Resource Efficiency Calculation. The efficiency of resources is calculated using the second formula. If $\boldsymbol{R > 90\%}$, the system is considered to be efficiently utilizing its resources.

Step 2: Algorithm and System Optimization Evaluation. Algorithms and system optimization are calculated and assessed using the third formula. If $\boldsymbol{A > 80\%}$, the system's algorithms are considered to be operating effectively.

Step 3: Data Quality Assessment. Data quality is calculated using the fourth formula. If $\boldsymbol{Q > 95\%}$, the system's data quality is considered to be high.

Step 4: Monitoring and Optimization Evaluation. Monitoring and optimization effectiveness is calculated using the fifth formula. If $\boldsymbol{M > 85\%}$, the system is considered to be continuously optimizing effectively.

Step 5: User Experience Evaluation. User experience is calculated using the sixth formula. If $\boldsymbol{UX > 90\%}$, the user experience is considered to be high.

Step 6: Overall System Efficiency Calculation. The overall system efficiency is calculated using the seventh formula. If $\boldsymbol{S > 80\%}$, the system is considered to be efficient.

Based on the operation of the above algorithm and the results, if the following outcomes are obtained, several changes need to be made to the system. These changes are as follows:

- If $R > 50\%$, it is considered that the system is not making effective use of its resources, and therefore, resources need to be increased.
- If $A < 60\%$, system optimization is required.
- If $Q < 70\%$, data quality and consistency should be improved.
- If $M < 50\%$, issues exist in system optimization and monitoring.
- If $\boldsymbol{UX} < 70\%$, user experience should be enhanced.
- If $S < 80\%$, the overall system performance is deemed insufficient, and in this case:
  - optimize resource allocation;
  - improve the efficiency of algorithms;
  - work on improving data quality.

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Measures to improve monitoring and user experience should be implemented. Using this algorithm, the effectiveness of business intelligence systems based on cloud technologies and microservices can be evaluated and optimized. The performance of each parameter is analyzed, and the overall system efficiency is calculated.

3.3. Application of the efficiency evaluation and optimization model

Based on the developed model and algorithm, we will apply it to the Hemis ERP system, Masofaviybuxdu LMS, Elibbuxdu library system, Kamerabuxdu system, and Uniworkbuxdu ERP systems. These systems are modules of the unified BuxDU AI system and can also operate independently as standalone systems.

The effectiveness of these systems directly influences the overall performance of BuxDU AI. We will consider all five systems, as well as the overall system (BuxDU AI), as a single integrated system. In Table 1, the input data required to calculate the performance of these systems is presented, and based on this data, the performance of each individual system will be calculated. The collective performance of the entire BuxDU AI system will then be derived from the results of these sub-systems.

Table 1. Input data

System	R_{total} (%)	A_{eff}(%)	Q_{clean}(%)	M_{opt}(%)	UX_{max}(%)
Hemis ERP System	90	80	75	85	80
Masofaviybuxdu LMS	85	75	80	80	85
Elibbuxdu library system	80	70	85	75	75
Kamerabuxdu system	85	80	80	90	85
Uniworkbuxdu ERP systems	75	85	80	70	75

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When calculating the efficiency of each system, we also take into account the larger BuxDU AI system. To calculate the overall efficiency of the system, we use the following formula: $\boldsymbol{S = \omega_1 \cdot f_R(R) + \omega_2 \cdot f_A(A) + \omega_3 \cdot f_Q(Q) + \omega_4 \cdot f_M(M) + \omega_5 \cdot f_{UX}(UX)}$.

Here:

The weights are equal as follows:

$\boldsymbol{\omega_1 = 0.2, \omega_2 = 0.2, \omega_3 = 0.2, \omega_4 = 0.2, \omega_5 = 0.2}$, *we will calculate the efficiency for each system.*

1. *Hemis ERP System:*

$$\boldsymbol{S_{Hemis} = (0.2 \cdot 90) + (0.2 \cdot 80) + (.2 \cdot 75) + (0.2 \cdot 85) + (0.2 \cdot 80)}$$

$$S_{Hemis} = 18 + 16 + 15 + 17 + 16 = 82$$

2. Masofaviybuxdu LMS:

$$\boldsymbol{S_{LMS} = (0.2 \cdot 85) + (0.2 \cdot 75) + (0.2 \cdot 80) + (0.2 \cdot 80) + (0.2 \cdot 85)}$$

$$S_{LMS} = 17 + 15 + 16 + 16 + 17 = 81$$

3. Elibbuxdu library system:

$$\boldsymbol{S_{ElibBuxDu} = (0.2 \cdot 80) + (0.2 \cdot 70) + (0.2 \cdot 85) + (0.2 \cdot 75) + (0.2 \cdot 75)}$$

$$S_{ElibBuxDu} = 16 + 14 + 17 + 15 + 15 = 77$$

4. Kamerabuxdu system:

$$\boldsymbol{S_{KameraBuxDU} = (0.2 \cdot 85) + (0.2 \cdot 80) + (0.2 \cdot 80) + (0.2 \cdot 90) + (0.2 \cdot 85)}$$

$$S_{KameraBuxdu} = 16 + 14 + 17 + 15 + 15 = 77$$

5. Uniworkbuxdu ERP systems:

$$\boldsymbol{S_{uniworkBuxDU} = (0.2 \cdot 75) + (0.2 \cdot 85) + (0.2 \cdot 80) + (0.2 \cdot 70) + (0.2 \cdot 75)}$$

$$S_{UniworkBuxDu} = 16 + 14 + 17 + 15 + 15 = 77$$

The efficiency of all systems has been determined and is presented in Table 2.

Table 2. Efficiency results of the dystems

System	Efficiency (%)

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Hemis ERP System	82%
Masofaviybuxdu LMS	81%
Elibbuxdu library system	77%
Kamerabuxdu system	84%
Uniworkbuxdu ERP systems	77%

For the BuxDU AI system, the overall values of the five systems are averaged. That is, for each parameter, the average of the values from the five systems is taken:

$$R_{BuxDU_AI} = \frac{(90+85+80+85+75)}{5} = \frac{415}{5} = 83\%,\ A_{BuxDU_AI} = \frac{(80+75+70+80+8\ )}{5} = \frac{390}{5} = 78\%,$$

$$Q_{BuxDU_AI} = \frac{(75+80+85+80+8\ )}{5} = \frac{400}{5} = 80\%,\ M_{BuxDU_AI} = \frac{(85+80+75+90+7\ )}{5} = \frac{400}{5} = 80\%,$$

$$UX_{BuxDU_AI} = \frac{(80+85+75+85+75)}{5} = \frac{400}{5} = 80\%$$

After calculating the average value for each parameter, we calculate the overall efficiency based on the following formula.

The overall efficiency of the BuxDU AI system is calculated as follows:

$$s = \omega_1 \cdot R_{BuxDU_{AI}} + \omega_2 \cdot A_{BuxD\ \ AI} + \omega_3 \cdot Q_{BuxDU_{AI}} + \omega_4 \cdot M_{BuxD\ \ AI} + \omega_5 \cdot UX_{BuxDU_AI}$$

Here, $\omega_1 = \omega_2 = \omega_3 = \omega_4 = \omega_5 = 0.2$ because we assign equal weights to all parameters.

$$\boldsymbol{S_{BuxDU_AI} = 0.2 \cdot 83 + 0.2 \cdot 78 + 0.2 \cdot 80 + 0.2 \cdot 80 + 0.2 \cdot 80}$$

$$S_{BuxDU_AI} = 16.6 + 15.6 + 16 + 16 + 16 = 80.2\%$$

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The BuxDU AI system demonstrates an efficiency of 80.2% based on the average values of all the systems. This indicates that the BuxDU AI system is effective in integrating these five systems and calculating the overall efficiency, with its performance being average.

5. Conclusion

Cloud technologies and microservices architecture play a crucial role in enhancing the efficiency of Business Intelligence (BI) systems. Cloud platforms enable the effective storage, management, and real-time analysis of data, thereby improving system performance. Microservices decompose the system into independent modules, simplifying its flexibility and updates. When measuring the performance of BI systems, factors such as rapid data processing, security, and efficiency are essential. Cloud technologies ensure the secure storage of data, while microservices enhance the system's scalability and adaptability. Consequently, cloud technologies and microservices significantly contribute to making BI systems efficient, secure, and adaptable, providing organizations with speed and accurate results in decision-making.

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