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APPLICATION OF BIM TECHNOLOGIES IN BUILDING OPERATING ORGANIZATIONS

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Zafar Matniyazov, Bakhrom Tulaganov, Zarifjon Adilov, Rustamkhon Khadjaev, Samidullo Elmurodov
Tashkent University of Architecture and Civil Engineering

Abstract

This article is dedicated to the application of Building Information Modeling (BIM) technologies in organizations operating buildings. It discusses the use of the Asset Information Model (AIM) for effective data management during the building's operational phase. The advantages of applying BIM are outlined, including enhanced communication, efficient data exchange, minimization of data loss, and improved building maintenance. Special attention is given to creating a Common Data Environment (CDE) and establishing standards for data exchange and management. The paper also discusses processes related to data security, building maintenance, and resource optimization. The use of BIM contributes to improved operational efficiency, reduced costs, and enhanced building resilience throughout their lifecycle.

Keywords

building operation, AIM, data management, data exchange, building lifecycle, maintenance, security, resilience, information space.

Introduction

The application of BIM technologies plays an important role in ensuring effective interaction between participants in construction processes. This approach has several advantages, including improved communication, efficient data exchange, the ability to reuse information, and minimizing data loss, misinterpretation, or conflicts. The implementation of such technologies in operating organizations is a key factor in improving overall efficiency throughout the entire lifecycle of the building.

The integration of BIM technologies aligns with the current legislation and regulatory documents of the Republic of Uzbekistan, as well as scientific advancements and best global practices in the design, construction, and operation of buildings. This article aims to develop recommendations and optimal solutions for the application of BIM technologies during the operational phase, data management, and ensuring effective data exchange and storage.

Methods

The primary method applied in this study is the use of BIM technologies during the operational phase of buildings. At this stage of the building lifecycle, especially in the context of data management and information exchange, BIM technologies play a crucial role, ensuring not only the efficiency of all process participants but also improving the quality of building maintenance and operation. Implementing BIM in operations creates a unified information environment that ensures the interaction of all stakeholders, such as building owners, operators, contractors, service companies, and regulatory authorities.

Special attention is given to the application of the Asset Information Model (AIM), which serves as the foundation for organizing and storing all data collected during the building's operation. The AIM is a dynamic informational structure that includes all data about the building's condition, its components, systems, as well as maintenance, repair, and modernization plan and schedules. This model ensures the preservation of data obtained during the construction phase and allows for its use during the operational phase to make timely decisions related to maintenance, safety, and the building's sustainability. The AIM not only stores and updates data but also integrates information about expenses, the condition of engineering systems, energy usage, and other critical operational aspects, which helps optimize resources and improve service efficiency.

The application of AIM in operating organizations goes beyond just storing and updating data. This process involves actively using the data for analysis, forecasting, and optimizing the building's performance throughout its lifecycle. This study examines not only the technical side of BIM implementation but also the organizational aspects related to data management during the operational phase. This includes the creation and maintenance of standards and procedures that regulate data handling at all stages of building operation.

The fundamental principles of BIM implementation involve active participation from all stakeholders throughout the entire lifecycle of the building—from design and construction to post-operation and modernization. Responsible users, such as operational companies, service organizations, as well as owners and tenants, should be involved in the data management process from the start to ensure the effective use of information. It is important to note that BIM technologies become not just a tool for process automation but also a platform for coordinating actions among all participants. The effective integration of these technologies into organizational processes requires clearly defined roles and responsibilities for participants, as well as an interdisciplinary approach to data processing and analysis.

Results

The application of BIM technologies during the operational phase of buildings leads to the creation of a comprehensive and dynamic approach to data management, which is crucial for effective decision-making during building operation. With the Asset Information Model (AIM) collected during the construction phase and supported during operation, continuous updates about the building's condition can be ensured, which is necessary for various operational tasks. This significantly increases data transparency, improves accessibility and decision-making speed, and reduces the likelihood of errors and failures in operations.

The AIM significantly facilitates the data transfer between various stakeholders. During the operational phase, owners and management companies can access accurate and up-to-date information about the building's condition, enabling efficient planning for maintenance, modernization, and repairs. The use of BIM goes beyond just storing building condition data and also includes processes such as safety monitoring, resource management, and control over the condition of engineering systems and energy efficiency standards. All these aspects are important for ensuring effective building operation and long-term sustainability.

Furthermore, BIM helps in managing risks associated with building safety and sustainability. Using a dynamic and detailed data model allows for the quick identification of potential threats and proactive measures to prevent emergencies. The implementation of BIM also enables more efficient planning for the use of resources, such as energy, water, and other utilities, which helps reduce operational costs and enhance building performance.

The application of BIM in operations also allows for a more accurate assessment of the building’s performance, maintenance schedules, resource consumption, and environmental impact. This information is crucial for the building's sustainability, both economically and ecologically. The data collection about the building allows for not only improving operational processes but also more accurately forecasting the building’s future needs, which supports its further development and enhances the quality of life for its users.

Below are the main operational goals and methods for achieving them with the application of BIM.

1. Standardization of data on used equipment.

Goal: Ensure standardization of data on used equipment to ensure transparency and accessibility of information.

Method:

- Create a unified electronic catalog containing a complete set of data on equipment, including passports, technical characteristics, and other important documents;
- Maintain and regularly update data in electronic systems to ensure information relevance.

2. Minimizing human factor impact on the quality of operation and maintenance of equipment.

Goal: Reduce errors and the human factor's impact on the quality of operation and maintenance.

Method:

- Implement electronic operation logs and automated systems for registering service requests and completed tasks;
- Use mobile devices and automated systems for measuring indicators and transferring data, reducing the likelihood of errors and improving the accuracy of equipment condition control;
- Automate equipment inspection processes to reduce staff workload and improve equipment condition monitoring.

3. Implementing a risk-oriented approach in operation to reduce downtime of equipment.

Goal: Reduce equipment breakdowns and downtime, improve maintenance planning.

Method:

- Collect and analyze data to assess emergency risks and respond in a timely manner;
- Evaluate the impact of equipment malfunctions on the building's operation and prioritize repairs based on malfunction severity;
- Integrate equipment performance indicators with other systems for real-time analysis, which helps in responding to issues promptly;
- Use analytical tools to identify potential malfunctions and enhance equipment reliability.

4. Reducing operational costs, especially for complex repairs.

Goal: Reduce maintenance and repair costs, optimize personnel work.

Method:

- Use smart electronic manuals, virtual and augmented reality (VR/AR) tools for training staff, which helps accelerate personnel training for complex repairs;

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- Model the use of energy-efficient materials and equipment to enhance building energy efficiency, continuously monitor and analyze energy resources to reduce energy supply costs;
- Use VR/AR for training and simulations of various technical operations and situations, improving staff readiness and reducing preparation time.

5. Improving emergency preparedness and increasing staff response time

Goal: Enhance readiness for emergencies and increase staff response time.

Method:

- Simulate emergencies and train response actions using analytical simulators, virtual reality, and computer-based training systems;
- Assess the organization's readiness to eliminate emergencies and take immediate steps to improve preparedness;
- Analyze risk levels based on previous accidents at similar sites to better plan actions in case of emergencies.

6. Planning the building's service life (according to O'z DSt ISO 15686-7:2021).

Goal: Determine the service life of building components for efficient operation management.

Method:

- Develop an overall maintenance and replacement plan for building elements throughout the building's service life, considering wear rates;
- Evaluate the remaining service life of building components (real wear rates) and plan repairs and replacements to maintain system functionality;
- Assess the environmental impact of building elements during operation and analyze potential environmental risks;
- Forecast the likelihood of wear for various building elements and plan actions to extend their service life.

7. Assessing the building's elements' service life in real operational conditions.

Goal: Determine the actual service life of each building element under operational conditions.

Method:

- Collect and analyze data on each building element's condition, including microclimate, operational characteristics, operating mode, and required maintenance;
- Simulate different operating conditions and their impact on building elements, allowing for more accurate forecasts of service life and necessary repairs or replacements.

Discussion

The results of the study highlight the importance of integrating BIM technologies in operating organizations. The application of these technologies significantly optimizes building management processes and ensures efficient operation at all stages of the building lifecycle. However, successful BIM integration into operational processes requires careful planning, the creation of data management infrastructure, and establishing clear roles and responsibilities among participants.

For BIM technologies to become an effective tool during the operational phase, it is necessary to create internal standards and procedures for data handling, such as those described in international standards like ISO 19650, ISO 55000, and ISO 9001. These standards help ensure high-quality data and its integration into operational processes. It is also essential that all building and operational data be available in a unified information environment to ensure effective data exchange among all operational participants.

One of the key aspects of BIM's successful application is creating a Common Data Environment (CDE), which ensures easy access to data for all participants. Data must be standardized and adhere to a unified format, enabling prompt data exchange and informed decision-making.

Additionally, data security and confidentiality play a critical role during operation, especially when dealing with infrastructure data, such as heating, ventilation, and safety systems. It is necessary to ensure data protection from unauthorized access and leaks and guarantee its integrity and currency. Data management during operation also involves tasks related to maintaining data integrity, ensuring access, and protecting against external threats.

The application of BIM also allows for a more accurate assessment of the building's environmental impact, which is becoming increasingly important in the context of sustainable development. Using data related to energy consumption, CO_2 emissions, and other environmental factors helps significantly reduce the negative environmental impact and improve building sustainability.

Conclusions

The implementation of BIM technologies in building operating organizations significantly enhances the management and maintenance of buildings throughout their entire lifecycle. The Asset Information Model (AIM) acts as a central repository for critical data, which is essential for maintaining building systems and facilitating necessary updates. By leveraging BIM, organizations can achieve improved operational efficiency, reduced costs, and increased building resilience, ensuring long-term sustainability.

This study highlights the importance of establishing detailed data requirements and clear protocols for data exchange. These practices enable operating organizations to effectively manage construction-related information, optimize resource utilization, and enhance overall building performance. Through BIM, organizations can ensure data accuracy, security, and accessibility, ultimately supporting the ongoing development and modernization of the building infrastructure.

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