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INVOLVEMENT OF BUILDING INFORMATION MODELING IN ENERGY EFFICIENCY AND RETROFITTING OF BUILDING PROJECTS

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1. State of art

Nowadays building projects have been encouraged to adopt green and sustainable construction strategies as the construction sector is being responsible for using 42 % of the world's energy, 30 % of its raw materials, and 25 % of its fresh water. The priority purpose is not only to upgrade and enhance projects of existing buildings, the target is also to reevaluate the approach of the whole construction sector [5]. The issue requires complex and modern methods which should include retrofitting as well as reconstruction of existing infrastructure. The housing fund of Ukraine as well as other European countries calls for alterations which will lead to gaining and raising its energy efficiency. To create the optimum alternatives there should be conducted an investigation of the possibilities of changing the real estate's usage. A framework for value engineering and building information modeling, especially appropriate for existing buildings, is required to aid decision-makers in selecting the best options for current building utilization.

Retrofitting is the process of modifying something after it has been manufactured. Retrofitting a building involves changing its systems or structure after its initial construction. As a result there are improvements in amenities and significant reduction in energy and water usage. Moreover, upgrading entire building and its systems decreases negative effects on the environment and therefore benefits the comfort of residents. Thus, such targets as reducing operational costs, improving residents` health and productivity can be achieved Energy efficient retrofit of the building stock is an important and contemporary issue in the built environment [1]. Building Information Modeling (BIM) can offer a comprehensive and integrating platform for construction projects, as has been demonstrated for many large-scale schemes, mostly in new buildings but sometime also in retrofit projects. This research focuses on the potential of adopting BIM through a smaller scale activity of residential retrofit to achieve energy efficient housing. Although many strategies and technologies have been developed during the last decades, retrofit processes are still confronted by technical, economic and social challenges. This paper investigates how BIM may be integrated all the way through the residential retrofit process and how new digital technology can be engaged.

2. Key targets of the research

One of the purposes of the research is to improve the energy efficiency of the building through a review of alternatives for architectural and technical solutions. This may be achieved by making an attempt to merge them during retrofitting process. Thus, the strategies are established and the energy consumption of the building can be simulated using various BIM programs. As a result, we acquire reduction of energy consumption and increase of the lifespan of the building by choosing one of the retrofitting methods. The effectiveness of BIM technologies allows implementing modern requirements to reduce the time and cost of design, optimize design solutions based on experience in designing new buildings and structures, providing the necessary information support of the investment project throughout its life cycle [1]. BIM is not just a technology, but also a collaborative method that can be used to enhance the quality of a project. The potential benefits of implementing BIM are consistent with the efficiency-related concerns previously stated, with some of the benefits of BIM adoption including the following:

• Process efficiency: the capacity of BIM to integrate all parties engaged in a project in order to facilitate information sharing and decision-making throughout the project life cycle;

• Communication effectiveness: BIM's capacity to provide a simpler communication system and flow between parties;

• Efficiency in monitoring project progress: the capacity of BIM to allow direct visual monitoring of what has been completed and what remains to be completed;

• Improved construction planning: BIM simplifies the planning stage of a project's lifecycle due to the concept of visualization of the project's activities and execution [5].

3. The results of the research

Achieving low energy consumption through retrofits of existing buildings is a feasible objective. Lately, the Architecture, Engineering and Construction (AEC) industry has witnessed an increasing interest in using the concept of building information modeling in conjunction with sustainability principles during the design and construction of green building projects. BIM tools could help designers explore different design alternatives at the early stage and to transfer the design information to energy and simulation tools for validation and analysis efficiently and fast. On the other hand, by using BIM tools, owners can better visualize the development of their building projects all over the different stages of their construction. The building team uses BIM models to coordinate activities, takeoff material quantities and detect possible clashes between equipment [2].

A successful retrofitting project`s outcome includes improvement in vast number of aspects. The obtained developments cover

- Lower operating costs.
- Diminishing the building's energy expenses
- Increasing the life span of the building.
- Preserving the investment value of the project.

- Updating the building drawings which can be used for maintenance later.
- Improving the quality of the building's internal environment.
- Reducing the amount of carbon emissions emerging from demolition and manufacturing operations.
- Saving resources.
- Achieving thermal and visual comfort for residents of the building.
- Advancing the health of the residents.
- Creating opportunities for simple social relations and activities by exploiting the roof of the building or any unexploited spaces [1].

4. Conclusions

The expected outputs listed above may be achieved by means of Building information modeling (BIM). BIM is a mix of software and methodology. It creates a virtual building to construct it physically. The integration allows designers and builders to collaborate on a single aim in the most efficient way possible. The core of BIM is the concept of sharing and exchanging information among project's stakeholders throughout the entire building's life cycle. It provides platform-neutral file format which can be read and edited by any BIM software for better coordination and interoperability, hence, remaining linked to a generalized central approach that houses all building-associated data. It also supports the decision-making process using its multifaceted data processing and problem-solving techniques through modeling, simulation, visualization and optimization of alternatives [4]. This determines the precision and validity of the environmental analysis which is required for performing uncertainty and sensitivity analysis.

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