

# Use of Information Model in Creating the Investment-Construction Project

V M Cherkina<sup>1</sup>, N S Shushunova<sup>1</sup>

<sup>1</sup>Moscow State University of Civil Engineering, Department of Integrated Safety in Building, 129337, 26, Yaroslavskoye Shosse, Moscow, Russia

nshushun@gmail.com

**Abstract.** The use of information modeling technology in creating the investment-construction object provides a number of advantages to design, construction and operating organizations. Leading development companies should be transformed into a kind of IT-structure. In this regard, construction companies that develop their own strategies for switching to digital technologies and generate digital assets should, first of all, create the basis for their functioning - the integrated information model of the object - the BIM model. The latter includes all sections of the project and contains reliable and relevant information about the existing physical object. The concrete examples in this article show the results of the successful implementation of this approach in relation to capital construction projects of varying complexity.

## 1. Introduction

With the development of Building Information Modeling or BIM technologies, it becomes clear that the focus of interest in the construction industry is shifting toward the consumer, communication with him, as well as the means, channels and tools that make this communication as efficient and comfortable as possible. Developers in America and many European countries are already actively investing in startups which are creating digital ecosystems in residential projects and contribute to the digital transformation of the entire industry. Information modeling processes allow you to integrate and link the individual elements of technology, organize the collection and processing of data, support the process of making managerial decisions.

The relevance of using information modeling is also confirmed by the fact that since July 2019, Russian developers working under the shared construction scheme are required to apply to bank project financing exclusively using escrow accounts, i.e. with the deposit of monetary amounts from a third party so that these amounts are issued to the developer after fulfillment of certain obligations by him. This complication of financing instruments brings to life such qualities of the project as its transparency, accessibility to all participants in the transaction on-line, the ability to quickly analyse the sensitivity of the model to variations in design parameters, etc. In addition, there is a need for additional control of environmental friendliness, safety, quality of construction and ensuring the predictability of successful completion of the project. All these issues are extremely difficult to solve in the complex without using the BIM-model of the object.



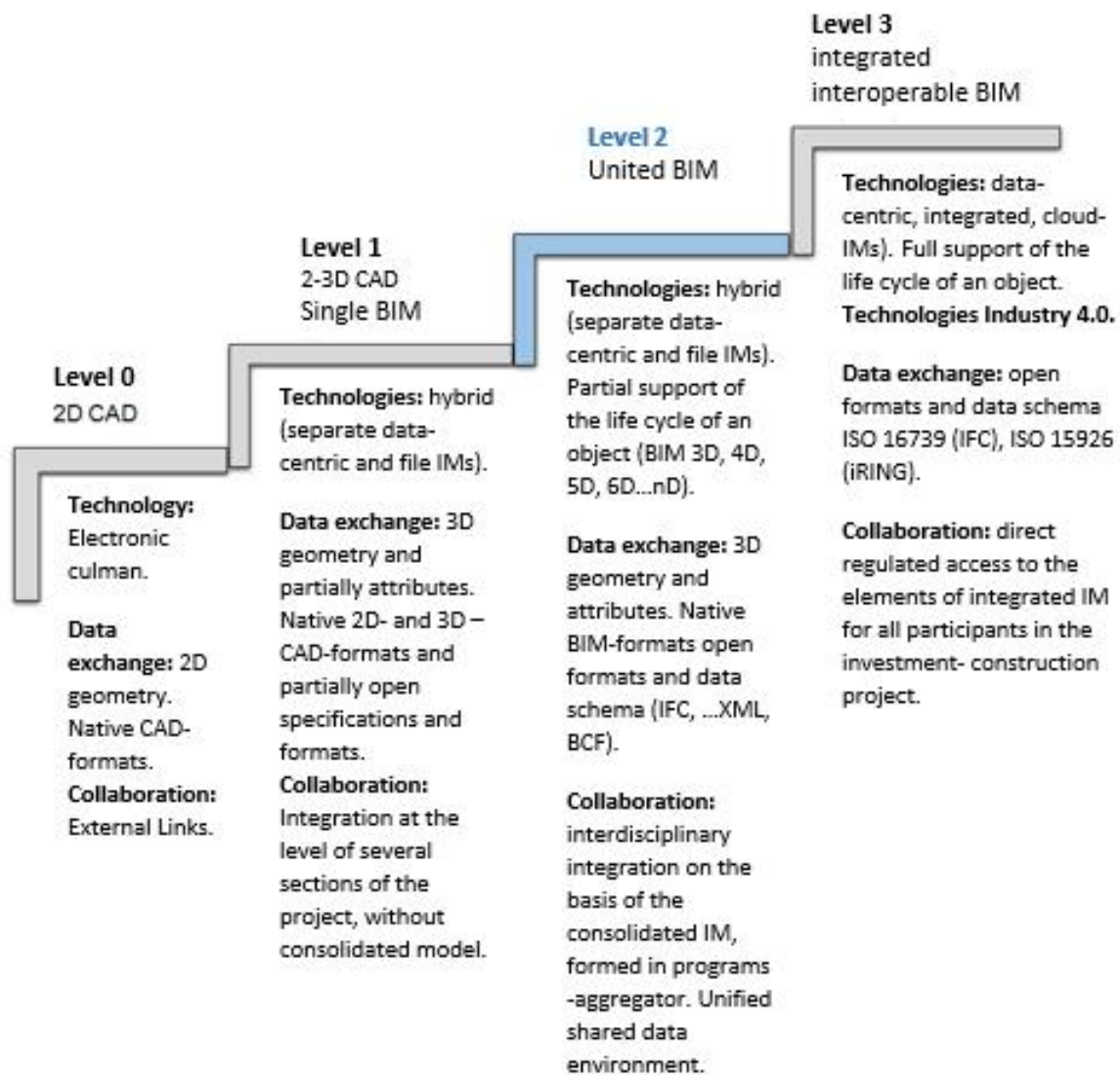
## 2. Methodology

There are standards and National Building Specification (NBS), UK-based technology platform and system of construction specification, used by architects and other building professionals, that help organize information modeling processes and establish modes for using information models at various stages with multiple methods for geometric and energy-related data acquisition to achieve one or more project goals [1,2].

### 2.1. Determination of the required level of study at various stages of the project

The factors, determining the necessity of buildings refurbishment are related to the problems encountered in particular building. We are considered one of the tasks of the design process - determining the required level of development of model elements at various stages of the project, in other words, determining the maturity level of information modeling technology.

Figure 1 shows the maturity model of information modeling technology, showing progress from 2D CAD to BIM Level 3. The model describes the maturity levels in relation to the ability of construction industry organizations to produce, store and share structured information.



**Figure 1.** Maturity model of information modeling technology.

Level 0: Uses traditional CAD in 2D format. Data exchange is carried out mainly at the level of 2D geometry. Collaboration is practically absent or implemented through external links.

Level 1: This is the level at which most organizations currently operate. Usually this is a combination of 3D CAD / BIM and 2D CAD (preparation of design and working documentation). A composite model is not formed, as many disciplines work in 2D. Data is exchanged at the level of 3D geometry and attributes within disciplines using 3D CAD / BIM solutions.

Level 2: This is the current maturity level of BIM technology. The main difference from the previous levels and the main goal of this level is the organization of joint coordinated work of multidisciplinary project teams based on a consolidated model placed in a shared data environment. Data exchange is carried out at the level of 3D geometry and attribute information. This level involves the addition of the following measurements: 4D (time, linking the model to calendar and network charts) and 5D (cost, purpose and linking of resources and prices), as well as partial use of the BIM model at all stages of the object's life cycle.

Level 3: It involves working through web services of all participants in an investment and construction project, including all design disciplines, with a single integrated data-centric information model based on open schemes, data formats, semantics and ontologies. Note that currently there are no implementations of documents and international standards at this level.

In the framework of 3D modeling, we can talk not only about building models of objects, but also about filling them with data, which in turn allows us to optimize management decision-making processes and subsequently connect product design tools with their production tools.

The determination of the maturity levels of information modeling technology can be used in the formation of technical specifications for the creation of a BIM model of an object [3,4].

Some scientists bring together the theory of Life Cycle Assessment (LCA) and the capabilities of BIM to survey the current developments in the energy efficiency of structural systems [5].

### **3. Results and discussions**

Nowadays developments in the smart energy sector focuses on the techniques in the main application areas, while highlighting some of the key challenges currently faced and outlining future pathways for the sector [6].

Consider the process of forming the technical specifications for BIM "Reconstruction of covering with landscaping system in energy-efficiency building". Covering with landscaping system belong to the field of construction, namely to the constructive solution of the coating, and can be used in the construction of "living" coatings for residential buildings, sports facilities, as well as coatings for any stations. The design provides also vertical system, as well as the ability to place and use devices that accumulate and convert energy, elements of water-irrigation control. The 3D model shows a continuous-form wall panel of such a covering of a public zone in a building (Figure 2).



**Figure 2.** The process of forming the technical specifications for the BIM reconstruction of the project.

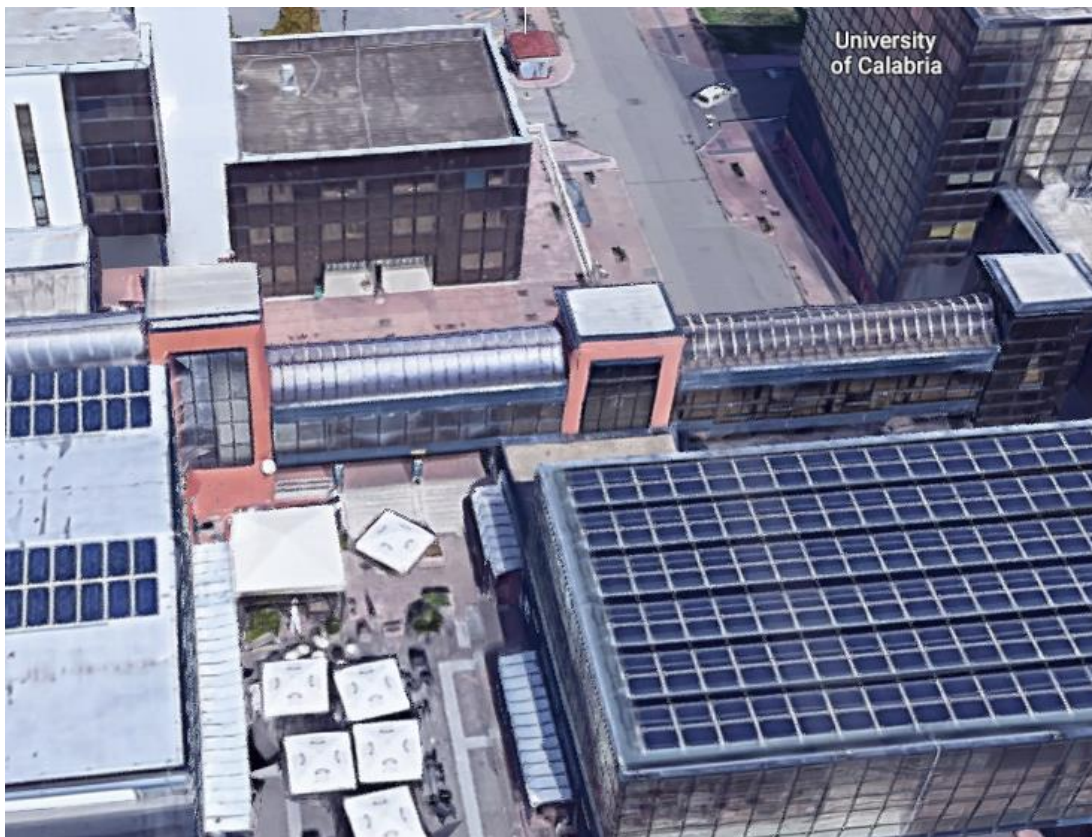
The technical result is achieved by the fact that space-planning schemes for the mutual arrangement of the coverage space. Thus, the problem of non-waste installation of structures is solved, since there is no labour-intensive work associated with cutting products.

3D models are needed to define the set of vital technical parameters depending of a vast spectrum of environmental and functional influences of the existing buildings under analysis [7].

Improved safety through increased construction awareness from easy review of complex details or processes on site, out of the working digital modeling benefits. Most of the public indoor facilities conditions do not meet the requirements of the hygiene standard, the thermal comfort parameters, in this case they must be renovated.

Creating of 3D models are allows to define the variety of technical parameters. The researching of coverings by P. Bevilacqua, D. Mazzeo, N. Arcurideals, M. Carbone et al. [21-26] with an experimental investigation of the dynamic thermal characteristics of a roof situated on a university building roof in south Italy, based on EN ISO 13790 Energy performance of buildings — Calculation of energy use for space heating and cooling (Figure 3).





**Figure 3.** The 3D view of roof, situated on the University of Calabria.

There are a number of BIM implementations from around the world that can be used to guide development of Russian BIM use, especially from GSA in the USA, and COBIM in Finland, Australian National Construction Code (NCC), Building Code of Australia (BCA) [8]. Thus, IFC, or "Industry Foundation Classes", is an international standard (ISO 16739-1:2018), usable across a wide range of hardware devices, software platforms, and interfaces for many different use cases, including the risk management assessments [9, 27-29].

#### 4. Conclusions

Nowadays many developers offer the buyer not just a specific unit of housing, but a diverse environment filled with infrastructure facilities, technological services and social activities. The choice of scenario will depend on the scale and resources of the company. However, in both cases, the priorities for investment will be BIM-design, mobile applications, intelligent systems of automatic control and management. Every third Russian developer offers high-tech solutions, which are commonly called "smart home" and "smart architecture". BIM technologies were involved in the design of 2 million square meters. m of real estate put into operation, which is about 30% of the total fund of objects [10]. Digital transformation is beneficial for both parties. The client receives a much more convenient product, adapted to his needs, and the developer optimizes costs, increasing efficiency. A new stage in the evolutionary cycle in the development of the industry has already begun. Its main content will be the opening by developers of additional opportunities and growth points in real estate management. Both construction companies and the consumer of their products have an interest in increasing the life cycle of projects. The client will receive the most comfortable living environment saturated with services, and the developer will expand the horizon for the development of the business or its individual segments.

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