International Journal of Sustainable Development and Planning
Vol. 19, No. 6, June, 2024, pp. 2125-2133
Journal homepage: http://iieta.org/journals/ijsdp

Investment in Housing Construction: Current Trends and Digital Technologies

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https://doi.org/10.18280/ijsdp.190612

Received: 18 January 2024
Revised: 10 April 2024
Accepted: 6 May 2024
Available online: 24 June 2024

Keywords:
ESG criteria, BIM technologies, crowdfunding, Fix-and-Flip, greening, smartization, security

ABSTRACT

Strengthening of such factors as urbanisation, aggravation of the ecological situation, the need to create safe living conditions, increase in building areas, high differentiation in the cost of housing and increase in the scale of social construction, etc. actualises the need to search for innovative forms of corporate investment strategies in housing construction. The purpose of article is to analyse modern trends in the development of investment processes in housing construction. The use of methods of generalisation and system analysis allowed to define the main directions of development of socially responsible investment in the sphere of housing construction; with the help of the method of system-structural analysis the strategy of using BIM-technologies was investigated in detail: essence, stages of implementation, peculiarities of use in different countries. The development of the housing construction industry is under the increasing influence of such external factors as safety, ecology, urbanisation and digitalisation. Corporate investment strategies in the residential construction industry are diversifying: Fix-and-Flip strategy, crowdfunding, investment in property investment funds. New flexible financial mechanisms are emerging, expanding the possibilities of attracting new resources. Modern digital tools make it possible to synthesise the imperatives of greening and smartisation on the basis of BIM (Building Information Modeling) technologies. The advantages of using BIM-technologies are: optimisation of the management and control process, reduction of construction and operation costs, increased coordination of all project participants, reduction of errors and mistakes in project documentation.

1. INTRODUCTION

The relevance of the search for innovative forms of corporate investment strategies in housing construction is associated, first of all, with such factors as: increased urbanization, aggravation of the environmental situation and the need to create safe living conditions, an increase in building area, high differentiation in the cost of housing and the need to increase the segment of social construction. Increasing urbanization is leading to a high concentration of population in cities - currently 4.2 billion people (55% of the world's population) live in cities. By 2050, the urban population is projected to double, with almost 7 out of 10 people in the world living in cities. With more than 80% of global GDP generated in cities, urbanization can promote sustainable growth by increasing productivity and enabling innovation and new ideas, but it also places greater pressure on the environment.

At the same time, there are significant disproportions in the cost of housing in different regions of the world. Thus, as of 2023, according to the International Construction Costs 2023 rating, Geneva has become the most expensive city for construction in the world, ahead of London. The UK capital came in second, New York came in third and San Francisco came in fourth. Overall, the top 10 most expensive places to build [1] included Geneva, London, New York, San Francisco, Munich, Zurich, Copenhagen, Hong Kong, Boston and Philadelphia. It is interesting to note that 4 of the most expensive cities to build are in the US, two are in Switzerland and only one is in Asia. There are quite a few British cities represented in the top 20: Bristol (13th place), Manchester (15th), Birmingham (17th).

Also in European countries, the problem of reducing the significant energy consumption and CO_2 emissions associated with the construction and operation of buildings requires immediate solutions. In this regard, current EU policy is focused on improving the energy efficiency of building structures during their operational phase (buildings account for 40% of final energy consumption in the EU and 36% of CO_2 emissions, making them the largest source of energy consumption in Europe [2]. However, more than four billion tons of cement are produced annually, which accounts for about 8% of global carbon emissions [3]. The resolution of environmental and economic conflicts associated with the development of the modern construction sector and the simultaneous urbanization of territories requires enterprises to

search for new strategies. These strategies must take into account social and environmental and economic priorities of modern society and are aimed at coordinating the interests of all participants in the housing construction market. For example, in the UK, all companies participating in tenders for government contracts worth more than £5 million per year must commit to achieving net zero emissions levels by 2050 [4, 5].

The purpose of article is to analyse modern trends in the development of investment processes in housing construction.

2. LITERATURE REVIEW

Complexity and diversity of problems of modern economic development make their adjustments in many processes, including the processes of housing construction. The problem of investment in housing construction has always been relevant in modern economic science and practice. The emergence of new trends and factors of economic growth (digital, environmental, social, etc.) has led to the emergence of new approaches to housing investment, and, accordingly, new theories of innovative investment: creative "investment theory" by Sternberg [6], direct investment theory by Dunning [7], social investment by Baron [8]. Large-scale digitalisation and platformisation bring revolutionary changes in the processes of investment financing, such new forms of investment as crowdfunding, Fix-and-Flip, green bonds, etc. appear. These new processes and phenomena are actively researched in contemporary works. For the first time the term crowdsourcing was applied by Dzh [9], justifying the advantages of collective intelligence, which is always more productive than an individual, even the most brilliant person. In his famous book he formulates the basic laws of crowdsourcing, gives many numerical examples of successful projects.

Crowdfunding emerged as a way to accumulate financial resources from multiple sources as donations. But now equity crowdfunding is also developing. The reasons for its growth are explored by A.K. Agrawal, assessing its impact on social welfare, rate and direction of innovation [10]. The differences between equity crowdfunding and donations crowdfunding are thoroughly analysed by Ahlers et al. [11]. Lehner [12] systematises the literature on social enterprise financing and crowdfunding, and states the need for its wider application, development of new approaches, investments based on bonds and shares.

Schweizer and Zhou [13] analyse the effectiveness of crowdfunding platforms, the interrelationships of their characteristics, the specifics of financing and the returns received. He proves that projects with higher investment risk (commercial property, development or reconstruction) on average have higher expected returns. Schwienbacher and Larralde [14] consider crowdfunding as an alternative way to finance projects, describes different business models used to collect money from the crowd, in particular with regard to the structure of the crowdfunding process. Mollick [15] analyses in detail the experience of implementing crowdfunding projects, the reasons for their successes and failures. Relates the success of the project to the personal characteristics and actions of the founders.

The possibilities of crowdfunding development in different spheres of economic activity are actively discussed in the literature. Thus, Gallego [16] describes mechanisms of participation in project financing for creative industries and offers a model that can work for all types of projects. Crowdfunding has a great potential for development in the sphere of real estate and housing construction, which also finds its development in scientific research. The advantages and disadvantages of using crowdfunding in the real estate sector are analysed by Vogel and Moll [17]. The advantages include Greater Transparency, More Investors and Smaller Minimums, Lower Fees, Benets of Having Local Investors, Enhanced Reporting and Accountability. Disadvantages include Investors Overestimate Their Expertise, Unrealistic Projections, Lack of a Personal Relationship to the Project Sponsor and to Other Investors, etc. The peculiarities of crowdfunding campaign of investment projects in the real estate sector and the prospects of its development in Poland are developed by Polish scientists Firek [18] and Gostkowska-Drzewicka [19].

The increasing importance of environmental, social and safety aspects of housing construction also form new emphases in housing investment strategies. These emphases are also reflected in regulatory documents regarding housing construction standards and are also becoming the subject of research in scientific literature. The principle of "corporate social responsibility" (CSR) has firmly entered the practice of modern business, different aspects of which are actively studied in the scientific literature: Ackerman [20] closely links it with ESG-principles, Bowen [21] emphasises the balance between private and public interests and values. Currently, CSR and ESG-principles are implemented in many regulatory documents of national and international level (EU, UN, etc.).

In addition, the digital transformation is beginning to encompass the construction processes themselves, which has led to the emergence of BIM (Building Information Modeling) technologies. The issues of developing new BIM strategies for investment in residential construction in many scientific papers. In particular, the introduction of BIM-technologies is accompanied by a number of obstacles and difficulties, as confirmed by Morlhon et al. [22]. Pointing to the great potential of BIM-technologies, they talk about the difficulties and the lack of systematic information about the experience of implementation of various projects. Therefore, their goal is to develop such a model of assistance for the implementation of BIM.

Hore et al. [23] rely on the report of the World Economic Forum, an action plan to accelerate the implementation of building information modelling, which is considered as a central element of digital transformation of the construction industry. They also note the complexities and slow pace of development. The authors document the results of a consultative survey of stakeholder representatives in Ireland conducted in mid-2019. This survey was designed to explore the relevance of some twenty-seven specific actions identified by the WEF to drive digital transition in the Irish construction industry.

Chan et al. [24], evaluate critical success factors (CSFs) for BIM implementation based on a survey and investigate their ranking and main relationships. A review of previous success factor studies identified a total of 28 CSFs, highlighting five major success factors for BIM implementation (in order of importance): standard platforms for integration and communication; development cost; education and training; standardisation (of product and process); and clear definition and understanding of user requirements.

Based on the identification of problems and obstacles of

building information modelling (BIM) implementation Khosrowshahi and Arayici [25] provide a diagnosis of the UK construction industry. They consider it necessary to consolidate collective movements towards a wider implementation of BIM, as well as to develop a strategy and recommendations for BIM implementation.

Chien et al. [26], identify and evaluate risk factors of BIM technology adoption. Chen et al. [27] argue that the building industry is urgently changing towards intelligent and digitalised tendencies. They investigate BIM-IoT integration and the relationship between BIM-IoT and sustainable construction.

Information modelling of construction taking into account all environmental, social, urban, safety criteria and others has great development prospects, opens new opportunities, but also causes new risks. Therefore, despite the wide representation in the scientific literature, the problems of investment market development in the sphere of housing construction require further development: analysing the development potential, searching for new investment strategies, studying new risks, technologies of successful implementation and others.

3. METHODOLOGY

The study of the processes of BIM-technologies implementation in construction, first of all, is based on the empirical method of collecting information about the current practice of investment in housing construction. The use of methods of generalisation and system analysis allowed us to identify the main trends in the development of investment processes in the sphere of housing construction, and, accordingly, the directions of development of investment strategies. It was confirmed that modern investment strategies in housing construction are increasingly beginning to include the following aspects: diversification of financial instruments of investment and the emergence of new ones (crowdfunding, fintech, etc.); socialisation, ecologisation and smartisation of all stages and processes of housing construction; digital transformation and the spread of BIM-technologies in construction.

The article reveals the application of ESG criterion (E - "environmental", S - "social", G - "governance") in investment strategies using the visualisation method. The main aspects of taking into account the objectives of environmental, social development and corporate governance when making investment decisions, which are set along with the achievement of the required financial indicators, are disclosed.

Using the method of system-structural analysis the strategy of BIM-technologies use is investigated in detail: its essence, stages of implementation, peculiarities of use in different countries. On the basis of the analysis of existing obstacles and difficulties of BIM-technologies implementation the road map of BIM implementation in the construction corporation is developed, in which its stages are detailed taking into account short-term and long-term goals of new information environment formation, as well as key factors of BIM implementation. The advantages and risks of using BIM are synthesised. Limitations in the development of this model are associated with the insufficiency and fragmentation of specific information on the implementation of a variety of projects. This greatly complicates the development of a universal model. Nevertheless, the authors hope that the proposed model can be useful not only in housing construction, but also in many areas of the economy.

4. PRESENTING MAIN MATERIAL

Investing in housing construction is a traditionally widespread practice and an effective form of capital accumulation. The advantage of this type of investment is provided by the constantly growing demand, which is the result of permanent increase in population. At the same time, modern development trends (socialisation, greening, securitisation, etc.) require the emergence of new aspects in housing investment strategies. As a result of the performed research, the following features of the development of corporate investment strategies in housing construction were identified:

- the use of new diversified forms of investment, the use of Fix-and-Flip strategies, crowdfunding, investments in real estate investment funds;
- large-scale implementation of “corporate social responsibility” (CSR) provisions;
- greening, smartization, securitization of construction, and first of all, housing construction;
- distribution of Building Information Modeling (BIM) technologies.

The increasing need for housing and the simultaneous increase in housing prices necessitate a constant search for new flexible forms of investment that would expand the possibilities of attracting funds from the population, potential buyers, businesses, and financial intermediaries. Equally important is the search for mechanisms to ease the financial burden of payments for investors, reduce and distribute investment risks. As a result, new mechanisms are emerging: crowdfunding, crowdinvesting, crowdlending, real estate investments through cryptocurrencies and blockchain, Fix-and-Flip strategy [25] and others.

The Fix-and-Flip strategy focuses the company's efforts on flipping homes as an investment method and involves purchasing foreclosed homes through concessions. The crowdfunding strategy involves consolidating resources with other investors to purchase real estate or issue loans. This investing strategy allows companies to find and track deals in exchange for a commission. The use of crowdfunding will allow you to purchase shares in highly liquid and expensive commercial and residential properties, including apartment complexes and commercial real estate.

The real estate investment trust (REIT) investment strategy allows investors to earn additional income without having to concentrate on maintaining their rental properties. Real estate investment trusts accumulate the financial resources of several investors and pool them for the purpose of purchasing and managing investment properties. Marketing market research is a component of all strategies; it involves the implementation of an in-depth analysis of the real estate market, which is always localized. At the same time, the specific features of the primary, secondary and tertiary real estate markets should be taken into account. At the same time, modern scientific works [26] note that a mandatory component of the investment strategy of construction companies is marketing policy [27].

One of the modern trends is compliance by construction enterprises with environmental standards and conscious use of natural resources. On the other hand, the demands of consumers are currently undergoing significant changes,

acting on the market as an organized force that shapes consumerism as a movement of consumers to protect their rights. The spread of environmental imperatives also expands the concept of security. Security in housing construction is understood in a broad sense: security in terms of housing protection; safety in the context of using building materials that are not harmful to health and the environment; use of construction technologies that are friendly to the natural environment.

An important basis for the development of new investment strategies in housing construction is the provisions of "corporate social responsibility" (CSR), on which the functional purpose of ESG principles, which are actively used in the restructuring of modern business processes in various fields, depends. Thus, according to Ackerman R.V., CSR is a form of corporate policy in which the values and interests of society are established as strategic priorities, and the functional purpose of ESG principles is to harmonize the interests of society and business and develop schemes for the practical implementation of CSR tools in areas of social investment and greening company behavior [28].

Hamel and Prahalad [29] noted that CSR is a form of organizing corporate behavior of a business in relation to the balance of private and public interests and values. At the same time, the functional purpose of ESG principles is to build an effective business model of responsible corporate behavior in the interests of the well-being of the entire society. It should be noted that the practice of using ESG principles is very differentiated, which is associated with differences in investment legislation, the level of adaptability of innovative technologies, and the level of development of environmental culture. Thus, in the United States, the practice of using ESG principles is implemented in the field of lobbying the corporate interests of the industry within the country and on the global market, as well as in the field of protection during trade wars and the transfer of green technologies. In the countries of the European Union, this system of principles is used as a tool for attracting corporate investment in environmental projects and green technologies, and in China - as a combined tool for protecting their own interests in trade wars with the United States and in order to increase environmental culture and business responsibility for the impact they have on nature and society.

In general, the basis of this corporate governance system is the concept of "values-based investing" (VBI) [30] using ESG criteria (E – "environmental", S – "social", G – "governance"). Its implementation implies taking into account the objectives of environmental, social development and corporate governance when making investment decision, along with achieving the necessary financial indicators [31]. It should be noted that such an approach to value-based investing is rather the basis for creating an appropriate methodology for making investment decisions when choosing areas for investment, and therefore only indirectly affects the creation of a common value for the enterprise and society. Accordingly, the more developed the stock market is and the stronger the influence of stakeholders (primarily investors) on the activities of enterprises, the more actively the ESG criterion will be introduced into the development of stock market.

The principles of responsible investment were developed by the UN and include six main tasks for institutional investors [32]: – implementation of ESG priorities (environment, social environment, corporate governance) in investment analysis and investment decision-making processes; – active implementation of shareholder rights and introduction of ESG objectives into enterprise management practices; – requiring appropriate disclosure of information about ESG objectives by those enterprises in which funds are invested; – promoting agreement and adoption of the principles of responsible investment in the investment industry; – joint efforts to improve the efficiency of implementation of the principles of responsible investment; – reporting on the activity and achieved results of implementing the principles of responsible investment.

In general, all forms of socially responsible investments, the implementation of which is based on taking into account the ESG criterion, can be grouped into four main areas that directly reflect the target orientation of such investments: – "Esg" investments (E – environmental) – a group of socially responsible investments, implementation which involves achieving a positive environmental effect; – "eSg" investments (S – social) – a group of socially responsible investments, the basic criterion for the implementation of which is the achievement of social goals; – "esG" investments (G – governance) – a group of socially responsible investments, the central place in the implementation of which is occupied by the criterion of corporate governance at the enterprise - the level of involvement of stakeholders in management decision-making processes, the degree of influence of shareholders on the formation of the company's development priorities, as well as transparency its activities in the field of socially responsible investments. – "ESG" investing is a cross-industry approach to socially responsible investments, which is characterized by comprehensive consideration of both the financial indicators of investment activity and the social, environmental or other effects it creates [33].

As part of the implementation of the investment strategy of "corporate social responsibility" (CSR), much attention is also paid to SMART cities, which can significantly improve the quality of life of the population, taking into account the peculiarities of urbanization processes and the need to solve infrastructure problems. For example, smart city development in Europe and the United States usually focuses on smart lifestyle, smart economy, smart governance, smart environment, smart energy, smart communications and smart transportation. Thus, the United States is prioritizing the construction of smart cities at the national strategic level, investing in infrastructure and smart networks. Europe, on the other hand, has focused more on improving energy efficiency. Japan's i-Japan strategy aims to create citizen-centric digital cities that build trust and vitality, while Singapore's Smart Nation 2015 plan has launched numerous projects to create a smarter city of the future.

From the point of view of the development of the construction industry, SMART cities are a concentration of high construction technologies, ergonomic use of design solutions and environmentally friendly building materials and structures and provide for: optimization of heat and water supply; rational mobility; control and regulation of traffic; optimization of problem areas for parking and parking; attracting investors to "green construction projects"; efficient road construction and improving the quality of road repairs; creating an accessible and high-quality environment for the mobility of people with disabilities; reducing emissions and improving waste management [34]. In this regard, the city's SMART model is mainly based on the following subsystems: a distribution microgeneration system, a Smart Grid system, which has bidirectional data circulation between the service

center (or control center) and the user, a system for intelligent measurement of energy consumption of each user, a system Smart buildings using integrated energy production, home automation and greening systems.

By adapting this approach to the formation of socially responsible investments in the field of housing construction, it is possible to formalize it in the form of the following diagram, Table 1. As part of environmental protection, it is advisable to select components that are produced with less energy (material selection), control water consumption both during construction and during the life cycle of the building; use less carbon-intensive and more environmentally friendly construction methods and new and innovative technologies; implement waste management, including waste reduction and reuse; apply forward-looking design—anticipating future climate change and creating climate-resilient built environments.

Table 1. An approach to the formation of socially responsible investments in the field of housing construction for a construction corporation

Category	Content
Environmental Protection	Prospects Design Selection of Materials Water Consumption Use of New and Innovative Technologies Waste Management Construction Methods
Development of Social Environment	Impact on Society Availability of Housing Facilities
Effective Government	Supply Professional Development Development of Cooperation Interactions with Stakeholders

* Source: developed by the authors

The situation in investment markets is changing so rapidly that searching and processing information in real time may not always ensure the adoption of the right management decisions. That is why the need to resolve issues of information support for the strategic management process and form a set of alternative strategies that take into account possible changes and risks of a dynamic external environment becomes urgent. In this regard, it is advisable to consider the practice of BIM - technologies that can become a tool for making the most efficient use of the resources of a construction company, taking into account the capabilities of modern business process modeling systems that allow optimizing time, financial costs, as well as human resource costs.

Building Information Modeling (BIM technologies) - information modeling of a construction project) provide effective management of design and construction, which as a result can significantly reduce the project implementation period, simplify the maintenance of the finished facility and extend its service life. Building information modeling is an innovative method of erecting, equipping, maintaining the operation and repair of a building, as well as collecting and comprehensive processing of information about the building during the design and construction process (architectural, technological, economic, etc).

The peculiarity of this method is that the construction project is designed virtually as a single whole. Changing any one of its parameters entails an automatic change in the remaining parameters and objects associated with it, up to drawings, visualizations, specifications and a schedule. BIM allows for the development of more accurate virtual models of a building in digital format for the purpose of constructing a facility, including design, construction, production.

BIM (Building Information Modeling) is the process of managing a digital model of a construction project at all stages of construction (design, construction, operation), which ensures the creation of an accurate and reliable multi-component information base for decision making [35]. At the preparatory stage, the territory of future construction is studied; a conceptual BIM model is created; calculations are carried out and the volume of construction and installation work is determined based on the information model; geotechnical data are entered into the base model; a project presentation is created. The main stage includes detailing the information model; filling with information about materials; coordination of related sections of the project. In this case, the main element of the system is a unified information model of the building, to which all participants in the construction process have access. This allows you to effectively carry out construction control functions, develop estimates and synchronize construction schedules. The use of BIM provides the developer with data about the construction site throughout the development and implementation of the project.

The possibility of using BIM is determined by the maturity level (from 0 to 3) of this technology in accordance with the BS1192:2007 standard, developed in the UK based on ISO 19650 [36]. Technology maturity level 0 includes CAD drawings, information exchange between project participants via electronic media, but excludes the ability to work in a shared environment. Technology maturity level 1 involves the exchange of information in digital format through a document management system, the presence of basic information and a conditional shared data environment. Technology maturity level 2 is characterized by the interaction of various specialists with the model, through a software application using a common file format. Technology maturity level 3 provides for the creation of a multi-level unified environment that allows you to integrate the work of all project participants (architects, system engineers, contractors, developers, managers). This implies the integration of all project data and all stages of project implementation, taking into account international standards and the compatibility of all data with the IFC format. At this level, the information model is filled with operational data in real time, which can be used not only at the design and construction stages, but also at the operation stage, including the entire life cycle of the building.

Currently, in many countries of North America and Europe (Great Britain, USA, Germany) approaches have been formed that ensure the implementation of BIM in the field of design and construction of facilities. In the USA, since 2003, a national BIM program has been created for the purpose of introducing BIM. In Europe and Asia, the transition to innovative technologies has been carried out since 2007.

In 2011, the UK government developed a strategy for the implementation of BIM technologies, the goal of which is to reduce the cost of construction and maintenance of a building, as well as reduce carbon emissions. One of the first projects to use BIM was the renovation of Heathrow Airport in the 80s. According to NBS statistics in the UK in 2020, 73% of companies used BIM technology in their projects (in 2011 - 13%). However, 62% of small businesses (less than 15 employees) in the UK use BIM and 80% of large enterprises. All government projects, including infrastructure and public buildings, use 3D BIM, including project and asset

information, documentation and other data in electronic formats, enabling a high degree of collaboration during the design and construction phases. For private projects, the use of BIM is recommended, but not required [37].

In Germany, 70% of construction companies (mainly architectural and design companies) use BIM technologies with maturity levels 2 and 1. It should be noted that in Germany, BIM technologies were first used in 2006 for the construction of large-scale projects. Since 2015, BIM technologies have been used for the construction of projects with a budget of 25 million euros or more. Since 2016, government contracting organizations can require the contractor to use BIM technologies. This requirement also applies to the design of transport systems, drinking water infrastructure and energy projects. Since 2017, the use of BIM technologies has been mandatory for projects worth more than 100 million euros. Currently, the German government is implementing a number of activities to use BIM technologies.

The government initiative "Project BIM4INFRA2020" provides for the implementation of a roadmap for the use of BIM technologies, within the framework of which seven pilot projects have been implemented, including transport infrastructure projects. As of 2020, the use of BIM is mandatory for all government contracts related to the construction of federal infrastructure or infrastructure-related buildings.

The German government has created the German Center for Digitization of the Construction Industry, the main objectives of which are the standardization of BIM technologies, professional training and consultations, and support for projects that use BIM technologies. The Association of German Engineers (VDI) is responsible for developing legal safety standards (VDI2552) and the German national standard for BIM technologies. The Federal Ministry of Transport and Digital Infrastructure (BMVI) provides financial support to small and medium-sized enterprises using BIM technologies.

In France, 35% of developers use BIM technologies for real estate projects, 60% of leaders in the French construction market have switched to BIM technologies, 30% of design bureaus have a BIM manager on their teams. It should be noted that in France the use of BIM technologies is not mandatory for capital construction projects. The most common level of maturity of BIM technologies is level 2.

According to a survey by Kantar Polska (2019), in Poland, out of 287 architectural and construction companies, 43% used BIM technologies in their projects (in 2015 - 25%), 76% of companies used the methodology of BIM technologies, more than 70 public, state construction projects were implemented facilities, including infrastructure projects. The use of BIM technologies is actively supported by the state. Thus, in 2014, Directives 2014/24/EU and 2014/25/EU on public procurement of the European Parliament and Council were adopted (02/26/2014). In 2020, the Ministry of Development, Labor and Technology developed a roadmap for the implementation of BIM technologies for public procurement in Poland. According to forecasts, the use of BIM technologies will become mandatory in Poland for capital construction projects with the state budget no earlier than 2030.

In Austria, 20% of small and medium-sized construction companies use BIM technologies. At the same time, the most common level of maturity is level 1, level 2 is actively developing. This is due to the fact that the international IFC format for exchanging BIM technology model data is used by a small number of Austrian design companies, which limits the scope of cooperation between partners. Since 2018, the use of BIM technologies has been mandatory for budget control during the construction of public buildings. Since 2020, in accordance with the recommendation of the European Commission, the use of BIM technologies is mandatory in Austria for tenders and contracts for public works. However, legislation to ensure wider use of BIM in Austria has not been adopted. The decision to use BIM remains with the customer and can be specified in the contract [37].

In general, the implementation of BIM technologies in European countries is at different stages and is determined by the level of government regulation, investment activity and the level of development of the construction market. The main problem with the active use of BIM technologies by construction companies is the high cost of the necessary software and personnel training. At the same time, work on BIM modeling is paid an order of magnitude higher than the average design profession and provides for regular training. Also, the lack of uniform standards and norms, classifiers, and regulatory framework for the use of BIM technology makes their implementation difficult.

Based on a generalisation of existing approaches to BIM implementation [21, 22, 38-41], the authors have developed a roadmap for implementing BIM technology in a construction corporation. On average, the cost of implementing BIM technologies can range from 5% to 10% of the company's total budget for the year. The proposed roadmap details the stages of its implementation, taking into account short-term and long-term goals for the formation of a new information environment, key factors for the implementation of BIM. The roadmap involves the implementation of the following stages:

1. Analysis of the company's needs and assessment of existing technology and production process.
2. Selecting a BIM platform.
3. Integration of the company's existing 2D design standards into 3D design in BIM.
4. Creation of a design model for the main activities of the company.
5. Development of recommendations for changing key personnel functions.
6. Training company employees to work in BIM.
7. Development of basic design technologies in BIM, including intradisciplinary work and interdisciplinary interaction.
8. Creation of a system for exchanging professional skills and competencies of company specialists in the use of BIM technologies.
9. Creation of three-dimensional models within only one or two directions (for example, utility networks, architecture).
10. Identification of company employees who take part in the technical processes of BIM implementation.
11. Analysis and control of financing of work on the implementation of BIM.
12. Management and control of the BIM implementation process using different reporting systems.
13. Calculation of key performance indicators for the use of BIM.
14. Adjustment of project implementation plans.
15. Implementation of pilot projects.

Key short-term goals for implementing BIM technology may be: attracting additional software and hardware with BIM support; development of BIM standards and templates for specific areas of BIM use; converting the selected 2D library to BIM; training a selected team of participants in order to

increase the level of competencies in BIM; preparation of the BIM working group; identifying and solving existing problems in current practice based on the assessment report; optimization of communications within the company; achieving the selected BIM maturity level (Level 2 or Level 3) based on the current status, as well as detailing operational actions.

Key long-term goals are: increasing productivity; complete transformation of all activities at the organizational level into a BIM system; staff development; ensuring the level of return on investment in the implementation of BIM; creation of a BIM ecosystem with competent external consultants in accordance with project activities; increasing the efficiency of daily project activities both within the company and outside it; reducing information loss and design conflicts for all projects; improving the quality of all projects in general beyond the scope of work; achieving the level of BIM implementation (level 2,3 or 4); expansion of new business opportunities.

Summarising the scientific literature [22] and the experience of BIM implementation at a wide range of enterprises and in different countries [36-41], the following key factors of their successful implementation have been identified: communication and information exchange; leadership; BIM training; BIM vision and strategy; availability of resources; motivation; choosing a BIM supplier; BIM implementation plan and policy; network relationship management; BIM performance measurement; senior management support.

The proposed roadmap of BIM implementation concerns directly the sphere of housing construction. At the same time, information modelling is widely used in many spheres of activity and in many enterprises of different sizes and forms of ownership. This model focuses on the key points that are important for the implementation of BIM projects (use of appropriate software, training of personnel, efficiency control at all stages, etc.). Therefore, the use of this model is possible for many other enterprises as well.

In conclusion, BIM is an important growing trend in the construction industry because of its ability to provide visualisation of the entire construction project. The use of BIM allows for a great deal of sustainability throughout the construction industry, especially when compared to traditional structural engineering design tools. With the rise of sustainable construction, BIM is becoming more prevalent than ever as a tool to reduce wasted time and materials. Environmentally, BIM can help reduce carbon emissions and optimise the energy consumption of residential construction projects, generally improving energy efficiency in the construction process. At the same time, the use of BIM can significantly improve the level of professional competence of personnel, ensure increased labour productivity, and optimise network models for the construction of facilities, which in general will ensure high social and economic efficiency of the company's activities.

5. DISCUSSION AND CONCLUSIONS

Thus, the development of the housing construction industry is increasingly influenced by external factors related to safety, ecology, urbanization and digitalization. All these factors actualize the search for new innovative forms of corporate investment strategies in housing construction. Corporate investment strategies in housing construction are being diversified: Fix-and-Flip strategy, crowdfunding, investments in real estate investment funds. New flexible financial mechanisms are emerging, expanding the possibilities of attracting new resources. With the help of modern digital tools, new investment technologies are being created that make it easier for potential investors to invest money and receive additional income.

The modern trend in the development of housing construction is not just the strengthening of trends in the spread of the concept of corporate social responsibility (CSR) in the strategies of construction corporations. ITS significance is significantly expanding, complemented by the imperatives of greening and smartization in housing construction. Digital technologies make it possible to synthesize all these aspects in the process of developing investment strategies based on BIM technologies.

It is important to note that the process of introducing BIM technologies into a construction company is fraught with risks. They are associated with the need to increase the competence of company employees to work with BIM, and increased company costs due to the acquisition of new equipment and software. At the same time, the introduction of BIM technologies may require changes in the company's business processes, which will also lead to increased costs and require additional efforts from staff. Given that the implementation of BIM technology requires the availability of high-quality data, there is also likely to be a risk in the quality of the company's internal information used, including project data. Therefore, another risk is the data security risk that is associated with storing large amounts of confidential information.

Thus, modern experience in using BIM technologies at different stages of a construction project allows us to consider BIM as an important growing trend in the construction industry, capable of providing visualization of the entire construction project. At the same time, as advantages of using this technology, optimization of the management and control process in accordance with the work schedule, reduction of construction and operation costs, increasing the level of consistency of all project participants, reducing the number of errors and inaccuracies in project documentation are justified.

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