UDC 332.8:330.1:177.1
DOI: https://doi.org/10.32782/2708-0366/2024.19.17

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IMPACT OF ECONOMIC FACTORS ON DESIGN AND CONSTRUCTION PROCESSES IN ARCHITECTURE AND CONSTRUCTION

ВПЛИВ ЕКОНОМІЧНИХ ЧИННИКІВ НА ПРОЦЕСИ ПРОЕКТУВАННЯ ТА БУДІВНИЦТВА В АРХІТЕКТУРНО-БУДІВЕЛЬНІЙ ГАЛУЗІ

The influence of economic factors on the design and construction processes in the architecture and construction industry is under consideration and theoretically underpinned. The following aspects (factors of influence) were found to be among the economic problems faced by Ukrainian architects, developers and urban planners. Design and construction costs are the first problematic and applied area. The general classification of design and construction costs has been presented. It is noted that a project can be made more affordable and efficient through effective project cost management and finding ways to optimise costs. The economic feasibility of using the latest technologies is the second area of concern and application. The authors argue that the introduction of modern technologies such as BIM (Building Information Modelling), 3D printing in architecture and intelligent systems in buildings often faces economic barriers. However, by increasing process efficiency and reducing time and financial costs, they believe these technologies can be cost effective in the long term. Another problematic, applied area is energy efficiency. It has been noted that energy efficiency in construction requires up-front investment that can significantly reduce future building maintenance costs. Both the long-term savings and the improvement in the quality of operation of the facilities should be taken into

account when assessing the profitability of such investments. It has been found that there are a number of ways to optimise the activities of a construction company. One of these ways is to implement an energy saving strategy in the company. This strategy consists of several stages. The first stage, based on the parameters of the company's energy status, is to formulate a set of objectives. This means calculating and setting targets for reducing the energy consumed and improving energy efficiency. The second stage is the planning and implementation of a series of measures to save energy in the building. These may include the installation of energy-saving equipment, the modernisation of heating and air-conditioning systems, the introduction of energy-efficient technologies in the construction process, the integration of energy-saving management systems, etc. The third step is to monitor the energy-saving processes. This includes systematic analysis and evaluation of the results of the implemented measures, monitoring energy consumption, identifying and eliminating potential problems. According to the authors, intensifying the introduction of new energy-saving technologies is the innovative component of a construction company's energy-saving activities. It is also important to develop scientifically based means of organising and managing the energy saving process in construction. The fourth problematic and applied area is the development and implementation of cost-effective norms and standards. It should be noted that improving the quality of design and construction, as well as improving economic performance by optimising the use of resources, can be achieved by updating the regulations and standards governing construction and architectural processes through the integration of new knowledge and technologies. In particular, the cost of running construction projects can be optimised by considering economic parameters in the development of norms and standards.

Keywords: *economic factors, design, construction in the architectural and construction industry, cost, investment, new technologies, standards.*

Розглянуто та теоретично обґрунтовано вплив економічних чинників на процеси проектування та будівництва в архітектурно-будівельній галузі. Визначено, що економічні проблеми, з якими зіштовхуються українські архітектори, будівельники та містобудівники, включають наступні аспекти (чинники впливу). Перший проблемно-прикладний напрямок – вартість проектування та будівництва. Подано, загальну класифікацію вартості проектування та будівництва. Зазначено, що ефективне управління вартістю проекту та пошук способів оптимізації витрат може допомогти зробити проект більш доступним та ефективним. Другий проблемно-прикладний напрямок – економічна доцільність використання новітніх технологій. У авторів виявляється думка, що введення сучасних технологій, таких як BIM (Building Information Modeling), 3D друк в архітектурі та «розумні» системи в будівлях, часто стикається з економічними перешкодами. Однак, вони вважають, що в довгостроковій перспективі ці технології можуть бути економічно вигідними завдяки підвищенню ефективності процесів та зменшенню тимчасових і фінансових витрат. Третій проблемно-прикладний напрямок – забезпечення енергоефективності. Зазначено, що для досягнення енергоефективності в будівництві необхідно зробити попередні інвестиції, але це дозволяє значно знижувати витрати на утримання будівель у майбутньому. Оцінювання рентабельності таких інвестицій повинно враховувати як довгострокову економію, так і покращення якості експлуатації об'єктів. Визначено, що для оптимізації діяльності будівельного підприємства було визначено ряд шляхів. Одним з таких шляхів є впровадження стратегії енергозбереження на підприємстві, яка передбачає декілька етапів. Перший етап – формування комплексу цільових показників, які базуються на параметрах енергетичного стану підприємства. Це означає розрахунок і встановлення мети щодо зниження споживання енергоресурсів та підвищення енергоефективності. Другий етап – планування та виконання комплексу заходів з енергозбереження. Це може включати інсталяцію енергозберігаючого обладнання, модернізацію систем опалення та кондиціонування, впровадження енергоефективних технологій у будівельний процес, інтеграцію систем управління енергозбереженням тощо. Третій етап – контроль за процесами енергозбереження. Це включає систематичний аналіз та оцінку результатів впроваджених заходів, моніторинг енергоспоживання, виявлення та усунення потенційних проблем. На думку авторів, інноваційною складовою енергозберігаючої діяльності будівельного підприємства є активізація впровадження нових технологій з енергозбереження. Також важливо розробляти науково-обґрунтовані засоби організації та управління енергозберігаючим процесом в будівництві. Четвертий проблемно-прикладний напрямок – розробка та впровадження економічно ефективних норм і стандартів. Зазначено, що актуалізація нормативних документів та стандартів, які регулюють будівельні та архітектурні процеси, шляхом інтеграції нових знань і технологій, може призвести до покращення якості проектування і будівництва, а також до поліпшення економічних

показників за рахунок оптимізації використання ресурсів. Зокрема, врахування економічних параметрів при розробці норм і стандартів може допомогти в оптимізації витрат на експлуатацію будівельних об'єктів.

Ключові слова: *економічні чинники, проектування, будівництво в архітектурно-будівельна галузь, вартість, інвестиції, новітні технології, стандарти.*

Formulation of the problem. Architecture and construction activities are an important part of any country's economy. They influence social life, the cultural environment and sustainable development. In order to understand and address the challenges faced by architects, builders, urban planners and various stakeholders, it is essential to understand the economic rationale behind the issues in this sector. In particular, an understanding of the economic, social and environmental aspects of construction is necessary in order to address the challenges of the sector. Avoiding and solving problems in the construction sector can be achieved through effective management, optimising the use of resources and understanding market needs. Such a business case is key to the continued successful development of the architecture and construction industry, helping to ensure sustainability and improve the quality of construction projects.

Analysis of recent research and publications. Various aspects of this problem have been the subject of study and presentation in the works of Ukrainian scientists, such as Y. Teslya, V. Gotz, H. Gotz [1]; I. Azarova [2]; L. Vasyutynska [3]; R. Trach [4]; T. Tkachenko, Y. Tokarska [5]; S. Karabanyk [6]; O. Perkhach, U. Samotos [7]; V. Kurilyak, V. Mazur [8]; S.P. Sonko, M. Skrynko [9]; O. Shcherbyna [10]; V. Skryl, E. Vasylenko [11]; S. Belyaev, N. Belyaeva [12]; D. Palamarchuk, N.O. Palamarchuk [13]; V.I. Savenko [14]; O.M. Sukhodolia [15]; T.F. Kozlovska [16]; O.V. Stukalenko [17]; S.V. Shapoval [18]. However, the problem is of great relevance and the scientific and applied aspects of it are in a constant state of change.

Formulation of the article objectives. The purpose of the study is to consider and theoretically substantiate the impact of economic factors on the design and construction processes in the architecture and construction industry.

Presentation of the main material. The following aspects (factors of influence) are among the economic problems faced by Ukrainian architects, developers and urban planners:

The first area of concern is the cost of the design and construction of buildings. The construction and architectural process begins with the design stage, which requires significant investment in research and development of design solutions. Overall property prices, housing affordability and the ability to deliver infrastructure projects are directly affected by the cost of design and construction. This is because the cost of construction materials, labour, equipment and land rent, as well as design and permitting costs, can be a burden on developers.

If design and construction costs are high, the result can be higher prices for new housing. For a wide range of people, particularly those on low incomes, this makes housing more difficult to afford. Construction costs can also have an impact on the implementation of infrastructure projects, as high costs can be an obstacle to their implementation.

In general terms, the cost of design and construction can include the following elements:

1. *Design* includes developing architectural, structural and engineering designs, manufacturing designs and other studies. The cost of design can be estimated as a percentage of the total construction cost. This is usually between 5% and 15%.

However, as the project progresses through its lifecycle, the accuracy of the project cost estimate is a variable that increases. For example, an approximate rough order of magnitude (ROM) in the range of -25% to +75% can be estimated at the project initiation stage. In addition, as the project work is carried out and information on its cost is obtained, the final estimates may reduce the range of accuracy from -5% to +10% [3, p. 7].

Real estate development projects, for example, typically require investments that exceed the available resources of those involved in the project. Only by raising additional external

funds can such projects be financed. In the most common real estate investment scheme, after the investment of about 10% of its own funds in the project, the developer attracts a strategic investor who takes on at least 25% of the project costs. The next step is to take out a bank loan in the range of 25 to 30 per cent of the project cost. The contractor, who usually contributes 10% of the total estimated cost, then finances the project. Advances and previous rent payments from clients make up the rest. Looking for tenants starts no later than when the facility is 50% completed [2, p. 7].

It should be noted that the actual cost of construction and installation work is the sum of the costs incurred by a particular construction organisation in the course of the performance of specific work. The purpose of actual cost accounting is to reflect in a timely, complete and accurate manner the actual costs associated with the production and delivery of work to the client at various construction sites. It also identifies deviations from expected values and controls the use of material, labour and financial resources. In addition, cost accounting data are used for the analysis of internal production reserves and the determination of the actual financial performance of construction organisations and their divisions [6, p. 106].

2. *Materials*: the cost of materials used in construction can have a significant impact on the overall cost of a project. The price of materials depends on supply and demand as well as production and transport costs. For example, low-cost materials (sand, gravel) are unprofitable for long-distance transport. However, some are used in large quantities [7, p. 168]. Costs can be reduced by understanding market conditions and calculating material costs.

T.P. Tkachenko and Y.O. Tokarska [5] emphasize the importance of the above-mentioned thesis; in their opinion, every construction company should plan the costs of construction and installation works. Such plans are prepared separately for each type of construction and installation works or on the basis of contractual agreements. The main objectives of this type of planning in the company are as follows (1) to determine the amount of costs that will be incurred for the construction work; (2) to organise the management accounting of the contractor; (3) to determine the price of the tender. Design and costing documentation, contractual agreements and other sources of information can provide the data for such calculations. In the course of the calculations, the company should have a clear understanding of its capabilities and resources for the execution of the work. To achieve the most effective results, all the company's planned expenditure should be considered and evaluated.

3. *Labour*: labour costs, which include the salaries of labourers and engineers, also affect the total cost of the project. Depending on the standard of living, geographical location and skills of the workforce, the cost of labour can vary. One of the basic principles of modern management is the statement: "You only do what you are paid to do" [8, p. 163].

4. *Infrastructure*: infrastructure costs such as roads, utilities, communication systems, etc. may be included in the cost of construction. Especially in large cities or industrial projects, these costs can be high. S.P. Sonko and M.M. Skrynko note that infrastructure is massively transforming into a separate sector, which can be compared to wagons joining the train of known "real" production sectors, "basic" sectors (or those producing means of production), and even those producing consumer goods [9, p. 4].

5. *Overheads* include project management, licensing, insurance and other costs associated with organising and managing the construction process.

Developing and changing pricing policies should be in line with the company's objectives and reflect market fluctuations. Pricing is important for the profit and sales of the company. Effective competitive pricing can affect sales volumes, which in turn affect the costs and profits of the business as a whole. Pricing therefore helps to balance the interests of producers in terms of profitability, maintaining market positions and gaining new market shares, and increasing sales [10, p. 116].

The cost of design and construction can therefore be significant and can vary depending on a number of factors. A project can be made more affordable and efficient by effectively managing project costs and finding ways to optimise costs.

The economic feasibility of using the latest technologies is the second area of concern and application. The introduction of modern technologies such as BIM, 3D printing in architecture and smart systems in buildings often faces economic barriers. However, they can be cost-effective in the long run by improving process efficiency and reducing time and financial costs.

It is necessary to create an information environment structure that contains the information required for project management in order to make productive use of the concept and design phases.

The quality of all design, technological, organisational, economic and management decisions in all phases of preparation and management will be improved by the introduction of an information environment. This applies to the construction of new facilities as well as to the reconstruction and technical re-equipment of existing enterprises. This approach makes it possible to achieve tangible results in terms of savings in time, material and human resources [1, p. 57].

For example, the use of BIM (Building Information Modelling) allows the creation of digital models of buildings. This facilitates the management of the construction process, reduces errors and conflicts, and ensures the optimal use of resources. In addition, by reducing material and labour costs, the introduction of 3D printing in architecture can be cost effective. 3D printing enables faster and more efficient production of building elements than the traditional construction process, which can be time and resource intensive.

However, it's important to remember that the construction industry is considered to be conservative when it comes to adopting new technologies. Another difficulty is the construction industry itself. It has its own specific problems and is not fully ready for such a revolutionary technology. The transparency offered by this technology often puts the contractor at a disadvantage. In a "fuzzy" project, it is easier to increase the estimated cost, to include some unnecessary operations and to include materials that will not be needed later. This is not the case with a virtual construction model (Building Information Modeling, BIM), where it is very clear what needs to be done, where it needs to be done and, most importantly, how much it is going to cost. However, this kind of transparency in a project is not convenient for everyone [4, p. 212].

There are also economic benefits to be gained from introducing smart systems in buildings. For example, energy costs can be reduced and a comfortable environment maintained for residents through the use of advanced energy efficiency management technologies. Energy companies can reduce energy consumption by consumers through the use of automated demand response systems. These can encourage consumers to turn off power during peak hours, resulting in energy savings for both consumers and energy companies. In addition, energy companies can use information about the consumption patterns of appliances (understanding of the consumer profile) to develop energy efficiency projects for their customers [15, p.12].

Automated process control systems can reduce energy consumption by up to 10-20%, increase productivity by 5-8%, significantly improve comfort and safety, and reduce environmental impact in business centres, administrative buildings, hotels and other buildings. As a result, the total cost of running a building is reduced by up to 30%. Repair costs are almost halved. Thanks to automation, the technical operation of such buildings becomes easier – depending on the complexity of the automated solutions, one dispatcher per residential building is sufficient. Experts also note that building "smart buildings" from scratch, rather than upgrading existing ones, is more efficient and economically justifiable [20].

Thus, when a building is equipped with automated control systems for its technological processes, a significant economic effect is achieved. This effect varies not only according to the equipment used and the algorithms for optimising its operating modes, but also according to who operates the building and what the objectives of the investor are.

Reducing the cost of resources, materials and labour, increasing the productivity and efficiency of processes, shortening the time of project implementation and increasing the speed of commissioning, ensuring the quality and accuracy of work, and increasing competitiveness in the market for construction and architectural services are the main economic benefits of using the latest technologies.

It should be noted that additional investment and staff training may be required at the implementation stage to introduce the latest technologies. In the long run, however, they may turn out to be an investment that will bring significant economic benefits. Moreover, the development of the modern construction and architectural industry, which is constantly changing and improving, requires such technologies.

Energy efficiency is a very important area to consider and apply. The need for energy efficiency leads to an increase in upfront investment. However, it also allows for a significant reduction in future building maintenance costs. Long-term savings and improvements in the quality of building operation should be considered when assessing the return on such investments.

Thermal refurbishment of buildings is one of the most significant examples and areas of change in Ukrainian construction. According to statistics, on average three times more energy is spent on heating in Ukraine than in the neighbouring country of Poland [12]. Of the 18 billion cubic metres of gas that are 'burned' for heat production, approximately 9.5 billion cubic metres are lost. One of the necessary steps in the solution of the problem is the recognition of this situation and the implementation of thermal modernisation. This process, which takes into account the principles of energy efficiency, should apply to both old and new buildings. Owners of both private homes and businesses are actively working on this issue. Experience shows that it brings significant economic benefits by reducing energy costs. Significant cost savings can be achieved through the judicious use of energy-efficient solutions and the promotion of new technologies in construction and repair.

In particular, in order to improve the energy efficiency of residential and civil buildings, the thermal insulation of buildings plays an important role. Currently, external insulation of multi-storey residential buildings, together with the installation of double-glazed windows, is used by most construction companies in Ukraine. The walls are better protected against freezing and swelling by external insulation. This helps to even out temperature fluctuations. This reduces the risk of deformation, which is particularly undesirable in industrial construction. Installing external insulation also prevents dew points forming in the centre of the wall and eliminates the need for additional vapour barriers. Another advantage of external thermal insulation is increased heat transfer from the wall mass [14, p. 329].

A basic management tool - the energy audit – is an important development option. Costs during the heating season can be reduced by 20–60% through a comprehensive energy audit and the use of recommendations from specialists. An energy audit or energy survey of buildings and structures (companies and organisations) is an assessment of all components of the company's activities that are related to the costs of fuel, energy of various types, water and some energy carriers. Such surveys are necessary to determine the level of energy saving potential. Even new buildings can have defects in walls, ceilings or floors that cause monthly maintenance costs.

As a result, an effective energy audit at the decision stage of an energy efficiency project will provide concrete answers to the following questions

1. Where and why is energy consumption (heat, water, light) in the company/building inefficient?

2. How critical are these losses to the company/building now and in the short term?

3. What measures could be in place to improve the energy efficiency of the company/building?

4. What is the approximate cost of the measures under consideration?

5. In what order of priority should the proposed measures be carried out in the absence of adequate financial resources [12, p. 69]?

The potential for energy savings is enormous for the whole world. Saved energy is the cheapest energy. Saving energy in buildings can be seen as an equal resource for developing the heating system. It is important to stress that investment in modern materials and energy-efficient construction technologies is economically viable. Additional investment in improved thermal insulation (thicker insulation), high thermal resistance glazing and other technologies will be justified many times over by the significant savings in energy consumption over the life cycle of the building.

Let us have a look at the optimisation of the building company itself. For the implementation of an energy saving strategy in a construction company, the following steps are foreseen: 1. Formation of a set of target indicators, calculated on the basis of the parameters of the energy state of the company. 2. Planning and implementation of a comprehensive set of energy saving measures. 3. Energy saving process monitoring. The innovative component of the energy saving activities of the construction complex is the intensification of the introduction of new energy saving technologies, the development of scientifically based means of organising and managing the energy saving process of the construction. Only after the resource support of innovative energy saving activities has been assessed, it is possible to choose effective energy saving technologies and measures, study factors influencing energy saving [18, p. 29].

Preliminary investments in energy efficiency may include the installation of energy-efficient heating systems, the insulation of buildings, the use of ecological energy sources, the introduction of energy-saving technologies, etc. The profitability of building maintenance can be increased in the future by gradually reducing energy costs. The money saved can be used for other purposes. It can also be used to improve the technical equipment and the quality of life of the building's users.

Both direct economic benefits (reduced energy costs) and indirect benefits such as environmental protection, reduced emissions and improved reputation should be considered when assessing the return on investment in energy efficiency. Potential risks, such as fluctuations in energy prices or changes in legislation, should also be taken into account when assessing the return on investment. Proper planning and evaluation of the return on investment in energy efficiency can help organisations to ensure sustainable growth, reduce costs and improve their competitiveness. This makes this area very important for the development of the Ukrainian economy.

The fourth area of concern is the development and implementation of regulations and standards that are cost effective. Updating regulations and standards for construction and architectural processes by integrating new knowledge and technologies can lead to higher quality design and construction, as well as improved economic parameters through optimised use of resources.

Current trends can be taken into account and more efficient solutions developed by integrating new knowledge and technologies into regulatory documents. For example, the inclusion of energy efficiency standards requires the use of energy-saving technologies and materials, which can reduce heating and air-conditioning costs. Such changes can improve the comfort of the occupants and reduce the dependency of the building on the energy supply.

There are also economic benefits to optimising the use of resources. For example, raw material shortages and construction costs can be reduced by developing standards for the use of recycled materials and waste recycling. The integrated processing of raw materials, i.e. the rational use of all components, can be facilitated by using different technologies and expanding the product range at a production site. As a result, transport, raw material, energy and material costs can be reduced. This leads to a reduction in production costs and an increase in the company's profit [16, p. 203].

In addition, construction time and design and operating costs can be reduced by standardising the construction process. In addition, the introduction of new technologies, which can stimulate the development of innovative sectors of the economy, is encouraged by the updating of standards. For example, the market for environmentally friendly technologies and materials can be expanded by including standards for the construction of green buildings.

In the Czech Republic, for example, financial support is provided for the insulation of existing housing stock, the installation of heating using renewable energy sources and the construction of passive energy houses through the Green Savings Programme [11]. The financial support for energy saving and renewable energy projects is focused on residential buildings of various forms of ownership and public facilities. By compensating part of the costs of implementing measures that lead to a reduction of energy consumption for space heating by at least 20% or its limitation to 70 kWh/m² per year, this mechanism provides incentives to owners or managers of residential buildings or public facilities. Thus, quality of life is improved and energy consumption is reduced by supporting investments in energy efficiency.

It is important to note that a number of regulations have been adopted recently. Some of them can be used as a starting point for the development of the national regulatory framework. These include basic building requirements, reliability and structural safety principles, and loads and effects. At the installation level, the most important are Bridges and Pipes, High-rise Buildings, Thermal Insulation and Facade Insulation. In total, there have been more than 60 regulatory documents which are in force. Unfortunately, these are not fully applied when designing and constructing. In particular, the active implementation of advanced innovative technologies and European experience is most favourable in the engineering sector. The Ukrainian market is saturated with high-efficiency equipment: recuperation, combined heating systems with electric boilers, ventilation, gas flue, heat metering and control systems. The regulatory framework in this area has been in the direction of harmonisation. In the last few years, about 20 regulatory documents have been introduced on this subject. Documents such as “Heating and Ventilation”, “Internal Water Supply and Sewerage” and “Gas Supply” continue to be developed and reviewed. However, the technical level of the projects under implementation is much lower than in countries where technology is more advanced [17, p. 118].

In particular, there is often a lack of attention to sustainability and environmental standards. When formulating standards and architectural and planning solutions, it is necessary to take into account the principles of environmentally friendly development of territories. These principles include the following basic provisions 1. Ensure the efficient use of natural resources. This includes the reduction of energy and water consumption and the rational use of land and vegetation. 2. Preserve biodiversity and green areas, providing spaces for developing natural ecosystems and continuums. 3. Ensure a healthy and safe environment for living, working and recreation. This includes reducing noise, air and water pollution and impacts on human health. 4. Create sustainable building principles including energy efficient technologies, renewable energy, using secondary materials and waste. 5. Ensure accessibility and comfort of space for people of different ages, mobility and inclusiveness. 6. Create principles for the efficient use of transport infrastructure, including the promotion of public transport and the development of infrastructure for cycling and pedestrian areas. 7. Consider the location and accessibility of key infrastructure facilities, educational and health facilities and employment opportunities, and the potential for social and economic development of the areas. 8. Use smart technologies and innovative approaches to planning and managing territories that promote sustainable development and improve the quality of life [19].

Updating codes and standards is therefore an important element in improving the quality of design and construction, and contributes to economic development by optimising the use of resources and stimulating innovation. However, not only the development of relevant

documents, but also their implementation and monitoring are necessary for the successful implementation of cost-effective norms and standards. This requires training professionals, providing adequate resources and creating a supportive regulatory environment.

Conclusions. In architecture and construction, economic factors have a significant impact on the design and construction process. Some of the key aspects of this impact are outlined below.

1. The cost of design and construction is one of the main factors that have an impact on the customer's decision to undertake a construction project. Land, materials, labour, equipment, engineering systems and other costs are included in the cost of design and construction. The availability of financing is a key factor in the commencement and completion of construction projects. Construction projects require significant investment. Economic instability or limited credit availability can result in delays or cancellations of project development.

2. The economic feasibility of using the latest technologies in the architecture and construction industry is an important issue, as it can contribute to increased construction efficiency, reduced costs and improved quality of the constructed facilities. The use of the latest technologies, such as 3D modelling, virtual reality, the Internet of Things and augmented reality, can help to conveniently plan and design a building and identify potential problems and errors before construction begins. The cost of correcting mistakes during construction can be significantly reduced. However, with the introduction of the latest technologies into the architecture and construction industry, it is important to consider the economic feasibility of their application. The cost of such technologies can be high, so it is important to consider the cost of investing and the expected economic benefits they are expected to bring. It is also important to avoid overcomplicating the technology, which can lead to additional costs for training staff and maintaining equipment.

3. Ensuring the energy efficiency of the building and construction industry is a very important area of development and a challenge for Ukraine. The construction industry in Ukraine is a significant consumer of energy. It is also a major emitter of greenhouse gases. High heating and air-conditioning costs and increased CO2 emissions result from excessive energy consumption and poor design of buildings and structures. The development of energy-efficient architecture and construction is therefore key to reducing energy consumption and the negative impact on the environment. This can include using innovative materials and technologies, adding energy efficient heating, cooling, lighting and other energy-saving solutions. The development of energy efficiency in the construction industry is actively supported by the Ukrainian government and international organisations. Many projects and programmes aim to raise awareness and provide financial and technical support for energy-efficient construction, such as Energy Efficiency and Renewable Energy in Residential Construction and Energy Efficient Ukraine. In addition, regulations have been put in place to promote energy efficient construction. However, there is still a need for more widespread adoption of energy efficient solutions in the building and construction industry.

Therefore, both direct economic benefits (i.e. reduced energy costs) and indirect benefits should be considered when assessing the return on investment in energy efficiency. Reduced energy bills, reduced fuel costs, reduced maintenance and repair costs and increased productivity can all be considered as direct economic benefits. Indirect benefits can include reduced emissions of greenhouse gases and other pollutants, improved air quality and human health, conserved natural resources, improved resilience to climate change, and reduced environmental impacts. To fully assess the return on investment in energy efficiency, it is important to take into account both direct and indirect benefits. This provides a more accurate and complete picture of its economic efficiency.

4. Developing and implementing cost-effective norms and standards in architecture and construction is an important task for developing the Ukrainian economy. The aim of this area is the improvement of the quality and efficiency of construction, the reduction of costs

and the assurance of the economic viability of projects. In order to ensure optimal costs and maximum efficiency, the development of cost-effective norms and standards involves the establishment of mandatory requirements and recommendations for the design, construction and operation of buildings and structures. This includes aspects such as energy efficiency, using renewable energy, building sustainability, safety and user comfort. The implementation of these norms and standards will contribute to the reduction of energy consumption and emissions, the improvement of the quality of life of the population, the reduction of heating and electricity costs and the creation of competitive and innovative construction projects. However, for successful implementation in this area, a number of factors need to be taken into account. First, there is a need to establish and monitor clear and accessible rules and guidelines for construction. Second, the development and implementation of effective codes and standards requires cooperation between government agencies, communities, professional organisations, businesses and other stakeholders.

In general, the architecture and construction sector of a country is significantly influenced by economic factors and conditions. For successful design and construction, their consideration and application by professionals in the sector is essential.

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