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NEW TECHNOLOGIES OF GREEN CONSTRUCTION: SUSTAINABILITY OR GREENWASHING?

НОВІ ТЕХНОЛОГІЇ ЗЕЛЕНОГО БУДІВНИЦТВА: S USTAINABILITY OR GREENWASHING?

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Abstract. *The article considers issues of green construction technologies and materials application from the standpoint of sustainability and benefits for society and economy. Overall trends in green construction market are outlined. Special attention is paid to latent challenges connected with certification of objects and materials in green construction. It is shown that although the standards of green certification in construction are designed to expand the consciousness of the professional community, to support more modern and rational sustainable solutions, they do not actually require buildings to prove that they are sustainable - applicants can receive LEED status only by presenting computer models that project the building. Moreover, BREEAM and LEED focus overwhelmingly on operational emissions rather than emissions from the construction supply chain. These gaps create 'favorable' ground for greenwashing phenomenon in green construction industry throughout the whole value chain. Conclusion is made that although green construction projects in overall contribute to the implementation of sustainable development goals, in green construction it is necessary to implement a value-oriented approach that focuses on identifying groups of stakeholders of an investment and construction project and substantiating their values.*

Key words: *green construction; sustainability; greenwashing; certification.*

Introduction

The state of the environment, which sharply limits the possibilities for further economic growth, requires the formation of a new "green" course for the economy. Therefore, in various international documents, the terms "green" industry, "green" markets, "green" innovations are more often used, implying new technologies with minimal environmental impact (biofuels, alternative energy, etc.). In modern society, green technologies are commonly understood as non-waste production, non-aggressive to the environment and, accordingly, to humans. In particular, recently, there has been a relative increase in "green" buildings in the world. By the end of the 20th century, the need to improve the state of the environment began to grow sharply. This was the reason for the popularization of "green" technologies in construction.

Green technologies are widely used in construction, proving high efficiency compared to conventional technologies. "Green" building is based on the construction and subsequent operation of buildings with a minimum level of energy and material consumption throughout the entire life cycle of the building (from design to disposal). The constant expansion of the existing diversity of the world's "green" construction proves the prospects for the introduction of "green" technologies in this industry. The growth of green building rates is clearly shown in

Fig. 1 and 2 below. According to Green Building Market Research Report 2030, "the Green Buildings market industry is projected to grow from USD 634.78 billion in 2022 to USD 1312.12 billion by 2030, exhibiting a compound annual growth rate (CAGR) of 9.50% during the forecast period" (Green Building Market Research Report 2030).

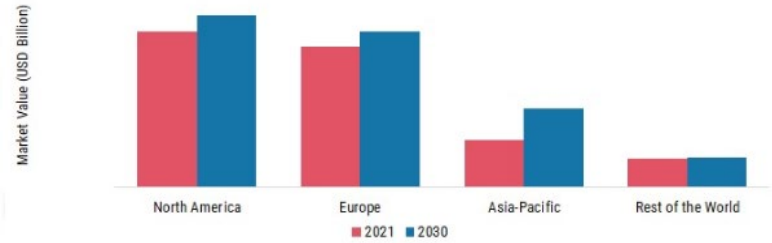

Fig. 1. Green building market size share growth (with forecast).
Source: Green building market research report 2030.

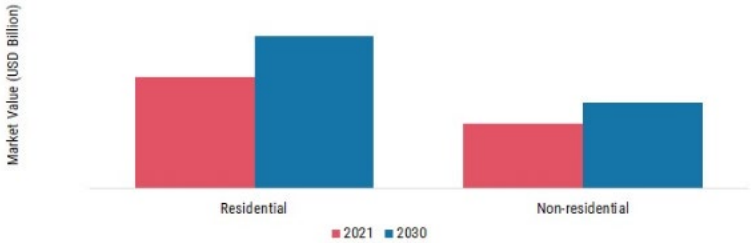

Fig. 2. Green building market size share growth in residential and non-residential sectors (with forecast).
Source: Green building market research report 2030

It is widely known that green buildings have less potential for negative environmental impact than standard buildings. This is achieved through a more efficient and rational use of resources, the use of alternative resources for the conservation of nature, waste recycling. Thus, the widespread practice of applying green construction principles in the world can be one of the effective tools for the sustainable development of society. Green buildings are designed primarily to reduce energy and water consumption. It is possible to reduce the consumption of these resources by an average of 25-30% and 30-50%, respectively (De Paula, Jyo, & Melhado, 2022; Kibert, 2022).

Success in achieving the goals of Green Building depends on many underlying factors in public life, the policies of states and the world community, professional knowledge in various fields of activity, the general interest and consistency of all sectors of society and specialists of various professions who are capable and striving for joint activities. Solving the problems of "Green Building" requires appropriate intellectual background and practical experience in the following areas: engineering communications, energy, building structures, materials science, ecology, architecture, urban planning, innovation, economics, law, organization, medicine, etc.

At the moment, green building in the world is developing rapidly. In many countries of the world, information about the economic, environmental, and social benefits of green building is in demand and is of interest to specialists and the public. Environmental benefits include: decrease of greenhouse gas emissions, reduction of

waste generation, reduction of polluted water discharges into the natural environment, conservation of natural resources. Economic benefits include: significant savings due to reduced energy and water consumption during building operations, increased facility capitalization, low financial and insurance costs, tenant interest, global recognition, corporate competition, openness and availability of green building technologies. Social benefits include: indoor comfort in terms of air quality, thermal and acoustic performance, better living conditions, health and well-being for residents and tenants.

However, along with the above benefits, there is also the infamous phenomenon of greenwashing in the field of green building. Today, it is quite obvious that green technologies are still more expensive than traditional ones, although their use also decreases the cost of all subsequent operation of buildings, reducing costs in the long term. Accordingly, the price for the consumer (user) of green buildings is significantly higher. Green building projects are very attractive for investors (and the interest of investors, including institutional ones, in the investing in green building projects is growing every year). In addition, green building developers in many regions and countries are entitled to some legislatively fixed preferences (in particular, in the field of taxes, etc., participation in tenders under public-private partnerships, etc.), which gave more rise to greenwashing. This applies not only to the construction of business real estate, but even to a greater extent - residential real estate, which is very often groundlessly positioned as eco-projects or high-quality business and elite class objects. In general, greenwashing ("green camouflage") represents a sound problem in the development of green building and requires careful study and development of measures to combat it.

Methods

In the course of the study, the methods of a systematic approach, behavioral economics, cognitive analysis, stakeholder theory, methods of analysis and synthesis, the methodology of a value-oriented approach were used, as well as general scientific methods of analysis and synthesis, a comparative approach, an abstract-logical research method for solution of the set research tasks.

Results and Discussion

Global green construction is based on the principle of "triple zero" - zero external energy consumption, absence of greenhouse gas emissions, and zero waste. In Europe, the eco-mainstream focuses on saving water and heat. Buildings are well insulated - for this purpose recuperators are used, that is, devices that allow heat to be taken from the air. A rainwater collection system is applied, thanks to which there are two water pipes: one is used for cleaning, watering, toilet, etc., while the other - for drinking water. An example of the mass construction of such houses is represented by passive unheated houses with ultra-low heat consumption. More than 15 thousand such houses have been built in recent years in Germany and Australia. A popular trend is eco-hi-tech - most often, office buildings with complex facades, a waste recycling system, and engineering systems are built in this style (Reddy, 2016).

Interestingly, an alternative to solar panels could be wind turbines, which are often used in high-rise buildings such as the World Trade Center in Bahrain. Located on high-rise floors of skyscrapers, wind turbines serve not only to generate electricity

which provides a significant part of the building's energy needs, but also to cool rooms, providing fresh air.

In green buildings, central systems for collecting melted and rainwater, as well as modern drinking water purification systems are installed. This equipment allows reducing the consumption of water resources from external sources. It is common to install special blinds that automatically change the level of inclination depending on natural light. So, on a sunny hot day, the blinds automatically close, which reduces the operating time of the air conditioning systems, and on cloudy days they provide access to light to reduce the use of artificial lighting. This technology allows for evident savings of energy.

Overall, benefits of using "green" technologies in construction are summarized in the Figure 3 below.

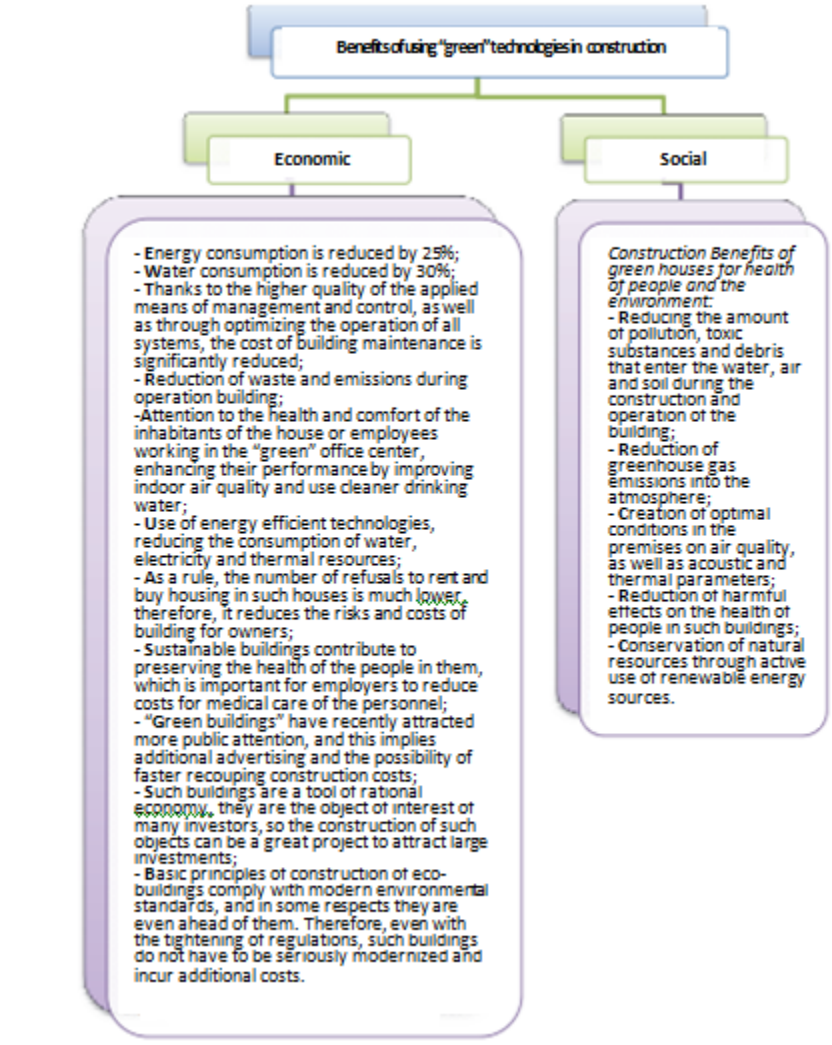

Fig. 3. Benefits of using "green" technologies in construction.

Source: Wen, B., Musa, S., Onn, C., Ramesh, S., Liang, L., Wang, W., Ma, K. (2020).The role and contribution of green buildings on sustainable development goals. Building and Environment, 185, 107091. https://doi.org/10.1016/j.buildenv.2020.107091

Green architecture seeks to minimize the amount of resources consumed in the construction, use, and operation of a building, reduce the environmental damage

caused by emissions, pollution and waste from its components, as well as minimize the harmful effects on human health and ensure environmental sustainability. Figure 4 below depicts the role and contribution of green buildings in sustainable development goals (Wen et al., 2020).

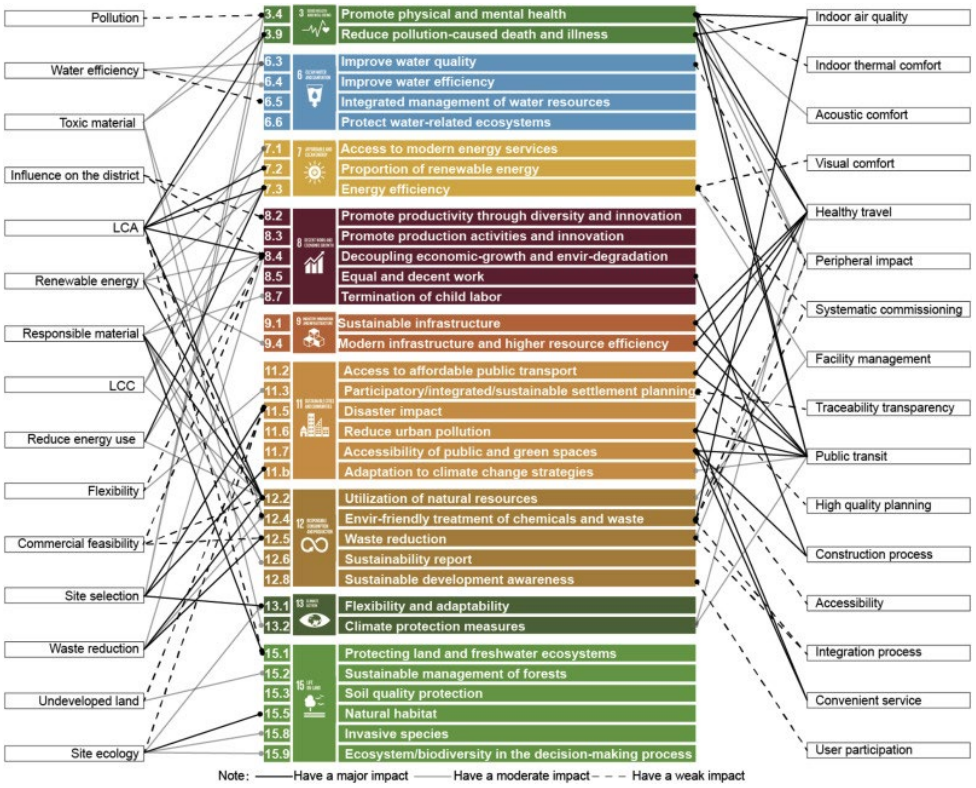

Fig. 4. The role and contribution of green buildings in sustainable development goals (SDG).

In the context of "green" building, the ideology of the "passive house" is widely used by European countries, which is partly due to the implementation of the relevant Energy Performance of Buildings Directive adopted by the EU countries, that provides for the approaching of all new buildings to energy neutrality - according to estimates of experts, namely buildings have the primacy in terms of energy consumption. In particular, 85% of energy consumption is for heating and cooling, and 15% for electricity (mainly for lighting) (Ledesma et al., 2020). Wall materials, ceilings, doors, and windows, as well as ventilation have a significant impact on energy consumption. In houses belonging to the category of "green" buildings, including "passive", heat saving and minimal use of energy for heating is achieved primarily due to the architectural and planning solution (for example, a blank north wall and a glazed south side for maximum insulation), installation of systems ventilation with recuperation (heat recovery), the use of renewable energy sources - solar panels, heat pumps and the like. The "passive" house is the modern and efficient form of energy-efficient building in the world that does not require heating, as heat is obtained from solar and internal thermal energy.

Each construction object built in accordance with the principles of green building must comply with certain environmental standards. This compliance is confirmed by a green certificate. Today, the leaders in the global environmental

community are the three environmental certification systems - BREEAM (Great Britain, 1990), LEED (USA, 1998), and DGNB (Germany, 2009). These environmental standards are actively used both in Europe and in other regions, while LEED is more popular among them. The green building certificate for a building is an indicator of quality in terms of environmental friendliness and energy efficiency, increasing the competitiveness and attractiveness of a building for tenants, customers and employees. In European countries, such a concept as an "eco-sustainable" architect is already actively developed – an architect who uses a national standard when designing, taking into account all aspects of environmental construction as much as possible. Construction objects are evaluated by points in categories (management, well-being, dangers, health, ecology, environmental pollution, energy, water, materials, waste, transport, innovation). After weighing all the points, a certification level is formed, expressed as a percentage of the result.

It is generally accepted that LEED certification increases the cost of a project. However, experience shows that the minimum certification or "Silver" level does not affect this, while certification for "Gold" and "Platinum" levels slightly increases the cost of the project during construction. Early integration of the LEED certification process reduces these additional costs. For example, the initial registration of a project under the LEED system in the US costs from $450 to $600, and the average cost of LEED certification is $2,000 and depends on the project itself. As environmental building standards improve and new technologies and innovations are introduced, the requirements of standards for environmental certification of construction projects are also changing. Thus, the tightening of requirements to reduce the amount of hydrocarbon emissions into the atmosphere during the operation of buildings leads to an increase in the number of LEED certification points that can be obtained for meeting these requirements. For example, for optimizing energy costs, now it is possible to get not 10, but 19 points, for the use of renewable energy sources in a project - not 3, but 7 points (Amiri et al., 2021). Reducing water consumption in the building by 20% compared to baseline calculations is now an obligatory requirement in LEED.

Customers are not ready to pay just for a certificate, experts confirm. However, after all, "green building" is not a certificate, but quite specific parameters of the object that need to be conveyed to the client. If a developer shows all the benefits of a "green" approach for the end consumer - be it energy efficiency, lower utility bills, visual and acoustic comfort in the building, etc. - buyers are willing to pay more for such objects.

In itself, a certificate in today's market is not a value for the client. It is only a confirmation of the developer's intentions to create a certain environment for life. Rather, it is a marketing ploy. However, building "in a green way" not only serves to attract customers, but also is really cost-effective for developers already at the construction stage.

In particular, price premium (%) acceptable to stakeholders with different degree of familiarity with green building concept is presented in Fig. 5.

Fig. 5. Price premium (%) acceptable to stakeholders with different degree of familiarity with green building concept

Source: Ofek, S., & Portnov, B. (2020). Differential effect of knowledge on stakeholders' willingness to pay green building price premium: Implications for cleaner production. Journal of Cleaner Production, 251, 119575.

The main principles underlying all modern green certification systems are the most rational and economical approach to the use of natural resources, respect for the environment and its minimum pollution, reuse of waste, the use of less harmful materials, etc. At the same time, the main task is to create comfortable conditions for a human, that is, lighting, air quality and indoor microclimate, convenient location of the building itself, its aesthetics and safety are just as important as a prudent approach to the environment. When developing LEED standards, for example, the goal was to expand the consciousness of the professional community, to support more modern and rational solutions that involve the use of more indicators, and not just the price and appearance of the product (Matisoff, Noonan, & Mazzolini, 2014).

The "green standard" is used primarily to prove the quality of real estate. This is a distinctive sign of prestige that enhances the image of the developer, and a marketing tool designed for appropriate audience. At the same time, this is also the testing of new technologies for subsequent construction. Standardization in green building, intended to promote the development of green technologies and ensure sustainability, at the same time has a downside - it becomes the "base" for greenwashing.

Ecological development requires a more thorough study of the construction site, carrying out all kinds of examinations and conclusions, which require additional financial costs and time, the choice of environmentally friendly materials, and so on. During the construction period, the costs will be somewhat higher and the technologies themselves are more complicated than in traditional construction, although the use of environmental standards and international green certification makes it possible to increase the investment attractiveness of projects and reduce operating costs. Therefore, those developers who build 'for the future', offer the market a higher quality product, are interested in long-term premium tenants, of course, advocate for "green" certification. In general, the concepts of "green project" and "benefit" are perfectly combined in the implementation of such a project. This becomes obvious if to include in consideration not only the actual implementation of the project, but also further operation of the object. Indeed, the building of a

commercial facility in accordance with the basic principles of green construction will cost the developer more. Based on international experience, one can say that the increase in construction costs is from 1% to 15% (Vyas & Jha, 2018). However, all this is subsequently more than compensated during the operation of the green building. Nevertheless, there are many players in the construction market - both developers and manufacturers of building materials - who are trying to get a green certificate when their products actually do not meet green sustainable building standards.

Companies which practice greenwashing, positioning themselves and their products as environmentally friendly for humans and nature, are in fact only aimed at increasing own profits. It is usually applied when significantly more money is spent on advertising and PR of "greenness" than on actually improving the consumer properties of the product/object and its production process. The use of such methods ranges from "unwinding" of some minor environmental factor to outright consumer fraud, when a green badge is placed on building and finishing materials containing harmful chemicals. One of the examples is "environmentally friendly" insulation. Often it is positioned as a product which includes only natural ingredients. However, information about the presence of binders - additional chemicals that are added to the material - is hushed up. In addition, the origin of raw materials is not taken into account (in particular, for production, wood that is cut down in violation of environmental legislation can be used). The fact that the material may emit harmful substances during operation is also not taken into account.

Various studies analyzed several thousand building materials that positioned themselves as environmentally friendly. The following categories of greenwashing have been identified (Chen et al., 2022; Goel, Ganesh, & Kaur, 2019; Kurnaz, 2021):

1. Hiding information - the environmental friendliness of any one factor is advertised, for example, the composition of the material, while the process of its production, installation, use, and disposal is extremely harmful to both nature and humans.

2. Lack of evidence. The manufacturer's claim is not supported by any significant research or third party certification.

3. Uncertainty. Too many green claims are deliberately made to give the customer a misleading impression, such as "contains only natural ingredients" on formaldehyde-releasing (natural but highly toxic) material.

4. Pseudo markings. A very popular approach is to put a green badge invented in the marketing department on the packaging of a material that has nothing to do with the environment friendliness.

5. Insignificance. The use of factors that are quite truthful, but in fact are not important for assessing the safety of the material.

Dykstra (2022) emphasizes that for more than 13 years of research on building and finishing materials, there have been hundreds of cases of minor allergic and dermatological reactions, as well as much more serious cases of significant deterioration in the health of residents, up to oncology and death.

Meanwhile, real, that is, credible labeling, firstly, must have a transparent, understandable methodological base, that is, a system for evaluating a product,

whether it is a building, material, or technology. Research methodology should take into account the impact on humans and the environment throughout the entire life cycle of the material, starting with production, continuing with installation, operation and ending with disposal. Another necessary requirement is the credibility and technical competence of the inspectors and laboratories. In addition, labeling should be independent of the major market players.

According to a Google survey, 58% of global CEOs have admitted to greenwashing and 68% in the US said their companies are guilty of greenwashing (Chen et al., 2022). Although these data are not directly related to the green building sector, they are very revealing. In addition to expanding the client base through greenwashing, unscrupulous players in the construction market are trying to get government preferences and government orders. For example, back in 2000, New York State was the first in the United States to introduce a green building tax credit, allowing some green building developers to deduct up to $6 million in taxes. The city's Department of Design and Construction has developed a set of guidelines that promote the incorporation of sustainable building practices into municipal projects. As a result, approximately $700 million had been invested in green building projects by the end of 2005. In the same 2005, the New York City government ruled that non-residential public buildings worth $2 million or more must be built to LEED standards in categories such as energy and water consumption, indoor air quality, and the use of renewable energy sources. The same legal requirements apply to private projects that receive $10 million or more in public funds or are funded 50% from the state budget (Leskinsen, Vimpari, & Junnila, 2020). Today, the volumes of PPPs in the field of green construction are even more impressive, which at the same time is a trigger for an increase in the scale of greenwashing in attempts by unscrupulous companies to win a tender for participation in construction PPP projects.

Companies are seeking success with their green credentials. “In 2020, the Competition and Markets Authority (CMA) discovered that 40% of green claims made online from companies could be misleading, particularly the construction sector, where it has been seen to make questionable net zero carbon claims in the last few years. For example, the CMA found that many companies were using vague claims and unclear language such as ‘eco’, ‘sustainable’ and ‘natural products’ without actually explaining what it means. Some were even hiding information from customers, hiding product pollution levels to make their products seem more eco-friendly” (Sadler, 2022).

Worldwide, more than two million buildings are LEED-certified, and about the same number are BREEAM-certified. A significant part of the buildings belongs to the ‘array’ of commercial real estate. On the one hand, this comes from the developer's obvious desire to capitalize on his project and increase its competitiveness. Many large companies principally rent offices only in “green” buildings. In addition, an object built using modern engineering solutions remains in demand on the commercial rental market for a longer time. On the other hand, an energy-efficient building can significantly reduce operating costs. At the same time, experts admit that environmental compliance certificates are, for the most part, a marketing tool. Many buildings that use energy wisely and delicately fit into the

environment may not have the ‘cherished insignia’ (Yudelson, 2016).

Eszter Gulacsy, a sustainability consultant from MTT/Sustain believes LEED is simpler in its approach, while BREEAM is more academic and more rigorous (Yadegaridehkordi et al., 2020). Thus, ‘skillful’ manipulation with features of both standards potentially can enable not quite fair obtaining of the certificate. Back in 2014, Forbes published shocking article, claiming that “LEED-certified buildings are often less energy-efficient than uncertified ones” (Swearingen, 2014). “Despite its name, LEED doesn’t actually require buildings to prove that they’re ahead of the curve on energy and water efficiency” – the article author writes, - “Applicants can acquire LEED status merely by offering computer models that project the building will meet a certain threshold. Moreover, they can do this even before the building is occupied. After that, buildings don’t have to demonstrate continued efficiency” (Swearingen, 2014).

Moreover, “Schemes such as BREEAM and LEED focus overwhelmingly on operational emissions rather than emissions from the construction supply chain, Waugh argued. However, embodied carbon emissions make up around half of all emissions from buildings. The percentage is rising as buildings become more energy-efficient and renewable energy becomes more prevalent. “The certification systems still focus on operational carbon,” said Waugh, who is founding director of London architecture studio Waugh Thistleton Architects (Fairs, 2021). “To achieve BREEAM's highest Outstanding rating, a building needs 85 credits, Waugh said. But only nine or ten credits are available for approaches that tackle embodied carbon, he claimed. To achieve Platinum under the LEED system, a building needs 80 points. But only three are available for embodied carbon, according to Waugh” (Fairs, 2021).

“The LEED rating system is also gimmicky. Installing a bike rack gets you a point, while adding only the minimum number of parking spaces scores you two. This allows buildings to take the easiest and cheapest path to green glory without actually doing much for the environment” (Swearingen, 2014). “Even though building developers can easily game the system, LEED certification can still add significant costs to a new building. These costs are often borne by taxpayers” (Swearingen, 2014).

At the moment, modern green construction is already one of the most effective tools for the sustainable development of various territories. Regional and local authorities in many countries are designing and implementing effective integrated programs for the development of green construction, thereby contributing to the sustainable development of the regions. Now all over the world, not just construction of green buildings is carried out, which are characterized by energy efficiency, water saving, favorable lighting and air conditioning, but already entire eco-cities are created. They are designed with the consideration of environmental impact and apply technology to minimize energy and water consumption, waste heat, carbon dioxide and methane air pollution, and water pollution. There are examples of sustainable cities in Australia, Brazil, Great Britain, Germany, Denmark, India, Ireland, Canada, Kenya, China, Korea, New Zealand, USA, Sweden, Ecuador, France. The application of real, non-greenwashed green building technologies has a number of environmental, social, and economic benefits.

Green buildings have a number of both obvious and hidden advantages. Explicit ones include an 8-10% reduction in operating costs, higher rental rates compared to traditional properties and a higher market value. The hidden benefit is more comfortable working conditions in such buildings. In Europe, America, and Asia, green building occupancy rates are higher than those of competitors. The market is finally beginning to realize the need to protect investments and their stability in the future - and not through short-term savings, but, on the contrary, by improving the quality of the project, which directly affects the life cycle of the building and its value. In turn, green building certification, which takes into account environmental aspects, is becoming the new standard, and investments in green building are increasingly affecting the future payback of the project and its financial attractiveness.

However, the misuse of such concepts as “environmentally friendly”, “green”, “organic” and others when positioning construction projects and facilities gives unscrupulous manufacturers the opportunity to mislead the consumer with impunity. The consequence of this is a decrease in the level of confidence of the latter in environmentally friendly products as such, including those actually certified as safe. Thus, conscientious manufacturers who have shown concern for their consumers and the environment and have incurred additional costs for the introduction of the latest environmentally friendly technologies, in the eyes of buyers, stand on a par with greenwashers and risk their positive reputation.

“Up until a decade or so ago, there were only a handful of sustainable buildings around the world. For example, in 2006, there were only 296 LEED-certified projects in the United States. However, the number grew to 67,200 in 2018, representing a 226-time increase” (Saleem, 2020). However, taking into account the above-mentioned drawbacks of certification quality, the field of green construction and its real influence on sustainable development requires further deep research.

Fighting greenwashing is difficult, but there are ways. In order to close the way to the market for unscrupulous manufacturers, joint efforts of all interested parties - from business to government - and the formation of a unified position on this issue are necessary. A fundamental factor in this fight is the education and literacy of consumers and stakeholders. Green building certification, or, as they say, “win-win”, in its essence, is a situation where everyone wins. The environment is less polluted, the users of the building acquire an environment of increased comfort, the certificate received by the architect confirms his professionalism, and the developer and builder, in addition to marketing advantages, receive additional profit.

The problem of developing “points of growth” in green construction is complicated due to the increase in investment costs compared to conventional construction projects. At the same time, the functional properties of green building products have a certain utility and, accordingly, value. Therefore, the most important requirement for the development of green construction is to increase awareness of the value aspects of objects and their corresponding economic efficiency throughout the entire life cycle. Objectively, the requirement for an adequate assessment of the economic profitability of the final and intermediate products of green construction is manifested based on the modeling of effects for all groups of stakeholders.

In connection with the foregoing, the development of evidence-based methodological tools and practical recommendations for managing the development of green construction based on the implementation of a value-oriented approach that focuses on identifying stakeholder groups of an investment and construction project and substantiating their values seems relevant. “Green Building” is a whole philosophy that requires a fundamental approach, a planetary, state, sectoral collective and individual approach and understanding.

Conclusion

Research, as well as daily practice of green construction itself in the world shows that green technologies used in building have an excellent potential to contribute to the achievement of UN sustainable development goals, both nationally and globally as a whole. Moreover, in the long term, the construction of green objects is economically beneficial for developers. At the same time, the desire for immediate profit is observed among the players in this market - it manifests itself in the form of the phenomenon of greenwashing. Even the well-established and seemingly reliable and trustable certificates LEED, BREEM, and the like, as practice shows, are not a guarantee of greenwashing’ absence. Effective counteraction to this extremely negative phenomenon, which undermines the foundations of investor’ and consumer’ confidence in green construction as such, is possible only on the basis of combining efforts and balancing the interests of all participants and stakeholders in the green building industry, including certifying bodies.

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Анотація. *У статті розглядаються питання використання технологій та матеріалів «зеленого» будівництва з позицій стійкості та користі для суспільства та економіки. Окреслено загальні тенденції ринку зеленого будівництва. Особливу увагу приділено латентним проблемам, пов'язаним із сертифікацією об'єктів і матеріалів у зеленому будівництві. Показано, що хоча стандарти зеленої сертифікації в будівництві розроблені для розширення свідомості професійної спільноти, підтримки більш сучасних і раціональних сталих рішень, вони насправді не вимагають реальних доказів екологічності будівель – заявники можуть отримати статус LEED лише шляхом представлення комп'ютерних моделей проекту будівлі. Крім того, BREEAM і LEED зосереджені переважно на експлуатаційних викидах, а не на викидах від будівельного ланцюга постачання. Ці прогалини створюють «сприятливе» підґрунтя для явища «грінвошингу» в галузі зеленого будівництва по всьому ланцюжку створення вартості. Зроблено висновок, що хоча проекти зеленого будівництва в цілому сприяють реалізації цілей сталого розвитку, в зеленому будівництві необхідно впроваджувати ціннісно-орієнтований підхід, який фокусується на визначенні груп зацікавлених сторін інвестиційно-будівельного проекту та обґрунтуванні їх цінностей.*

Ключові слова: *зелене будівництво; стійкість; грінвошинг; сертифікація*