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THE PROSPECTS OF GREEN BUILDING DEVELOPING IN UKRAINE ON EXAMPLE OF POLAND

Abstract. *This study is an analysis of the data and trends observed in green construction in Ukraine and Poland. Ukraine started developing green building in 2011 and Poland begin in 2008, but despite on little chronologic distance, modern situation in construction industry of these countries has dramatic differences. For today Poland is the leader of Eastern Europe green building with 845 certified objects and four new projects on average are registering every week, while less than 10 certificated green buildings present in all Ukraine. BREEAM is the most popular green certification system in Europe and share 76.8% of total green building market in Poland, but also LEED takes significant shares in education and hotel business, all HQE projects relate to housing, and DGNB appear in logistic and retail. The most perspective sustainable tendency in Poland is increasing green building projects in educational, logistic and industrial sectors. It is could be good example for Ukraine, as well as growing green certification of industrial buildings and residential real estate. Evidence is growing that green buildings bring multiple benefits and driving economic growth around the world. For Ukraine the key factors are promote sustainability in major building companies, create a favorable investment climate, and enlist government support to developing green building.*

Key words: *green building; certifications rating system; environmental safety*

Introduction

Construction is a resource intensive sector with a significant environmental influence [2]. Only energy consumption during operation of buildings (lighting, heating, air conditioning, etc.) is responsible for approximately 25%–40% of total energy consumption in in developed countries [9]. The building industry is responsible for 33% of energy-related greenhouse gas emissions, 40% of waste, and 12% of water use in the world [26]. In the same time, it is also the sector with the largest potential to reduce of negative environmental impact using currently available technologies. It was the reasons why green building arrangements are implemented in the construction sector for minimising negative impact to environmental.

Sustainability concept was adapted to fit construction industry, and reflected by numerous green buildings and structures. The sustainability in built environment also has three main dimensions: environmental, social, economic [9]. Green

buildings are responsibly created and managed construction environment, complying with the guidelines of natural environment protection and the efficient use of natural resources at the construction stage, their exploitation, reconstruction, and demolition [12]. Wherein sustainable buildings are not merely friendly to the environment, but also providing optimal utility to their users and local community, while ensuring certain profitability for their owners and investors.

Before, green building was exotic example of separate ecological trends outside the mainstream architecture, and the sustainable design was perceived as the opposite to economical design. In recent years there has been gradual shift in building sector paradigm, and now sustainability has been incorporated into mainstream of construction [16]. Currently most scientific papers show that innovative and sustainable real estate have higher value and positively related to return on investment and investment liquidity [1, 2, 7, 8, 9, 12, 13, 14, 17, 18, 19, 22, 24].

It is not surprising that European Commission identified construction as one of the three sectors, which should be the focus of efforts to resource efficiency of resources and the principles of sustainable development [11]. It is worth noting that certification systems such as Building Research Establishment Environmental Assessment Methodology (BREEAM), Leadership in Energy and Environmental Design (LEED), and Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB) have been applied not only in highly developed countries, but also expand on emerging markets more active with each year [4, 5, 16]. The problem of developing in the Ukrainian green building market is still understudied, both technically and conceptually. Poland is the leader of green building developing in East Europe [15], therefore their experience could be very useful for analyses and subsequent implementation in Ukraine.

Purpose of Research

The objective of this study is to compare the way of green building developing in Poland for adoption the best promising results in Ukraine according with modern trends of construction industry. This involves next tasks:

- analyzing the way of green building developing in Poland;
- choosing the best results of Polish experience for adoption in Ukraine;
- reviewing the main modern trends of building for imagine the future of construction industry.

Result of Research

The difference in the start time for the development of green building in Poland and Ukraine is only three years. Polish Green Building Council (PLGBC), founded in 2008, intends to transform the design, construction and operations of buildings in the entire country for the overall benefit of all residents as well as all participants of the construction process [21]. The first green buildings were certified in 2010 with British BREEAM and American LEED rating systems. Next certification system which come to Polish market in 2015 was French HQE. It is interesting that Germany standard DGNB which is very active in Europe made first certification in Poland only in 2016. Also need to mention WELL Building Standard which entered to Poland in 2017 (table 1).

Ukrainian Green Building Council (UAGBC) was established in 2011 and World Green Building Council (WorldGBC) assigned an initial status to the organization as “Perspective” [25]. DGNB support the creation of UAGBC and first in Eastern Europe green supermarket was received DGNB certificate in 2014 [5]. But first green buildings in Ukraine became U.S. Embassy and office of company Shell both certified under LEED in 2013. All U.S. federally-owned buildings have to be certificated under LEED standard [16]. In that time no office center in Ukraine had green certification, but according to Shell corporate policy it was obligatory to obtain certification of office space. First offices center in Kyiv was certified under BREEAM New Construction scheme in 2016 [3].

Table 1 – Comparison of green building developing initial stages in Poland and Ukraine

Green building stages	Poland	Ukraine
Green Building Council was established	2008	2011
First building with BREEAM certification	2010	2016
First building with LEED certification	2010	2013
First building with DGNB certification	2016	2014
First building with HQE certification	2015	--
First building with WELL certification	2017	--

Despite a more or less similar start, the further development of green building in Ukraine and Poland has dramatic differences. For today the number of certified buildings in Poland is more than 845 with 966 certificates [15] while there are less than 10 objects in Ukraine together with unfinished real estate projects (Figs 1, 2). While green building developing very slow in Ukraine, the sustainable positive dynamic growth dynamics observed in Poland. Now Poland is the certification leader in Central and Eastern Europe with 51% of certified facilities in are located here [15]. For other Eastern European countries the number of certified buildings are following: Czech Republic – 209, Romania – 202, Hungary – 163, Slovakia – 73, Lithuania – 49, Bulgaria – 47, Serbia – 18, Latvia – 17, Estonia – 14, Croatia – 9, Slovenia – 3 [3, 5, 10, 15, 16, 23].

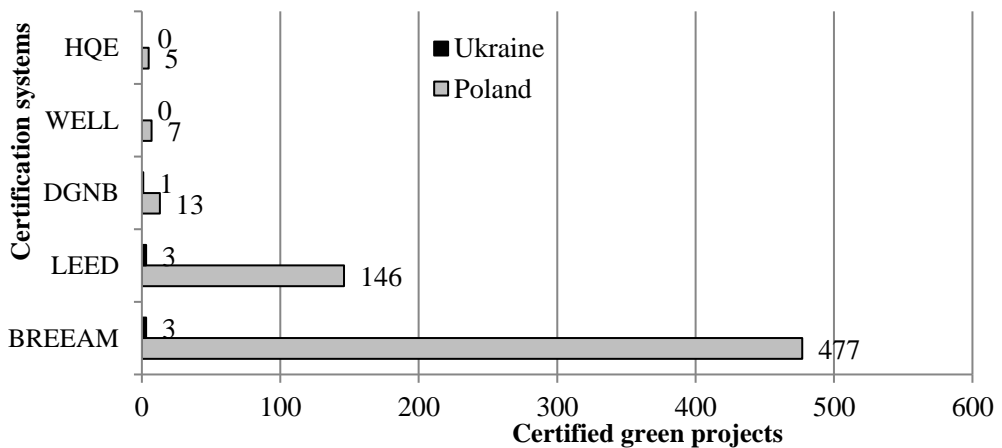


Fig. 1 – The comparison of number of certified green projects in Ukraine and Poland

The number of certified green projects increased in Poland during 2016-2017 by 22%, 2017-2018 – 24%, 2018-2019 – 29% [20], and 2019-2020 – 30% [15] among them BREEAM system share 78,3%. It happens that one certificate covers several buildings in a complex, but also one building awarded several certificates. On average almost 4 new projects were registered every week in Poland during March 2019 – March 2020 [20]. For two years in a row, Polish projects receive the BREEAM Awards as the best projects in Eastern and Central Europe [4]. Last year the BREEAM Award for the M1 Kraków project in the Commercial In-Use category was given for continuous improvement, based on sound management, and for using the evaluation and certification system to improve performance [15]. What lesson Ukraine could take from Poland experience for developing green building in our country?

All three certification systems DGNB, BREEAM and LEED were internationalized with significant success in Poland. BREEAM share 76.8% (649 certificated buildings) of total Polish green building market, other systems account for significantly less: LEED – 20.1% (169), DGNB– 1.7% (14), WELL – 1% (8), HQE – 0.6% (5) [15]. BREEAM is the most popular certification scheme in Poland and widespread in whole Europe [9]. The boasts dominant competitive position of this green certification system is reflected both by number of certified buildings and number of countries. The LEED system was established in the USA, but soon spread not only America, but also in the European market. LEED certification program also administers Green Business Certification Incorporation (GBCI), which certified the WELL Building Standard [23]. Internationalization of DGNB certification system is influenced by economic connections between Germany and other countries [9]. Noteworthy is the presence on the Polish construction market of the French system HQE [14]. Diffusion of green innovations in Poland was fostered by government support and progressive initiative from building organizations.

The comparison of numbers of green buildings by different sectors shows the predominance of office centers, which share 61.4% (519 projects) of total certification in Poland (Fig. 2). Green building in Polish office sector is already a

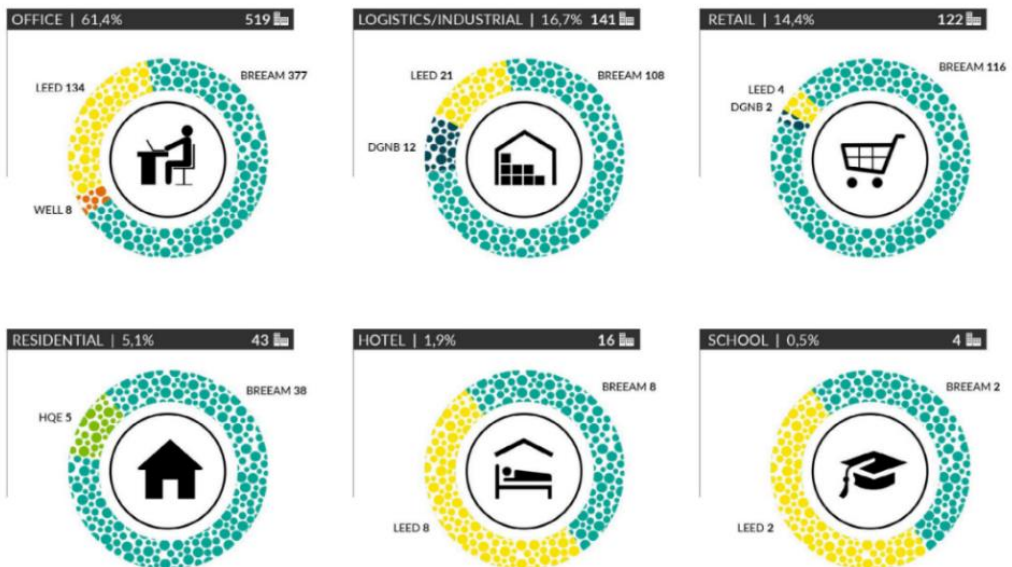


Fig. 2 – The comparison of certificated green projects by different sectors in Poland [15]

standard as evidenced by the fact that 76% of Polish total modern office spaces have a green certification, and in Warsaw these figures reach 87% [15]. The BREEAM system again has dominant position with certification 377 office buildings, yet another measure of its competing ability and also connected to awareness of tenants.

The green certification in the commercial real estate sector is already standard in Poland. A research based on a conjoint experiment shows the highest willingness to pay for having BREEAM certified office space, and slightly lower propensity to pay was observed for LEED certificate [2]. But LEED also holds a significant share (134 buildings) in the certification of Polish offices, and an interesting feature that all Polish WELL projects (8 buildings) concentrate in this sector [15]. WELL is grounded in a body of medical research that explores the connection between the buildings and the health and wellness of its occupants. The WELL Building Standard measuring, certifying, and monitoring features of the built environment that impact human health and wellbeing, through air, water, nourishment, light, fitness, comfort, and mind [23]. The lowest willingness in Poland to pay was estimated for DGNB certificate [19]. The CSR (Corporate Social Responsibility) is reflected on a property market in decisions to lease certified office space. Non-profit and government organizations display higher propensity to rent office space in an green building, guided by legal considerations [7]. Offices were actively certified from the very beginning of green building development in Poland, so now growth rates is going through relative saturation. Most numbers using BREEAM system, which share of 72% (6,087,100 m²) of green building certificated offices, less using LEED – 22.5% (2,166,036 m²), and only 2.5% (209,800 m²) using WELL [15].

The last two years have been a real burst of green certification in the industrial sector in Poland. The observation had demonstrated huge increase in the number of certified storage facilities. In the period March 2019 - March 2020, as many as 55 such facilities were added, reaching the number of 141 projects. As of now its share is 16.7% of total green building market in Poland with using BREEAM (108), LEED (21) and DGNB (12) standards (Fig. 2). The logistics and industrial sector more and more often decides to certify new investments. It is show as much as 70% increase in the area of this type of objects during 2019, which is promising tendency for Polish industry and could be perspective example for Ukraine [15].

Green certification of retail objects in Poland takes 14.4% (122 projects) with usual predominance of BREEAM (116 buildings), 4 buildings for LEED and 2 projects certified by DGNB (Fig. 2). The first restaurant KFC in Kraków was certified during last year in the multi-criteria evaluation system LEED New Construction [15]. However, for investors more secure and liquid commercial property types such as retail, expecting higher future yields. Ukrainian developer need to think about such tendency.

Indicative is the development in Poland of certification of houses, which worldwide are much less frequently certified than offices. Back in 2015 green-certified residential buildings were only 2, in 2016 there were 5 houses, in 2017 – 9, in 2018 – 28, and during last year 43 residential projects certificated in Poland (Fig. 3). It is a pity that residential real estate takes only 5.1% in the Polish green building market. But the growth trend looks promisingly composing 133% during 2019 [20] and an increase of 30% show in the last year [15].

The first residential investment in Poland was assessed in two systems last year. The buildings La Melodie estate (Bouygues Immobilier Polska) obtained the BREEAM certificate apart from the HQE certificate [15]. It is interesting that,

despite the usual dominance of BREEAM (38 buildings), this is the only sector where HQE (5 buildings) system appears (Fig. 2). From the very beginning, the French HQE system has focused on housing construction in Poland due the special requirements for aesthetics and comfort of buildings prescribed in their standards. HQE Urban Planning and HQE Infrastructure currently integrate four main assumptions of the HQE system: quality of life, respect for the environment, economic efficiency and responsible management. In case of apartments typical investor faced a trade-off between choosing relatively secure and liquid assets but at the expense of lower rate of return. In Ukraine first residential project was certified under BREAAM scheme in 2020.

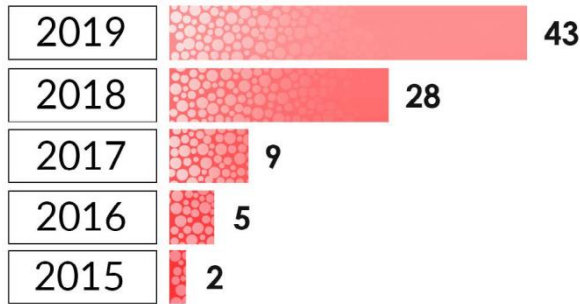


Fig. 3 – The dynamics of housing green certification in Poland [15]

The proportion of hotel sector is 1.9% (16 projects) among Polish green buildings with equal eight buildings of BREEAM and LEED certification (Fig. 2), moreover LEED doubled the number of green projects in the hotel business compared to last year [20]. The greatest new tendency is start to develop green certification for schools in Poland. For the moment it is only 4 certified educational institutions with 0.5% of green building market (Fig. 2), but it means 200% increasing in educational sector during 2018 [20].

The polarization of individual sectors with new dynamics of growth is more and more clearly visible in Poland. The most vivid parameter that shows the development of sustainable construction is the usable area of certified buildings, which has already exceeded 17 million m² (Fig. 4). During this year there was an increase of over 3 million m² of certified space and in 2019 it was an increase by 2 million m² [15].

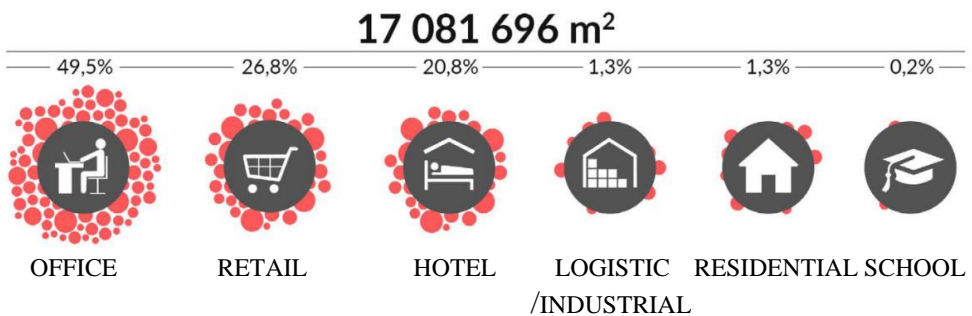


Fig. 4 – Share of green building certified area by sectors in Poland [15]

Although occupants may be willing to bear the higher costs associated with the use of ecological solutions in the construction industry, the interest of the occupants is not always consistent with the interests of the investor [2]. Developer seeks to maximize profit at the expense of the cost of construction, while the buyer's utility depends on the characteristics of the building, which should include life-cycle costs. Due to the asymmetry of information neither investor nor end user is able to assess the architectural and construction project and control the actions of the developer [9]. Both sides of the contract (investor / end user and developer respectively) have conflicting interests. To conclude, because of the agency problem, under conditions of asymmetric information in the property market, the end user is not able to observe and supervise the design and construction phase of an investment project. Due to asymmetric information developer is subject to moral hazard, and may be willing to reduce the cost of construction at the expense of quality. Minimizing the cost of construction can lead to inferior quality, and significant increase in operating costs incurred by the potential occupants [9].

Discussion

The Polish experience proves that sustainable construction and certification of green buildings are not a passing fad, but a confirmed direction of permanent changes in the construction industry. The world over, evidence is growing that green buildings bring multiple benefits. They provide some of the most effective means to achieving a range of global goals, such as addressing climate change, creating sustainable and thriving communities, and driving economic growth. There are at least four main reasons to choose sustainable property. First are direct economic benefits resulting from lower operating costs and lower energy consumption. Second are indirect economic benefits drawn from improved image, increased work efficiency of staff, lower staff turnover, and lower absenteeism due to sick building syndrome. Third are risk avoidance, which in market conditions translates into the rate of functional and moral deterioration of sustainable building, commercial character of a facility, future changes of energy prices and future institutional and legal changes. The fourth are ethical conduct related to CSR (Corporate Social Responsibility), responsible property investing, and corporate culture [9]. Also it is necessary to mentioned about privileges for "green investor" from Investment Banks such as EBRD or EIB. Additionally all of these issues are strictly connected and coincident with assumptions of GRI sustainability reporting. GRI helps businesses and governments worldwide understand and communicate their impact on critical sustainability issues such as climate change, human rights, governance and social well-being. This enables real action to create social, environmental and economic benefits for everyone. The GRI Sustainability Reporting Standards are developed with true multi-stakeholder contributions and rooted in the public interest. The GRI Sustainability Reporting Standards are developed with true multi-stakeholder contributions and rooted in the public interest.

In Poland the growing interest in certification is visible not only among large international developers, but also among local, smaller real estate investment companies. The difference between large and small developers is that the large ones most often decide on full certification, starting at the design stage, while the smaller ones commission the so-called preliminary assessment report, which supports their design decisions, or they decide to pre-certify themselves, without obtaining the final

certificate. In both cases, the goal is to create a healthy and user-friendly building with the least negative impact on the environment [15].

The certification of warehouse facilities has developed more and more dynamically recently. Warehouses are a key element of the logistics chain, which today play an increasingly important role in the success or failure of the organization. A warehouse is a kind of an intermediary between various participants in the supply chain, thus influencing its costs and service. In addition, in recent times, many organizations have taken steps towards centralized manufacturing and warehouse facilities, seeking to rationalize and manage their supply chain processes more efficiently. Consequently, this has led to an increase in the number of larger warehouses controlling distribution to a larger, more diverse customer base, in a larger region and therefore with more complex internal logistics processes. These processes are managed and participated by people for whom the quality of the environment and the place where they work is becoming more and more important. Therefore, incorporating the principles of sustainable construction into the design of warehouse and distribution centers is a win-win. It reduces harmful effects on the environment, encourages safety and comfort of work, while gaining the respect of customers and the community. And, which is very important from a business point of view, it lowers operating costs, ultimately improving the company's financial results [15].

Certified sustainable residential investment could include solutions such as elevators with energy recovery technology, LED lighting controlled by sensors or a rainwater recovery system for watering green areas. Moreover, thanks to the high insulating power of the building envelope, heating costs can be reduced. It is important to insulate the rooms with adequate sunlight, efficient ventilation and high acoustic comfort. On the other hand, during the construction phase, procedures should be implemented to protect biodiversity, raise environmental awareness of all project participants, and take measures to reduce waste production and water consumption. Such an approach will make sustainable construction a more and more common standard in the residential segment [15].

The implementing sustainable solutions in the architectural design and construction of built environment will yield positive effects throughout the building's life cycle, especially at the stage of its operation. There is a change in the approach to certifying buildings. While a few years ago thinking about a friendly building was limited to ecological buildings and materials, today it focuses on people. Planning by architects and investors of the green standard certification is becoming common, and thus the role of friendly interior acoustics is growing. And this trend will strengthen in the coming years due to the increasing noise pollution in cities. Most of the benefits will be related to their users (occupants). Rent in sustainable property could be higher according to modern preferences of tenants. The willingness-to-pay (WTP) for more sustainable living/working space and superior is expected to lead to lower maintenance costs, and lower necessity of costly refurbishment in future, and as results in lower operating expenses [9]. Sustainable property is higher liquidity, and shorter vacancy periods from investment perspective, and also less risk of losing tenants. Rents will increase in future, thus owner's income will grow due to competitiveness and green attraction. Most authors indicate lower operating expenses and rent premiums in green buildings range from 5% [18], 12% [8], even up to 17% [24]. Employees who can choose between employers are increasingly looking at non-wage aspects. One is the approach to issues related to health and well-being, largely based on the workplace. A rapid increase in interest in this subject has taken

place in recent years, therefore it is important for the entire office market to gradually standardize the solutions introduced, which will guarantee meeting the needs of today's employees. Green certificates of office buildings are now standard in Poland. It is often one of the basic criteria taken into account by tenants when searching for the perfect space. The growing awareness of society means that the health and well-being of future users should be taken into account when designing. The provision of very good indoor air quality, infrastructure for cyclists, gyms, green common spaces with the possibility of co-working, space for relaxing and eating meals, as well as building applications, has become a necessity. Developers and designers must start looking for innovative solutions to reduce the building's environmental impact. This is achieved, among others, by integrated design taking into account the entire life cycle of the building, passive design and the use of systems that optimize the demand for electricity, water and other utilities.

Artificial intelligence is set to play a major part in construction with the exponential growth in computing power and algorithm-based computer systems. Currently there are 800 built environment software apps in development in the UK, which aim to automate the development, design, and build process [4]. With the tech investment in the built environment, the growth of artificial intelligence, it's going to be possible to automate the optimized design and construction for any given project. They will be able to feed in planning policy, client requirements and automate the whole thing. Construction firms could lose business to IT giants and must be ready for major changes over the next three to five years. By the mid-2030s (in the next 20 years) 47% of all jobs were at a high risk of automation, including a substantial share of employment in construction occupations [6]. As noted Richard Steer, worldwide chairman of consultant Gleeds, these technologies will affect the industry's architects, surveyors, engineers and project managers. This doesn't mean, however, that anyone expects that engineer, surveyor or architect roles will become redundant. But the thrust of job roles could change, reducing time needed for the vital but often repetitive calculations and other tasks that were once at the heart of professionals' competencies. Despite all this, few envisage wholesale change in construction overnight. Barriers include the sector's relatively poor research and development and investment levels, the fragmented nature of the industry and question marks over the regulation and use of the data many envisage powering this digital revolution. Amazon, which is now the largest real estate developer in the world through its data centers and distribution hubs, is hoarding built environment data [26].

Resource Requirements of Future Urbanization calls for a new strategy to meet the needs of 21st-century urbanization. The report Sustainable Urban Infrastructure Transitions was produced by UN Environment says that collaborative governance, at all levels, and long-range planning will be needed to transform the cities [11]. The importance of sustainable development principles in construction industry and property market practices are increasing across the world [22]. For Ukraine the key factors are emergence and development of organizations that promote sustainability in real estate, and growing environmental awareness and adoption of Corporate Social Responsibility guidelines by major building companies. We have a once-in-a-lifetime opportunity to shift this expected urbanization on to a more environmentally sustainable and socially just path. Decisions made today on urbanization and land-use models, as well as on critical infrastructure, will determine whether our investments are future-proof, or whether they lock us on to an unsustainable path [25].

Conclusions

Ukraine started developing green building in 2011 and Poland begins in 2008, but despite on little chronologic distance, modern situation in construction sector of each country has dramatic differences. For today Poland is the leader of Eastern Europe green building with 845 certified objects and three new projects are registering every week, while less than 10 certificated green buildings present in all Ukraine.

BREEAM is the most popular green building certification system in Europe and share 76.8% of total green building market in Poland, but also LEED takes significant shares in education and hotel business, all HQE projects relate to housing, and DGNB appear in retail.

The unchanging industry leader in Poland is the office real estate sector with an almost 62% share and decrease of 3% compared to last year. High activity in green certification of industrial and logistic buildings was noted with increased by 64% compared to the previous year. The greatest new tendency is start to develop green certification for schools in Poland. It is could be good example for Ukraine, as well as growing green certification of industrial buildings and residential real estate.

Artificial intelligence is set to play a major part in construction and it's going to optimize for any building project, but the most these technologies will affect the industry's architects, surveyors, engineers and project managers.

Evidence is growing that green buildings bring multiple benefits and driving economic growth around the world. For Ukraine the key factors are promote sustainability in major building companies, create a favorable investment climate, and enlist government support to developing green building.

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Т.І. Кривомаз, Ю. Хмелевська, Т.Ю. Канащук ПЕРСПЕКТИВИ РОЗВИТКУ ЗЕЛЕНОГО БУДІВНИЦТВА В УКРАЇНІ НА ПРИКЛАДІ ПОЛЬЩІ

Анотація. В дослідженні проаналізовано тенденції в секторі зеленого будівництва в Україні та Польщі. В Україні розвиток зеленого будівництва розпочався у 2011 р., а у Польщі – в 2008 р., але, незважаючи на невелику хронологічну різницю, сучасна ситуація в будівельному секторі цих країн кардинально відрізняється. На сьогоднішній день Польща є лідером зеленого будівництва у Східній Європі з 845 сертифікованими об'єктами, до того ж щотижня реєструється по чотири нових проекти, тоді як у всій Україні менше 10 сертифікованих зелених будівель. BREEAM є найпопулярнішою системою сертифікації зелених будівель у Європі та займає 76,8% всього ринку зеленого будівництва у Польщі, але також LEED займає значну долю в освітніх будівлях та готельному бізнесі, всі проекти HQE стосуються житла, а DGNB проявляється у роздрібній торгівлі. Найбільш перспективною стійкою тенденцією у Польщі є збільшення кількості проектів зеленого будівництва в освітньому, логістичному та промисловому секторах. Це може бути гарним прикладом для

України, так само як і зростаюча кількість зелених сертифікатів серед промислових будівель та у житловій нерухомості. Все більше свідчень того, що зелені будівлі надають численні вигоди та сприяють економічному розвитку у всьому світі. Для України ключовими факторами є пропагування сталого розвитку серед великих будівельних компаній, створення сприятливого інвестиційного клімату та залучення державної підтримки до розвитку зеленого будівництва.

Ключові слова: зелене будівництво; сертифікаційні рейтингові системи; екологічна безпека

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