Tendencies of the Green Construction in Russia

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Abstract. With the development of scientific and technological progress and the dense development of large metropolitan areas, the issue of ecology is particularly relevant. The purpose of the study is the study of new technologies that allow existing a green roof. Research methods include analysis, comparison and detailed study of the components of a green roof. We examined in detail the components of the green building on green rooftops in different countries and analyzed the main elements of the green building coverings system. In this article, using concrete examples, the solution of a whole complex of highlighted problems, with the intensive development of green innovations is shown. The result of the research is an evaluation of the effectiveness of the different tendencies of green construction, including the use of green coverings.

1. Introduction
Most of the investors and design-project organizations in Russia have an ambiguous attitude towards the construction of the green roof of a residential building, due to the harsh climate. But still, new technologies are being developed that allow a green roof to exist. So, in the largest and most developed cities of the Russian Federation, specialized organizations involved in the design of a green roof have appeared, and have already been implemented in more than 50 objects. For the large-scale implementation of green construction on the territory of our state, it is necessary to develop and form national Green standards [1]. Currently, there are more than 30 standards in the world. The objectives of international environmental standards, such as known systems BREEAM, LEED, DGMB, are the following:
• assessment of environmental practices;
• high level of energy efficiency and construction quality;
• reduction of negative environmental impact;

The main task of these standards is to assign a level of compliance and issue a certificate based on a special method of assessment. In Russia, there are two certification systems - “Green construction” of residential and public buildings. Rating system for assessing the sustainability of the habitat STO NOSTROY 2.35.4-2011 and the Olympic green standard. These systems are also the rating systems for evaluating a building or structure being constructed. However, there is a problem with the development of green standards in our country. It is related to the non-compliance of the criteria for
evaluating green standards with the requirements of the regulatory building Codes: SNiP, SP, GOST (in Russian).

2. Methodology
We had examined in detail the components of the green building-in the green roof, which are successfully developing in North America, Europe and in the countries of the Scandinavian Peninsula, and we had analyzed the main elements of the system of green construction: green coverings.

The main advantages of the green coverage over the traditional one within the conditions in Russia:

- Increasing the green area within the city limits. The largest megalopolises are developing and becoming larger. Massive development and progress of the forest industry lead to serious environmental problems. Therefore, the device of green roofs, can fill a small part of the green area of the city and increase the aesthetic component of cities.

- Improving the microclimate of buildings, namely the regulation of temperature and humidity, increasing the level of noise insulation, air purification from harmful impurities. The level of heat exchange regulation increases, in winter the heat is delayed reducing heating costs, and in the summer house, there is a pleasant coolness. Plants and soil reduce the level of noise penetrating into the rear, by 2-6 decibels. This is a very important factor because buildings built in the area of the highway or airport have a non-comfortable effect on the residents of the house. So, conventionally, 35 decibels for human hearing is quite a noisy effect, but lowering the noise level by 5 decibels will contribute to a slight decrease in the noise level, which will no longer have a negative impact on a person [2]. The increase in the number of living plants favorably affects the general state of the air, because as a result of photosynthesis, more oxygen is produced. Also, plants purify the air, retaining about 20% of harmful impurities.

- Reducing the HIE (heat islands effect). The HIE is a phenomenon that adversely affects people's health, it is connected with the fact that the constructed structures longer retain and give off heat. This entails a violation of natural convection in nature, and, consequently, an increase in temperature within the city limits. Green spaces on the roof partially eliminate this problem.

- Rainwater filtration.

- Improved air.

According to the study [3], the intentions to maintain green performance levels and adopt green practices have to come from all levels of society. The steady growth has recorded between 1992 and 2018: at least 44% of 195 countries are involved in green building research [4]. Our research is based on scientometric analysis of global green building and analysis of green building rating systems: Chinese standards, namely Chinese evaluation standard green building (ESGB), and other international standards LEED, BREEAM, and Green Star, and assessment of green building industry in different countries [5-8].

The modern developing enterprises are forming by complex models of active control systems and effective risk management for energy-efficient tendencies in construction [9-11]. Green roof is one of the main elements of energy-efficient tendencies in construction.

The bright example of an unusual existed green roof is the park-like landscaping roof of Nanyang Technological University’s School of Art, Design, and Media in Singapore, with the nonlinear thinking forms that a «building-that-is-a-hill» seems to suggest the mirrored walls, which shown in Figure 1.
Figure 1. The all-over green covering systems, designed by CPG

The Russian climate is similar to the climate of Norway, where this technology is successfully used. Many Russian companies successfully borrow foreign experience. But at the same time, adaptation is needed for each region. Also, in Russia, it is possible to use perennial plants that tolerate frosts for extensive roofing: Chisel, Azarum, Periwinkle, etc. The problem is the complexity of the service lies in the insufficient number of specialists in this field. With proper design and installation of a green roof, caring for her comes down to the classic care of vegetation (in the case of an extensive roof).

An example of the implementation of the green roof is technology, used by Zinco, which was founded in Germany in 1957 and in 2009 a branch appeared in Russia. This company is one of the most successful to date. Since the technology was borrowed from a country of a different climate, it had to be adapted.

3. Results and discussions
The implementation of the green building varies in different countries. The active participation of stakeholders, including government, developers, technology builders, and consumers, the economic and ecological behaviors of stakeholders may be the key to driving sustainable development of green construction [12]. So, in 2011, the Dubai government decided to issue the Green Buildings Regulations and Specification (GBRS) to form a market shift toward a Green Economy for Sustainable Development [13].

In this article, we are considering the various green roof and green wall coverings, that include all-over covering systems (non-modular type) and modern modular greening systems for covering [14], which shown in Figure 2.
The modern green covering systems are the new tendencies of green construction and energy-efficient decision for solving the various problems: the heat loss is much less than during the operation of a conventional roof. Thus, this leads to a reduction in heating costs in the cold period, and in the hot period in cooling the room and air-conditioning.

These benefits suggest employees in the green construction ecofriendly attitude improved satisfaction overall [15]. This research is to evaluate the effectiveness of the different tendencies of green construction, including the use of green coverings. The main advantage of green coverings over traditional ones lies in their undeniable environmental friendliness. Both green roofs and green walls clean the air and save energy, protect waterproofing from solar radiation and temperature extremes.

In Russia, green construction is unfortunately less developed. The main reasons for slowing down the introduction of green technologies are following (by point-view of design-project organizations):
- Increased construction cost;
- Complexity of service and high cost of repair;
- Increase the weight of building structures.

4. Conclusions
Thus, the development of green coverings in Russia requires special attention. It should begin with the development and formation of "green" standards, with further comparison by a set of rules and state standards. The introduction of clear requirements and rules will entail a competent design of green coverings. This, in turn, will cause interest at the state level. Perhaps the introduction and opening of specialized Green departments in construction universities, which will be focused on the green construction. The existence and development of a green roof in Russia are real. It is necessary to take into account the climatic features of the country. The potential and interest in this topic are growing every day. There are new ways to use green coverings. It is important for the state to pay attention to the environmental problems of large megacities and gradually reduce the problem of resource exhaustion with the use of green construction.

The green covering system on the buildings is one of the progressive components of green innovations and key tasks in solving global problems related to the construction ecology and the formation of the living environment. Thus, as a result of this study, we conclude that the design of
modular greening systems for covering is much more efficient in terms of the development of green construction both in Russia and other countries with favorable climate.

References

[1] E. Korol, and N. Shushunova, Research and Development for the International Standardization of Green Roof Systems, Procedia Engineering, 153, pp. 287-291, 2016 https://doi.org/10.1016/j.proeng.2016.08.117.

[2] E. Korol, N. Shushunova, O. Feoktistova, T. Shushunova and O. Rubtsov, Technical and economical factors in green roof using to reduce the aircraft noise, MATEC Web of Conferences, 170, 01081, 2018 https://doi.org/10.1051/matecconf/201817001081.

[3] M. Sharma, Development of a ‘Green building sustainability model’ for Green buildings in India, Journal of Cleaner Production, Vol. 190, 20, pp. 538-551, July 2018 https://doi.org/10.1016/j.jclepro.2018.04.154.

[4] I.Y. Wuni, G. Q. P. Shen, and R. Osei-Kyei, Scientometric review of global research trends on green buildings in construction journals from 1992 to 2018, Energy and Buildings, Vol. 190, pp. 69-85, 1 May 2019 https://doi.org/10.1016/j.enbuild.2019.02.010.

[5] Z. Ding, Z. Fan, V. W. Y. Tam, Y. Bian, and S. Moon, Green building evaluation system implementation, Building and Environment, Vol. 133, pp. 32-40, April 2018 https://doi.org/10.1016/j.buildenv.2018.02.012.

[6] A. Darko, A. P. C. Chan, X. Huo, and D. Owusu-Manu, A scientometric analysis and visualization of global green building research, Building and Environment, Vol. 149, pp. 501-511, February 2019 https://doi.org/10.1016/j.buildenv.2018.12.059.

[7] B. C.-M. Leung, Greening existing buildings GEB strategies, Energy Reports, Vol. 4, pp. 159-206, November 2018 https://doi.org/10.1016/j.egyr.2018.01.003.

[8] S. Ulubeyli, and O. Kazanci, Holistic sustainability assessment of green building industry in Turkey, Journal of Cleaner Production, Vol. 202, pp. 197-212, 20 November 2018 https://doi.org/10.1016/j.jclepro.2018.08.111.

[9] K. O.A. Issledovaniya i naukoyemkiye razrabotki v oblasti energoeffektivnogo stroitel'nogo proizvodstva [Research and knowledge-intensive developments in the field of energy-efficient construction production] Stroiteľnıy materialy [Construction Materials], no 6. pp. 13-15, 2015 (In Russian).

[10] V.G. Borkovskaya, Complex models of active control systems at the modern developing enterprises, Advanced Materials Research, Advanced Materials Research, Vol. 945-949, Chapter 22, Pages 3012-3015. (2014) Manufacturing Management and Engineering Management. June 2014. DOI: 10.4028/www.scientific.net/AMR.945-949.3012.

[11] R. Roe, W. Bardenwerper, V. Borkovskaya, Using a Case Study Interactively to teach Sustainability Risk Management, MATEC Web of Conferences, Vol. 251, 06028, 2018. DOI: https://doi.org/10.1051/matecconf/201825106028 .

[12] J. Teng, X. Mu, W. Wang, C. Xu, and W. Liu, Strategies for sustainable development of green buildings, Sustainable Cities and Society, Vol. 44, pp. 215-226, January 2019 https://doi.org/10.1016/j.scs.2018.09.038.

[13] B. Abu-Hijleh, and N. Jaheen, Energy and economic impact of the new Dubai municipality green building regulations and potential upgrades of the regulations, Energy Strategy Reviews, Vol. 24, pp. 51-67, April 2019 https://doi.org/10.1016/j.esr.2019.01.004.

[14] GroofLab, Green Innovations for Life!, Copyright 2019 Grooflab, Inc.C. [Online] 2018 [Accessed 22. 01. 2019] Available at: https://www.grooflab.com/home-4-de.

[15] D. O. Sant’Anna, P. H. Dos Santos, N. S. Vianna, and M. A. Romero, Indoor environmental quality perception and users’ satisfaction of conventional and green buildings in Brazil, Sustainable Cities and Society, Vol. 43, pp. 95-110, November 2018 https://doi.org/10.1016/j.scs.2018.08.027.