



# Greening of Training Programs for Construction Specialists for Sustainable Development

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**Abstract:** Modernization of professional training programs in solving the problems of sustainable development is considered. To study the share of green initiatives in employees' job functions, the professional standards of specialists with higher education who solve organizational and managerial tasks in construction were analyzed. The necessity of transforming the educational paradigm for adding green initiatives to personnel training programs is proved, the model is offered of adding green initiatives to the degree program for training construction specialists based on developing the interdisciplinary approach and integration of the environmental component into obligatory and elective competencies, expanding the content of competences taking into account the prospects of new professions emerging. Proposals for forming the educational program "Eco-engineering in construction and design" were developed, the main competencies were formulated. The paradigm of green education is implemented on the basis of adding green initiatives to universal, general professional and narrow-focused professional competencies.


## 1 INTRODUCTION


The concept of "greening" appeared in the scientific lexicon late in the XX century and is actively used in modern scientific literature. By the definition of Reimers, N.F., greening means "a versatile, more systematic approach to the objective world and a greater awareness of the role of nature in human life" (Reimers, 1990). Greening the economy from industries to households "results from realizing the necessity of harmony in society, in the relationship between human and nature" (Bobilev, Zakharov, 2015). In a broad sense, greening means the transition to an environmentally and socially oriented model of developing all spheres of the economy. The development effectiveness of greening the economy is inextricably linked with the education and training of specialists.


Adding green initiatives to professional education and training programs is an urgent task of the modern world community (Report of the UNESCO-

UNEVOC, 2012). The declaration of the UNESCO World Conference on Education for Sustainable Development (Aichi-Nagoya, Japan, 2014) calls for increased efforts to transform educational processes and programmes following the Sustainable Development Goals (SDG) and "expand their reach, to meet the needs of both present and future generations, based on a balanced and integrated approach to the socio-economic and environmental aspects of sustainable development" (UNESCO Aichi-Nagoya Declaration, 2014). One of the declaration points was an appeal to the governments of the states on the need to ensure the integration of SDG in education and training programs.

In the works by Glazachev, S.N. (Glazachev, 2011), humanization and greening of education are considered as the basic principles that determine the strategic development of modern education and reflect the ideas of Vernadsky's V.I. noosphere concept. The theoretical foundations of the noosphere

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paradigm of education are considered in the works by Smirnov, N.G. (Smirnov, 2008; Smirnov, 2001).

The authors of the analytical report (Grachev, Ilyin, Ursul, Ursul, Andreyev, 2017) focus on the importance of education as a key tool for achieving the Sustainable Development Goals. According to scientists, the transition to sustainable development actually begins with forming Education for Sustainable Development (ESD). The content of green education is considered as part of the peculiarities of development and formation of the noosphere education system. These are the temporal peculiarity and futurization of education, i.e. the shift of emphasis in education to the forecasting study and modelling of processes evolving in the future; the globalization of education in relation to social, economic and environmental development processes; the close relationship with security problems in a broad sense (Grachev, Ilyin, Ursul, Ursul and Andreyev, 2017; Ursul, A.D. and Ursul, T.A., 2015; Ursul A.D. and Ursul T.A., 2017).

The works (Kaz, 2020; Sokolova and Ermakov, 2020; Sokolova and Ermakov, 2020; Zakharova, Tarshis and Mamontova, 2020) analyze and summarize the experience of introducing elements of sustainable development into Russian and foreign education systems. The development of higher education has a significant impact on progress in greening in economic development. Indeed, it is specialists with higher education who possess interdisciplinary knowledge, develop and advance knowledge-intensive and resource-saving technologies, successfully adapt to the conditions of high-tech production, and implement projects in environmental protection for sustainable development. The paper (Wenjuan Gao, Xiaohao Ding, Ran Chen and Weifang Min, 2019) suggests estimating green GDP based on modelling the relationship between education quality and green economic growth. The sensitivity of "green" GDP to changes in higher education has been empirically proven.

The peculiarity of modernizing educational programs for engineering and technical specialties is its interdisciplinary aspect. In developing and implementing construction projects, future engineers must solve technical problems connected with social, economic and environmental ones (Muravyova, Oleynikova, 2016).

## 2 RESEARCH METHODOLOGY

Modernization of education for sustainable development requires transforming the educational paradigm, the key element of which is changing the content of educational programs (Muravyova, Oleynikova, 2016). The methodology of the ecosystem approach should be integrated into the educational programs of training specialists at all levels, the essence of it is the interrelation of economic, environmental and social components in solving professional tasks and performing job functions.

In accordance with the current priorities of urban development, construction technologies for the construction of objects and the development of territories are being upgraded, innovative and environmentally friendly materials, structures, engineering systems are being used, and social architecture is being developed. Methods and tools for regulating urban planning are developing: participatory design is becoming more widespread; the number of real estate objects certified according to "green" standards is increasing; along with social aspects, construction business enterprises actively declare activities that lie at the heart of environmental responsibility; non-profit structures, representatives of public organizations and movements are involved in green construction.

Recognizing social and environmental priorities for the development of production systems and territories in the XXI century was the ground for introducing the methodology of the ecosystem approach for transforming educational programs of training future specialists in all the fields. Realizing the ecosystem approach at construction companies will require management process reengineering. And this is most closely related to specialist training based on the implementation of the competence approach. To develop specialists' skills in the XXI century, it is necessary to integrate the key competencies of sustainable development into educational programs at all levels (González-Salamanca, Agudelo, Salinas, 2020).

The conceptualisation of making training programs green is based on a comparative analysis of current professional standards in Construction, studying job functions, as well as the requirements for knowledge and skills of specialists.

The methodological basis for designing the architecture of the program of professional training for green construction is a paradigm based on the greening of knowledge, skills and abilities (green

education), taking into account the interdisciplinarity of the professional tasks to be solved.

### 3 RESULTS OF RESEARCH

Currently, one of the determining factors in the justification of management decisions in urban planning is how significant results of construction projects implemented are for ecological and economic systems at various levels. Modern urban planning policy, the priority of which is forming a comfortable urban environment, is consistent with these trends. (Irina Nuzhina, Maria Zolotareva and Iuliia Vasileva, 2018; Vyacheslav Buzyrev, Irina Nuzhina and Maria Zolotareva, 2018). A future specialist training in Construction should know not only the current trends in Russian and foreign green construction technologies but also possess skills in organizing construction, using environmentally-oriented methods and management tools.

To study the environmental component in the job functions of specialists with higher education (bachelors and masters), the professional standards (PS) of specialists who solve organizational and managerial tasks in construction were analyzed. The analysis results showed that the environmental component is present in the competencies of training specialists in almost all the considered professional standards.

Summarizing the professional standard analysis results, we can draw the following conclusions:

firstly, to a greater extent, the environmental component takes place in job functions of the organizer of construction operations (PS "Organizer of Construction Operations" (Order of the Ministry of Labour of the Russian Federation No. 516H dated June 26, 2017). Besides knowing regulations and legislation in environment, fire and labour safety, a qualified employee must possess skills of identifying types of negative impacts on the environment in performing general and special construction works and know methods for their prevention and minimization. This significantly complements the knowledge and skills in ensuring only the safety of construction.

Secondly, the PS "Head of a Construction Organization" (Order of the Ministry of Labour of the Russian Federation No. 803H dated November 17, 2020) only contains requirements to know laws and regulations in labour, environmental and fire safety and to use rationally natural resources (for the master's degree). In full, the job functions of the head are not green.

Thirdly, the construction department can be managed by a professional urban planner according to the PS "Urban Planner" (Order of the Ministry of Labour of the Russian Federation No. 110H dated March 17, 2016). An urban planner who performs a master's degree functions must know not only the principles of sustainable development of territories but also the basic principles and methods of urban ecology and nature management. It is also obligatory to know the regulations in the environment and life safety, requirements for final products and preparing urban planning documentation. The urban planning documentation includes landscape and environmental solutions, proposals for territory protection from natural and man-made emergencies, etc. The specialist must know the technologies that ensure urban planning safety and ways to preserve a particularly valuable natural and historical-cultural environment. It is noteworthy that the basic groups of positions (professions) include sociologist in urban planning, ecologist in urban planning, economist in urban planning (per Unified Qualification Reference Book). The latter fact proves the transition to developing territories as socio-ecological and economic systems.

Fourthly, environmental surveying is of particular importance for the creation and subsequent operation of a construction object. The Ministry of Labour of the Russian Federation has prepared a Draft Order "On Approval of the Professional Standard "Environmental Engineer in Surveying for Design, Construction, Repair and Reconstruction" (dated September 13, 2018). This standard will appear for the first time. According to this project, the main types of professional activity are organization and management of a certain type of work (college degree - bachelor) and organization and technical management of engineering and environmental surveying in general (college degree – master). In the first case, the management aspect is related to performing the following job functions: planning engineering and environmental works; management of field and office engineering and environmental works; organization of environmental monitoring; preparing reports on surveying performed. In the second case, they are planning engineering and environmental surveys; organizing engineering and environmental surveys; improving the efficiency of engineering and environmental surveys.

Fifthly, we note that in such a professional standard as "Specialist in Planning and Economic Support of Construction Operations" (Order of the Ministry of Labour of the Russian Federation No. 504H dated July 18, 2019), the environmental

component in the competencies is not indicated. Environmental issues in the production activities of industrial enterprises have until recently been solved by environmental safety specialists. Taking into account the peculiarity of construction and its importance for forming a comfortable and safe environment for human life, one can say that training construction specialists to solve organizational and managerial tasks, proceeding from social, environmental and economic aspects of the activity, is very relevant and in demand.

When designing educational programs, the environmental component can be included in the learning system as super professional, universal knowledge, skills and soft skills, which are necessary for any specialist.

The authors of the Atlas of New Professions (Atlas of New Professions 3.0, 2020) focus on the need to possess super professional skills to become a successful specialist. According to the authors, possessing super professional skills will ensure specialists' being mobile and in demand. The following super professional skills are identified: working with people; focus on customer; multilingualism and multiculturalism; project management; intersectoral communication; working in conditions of uncertainty; systems thinking; programming, robotics and artificial intelligence; lean manufacturing; skills of artistic creativity; environmental thinking.

It should be noted that some professions, the skills of which are already being implemented to some extent today, have been referred by the authors of the Atlas to the category of new professions in construction. These are such professions as construction technology upgrade specialist; 3D printing engineer in construction; industrial zone redevelopment specialist; specialist in the development of new building materials, structures and BIM manager designer. New professions can be formed in various professional spheres.

In Figure 1, based on the Atlas data, we have identified new professions in construction, ecology and management that are directly related to solving the problems of sustainable development through urban planning. Environmental thinking becomes an integral characteristic of future specialist. Today, analysis and evaluation of environmental aspects of construction are functional responsibilities of certain specialists in the enterprise, who, as a rule, combine these functions with solving main production or organizational and managerial tasks.

Taking into account the current trends in developing "green" construction, we can confidently

say that the profession of "environmental analyst in construction" is the nearest prospect. Even today, society needs information about the impact of constructed objects on environmental systems, how to prevent the construction negative impact on the environment, and ways of waste disposal. The environmental analyst's work will be professionally connected with the activity of the zero energy house architect and the urban object lifecycle manager.

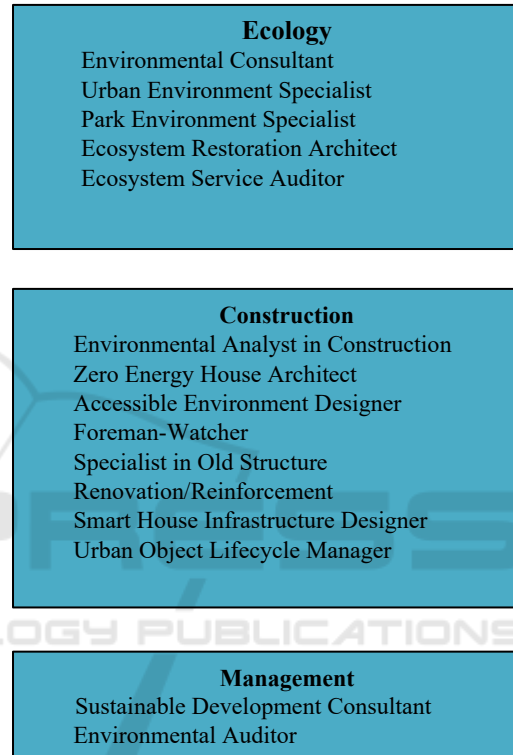


Figure 1: New professions in construction for sustainable development.

Issues of eco-oriented development of production systems are interdisciplinary. This is clearly seen in the development of the environmental specialist's profession. Although all the professions listed above are related to ecology, they are, among other things, based on knowledge and skills in construction, architecture and management. Thus, the model of further development of specialist training is based on integrating professional competencies prescribed in educational standards (hard skills) and "soft" competencies (soft skills), formed by the designers of educational programs, taking into account the current needs of potential employers and promising areas of professional development. Adding green initiatives to educational programs is achieved on soft skills developed, their development will allow finding

solutions to environmental problems requiring knowledge and skills from various fields of science.

## 4 RESULTS AND DISCUSSION

Professional training of students for advancing green construction should equip the future specialist with knowledge and skills in engineering, which ensures an improvement of construction business efficiency based on technology development for implementing organizational and economic tasks of construction at all stages, steps and processes of the construction product lifecycle.

An analysis of the demand for graduates in Construction (Lidiia Shershova, Irina Nuzhina, and Evgeny Kurochkin, 2018) showed that employers preferably focus on innovative educational programs. Innovative engineering is the most important component of the development of the modern construction business (Kaverzina, Cherutova and Nuzhina, 2020).

Of course, the content of engineering will vary depending on the application and will require some specialization of employees. In our opinion, in "Construction" it is advisable to form an educational program of specialist professional training for green construction "Eco-engineering in construction and design". The methodological basis for designing the architecture of such a program is a paradigm based on the greening of knowledge, skills and abilities (green education), taking into account the interdisciplinarity of the professional tasks to be solved. Greening of universal competencies is developing super professional knowledge and skills that will allow any specialist to consciously apply the principles of the ecosystem approach in implementing professional tasks and achieving personal growth. The analysis of universal competencies of the educational standard in "Construction" allows identifying such components of super professional skills as communication capacity, including multilingualism and multiculturalism; systems and critical thinking; project management, work within a team, assessing the potential and realizing personal priorities. For greening skills, it is necessary to supplement this list with the following competencies:

- Methodology of the ecosystem approach in regulating construction activities, the concept of sustainable development;
- Identifying and analyzing the social, environmental and economic aspects of construction;

- Research skills for greening the needs of construction products;
- Principles and skills of applying lean manufacturing tools.

Greening of general professional competencies is developing competencies by integrating the environmental component into the existing list of recommended indicators. The most important ones include:

- Solving professional tasks by ecosystem approach;
- Analyzing trends in the technical and technological development of construction, taking into account the environmental factor;
- Searching and using scientific and technical information in green construction;
- Knowing and applying laws and regulations in environmental and economic aspects of construction;
- Selecting and applying mandatory and voluntary laws and regulations in green construction in preparing project documentation, organizing design, survey and construction works, managing a construction organization.

When forming professional competencies for the program profile, we take into account the type of tasks to be solved. So, for the organizational and managerial type of tasks under the program "Eco-engineering in construction and design", the following knowledge and skills are required:

- Knowledge of the status and directions of forming an environment of environmental-oriented institutional regulation of construction activities;
- Analysis of the activities of the construction enterprises, taking into account the ecological and economic aspects, resource and environmental intensity of the products of the construction enterprises;
- Development of the organization's strategy, taking into account the development of tools for social and environmental responsibility of the construction business;
- The organization's business process reengineering using the technology of 'lean manufacturing';
- Taking organizational and economic measures that provide green investment and construction, taking into account all stages and steps of the construction product lifecycle;
- Preparation of public environmental reports.

## 5 CONCLUSION

When designing educational programs, the requirements for knowledge and skills formulated in professional standards are taken into account. The question is what professional standards should be based on when an educational program designed? As shown above, not all professional standards have an environmental component. It can be assumed that with new professions introduced, new standards will also appear. Since green construction specialists are already in demand today, it is necessary to review the existing standards (for example, the standards "Specialist in Planning and Economic Support of Construction Operations" and "Head of a Construction Organization") and make appropriate adjustments.

Thus, greening the knowledge and competencies formulated in these standards is achieved by adjusting them through integrating and completing socio-ecological and economic aspects.

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