

Implementation of the Biosphere Compatibility Principle in Urban Planning: How to Train Next-Generation Specialists

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Abstract

The co-authors address the relevant issues concerning the need to implement the principle of the biosphere compatibility as the core prerequisite for the symbiotic co-existence of man and nature. Caring treatment of the biosphere, termination of its excessive exploitation, analysis of the ratio between the biospheric potential of specific areas and the needs of their population represent the most relevant problems. Ecological problems are particularly grave in Russia. However, only the new generation of specialists, having the ecological awareness and applying nature preservation techniques to their activities, can meet the challenge. The authors provide the findings of the sociological survey into the state of the human capital in the Russian urban planning industry and propose a set of actions aimed at its improvement.

Keywords: biosphere, sustainable development, biosphere compatibility, humanitarian balance of the technosphere, human capital, ecological education

1. Introduction

Presently, over fifty per centum of the human population lives in cities and towns. The urban population of the Russian Federation totals at about 74%. The first ecological rating of the major Russian cities, compiled in 2012 on the basis of the data covering 2011 and the first quarter of 2012, took account of the following seven criteria: aerial environment, water consumption and quality, waste management, land use, transportation, power consumption, and management of environmental impacts. Moscow, Krasnoyarsk, Irkutsk, Chita, Novokuznetsk, Magnitogorsk, Nizhniy Tagil, Ivanovo, Bratsk, Volzhskiy, Norilsk, and Yuzhno-Sakhalinsk top the “ecological blacklist”. (The Ministry of Natural Resources and Environment) “According to the data generated in the course of regular monitoring procedures in 2011, atmospheric contamination remains high in the Russian Federation. The population of the cities, demonstrating high and very high atmospheric contamination, totals at 55.1 million people, or 53% of the urban population of the Russian Federation. The top-priority list comprises 27 cities having the total population of 16.3 million people (in 2010, the blacklist had 36 cities, while in 2009, there were 34 cities on the blacklist).” (Ecological Rating of Russian Cities, 2011-2012).

Russian specialists have to admit: “Stagnation, depopulation, degradation, and physical extinction of populated localities take place in the 90% of Russia’s territory. These processes outspread in rural areas, small, mid-size, and big towns, large and major cities. “Desertification” of well-developed areas and “disintegration” of inhabited networks are underway, although the latter serve as the material basis for the integration of the socioeconomic, nation-wide and state-run space of Russia.” (Yusin, 2013).

According to the assessments, made by the international organizations, covering 215 major cities worldwide, and based on the integrated life quality criteria (per capita income, life duration, availability of housing and leisure facilities, water quality, social package cost, etc.), St. Petersburg takes the 196th position, and Moscow takes 205th position, and the capital went ten point down over the past ten years (Agasyants, 2009).

According to the analytic data, extracted from the Global Index for Urban Liveability and published in World Review of Science, Technology and Sustainable Development, Moscow takes the 62nd position in the rating of liveable cities that has sixty-four cities. Analysts base their conclusions on the social, cultural and public environment, economic criteria, competitiveness, safety and environmental friendliness (Giap, Thye, & Aw,

2014).

“Cities are the source of degradation of the biosphere, they are the places where its consequence—the degradation of humans—manifests,” says academician V.I. Ilyichev, director of the fundamental research project entitled Biosphere Compatible Communities and Human Development, developed by the Russian Academy of Architectural and Construction Sciences. The basic mission of the project is to consolidate inhabited localities (of any size, including isolated farmsteads and megalopolises) and the natural environment to assure the progressive and harmonious development of human beings, technologies, and the biosphere (Ilyichev, 2011).

There is a need to initiate a systematic and thorough research into the satisfaction with the living conditions and the damage caused to the biosphere, to have these problems completely resolved and to ensure the symbiosis between the biosphere and the society.

2. Research Methodology

The co-authors employed versatile methods and instruments to perform the research analyzed in this article. The core method represents an overview of the most recent publications in varied sources, including statistics, environmental monitoring data, findings of sociological surveys, opinions issued by panels of experts, and the research articles written by the leading researchers. The co-authors made their contribution into the paradigm of biosphere-compatible cities and villages, based on the research findings of Ilyichev, Kolchunov, Bakaeva, and Azarov, and offered their original solutions (Azarov & Dontsova, 2012). The co-authors also launched a wide-scale social survey into the workforce capacity of Russia’s construction industry in order to assess the condition of the human capital capable of introducing the new urban development concept. The survey demonstrates the modernity of thought and a deep insight into the degradation processes that are underway both in the biosphere and in the society. The findings of the opinion poll, involving three categories of respondents—executives of construction enterprises, recent university graduates, and students in their final year of studies, also serve as the source data for the research project discussed in this article. The sociological toolkit comprises three special-purpose questionnaires.

3. Research Findings

3.1 Generation of Biosphere Compatible Cities: Prerequisites

Ilyichev is the developer of the matrix designated for the transformation of a contemporary city into the one that is compatible with the biosphere and capable of developing humans (Ilyichev, 2011). “The matrix...describes urban life and represents the pattern designated for its management and planning; it offers urban performance criteria for the city as a whole and for its specific service providers; it sets urban priorities and the hierarchy of notions; it detects weak points in urban life arrangements; above all, it may be employed to analyze the symbiosis between the city and the nature and to make quantitative assessments of human development opportunities offered by the city” (Ilyichev, 2011).

Ilyichev has made a substantial contribution into this problem resolution, as he has developed the equations designated for the calculation of ratios between local population numbers, areas where human needs are satisfied (the technosphere), and the biosphere’s life potential, or humanitarian ratios of the technosphere integrated into the biosphere.

The humanitarian ratio of the technosphere, integrated into the Biosphere, represents a set of equations employed to identify the ratios between:

- a) The biosphere’s life potential, population numbers, and the number of areas where human needs are satisfied,
- b) The needs demonstrated by humans and the technosphere for the resources of the biosphere, and the ability of the biosphere to satisfy them.

The main point is the hosting landscape, “as, ultimately, the man can only succeed in the place where nature allows him to succeed” (Ilyichev, 2011).

The calculation of the aforementioned ratios will make it possible to preserve and develop the biosphere in the reasonable and rational manner, provided that development rather than growth is the main goal. In his effort to set the limits to growth, D. Meadows, the co-author of *The Limits to Growth*, stated that development rather than growth was needed. Wherever development requires physical expansion, it must be limited and maintained within the limits of sustainability and with account for any costs incurred and disbursements made. “Unfortunately, the environmental load imposed by humans keeps growing, despite any technological developments and efforts invested by public organizations. The situation turns more serious, as the humankind has already stepped beyond the limits, and it is now in the instable domain. Nonetheless, the understanding of

this problem is desperately insufficient worldwide. There is a need to reconsider personal and public values to reduce the impact produced on the environment and to roll back to the acceptable level, and a lot of time is needed to win the support from the politicians in this respect”, D. Meadows says in his preface to the Russian edition of his book “Limits to Growth: The 30-Year Update” (Meadows & Randers, 2007).

“Development objectives should be attained through the system of educational, moral, biological, demographical, socioeconomic, and humanitarian frameworks, emphasizes academician V.A. Ilyichev. The key components of these frameworks include innovative investment vehicles, designated to boost the development of humans, machinery, technologies, socioeconomic relations, or the development of productive forces in their entirety, together with the main productive force, the one of the biosphere” (Ilyichev, 2012). The diagnosis that reads as “the Earth is sick with humans” must be treated through the implementation of a different kind of philosophy or, at least, “the ecologization of the human conscience” (Ilyichev, 2012).

Behavioral patterns need alteration; basic values of the man-induced culture need reconsideration; ideals of the consumer society must be given up, and spiritual reformation must be triggered. To begin with, behavioral patterns of urban planners must be altered; the urban planning ideology needs thorough changes to be further based on ecological values.

The RF Federal Law “On Environmental Protection”, issued on January 10, 2002, states that “...the system of general and comprehensive ecological education is established with a view to the formation of the ecological culture and professional training of specialists” (Art. 71) In the meantime, “speaking about the state of development of the ecological education in Russia, the impression is that the present-day low level of ecological education arrangements in the country can in no way match the seriousness of ecological problems, and it is no consequence of the unavailability or insufficiency of legal acts. It is the most likely consequence of the absence of any federal policy in the area of ecological education, instruction, and enlightenment,” says Cherkashin, member of the Foreign Economic Council of the State Duma committee in charge of natural resources, nature management and environmental protection (Cherkashin & Ulanova, 2014).

Despite any legal and regulatory actions, aimed at the promotion of ecological education, effective continuous ecological education is unavailable in Russia, and any eco-education programs offered in this country fail to meet any up-to-date standards. Reduction in the number of disciplines and unification of curricula within the framework of programs accompany the ongoing higher education reform. This process also applies to sociological and ecological disciplines. Moreover, social ecology has been next to ousted from university-level curricula.

Educational reforms, training of the next generation of skillful civil engineering, urban planning, and architectural design specialists, having an eco-centric image of the world and nurturing the human capital capable of satisfying the needs of the present-day world comprise the main objective of the present-day Russia.

Today, Russia’s human capital fails to serve the imperatives of our time both from the viewpoint of ecological training and from the viewpoint of professional education. Contemporary researchers insist that “numerous failures in the implementation of state-funded construction projects, legislation reforms, economic transformations and other efforts of the Russian government represent an immediate consequence of the comparatively low quality of Russia’s human capital and its inefficient performance” (Korchagin, 2014).

According to Agasyants, professor of the Moscow State University, the low level of culture and the lack of professionalism, demonstrated by the government officials in charge of the urban development, pre-determine the comprehensive lawlessness that accompanies the implementation of urban construction projects, extends to the preservation of the monuments of history, architecture, culture, as well as the under-maintenance of the utilities sector. As a result of distortions in the state of affairs in the cities, window-dressed by architectural projects, the government pays less attention to the problems that accompany functional urban planning processes, training of urban planning specialists, and maintenance of engineering facilities” (Agasyants, 2009).

3.2 Condition of the Human Capital in the Russian Construction Industry

In 2011, within the framework of the joint project implemented in cooperation with the University of Arizona through the involvement and support extended by Department of Labor Relations and State Civil Service of the Ministry of Healthcare and Social Development of the Russian Federation, a research team of Department of State Management, Moscow State University, conducted a poll among the experts and executives of Moscow-based construction companies in respect of the state of the market of labor resources in the Moscow metropolitan area. Ten executives of construction companies (with the number of employees varying from 50 to 200) and five labor market experts participated in the poll. The poll had 40 questions clustered into the four main

groups: personnel recruitment, personnel motivation, general trends in the construction industry's labor market development, and the main development trends typical for the construction industry. According to the poll findings, 80% of the respondents believed that the construction industry did not suffer from the insufficient supply of unskilled manpower, rather, its supply was excessive, but the industry suffered from the insufficiency of skilled specialists, including architects, designers, managers, logistics specialists, engineers, accountants, budget officers, and construction site supervisors. Today, Russia's construction industry also suffers from the insufficiency of key and semi-skilled workers, such as electricians, welders, and crane operators. 83% of the respondents believe that the insufficient number of construction specialists and the small number of graduates of civil engineering universities, choosing to work as civil engineers, cause this deficiency. Besides, the respondents believe that the quality of the system of engineering education is poor (Kvashonkin & Kochneva, 2014).

Department of Social and Political Sciences of the Moscow State University of Civil Engineering, including the co-authors of this paper, implemented a sociological survey to study the human resources of the construction industry in 11 Russian regions. The poll dates back to November and December, 2011, and it involves three categories of respondents, including employers, young specialists, and graduate students.

The poll findings have proven that each region suffers from the insufficiency of highly skilled engineers. Moreover, some engineers, employed at construction sites, have no civil engineering degrees. The number of degree specialists employed with construction companies in Moscow, St. Petersburg and Kazan, is sufficiently high, while Nizhniy Novgorod, Voronezh, and Volgograd demonstrate a striking deficiency of civil engineering professionals. Notably, top executives of construction companies are sure that their engineers need no degrees and that any person can acquire the civil engineering knowledge and experience on the job. That's the reason why the majority of employers believe that they have a sufficient number of civil engineering specialists at their disposal, although the number of respondents who believe that the number of their specialists cannot satisfy the needs of their companies is a little higher in Nizhny Novgorod and Moscow.

Perhaps, the widespread notion of the low quality of training failing to meet the requirements, set by construction companies, underlies the "show-me" attitude towards civil engineering degrees. According to the poll findings, the majority of employers, except for those based in Novosibirsk, believe the set of skills, typical for recent graduates, fails to comply with their responsibilities performed on the job. 70% of the executives of construction companies based in Samara, 60% of the executives of construction companies based in Volgograd, 66.7% of the executives of construction companies based in Voronezh, and 55% of the executives of construction companies based in Moscow believe that the incompetence of applicants for engineering vacancies is the main reason for their failures in finding jobs.

Today, the labor market needs engineers who have acquired the most advanced set of knowledge and mastered the most advanced technologies. The competence means the ability to apply the knowledge accumulated at the university in the course of job performance, to solve specific problems, and to attain pre-set objectives. The applicability of the university knowledge and skills on the job boosts the value of education. From 80% to 100% of employers, based in different Russian regions, believe that the ability to apply the theoretical knowledge, accumulated at the university, is "important" or "very important". The employers, based in St. Petersburg, Tyumen, and Penza, highly appreciate this ability.

No employer is happy to merely recruit a highly skilled specialist. Any employer wants his/her subordinates to demonstrate strong social skills, including the ability to work in a team, and to be efficiently motivated to attain corporate objectives. The majority of the executives of construction companies (Novosibirsk–70%, Moscow–57.1%, Samara–55.0%, Penza–53.8%, Tomsk–50.0%) indicated the importance of the competence that reads as "the ability to work in a team". The competences that read as "the ability to take the initiative" and "the ability to identify and attain goals" are particularly important for the employers based in Novosibirsk, Samara, Penza, and Tyumen. Other personal features, identified by the employers as very important, include responsibility, discipline, and can-do attitude.

4. Discussion

4.1 Education Quality Deterioration as the Reason for the Human Capital Quality Degradation

The survey, conducted by Department of Social and Political Sciences of the Moscow State University of Civil Engineering, confirms the conclusions of the above poll. Executives and experts believe that the most valuable features of highly and semi-skilled specialists include decision making and leadership skills, the ability to timely improve and brush up one's knowledge, and a good command of advanced computer technologies. The findings of the poll of experts have proven that the weaknesses include the insufficiency of professional skills, poor

knowledge of specific features of the construction industry, poor professional education, and insufficient computer literacy of highly and semi-skilled specialists (Kvashonkin & Kochneva, 2014).

We have to acknowledge that the quality of Russia's human capital keeps deteriorating. According to the report issued by the State Duma committee, the share of education-related expenses in the Federal budget went down from 5.1% in 2013 to 4.3% in 2014. The share of the budget-funded education in the GDP went down, as well. In 2013, it was equal to 1.0%, while in 2014–2015 it reaches .8% a year (Korchagin, 2014).

Against this background, modernization, improvement, and “the update” of degree programmes for the latter to meet the standards of the top universities, may jointly solve the human capital problem. Third-generation standards of education, issued by the Ministry of Higher Education and Science of the Russian Federation, apply to bachelors and masters. Universities of architecture and civil engineering and institutes of architecture and civil engineering rework their bachelor and master-level programs to meet the new standards. Few universities offer bachelor degrees in urban planning, and the number of their graduates does not meet the market demand for such specialists. The number of master degrees is also small; nonetheless, some experience in their training has already been accumulated.

4.2 Overview of Urban Planning Curricula Offered by the Russian Universities

The co-authors have performed a selective research into the master-level urban planning programs offered by the Russian universities. The program entitled Generation of Spatial Systems in Urban Planning and offered by the Moscow State University of Civil Engineering, is a well-balanced product designated for master students specializing in land development and use. This program has a modular structure, and it encompasses:

- The methodological fundamentals of urban planning, including the study of the positive historical experience of Russian and international urban planning;
- Advanced research aspects of urban planning designated to ensure a favorable living environment and sustainable land development;
- The significance of the cultural heritage as the part of the urban architectural design and the legal framework applicable to historical sites and their preservation;
- Social and demographic issues associated with urban and rural planning activities based on the study of the principles of assessment and regulation of human needs, population structure, and the influence of the household composition on the housing structure to ensure a comfortable living environment;
- The social aspects of urban planning activities;
- The urban planning framework, its relevant challenges and prospects for its development;
- The innovative potential of information technologies in urban planning based on the packages of software designated for traffic planning and GIS technologies;
- The urban planning constituents of municipality-level management;
- The engineering constituents of rural and urban planning and their impact on master plans;
- The role of transport service patterns applicable to residential and public areas within the framework of urban planning technologies;
- The importance of engineering research for urban planning purposes;
- The present-day aspects of the civil engineering science and technology as part of the design of urban engineering facilities;
- The patterns for the innovative development of the urban economy;
- The ecological safety of urban areas, the importance of the environmental framework for urban planning solutions.

Along with the study of the theoretical constituent of the program, master students can take internships at various leading R&D and design institutions, including the Urban Planning Institute of the Moscow Region, the Research Institute of the Master Plan of Moscow, etc. (Master-level Program, Generation of Spatial Systems in Urban Planning, Moscow State University of Civil Engineering)

Other universities of civil engineering and architecture, based in Russia and in the CIS states, have also implemented exclusive master-level urban planning programs. For example, St. Petersburg University of Architecture and Civil Engineering offers a master-level course in the theory of urban and district planning. (Master course in urban planning, district planning, and rural planning, St. Petersburg University of Architecture

and Civil Engineering) Moscow Institute of Architecture trains master students majoring in urban planning and design. This institution of higher education has long-standing traditions of training architects and urban planners. Within the framework of this master program, students learn to assess and project the condition of urban areas, to design urban planning concepts, to develop spatial solutions for complex urban planning hubs, to solve the problems of localization of architectural designs in the non-standard environment, and to design area development patterns and their implementation procedures. The mission of this master program is to train urban planning specialists designated for design companies, research institutions, and public agencies. Program graduates must be able to apply their fundamental and applied knowledge and innovative technologies to their creative urban planning designs (Urban planning and design, a master-level program, Moscow Institute of Architecture).

Higher School of Economics offers a master program entitled *The City: Spatial Planning*. The urban planning school, founded by this university, is considered to be the most advanced one in Russia. The mission of this program is to train specialists in urban space planning comprising land use planning, urban development zoning, and site planning for the purposes of public and municipal management, construction and infrastructural development, as well as the research into cities and urban environment, urban economy and other networks. This program drives particular attention to the inter-disciplinary approach. It contemplates the study of economic and sociological urban theories, methodologies and their application techniques. This program manifests a unity of humanitarian and engineering approaches to the training of specialists in urban planning. The program has numerous modules encompassing issues of arts and social sciences (Master Program, Higher School of Economics).

The Institute of Architecture of the Southern Federal University (Rostov-on-Don) has implemented a master-level program in the theory of urban and district planning. This program is tailored to the specific features of space and land use planning in the southern areas of the Russian Federation. The program contemplates the research into social, economic, ecological, urban planning and other problems that accompany the transformation of the environment in the south of Russia, or the fundamentals of architectural design aimed to transform the cities and towns of the Russian South in the present-day social and economic context. The program unveils the problems that accompany the formation and development of settlement and urban planning patterns typical for the Russian south, namely, settlement patterns followed by migrants; urban planning methods employed for the recovery of coastal areas of the Black and Azov seas, development and arrangement of production facilities in the hosting environment of the Rostov region (Abstract of the Master Program in Architecture, Southern Federal University).

The program in the design of urban eco-systems, developed by the St. Petersburg National Research University of Information Technologies, Mechanics, and Optics, encompasses advanced solutions in urban development, architecture, and planning. The program drives particular attention to the study of the European expertise in the land use zoning and planning, as well as ecological factors (St. Petersburg National Research University of Information Technologies, Mechanics, and Optics).

The master-level program in the design of urban landscapes, offered by the National Research Irkutsk State Technical University, focuses on the management and self-organization of urban planning systems, interrelation between land zone planning and urban engineering and traffic systems (National Research Irkutsk State Technical University).

Department of Architecture, Krasnoyarsk Institute of Urban Planning, Management, and Regional Economy, offers a master-level program in the design of urban landscapes; its top-priority constituents include the design of a comfortable living environment, urban ensembles, urban traffic design, functional and artistic approaches to urban leisure areas, “green” networks of parks, boulevards, restructuring of urban and rural areas, ecological problems of urban planning (Krasnoyarsk Institute of Urban Planning).

4.3 Conclusions based on the Analysis of Curricula and Programs

The market of master-level programs in urban planning is quite saturated, although the content of the programs offered in the market is highly heterogeneous. The market offers few urban planning programs focused on environmental problems. The programs, implemented by various universities, contain few ecology-related disciplines. The problem is that Russian universities have just initiated this process that takes advantage of the resources at their disposal, their faculty and local needs. Unfortunately, Russian regions have an insufficient number of well-trained lecturers. Besides, the State educational standards of the third generation comprise no ecological competencies. Universities fail to coordinate their efforts in developing and launching new programs, and therefore, they cannot meet students’ academic mobility requirement imposed by the Bologna process with a

view to the provision of the in-depth ecological education.

Development of bachelor and master-level urban planning programs in furtherance of the European requirements has turned particularly relevant. New programs must also focus on the sustainable development of cities and rural areas with account for the principle of the biosphere compatibility and specific features of local landscapes. Moreover, these programs must take account of the most recent international trends in the training of urban planning specialists, the most advanced achievements of the urban planning research, and its practical application in the most advanced countries of the world.

Tempus Project CENEAST: Reformation of the Curricula on the Built Environment in the Eastern Neighborhood Area pursues these goals. The objective of this project is to facilitate the transformation of the curricula designated for bachelors, specialists, and masters specializing in natural sciences, technology, environmental protection and social sciences. Successful implementation of this project will help universities to train skilled, open-minded, and ecologically conscious urban planning specialists who will demonstrate their caring treatment of the biosphere.

The project co-developers have drafted twenty-one modules designated for bachelor and master students, as well as PhDs. They include Sustainable Urban Design; Green Built Environment; Environmentally Sustainable Cities Development; Sociological Methods Used for Sustainable Urban Development; Integrated Analysis of the Built Environment Life Cycle, etc. (Project CENEAST) In the 2014/2015 academic year, CENEAST partner universities integrate these modules into their curricula. In particular, Moscow State University of Civil Engineering has launched a special-purpose master-level program in Architectural and structural design and theory and practice of sustainable architecture. This program has several modules developed within the framework of this project.

5. Conclusion

Against the background of dangerous environmental conditions, that may develop into the gravest ecological crisis, formation of ecological consciousness, ethics and aesthetics; training of ecologically conscious urban planners should be the top-priority objectives of the Russian universities. They may be broken down into the following actions:

- Coordination of the content of curricula and modules, development of unified requirements applicable to the competencies to be developed by future urban planning specialists within the framework of the Europe's educational space.
- Development of the ecological constituent to be integrated into social and engineering disciplines. Implementation of the principle of continuity in the ecological education.
- Development of inter-disciplinary educational modules.
- Focus on ecological competencies for students who do not major in environmental protection.

It is the new generation of researchers, executives, engineers, architects, designers, or the high-quality human capital, who may reengineer the industry-focused worldview and the anthropocentric treatment of nature to ensure the transition to the new civilization that will value the preservation of the biosphere as its top priority.

Any further research projects must focus on the identification of methods designated for the coordination of civil engineering and urban planning degree programs within the framework of the European educational space, and on the training of specialists in green building and eco-sustainable architectural design.

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