Rational Environmental Management: The Platform for Integration and Optimization of Resources

Mikhail K. Starovoytov, Lyudmila N. Medvedeva, Konstantin Y. Kozenko, Yana M. Starovoytova, Gennady I. Lukyanov, and Mikhail A. Timoshenko

Abstract The article is devoted to questions of optimization of resource management, namely, the management of the city authorities. The article gives a definition to a city as a cluster, as an integrated expression of the predicted productivity of efforts of the city authorities indicators of a development of the city, satisfaction of its inhabitants have to act with work and life. Also, the paper provides materials of calculation of an index of development of industrially developed average cities. Approaches to strategic planning in the cities are defined. It is proved that ensuring dynamic balance and positive dynamics in development of social, ecological, and economic systems of the cities can be based on the principles of foresight-management. Authors offer the concept of the green cities as the most perspective concept in the twenty-first century. The question of development in the city of a specialized cluster of green construction is considered.

The modern global economy is an urban economy: nowadays a half of the population of the planet lives in them, it increases every year by 65 million people; in the cities the 80 % of world gross product is produced (Medvedeva and Starovoytova 2013). In the report of the Organisation for Economic Co-operation and Development (OECD), within the project Future Global Shocks, main potential risks which

M.K. Starovoytov (✉) • L.N. Medvedeva • G.I. Lukyanov
Volzhsky Polytechnical Institute (branch of Volgograd State Technical University), 42a Engels St., Volzhsky, Volgograd Oblast 404121, Russia
e-mail: vem-205@volpi.ru; milena-med@yandex.ru; vem-205@volpi.ru

K.Y. Kozenko
All-Russia Research Institute of Irrigative Agriculture, 9 Timiryazeva St., Volgograd 400002, Russia
e-mail: k-kozenko@rambler.ru

Y.M. Starovoytova
Volgograd State Technical University, 28 Lenin Ave., Volgograd 400005, Russia
e-mail: felindra@mail.ru

M.A. Timoshenko
Volgograd State Soco-Pedagogical University, 27 Lenin Ave., 400005 Volgograd, Russia
e-mail: tma1954@mail.ru

E.G. Popkova et al. (eds.), *Integration and Clustering for Sustainable Economic Growth*, Contributions to Economics, DOI 10.1007/978-3-319-45462-7_36

with the increasing force will cause a loss to mankind are designated: virus pandemics; cyberattacks on the main infrastructure objects; financial crises; social disorders; climate changes. The coherence and complexity of the occurring phenomena cause needs the weighed and optimum control of the resources which are situated in management of the city authorities. It allocates the cities conditionality with the real power which is similar to the rights and obligations of large corporations. American scientific G.E. Frug considered (Frug 1980), that "the modern city is not staff in a miniature, and it is rather, commercial (business) corporation: put it—reasonably to manage local affairs and was able to use (commercial) methods in the scheme of municipal management". The authorities of the cities can successfully or inefficiently operate the resources as heads of the companies, which are available at their order. The cities can be insolvent in providing the obligations and to become bankrupts as well as corporations have municipal property and during a certain period of development. In the USA, in case of bankruptcy of the city of its power the obligation passes to the higher level of territorial education—the staff. In 2011 the largest district of America—the State of Alabama declared the bankruptcy. The district ran into debt to creditors (banks and finance corporations) of $4.1 billion. It was not the first municipal bankruptcy in the USA—in 2011 the bankruptcy was declared by the capital of the State of Pennsylvania—Harrisburg. According to laws of the USA, any administrative unit which declared itself a bankrupt is exempted from debt burden and carries out sanitation of the obligations. For Russia, it is rather useful experience, as during world crisis many small and average cities can't provide social payments, for they actually are legally insolvent subjects. Creating the institute of the municipal right in the cities, the federal authority not only unites in it the public and local administration, but also creates prerequisites for a choice of an independent way of development. Throughout all history scientists and practitioners tried to prove the mechanism of emergence and formation of institute of the cities. The works devoted to this topic include: Eduard Meyer (theory of "iron will of the sovereign") (Protasova 1938), M. Weber (Weber 1922), Richard Whitley (Whitley 1980), L. Wirt (Wirt 1969), W. Maitland (Maitland 1962), F. Ratzel (Ratzel 1923), I. Thunen (Thunen 1850), D.M. Petrushevsky (Petrushevskiy 1912), V.V. Stoklitskaya-Tereshkovich (Stoklickaya-Tereshkovich 1960), V.G. Davidovich (Davidovich 1959), L. Velikhov, R. Grinberg, V. Lexin, E. Pertsik, A. Netshadin, et al. In their researches the city appears as concentration of "spirit of the age", as the uniform organism penetrated by numerous communications and the relations of objects of economy and society. By the nature of the city have the dual nature: on the one hand, it the "central places" serving needs of the adjacent territory, with another—"knots" of various networks, including international, going beyond controlled space. Such state provides them necessary stability, and creates the base for further transformation. The subject of education and development of clusters, it always was among priorities of world science. The author and the developer of the theory of clusters M. Porter considered that "the cluster is a group of geographically adjoining interconnected companies and the related organizations of education, state bodies operating in a certain sphere and complementary each other". Scientific views of M. Porter concerning subjects, and the communications arising between us in a cluster

quite "keep within" urban economics. If we look at the city, we can see that it is the complex of producers and consumers, the stockholder is connected by the developed relations for a rather large period of time created in a certain territory. The problem of identification of clusters is permanently actual for scientists and for governing bodies. The institute of strategy and competitiveness of Harvard Business School (USA) analyzed the structure of a large number of clusters and classification of kinds of activity in them is made. It was proved that a big variety of elements of system (cluster) provides it with large stability and adaptability, and "maintenance of a necessary variety" provides its structural flexibility. In Peter Dicken's works clusters are subdivided into two groups: generalized, based on the territorial concentration and positive externalities arising, in particular, in the course of an urbanization, and specialized, based on concentration of efforts of subjects in one branch. There are reasons to believe that each city is the general cluster in which there can be specialized clusters. Taking into account that the IT component share grows in the world in management, it is possible to assume that authorities of the cities more and more become certain "service company" which as "information umbrella" blocks and coordinates all city resources and information streams. The cluster paradigm as initial frame of reference on development of world economy is exposed to serious changes. It is necessary to consider that a role of the cities as independent subjects of the international relations becomes more significant. It becomes increasingly important to gain "intimacy" for them between such subjects as institutional, geographical, organizational, cognitive, social, communicative, and entrepreneurial.

In 2010, the population of the Russian Federation lived in 2386 city settlements and 134,000 rural settlements (Table 1).

The tendencies of development of world economy differ in complexity and divergence; very often the cities which are at different stages of development are at the same time involved in similar processes under the influence of objective and subjective conditions. The conducted research (with use of the program "Statistical

Table 1 Change of population in the Russian cities

The grouping of urban settlements	The number of urban settlements		The number of inhabitants in them, thousands people		Number Residents in 2010 in % as to 2002	Number residents % of total	
	2002	2010	2002	2010		2002	2010
Total cities with a population (thousand people):	1098	1100	95,916	97,527	101.7	100	100
Up to 50	768	781	16,623	16,445	98.9	17.3	16.9
50–100	163	155	11,083	10,854	97.9	11.6	11.1
100–250	92	91	13,817	14,105	102.1	14.4	14.5
250–500	42	36	14,574	12,146	83.3	15.2	12.4
500–1000	20	25	12,403	15,755	127.0	12.9	16.2
1000 and more	13	12	27,416	28,222	102.9	28.6	28.9

Note: (URL: http://www.perepis-2010.ru)

Package for Social Scientists") allowed structuring the group of industrially developed average cities, with a characteristic set of demographic, economic and dynamic characteristics. The group of 16 average industrially developed cities creates the integrated spatial cluster of the average industrially developed cities. Scientific concepts, programs, and development models developed for one city with full success can be embodied in other city which enters this integrated cluster. For quite a long time, the Swedish authorities have been offering the program of a sustainable development of the city—Symbio City. Implementation of the Symbio City project will allow local authorities to use effectively city natural resources, to provide interaction of various city systems and technologies. Authors of the project claim that there are a lot of advantages at the model, it rather flexible, it is capable to be arranged under needs of the concrete city. However, the practice shows that distribution of symbiotic model goes very slowly. The model developed by authors: "The typology of the cities on an economic state and tendencies of development", allows to classify the cities for association in the integrated clusters (Table 2).

As integrated expression of the predicted productivity of efforts of the city authorities of group of the average industrially developed cities indicators of a development of the city, satisfaction of its inhabitants with work and life will act. The main indicators of the reached level of development (CDI) industrially developed average cities are presented in Table 3.

Calculation of an index of development of industrially developed average cities, except for basic indicators (a level of development of infrastructure of the city; waste disposals; state of health and education of the population; the volume of release of a city product) includes additional ones (road condition, number of cars per 1000 people, security with kindergartens per 1000 people, indicators of development of MSP and introduction of innovations, state of ecology, level of improvement and visual appeal of the city). Improvement of quality of life of citizens is a strategic reference point of activity of authorities. The simple increase in investments into city infrastructure and construction isn't panacea from all problems. Very often, traditional decisions lead a development of the city up a blind alley, or are connected with big expenses, and aren't capable to change life of most of the population qualitatively. If the city authorities neglect those opportunities which are

Table 2 A matrix for justification of creation of the integrated cluster of a certain group of the cities

		Economic state			
		Steady	Rather unstable	Stagnation	Crisis
Level of development	High	Strategically steady	Economically developed	Economically problematic	Economically underdeveloped
	Average	Tactically steady	Rather economically developed	Rather economically problematic	Economically problematic
	Low	Quickly steady	Economically underdeveloped	Economically highly problematic	Economic crisis

Table 3 A cluster of industrially developed average cities with development indicators—CDI, 2014

No.	Cities	Index of city development	Including sub-indices				
			Infrastructure	Housing comfort	Population health	Education of population	City product
1	Magnitogorsk	68.58	60.20	89.0	41.90	82.70	69.10
2	Nizhny Tagil	65.60	60.10	90.50	41.10	80.10	53.60
3	Volzhskiy	58.82	59.40	91.00	44.50	83.00	38.70
4	Cherepovets	75.16	60.80	89.50	40.80	82.00	81.70
5	Surgut	75.90	67.70	90.50	42.20	83.60	95.70
6	Sterlitamak	60.98	60.00	90.00	42.00	83.40	29.50
7	Komsomolsk-on-Amur	58.50	65.20	88.30	41.60	80.70	16.70
8	Taganrog	58.24	60.40	87.90	43.20	80.90	18.30
9	Nizhnevartovsk	95.50	67.70	89.0	42.20	85.50	193.10
10	Bratsk	60.24	61.60	86.40	39.40	84.00	29.80
11	Novorossiysk	57.84	63.80	86.10	42.30	82.70	14.30
12	Nizhnekamsk	82.86	62.70	91.10	42.80	82.20	135.50
13	Stary Oskol	68.42	59.50	89.30	42.80	84.00	66.50
14	Norilsk	76.22	68.90	90.90	41.70	83.40	96.20
15	Dzerzhinsk	59.82	58.00	89.40	41.30	84.50	25.90
16	Orsk	58.38	61.60	90.60	41.80	82.20	16.70

Source: Prepared by L.N. Medvedev in the basis of the research materials (Medvedeva 2011)

opened before them by green economy in the field of management and preservation of natural resources, at best they will continue "to mark time", and in the worst—will appear outsiders and start losing the main resource—human. Today, the search of decisions is conducted in areas: from the increase of efficiency of power to more perfect system of recycling, from development of clever transport infrastructure before safety and comfort of the dwelling. The presence of information technologies only strengthens movement of resources, expands borders of the traditional markets, strengthens the international division of labor. The analysis of foreign and domestic experience indicates the need of the differentiated approach at the solution of questions of development of the average industrially developed cities. The main requirements of development of strategy of the city have to be the following: creation of conditions for attraction of investments (introduction of effective instruments of financing and budgeting); development of the state and public institutes (definition of the interdepartmental working group responsible for preparation and realization of strategy); advance of innovative (green) technologies; information stimulation of city community (the forums, conferences advancing image of the city and its transformations).

On June 28, 2014 the Federal Law No. 172 "On strategic planning in the Russian Federation" was adopted. Activities for strategic planning in the cities, as well as documents, became legitimate, are entered into a legal framework. Under the difficult conditions of global competitive fight, it is difficult for local authorities to count on serious positive changes without processes of strategic planning. Different schools of science offer the approaches to the contents, staging, and process of a strategy making in the cities. In the majority of the developed countries of the world the document Strategic Urban Planning is the cornerstone of strategy of the cities. Process of development is carried out through coordination of interests of various key communities. Under the adopted law of strategy of the cities have to coordinate with long-term goals of development of Russia in general, and also separate sectors and branches of economy. Coordination of strategy of development of the cities with federal programs happens on interaction—"management by results" that allows to provide interrelation of results of activity of authorities with the budgetary process. As emergence of strategy as a tool of management with anticipation of the future is obliged to corporations, it starts getting the model of management connected with processing of the considerable arrays of information which are difficult giving in to the analysis. Allocation is more whole, definition of internal and external conditions of development of the cities; establishment of opportunities and restrictions in the social and economic sphere; definition of resources; identification of stakeholders and designation of competitors; establishment of indicators of development, allow to create the mechanism of activities of authorities for achievement of a main goal—to improvement of quality of life of citizens. Use in strategic management of certain tools—models of the balanced indicators, road map, system of RM, the theory of restrictions of TOS—opens before governing bodies by the wide horizon for the analysis and decision-making. Each of the used models in strategic planning has the theoretical base, the principles, and algorithm of decisions. For example, the concept of economical

technologies of management (SCPM) explaining manifestation of synergetic effect in planning has a strategic map, a matrix of the balanced indicators, and a matrix of ranging of processes in the baggage. Any successful techniques demand reconsideration depending on a concrete context (historical, economic).

Local authorities can make realization of strategy on a basis: standard of Total Quality Management (TQM); theories of performance management (Performance Management); concepts of management of competences (Competence Management), etc. (Senge 2005). To operate the modern city means to carry out functions: analysis, planning and forecasting, ensuring control, motivation of workers; to realize the principles: integrity, territorial security, strategic and innovative orientation, and corporation culture; to use by methods of impact on the social and economic sphere. Winners Nobel awards George Akerlof and Robert Schiller to correlate theoretical bases of strategic management to the changing operating conditions of world economy have suggested the authorities of the cities to use the project—"SAGA" ([S]mart, [A]ttractive, [G]reen, [A]ccessible). Ensuring dynamic balance, balance, and positive dynamics in development of social, ecological, and economic systems of the cities can be based on the principles of foresight management (Hines 2007; Jemala 2010). Foresight's methodology helps local authorities on the basis of calculation of competitive advantages, strong and weaknesses—to create 'the desirable future of the city'. The offered Foresight's matrix helps the authorities to concentrate on those sites of management which are most critical for the present, and especially for the future. The main values of Foresight management in the cities are the following: effective management of the human capital, quality of goods and services (from a position of "customer satisfaction") to the concept of "customer delight" (Kolesnikov 2014). Main objectives and the directions of strategy of development of the middle industrially developed city are presented in Table 4.

When developing a strategy of development of the average cities, it is necessary to consider not only today's situation, but also history and evolution of the city, his settled communications, features of a geographical arrangement and inclusion in the international division. The city authorities have to find the answer to questions: what competitive advantages city resources have? How can the global competition affect development of the city? One of the ways of development of the averages which are industrially developed lies in the plane of green economy. Innovative solutions in the sphere of ecology and careful attitude to natural resources, alternative energy sources and resource-saving innovations, and technologies of full processing of waste are called "green technologies". The use of innovative developments, the progressive ideas concerning spatial development, public transport, urban economy, and waste-free technologies will allow increasing competitiveness of this group of the cities. The modern municipal government includes the following spheres of activity: providing the population with the main services (safe drinking water, housing, and high-quality services in health care and education); effective use of local resources; formation of an ecological framework and innovative infrastructure. During the assessment of municipal economy it is very important to provide the correct accounting of extent of impact of the person on

Table 4 The main directions of development of the middle city, included in strategy

Purposes of the strategic direction	Problems of the direction
Introduction of quality management system	To transfer work of services of administration Quality management system of ISO 9000:2008 and standards of green economy
Strengthening of ties with other cities	To increase the management level, technical and information capacity of structures of management
Advance of the city in world space	To continue work on strengthening of reputation of the city as most well-planned middle city
Introduction in work of innovative methods	To create system of the interconnected innovative centers, technological parks, financial institutions and investment structures in the city
Integration into world information space	To create modern image of the city in information space. To continue development of model of "The electronic city"
Creation of image of the well-planned average city	Creation of image of the well-planned average city
Formation of zones of activity of business	To legislatively fix zones of activity of business activity, to open the center of green technologies
Development of a network clever city automobile and electro transport	To create the uniform control system of the motor transport supplementing and interconnected with system of city electro transport; to develop the project development by clever transport
Development of the infrastructure engineering	To increase quality of drinking water for the population; to reduce specific consumption of energy and water resources
Improvement of an ecological situation in the city	To protect environment from an adverse effect of production wastes; to realize the production and ecological project: "The big Estuary"
Formation of the social environment of high-quality services	To promote employment of the population, to open green workplaces; to create effective system of social protection of a family and the childhood
Solution of a housing problem	To improve living conditions of needy and socially unprotected citizens. Fund of resettlement from shabby housing
Reforming of system of housing and communal services	To create the competitive environment and an effective control system and service of housing stock
Creation of conditions for safe life of the personality, family	To reduce the level of technogenic and natural dangers to the population. To increase social safety of the personality, a family and society

environment. It is possible to carry to types of human impact on the nature: industrial influence according to branch features; municipal and transport influence; impact on the natural and landscape environment. At discussion of a problem of natural resources on average the city more and more attention is paid to the resources connected with existence of the person, health of society. The management of natural resources with focus on health of the person has put in the forefront the requirement: from minimization of impact on environment to minimization of harmful effects on the person. Interaction with environment relies, besides the

power and technological bases on knowledge of laws of society, on the one hand, and the nature—with another. The understanding of laws of development of a civilization is an understanding and using the saved-up thousand-year experience of generations of people. The mechanism of management of rational use of natural resources on average the city represents system of the relations in which creation of organizational and institutional communications and the relations between economic entities, the society and environment is provided on the basis of the balanced approach (Fig. 1).

In reproduction process of the cities rational use of natural resources is defined on the basis of the made decisions and the fundamental principles: the differentiated approach to establishment of the mode of use of objects of environmental management; evidence-based combination of ecological and economic interests of society; blaze of publicity about a condition of environment; priorities of precautionary measures in the field of environmental protection; availability at a price of the environmental management and indemnification caused to environment; stage-by-stage introduction of green technologies in municipal economy. The data obtained in the course of activity of the city administration forma the system of indicators on the basis of which it is possible to draw the scientifically based and statistically confirmed conclusions about efficiency use of natural resources in the city (Table 5).

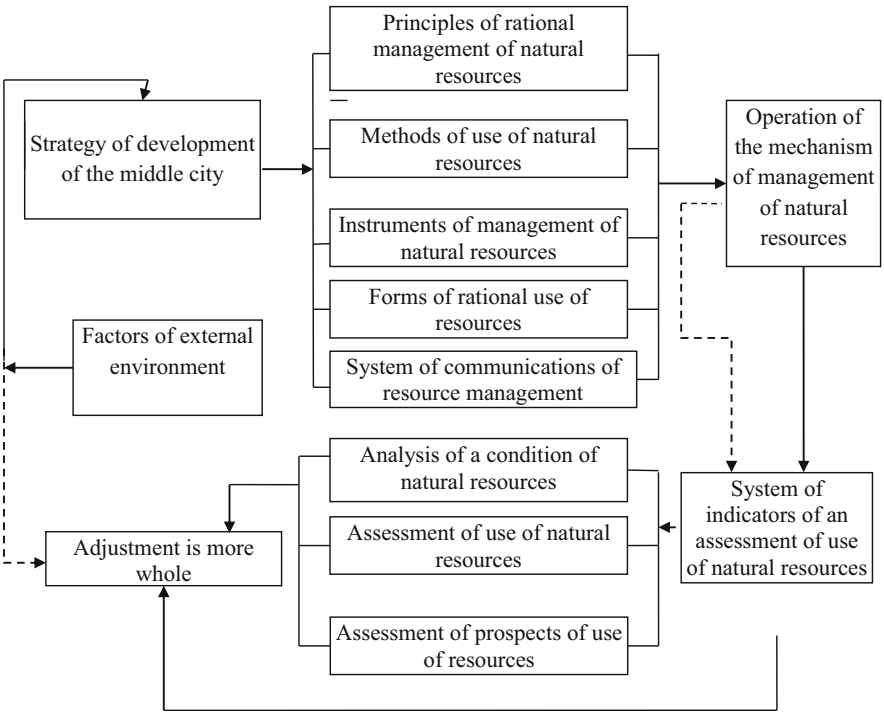

Fig. 1 The mechanism of management of natural resources in average industrially developed city

Table 5 System of indicators of an assessment of rational use of natural resources at the city level

Resource security of the city	Readiness for rational use of natural resources	Productivity of use of natural resources
1. Total area of lands of forest fund, thousand hectares per capita. 2. Area of green plantings: thousand hectares per capita; m3. 3. The area of especially protected lands, one thousand hectares/persons. 4. Use of water, thousand m3 per capita. 5. A water intake from natural sources, m3p ersons. 6. Costs of environmental protection, $ thousand per capita. 7. Financing of nature protection actions, $ thousand/persons.	1. Number of the operating organizations, the processing productions/1000 people 2. Number of the operating organizations, production and distribution of the electric power, gas and water/1000 people 3. Permissions to dumping of the polluting substances into water objects, quantity. 4. Permissions to emission of the polluting substances in air, quantity. 5. Actions for control of objects of economic activity/1000 people. 6. Acts concerning rational environmental management, quantity. 8. Examination of compliance to the planned activity to requirements of the nature protection legislation, quantity.	1. Dumping of the polluted sewage into superficial water objects, one thousand m3/persons. 2. Emissions of the polluting substances in air departing from stationary sources, thousand tons per capita. 3. Production wastes and consumption in a year, one thousand tons/persons. 4. Incidence of the population on groups per 1000 people 5. Investments into environment, $1000 per capita. 6. The size of tax revenues in the budget from the use of natural resources, $ per capita. 7. Payment for negative impact on environment, $.

The city, big or small, constantly seeks for updating its functions. The main directions of sustainable development of the average cities on the platform of green economy are created (Table 6).

Contemporary view on the issue of economy in middle-sized city should be based on the idea that balance of ratio of socio-economic needs and rational nature use should be equal.

This could be determined with the help of the following formula:

$$\mathrm{Ft}\,(\mathrm{L},\ \mathrm{K},\ \mathrm{P},\ \mathrm{I}) \ \leq\ \mathrm{Ft} + 1(\mathrm{L},\ \mathrm{K},\ \mathrm{P},\ \mathrm{I}), \tag{1}$$

where: Ft (L, K, P, I)	function of sustainable development
L, P	labor and natural resources
K	artificially created (physical) capital, production means
I	institutional factor
t	time factor (at $0 \leq t$).

The main ecological indicator, which should be taken into account by local authorities, includes:

Table 6 The main directions of development of the average cities on the basis of realization of the principles and provisions of green economy

Name	Specific directions
First level—greening of components of a city landscape	
Restoration of quality of air	Law: "The code on air" Control of pollutants of air Improvement of the quality standards Phytomelioration
Improvement of quality of drinking water	Law: "The code on water" Program of "steady water consumption" Reduction of dumping of pollution into water
Restoration of soil properties	Law: "Code about soils" Restoration of properties of soils (aeration, washing, and microbic restoration) Phytomelioration
Restoration of flora and fauna	Law: "The code about city flora and fauna" "Green channels" Creation of sites of "the wild nature", gardening of roofs and walls
Restoration of a relief, hydrosphere	Law: "The code of development of city landscapes" Recultivation, prosthetics of the broken landscape Restoration of quality and condition of ground waters
Second level—greening of a city economy	
Greening of transport	Adoption of the Ecotransport program Encouragement of eco-friendly means of transport Encouragement of pedestrian also conducted—the movements
Greening of a power complex	Adoption of the Steady Power Complex program Energy saving, warmth utilization Use of new power sources
Greening of industry	Modernization of the Industry taking into account Requirements of Ecology" program Eco-biotechnologies and "clever" equipment Use of resource-saving technologies
Greening of architecture, construction	Application of a wide complex of eco-friendly buildings and engineering constructions Creation of a beautiful and eco-friendly framework of the city
Third level—greening of needs of residents	
Biological requirements	Providing with clear drinking water and air Physical comfort in the city and in each dwelling Providing necessary vital space Eco-friendly clothes, food, furniture, phyto-design
Economic requirements	Green workplaces Work in which not renewable, rare or dangerous resources aren't used
Social requirements	Guarantee of civil liberties and addresses, support of initiatives

1. Indicator of atmospheric pollutant emissions:

$$\mathrm{Bn} = \sum_{i=2} (1 - \Delta \mathrm{Bi} / \mathrm{Boi}), \tag{2}$$

where: Boi total pollutant emissions for i-th component at the beginning of the forecast period, thousand tons per year

ΔBi reduction of pollutant emissions for i-th component at the end of the forecast period by means of nature protection measures, thousand tons per year

– indicator of waste water discharge into water basin:

$$\mathrm{Cn} = \sum_{i=2} (1 - \Delta \mathrm{Ci} / \mathrm{Coi}), \tag{3}$$

where: Coi total pollution discharge for i-th component at the beginning of the forecast period, million cubic meters per year

ΔCi reduction of pollution discharge for i-th component at the end of the forecast period by means of nature protection measures, million cubic meters per year

2. Indicator of soil pollution in city:

$$\mathrm{On} = \sum_{i=1} (1 - \Delta \mathrm{Oi} / \mathrm{Ooi}), \tag{4}$$

where: Ooi volume for i-th type of waste at the beginning of the forecast period, thousand tons per year

ΔOi reduction of volume for i-th type of waste at the end of the forecast period by means of nature protection measures, their secondary use or processing, thousand tons per year

3. Indicator of area of greening of city territory:

$$\mathrm{Sn} = \sum_{i=1} (1 - \Delta \mathrm{S} / S\Pi K\mathrm{o}), \tag{5}$$

where: SΠKo area of green plantings at the beginning of the forecast period, thousand hectares per year

ΔS growth of the area of green plantings at the end of the forecast period, thousand hectares per year.

Ecological indicators include:

4. Indicator of the use of city territory, taken out from the system of city nature use:

$$Fn = \sum_{i=1} (1 - \Delta F / F3), \tag{6}$$

where: F_3 area of real estate development at the beginning of the forecast period, thousand square meters per year

ΔF growth of real estate development at the end of the forecast period, thousand square meters per year.

5. Indicators of the use of public transport (passenger turnover of public transport):

$$Tn = \sum_{i=1} (1 - \Delta Ti / Toi), \tag{7}$$

where: Toi passenger turnover of i-th type of public transport at the beginning of the forecast period, billion passenger-km per year

ΔTi growth of passenger turnover of i-th type of public transport the end of the forecast period, billion passenger-km per year.

6. Indicator of the time of excess of the normed pollution of the atmosphere (number of days in a year with pollution, which exceeds average daily maximum permissible discharges in the atmosphere):

$$Qni = \sum_{i=1} \Delta Qi / 365), \tag{8}$$

where: Δ Qi number of days with concentration of i-th component which exceeds average daily maximum permissible discharges in the atmosphere at the end of the forecast period, days; 365—number of days in a year

7. Indicator of ecological investments (investments into basic capital, aimed at protection of environment and rational use of natural resources):

$$In = \sum_{i=1} (1 - \Delta I / I3), \tag{9}$$

where: Iз investments into basic capital, aimed at protection of environment and rational use of natural resources at the beginning of the forecast period, RUB thousand per year

Δ I increase of investments into basic capital, aimed at protection of environment and rational use of natural resources at the end of the forecast period, RUB thousand per year.

For city authorities, it is important to found on generalizing ecological indicator during economic decisions making:

$$\mathrm{Et} = \mathrm{Bn} \times \mathrm{Cn} \times \mathrm{On} \times \mathrm{Sn}, \tag{10}$$

where: Bn, Cn, On, Sn –particular adjustable indicators of pollutant emissions into atmosphere, waste water discharges, soil pollution, and greening area. ValueEt < 1 shows improvement of the quality of city environment (Starovoytov and Medvedeva 2010).

The city which is capable to be responsible for the actions and for life of citizens is the one on the side of new philosophy of rational environmental management. Development in the city of a specialized cluster of green construction stimulates not just the market of construction materials and technologies, and stimulates new standards of life. With transition of the construction industry to green rails citizens get chance to begin to live not only in safe, but also much more comfortable, power effective and ecological environment which conforms to the most advanced international standards of quality. Now the international certification of production is carried out on all life cycle and considers influence of components of a product on environment and health of the person. Among the studied product parameters the main are: sources and ways of production of raw materials, production (power consumption and toxicity of emissions), the volume of necessary transportations of raw materials to the enterprise and finished goods to the consumer, structure and level of toxicity of finished goods for the person, possibilities of secondary processing of production, the address with packing. In the world there are 400 green markings and standards, however wide use was received by standards of the ISO 14020 series from which is flagman—ISO 14024. Eco-marking of the I type means that production is certified taking into account influence on environment and the person. Ecomarkings of the I type estimate on the standard: sources and ways of production of raw materials; features of production (its power consumption and environmental pollution); the volume of necessary transportations of raw materials to the enterprise and to the consumer; structure and level of toxicity of finished goods for the person; a possibility of secondary processing of production at the end of life cycle; the address with packing of production. Often, to show belonging of the product to the sphere of EKO, producers resort to such tool as the self-declaration. The majority of programs of eco-marking of the 1st type are included into the World association of eco-marking (Global Ecolabelling Network, GEN). Among them such known as “The European flower” (EU), “A blue angel”

(Germany), "A northern swan" (Scandinavian countries). In Russia ecological marking of the 1st type—"A life leaf", developed by Company "Ecological Union" is recognized by the international expert community (Fig. 2).

Certifications "A life leaf" are a part of the system standards for: finishing and construction materials, eco-offices, eco-hotels, eco-shops, household chemicals, cosmetics, electronics, food. Standards of "A life leaf" differ in strict sanitary standards to emission of harmful substances from finished goods. For example, the most admissible level of emission of formaldehyde from heat-insulating materials and floor coverings is established at the level of 3 mkg/m3 while the legislation of the Russian Federation allows norm in 10 mkg/m3, and the European marking "A blue angel"—60 mkg/m3. Observance of requirements of standards stimulates producers to introduce more and more technological and transport chains for decrease in emissions of CO_2, to increase use percent in production of own waste. Besides, eco-marking becomes marketing advantage, opens new opportunities for work, both on internal, and in foreign markets. As for certification of services, this direction has some features which are defined by activity of the company. For example, the general for offices, hotels, shops are requirements for existence of system of green purchases, policy of resource-saving, the competent address with waste, programs for formation of ecological culture. Greening of a service sector in the cities is also a very perspective segment, as it promotes creation of a favorable situation for work of employees and does functioning of the company economic due to decrease in resources consumption. In order to be able to call ecological building green, it is necessary to respect certain standards and the rules on each of construction stages. Special tools are voluntary systems of certification of buildings which at the moment in the world there are several tens have been developed for an adequate assessment of projects in the sphere of real estate in the developed countries. The two widespread systems of a rating assessment of buildings are most known. It is the BREEAM system developed by the British institute Bre Global and the LEED system developed by the American Council for ecological building. According to the analytical company McGraw-Hill in 2013, 67 % of the American developer companies were implemented by the ecological principles in 60 % of the projects, and 94 % plan to reach this level to 2017. Growth rates of the industry of green construction abroad—30 % a year, the emphasis on ecological

Fig. 2 The green standard "Life Leaf" in Russia

properties is considered many one of the main competitive advantages of the companies. In practice it is shown in green buildings are more expensive than those built on traditional technologies. So, in the USA, the houses in the country cottage settlement certified according to the LEED standard cost by an average 30 % more than usual ones. But that doesn't stop buyers as the desire to live in harmony with the surrounding nature becomes prevailing. One more international standard of WELL positions idea of "the healthy building" (the rights for the standard belong to the American company Delos Living LLC). Emphasis is put on health and comfort of the people who are considerable part of time in the building. So version 1.0 of the WELL standard has 102 standards, the part from which is looked through also in other standards, concerns illumination, thermal comfort, a condition of air, lack of toxic substances in materials, protection against pollution on entrances and in the building, a smoking ban. Others are quite specific: for example, requirements to cleaning and to cleaners, to water disinfection, a ban on transgene fats, the equipment of rooms for meal, space for rest and a dream. A large attention is paid to actions which are urged to create "healthy" behavior at workers. In the LBC standard of 20 requirements are called "imperatives". They are distributed between seven categories: "Place", "Water", "Energy", "Health and happiness", "Materials", "Equality and beauty". Two basic rules of LBC considerably distinguish it from other green standards. First, all requirements of the standard are obligatory for performance only for object of any scale and appointment. Secondly, certification is based on check of actual indicators of functioning of the building, but not on settlement, as in other systems. The project has to be constructed and put into operation and work not less than 12 months till the moment when it is possible to estimate observance of the majority of imperatives. On completion of construction only preliminary audit is booked. Many countries

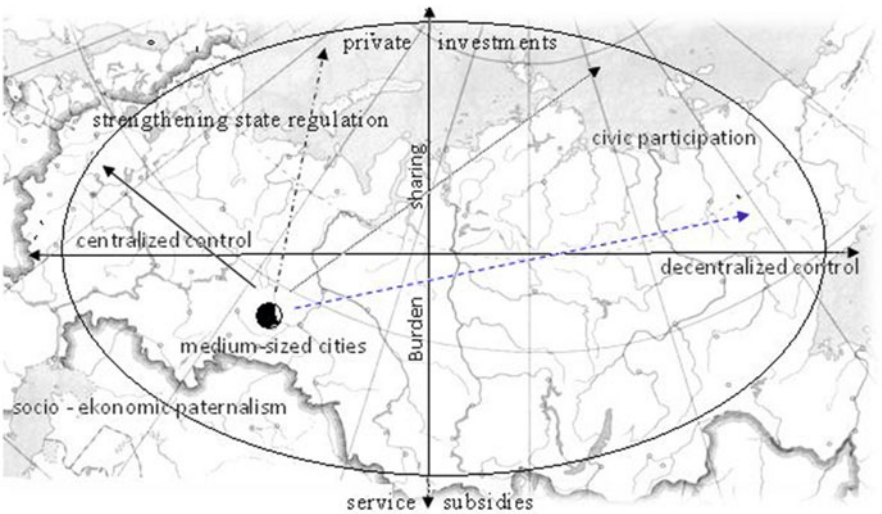

Fig. 3 Trends of development of the averages which are industrially developed in Russia

(Japan, Australia, Germany, New Zealand, and Canada) create the national green standards. Others take someone else's standard as a basis and under the leadership of his owner prepare the national versions. Norwegians (BREEAM NOR standard), Swedes (BREEAM-SE) have acted this way, for example. India and Italy adapted for themselves LEED, having released the national versions. Today's average industrial cities are not only a zone of the increased household comfort, but also business incubators, science and technology parks, a cluster of green construction and green technologies. In Fig. 3 the main trends of development of the average industrially developed cities in Russia are presented: 1—undesirable trend, 2—inertial trend, 3—most desirable trend, 4—a realistic trend.

References

Davidovich G (1959) Genetic classification of cities. Davidovich G. Issues of Geogr 45:S. 45–51
Frug GE (1980) The City as a legal concept. Harv Law Rev 93(6)
Hines A (2007) Thinking about the future, guidelines for strategic foresight. Hines A, Bishop P. Social Technologies, 1st edn
Jemala M (2010) Evolution of foresight in the global historical context. Jemala M. Foresight 12 (4):65–81
Kolesnikov R (2014) Forsayt-menedzhment. Seven rules of success in business. Kolesnikov R. Knizhny Dom LLC, St. Petersburg, 48p
Maitland (1962) William Selections from his writings, ed. by R. L. Schnyler, Berk.-Los Angeles, 1960; Selected historical essays, chosen and introduced by H. M. Cam, Boston. http://dic.academic.ru
Medvedeva LN (2011) Management of medium-sized towns in urban era (methodology and practice). VSTU Publishing, Volgograd, 222p
Medvedeva LN, Starovoytova YM (2013) Strategy of development of Russian cities. Horiz Econ 2 (7):89–95
Petrushevskiy D (1912) Emergence of city mode of middle ages. Petrushevskiy D. Moscow, 165p
Protasova SI (1938) History of the ancient world in the vision of J. Meyer, S.I. Protasova. Bulletin of ancient history. No. 3. Gierke, Otto von Das deutsche Genossenschaftsrecht, 1868-1913. [E-source]. http://how2buy.ru/
Ratzel F (1923) Politische Geographie, 3 Aufl., Münch.—B. http://dic.academic.ru/dic.nsf/bse/
Senge P (2005) The fifth discipline. Senge P. Ikspika BiznesBuks, Moscow, 352s
Starovoytov MK, Medvedeva LN (2010) The environmental component in urban development. Interaction research units of industrial enterprises and universities to improve the efficiency of management and production: Materials 5th Interregional Scientific and Practical Conference, Volzhsky, April 24–25, 2009, Volzhsky Polytechnical Institute (branch) VSTU, Volgograd, pp 23–26
Stoklickaya-Tereshkovich VV (1960) The main problems of the history of medieval city of X–XV centuries. Stoklickaya-Tereshkovich VV. Moscow, 231p
Thunen I (1850) Der Isolierte Staat in Beziehung auf Landwirtschaft und Nationalokonomie. V. 2. Economic life, Moscow, 1926, 326p
Weber M (1922) Die Stadt.—Wirtschaft und Gesellschaft, Kap 8. Grundriss der Sozialökonomik. III. Abt. Tübingen, S. 513–600. http://www.gumer.info/bibliotek _Buks/Sociolog/Weber
Whitley R (1980) Cognitive and social institutionalization of scientific specialties and spheres of research. Scientific Activities: Structure and Institutes, Moscow, pp 221–257
Wirt L (1969) Urbanism, as way of life. In. Sennet R (ed) Classical essays in urban culture. Appleton Century Grofts, New York, NY [E-source]. http://sociologist.nm.ru