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Methodological Approaches to the Assessment of the Innovative Urban Model

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Abstract--- *The relevance of the research issue is due to the problems of development of Russian cities in the innovation economics. In this regard, this article aims at identifying the need to develop an innovative urban model. The leading approach to the study of this problem is a systematic method that allows a comprehensive study of the green economy in the modern city as a whole, as well as identifying the variety of cause-effect relationships occurring both within the system under study and in its interaction with the external environment. In this paper the authors consider the green economy index, cities prosperity index, their role in the formation of an innovative model of the city. The article presents an innovative model of a modern city and reveals the assessment methodology of urban development; the basic conditions for sustainable urban development are identified and justified. The materials of the article are of practical value for the authorities at the regional level in making management decisions on sustainable development of the region.*

Keywords--- *Modern City, Green Economy, Sustainable Development, Innovative City Model, Index Method.*

I. INTRODUCTION

In a multi-crisis situation, the problem of development of the modern city is the most noticeable. It is now believed that urban agglomerations are the most important carriers of the "new economy", formed by the development of complex services and technologies, as well as the ultra-fast growth of the consumer market. Indeed, the density of connections, quality of life and features of the economy of modern cities make it possible to transit to an innovative level of development of socio-economic relations.

According to the authors, traditional methods of urban development are more negative than positive. The development of the "new economy" with its increased requirements for connectivity within the city faces critical challenges. Thus, the explosive growth of car ownership and the inability of transport systems of cities to cope with traffic create a contradiction between the standards of life quality and the objective characteristics of urban space.

Thus, a new area of investigation is emerging in the modern economy, dealing with the relationship between natural ecosystems and socio-economic systems in the broadest sense. Green economy solves the current human problems, as well as the problems of building eco-friendly cities.

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Since the sustainable development of cities is only a relatively new general idea, designed to unite all people in the movement for the preservation of the nature of the Earth and man himself, the prospects for the evolution of consciousness and human actions in this direction remain unclear. There have been many useful and correct teachings and ideas in human history, beginning with the Bible. But, as there is no coins with one side, as there is no only black or white, as there is no unilateral aesthetic categories (only “good”), so and in a long human history until there have been good, and evil, and truth, and lie, and peace, and wars. However, humanity has not only survived, but also turned into a powerful global force, mastered high technology, created huge man-made modernization areas, cities with high quality of life. On the way to sustainable development, humanity faces many challenges. But there is hope for the ecologization of thinking and human development in the transition to sustainable development. To this end, humanity has already accumulated a large body of knowledge about the preference for sustainable existence and has created the “islands" of more sustainable territories on Earth, which can serve as catalysts for its dissemination in all territories. Nevertheless, there are major challenges in implementing sustainable development.

The first problem is the development of a strategy for the transition to sustainable development, the fundamental provisions of the theory of sustainable development, approved by all countries and people. So far, there are a lot of definitions of this development and its content, and, the further, the more questions and interpretations appear. Apparently, this is an objective process associated with the incredible complexity of the problem and the involvement of an increasing number of researchers in the study of this issue. The situation is somewhat better with “sustainable” construction and design. However, the lack of development of the theory of sustainable development is not a reason to stop moving in this direction.

The second and most difficult problem is the possibility of general improvement of human qualities; education of society and its members in the spirit of love, friendship, understanding, solidarity, sociability, altruism. To what extent is this possible in an environment where society is focused on completely different qualities? And, in general, is it possible to raise the issue of general and fast change of human qualities? Is better to be guided by ordinary people with their advantages and disadvantages? This is some researchers’ opinion. For the gradual formation of people with new qualities, a system of universal environmental education and upbringing is required.

The third problem is the formation of a new system of values necessary for the education and maintenance of new human qualities: spiritual, ethical, philosophical, social, aesthetic, political, cultural, etc. The main thing in this problem is a relatively short period allocated by history for the formation of a new system of values. One of the main problems here is the need to replace the usual anthropocentric thinking with ecocentric mindset.

The fourth problem is whether humanity can cope with wars, inequality, poverty, various vices (crime, etc.), which, as a shadow accompany a person throughout his history. Sustainable development is impossible in wars and inequality, poverty and hunger, the lack of shelter and consumption above all norms.

The fifth problem is whether humanity has time to develop new eco-friendly, closed (nature-like) technologies that should replace the existing non-ecological technologies. Will it be able to create new technologies that will allow not only not to destroy nature, but also to restore the previously disturbed environment, to carry out ecological restoration of landscapes? Can it ecologize all its activities, including consumption?

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From the above, it can be concluded that the creation of eco-friendly urban areas is a complex process. In today's world, it is the green economy that should solve the problems of the social sphere and urban ecology. The formation of the city model as a stable functioning socio-economic, ecological and economic system is associated with the need to develop and solve a number of complex problems.

II. LITERATURE REVIEW

According to the Polish urban researcher T. Tolvinsky, in the middle of the XX century there was the global urban crisis that forced people to look at the future ecological and economic model of urban economy in a new way.

In today's economy, a new area of research is emerging; it deals with the relations between natural ecosystems and socio-economic systems in the broadest sense. The green economy solves the current human problems, as well as the problems of building an "eco-city".

The term "eco-city" was first introduced by the American builder and ecologist Richard Register in 1978. According to the scientist, the term "eco-city" should be understood as an eco-friendly city. Currently, the definition of R. Register began to be considered in a broad sense and it is defined as a city that is able to provide itself with food and energy, while the area alienated for construction and, consequently, the residential area should be as minimal as possible [7].

According to the Russian scientist A.N. Tetior, an "eco-city" is a city built on the principles of ecology, which is in ecological balance with nature and not rejected by natural ecosystems, it does not pollute nature and permeated with green corridors with niches for the life of wild animals, with eco-friendly buildings and ecologization of all human activities in the city, with the best quality of life, environmental education system and involvement of all residents in ecologization of their lives and activities [6].

According to the authors, an eco-city should be understood as a natural-adapted model that has an economically productive and socially effective environment of functioning, based on ecologization of life.

However, for many years in the modern world, the creation of eco-cities has only been discussed but not implemented. At the "Global Forum '94" the world's first real eco-city project was presented in Sweden, it was created in accordance with the provisions of the strategy for sustainable development. At the beginning of the XXI century the concept of eco-cities was adopted at the global forum "Habitat-II" [1].

The main task to be solved when creating an eco-city should be its organic inclusion in the course of natural processes of the territory. Conditions must be created here for responsibilities and the most important social functions in the family, group and society. Thus, the eco-city should become a generator of cultural processes taking place in the urban system [2].

In the modern economy, it is possible to distinguish three types of eco-cities (figure 1).

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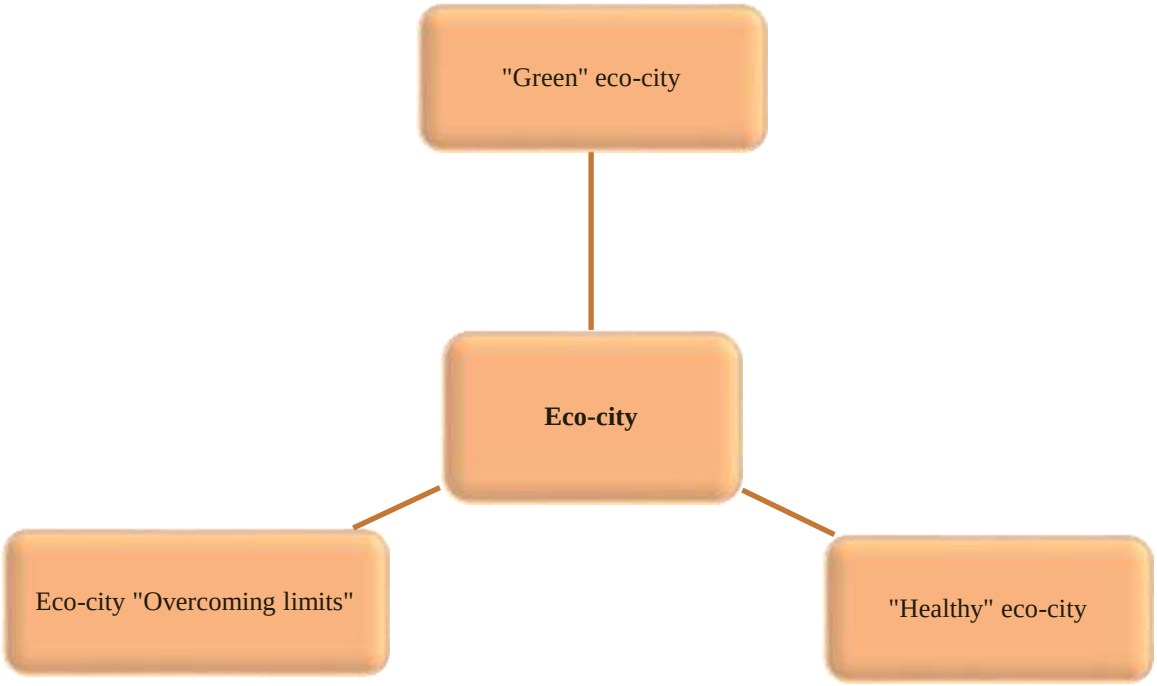

Figure 1: Types of Eco-cities*

* compiled by the authors based on the materials of the Canadian scientist Sebastian Moffett

Thus, the task of the eco-city is to ensure the best quality of life in the city, in the region, in the country and on the planet. Figure 2 shows the parametric rhombus “Eco-city”.

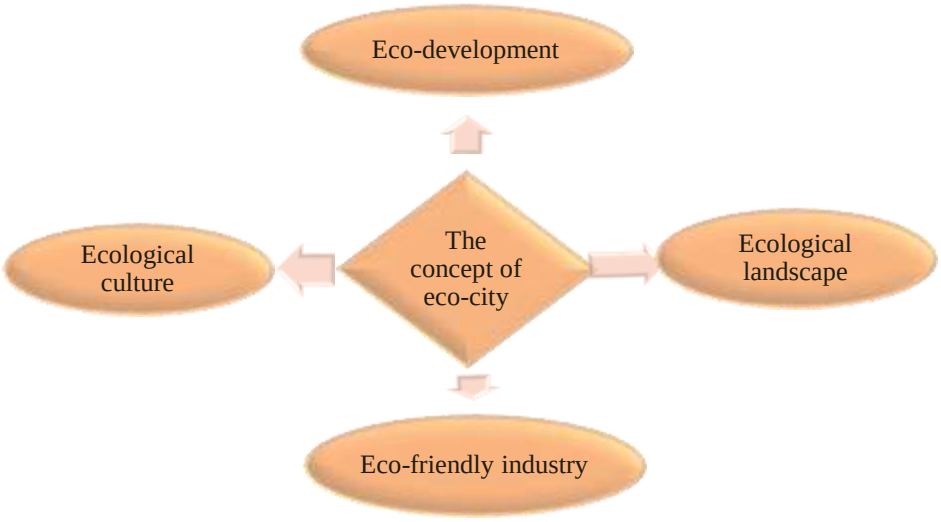

Figure 2: Parametric Rhombus “eco-city”

* developed by the authors based on the materials of this study

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Figure 2 shows that the parametric rhombus "Eco-city" consists of four interrelated elements: eco-development, ecological culture, eco-friendly industry and ecological landscape.

At the present time, eco-development is a new trend of the world real estate. In the 70-ies of the last century people in Western Europe and America for the first time thought about the economically-responsible approach to the expenditure of resources in the construction and building management. The prerequisites for such trends are the widespread emergence of "green" movements, awareness of the harmful impact of population on the environment, the sharp rise in oil prices, which forced representatives of various industries to think about alternative sources of energy.

First, fashion trends picked up the more affluent segments of the population, starting to build country villas in exotic eco-style using, for example, solar panels. Further, the initiative was taken up by the state, allocating money for research in this area. The first demonstration buildings were built, in the 90s the first standards of "green" construction and methods of assessing the environmental performance of buildings appeared, which not only set the standards of "green" design and construction, but also allow comparing different buildings in terms of their impact on the environment. Two main environmental assessment methods (American LEED and English BREEAM) are the most common [3].

In the first decades of eco-development, architects and designers focused on energy efficiency. Since then, the concept of "green" construction has become much wider and fuller. Under eco-development the creation of the most comfortable environment for human life, based on its physiological needs and characteristics of life is understood. In other words, modern eco-development is not only energy efficiency and minimization of harmful effects on the environment, but also attention to the health and safety of future users of the building [4].

Thus, eco-development (green development) consists of two concepts: economic development, contributing to the most efficient use of resources in the construction of buildings of the city, and environmental development, based on the minimization of environmental damage [5].

Green development can be divided into two directions:

1) green development of real estate – construction and modernization of real estate using environmental approaches, materials, technologies, compliance with environmental standards and requirements in the design and construction, with the laying of eco-friendly solutions for all stages of the life cycle of objects;

2) social green development – education and upbringing of a person, increase of his/her ecological consciousness, formation of skills that allow living in harmony with nature and society, improving the environment and own health, as well as popularization of the ideas of sustainable development.

The second element of the parametric rhombus "eco-city" is an ecological industry, which is a restructuring of industrial production on the basis of the expanding use of technologies aimed at preserving and reproducing the healthy and safe environment through the gradual environmental modernization of all spheres of life.

The concept of ecological industry includes stimulation of the existing industry to resource conservation (the reduced consumption of energy, water, fuel and other resources) and the decrease of harmful emissions into water,

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air and soil (by strict regulation of emissions and requirements for ecological recycling of harmful substances).

At the current stage of urban development, the attention should be paid to such an element of the parametric rhombus as ecological culture, which is the basis of the general culture of society and is closely related to the environmental policy of the state. Thus, the ecological culture is understood as a system of social relations, individual moral and ethical norms, views, attitudes and values relating to the relations between man and nature.

Environmental culture is based on environmental education and environmental awareness and it is the main task of all levels of government and civil society institutions.

The ecological landscape is an individual ecological and territorial complex of the local economic system.

The modern practice of creating an eco-city has been developing since the early 60s of the XX century. It is mainly widespread in Europe, North America and Australia. However, the most active in the field of environmental construction were European countries, especially Sweden and Denmark. Germany, Belgium and Norway are involved in this process. In general, almost all European countries have joined the ecologization of their cities.

Currently, there are 6 eco-cities in the European Union: Malmo (Sweden), Dublin (Ireland), Tallinn (Estonia), Hillerod (Denmark), Hamburg (Germany), Augustenborg (Denmark) [5].

There are no implemented projects of eco-cities or eco-reconstruction of cities in the modern sense in Russia yet. But some organizations, specializing in environmental construction, are close to their development.

In the practice of Soviet urban planning much attention was focused on urban greening, i.e. the problem of ecologization has been solved. The concept of “green wedges” in the city, “water-green diameter” of Minsk, planning approach “city in the forest” in Siberia (among them Novosibirsk Akademgorodok, Ust-Ilimsk, Angarsk, Divnogorsk and other cities) were implemented. In general, until the 80s the issue of ecologization was reduced to the problem of complex greening of the urban area and elimination of harmful emissions from industrial enterprises.

In the early 1980s the “Ecopolis” program was developed, in which scientists of biological and ecological specialties actively participated. According to the concept of the program, “Ecopolis” is a settlement of a new type, which develops in accordance with the course of natural processes. The main efforts in this case were made to improve the natural basis of the city – urban and natural landscapes. In addition, the social environment of the city was formed, educational and information activities were conducted among the population. There were no notable planning events [2].

In the early 1980s the program “Eco-house” has been developed in Novosibirsk. The purpose of the program is to transfer all the construction of individual housing in the Novosibirsk region to the construction of energy-efficient, ecological housing and at the same time to begin reconstruction of the existing dwellings using eco-friendly technologies.

The program provides for the construction of individual houses, designed on the principles of ecological architecture. Several projects, implementing the ideology of eco-housing on the example of single-family dwellings with plots have been developed. According to the proposed concept of ecological dwellings – eco-friendly, comfortable, very warm individual or semi-detached houses with plots. Eco-houses are equipped with their own

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heating system, which uses, in addition to the usual, solar heating of the house and solar heating of water for household needs. Thus, at the first stage, the concept of eco-house was formulated for reducing the load on the natural environment [6].

Since the early 1990s, the international project "Ecological cities of the future" has been implemented. Within the framework of this project, measures are being taken to ecologize the historical cities of Russia, such as Tobolsk, Kirishi, Tikhvin, etc. The concept of ecologization in the project is generally consistent with the global trends of transition to sustainable development of human settlements [7].

The analysis of traditional experience and achievements of modern technologies allowed defining the eco-house as a system capable to increase ecological resource faster than natural ecosystems.

State structures show rather passive participation in this work and, despite the fact that a number of provisions consonant with the concept of sustainable development of human settlements are reflected in the legislative documents of the Russian Federation, there is no active state policy in this area yet.

In the Russian Federation, the process remains within the design and construction of individual eco-houses. There is the accumulation of experience in this area, organizational and financial resources. Apparently, in the near future a number of organizations will be able to carry out the construction of eco-towns in practice. However, in Russia, the development of ecologization of cities is mainly carried out by the efforts of scientists.

In Europe, the environmental problems of human settlements are alarming. Due to the high population density, the issues of ecological reconstruction of residential buildings are relevant.

In the Americas and Australia, large territorial resources and a relatively satisfactory environmental situation make it possible to deal with these issues less actively. Private charitable foundations supporting this process are extensive; the construction of eco-settlements is carried out by "green" groups and other organizations of environmental orientation.

In Russia and the CIS countries, which have quite a significant reserve of environmental, natural and territorial resources, the process has not yet found support from government agencies; it is developing by the efforts of individuals and organizations. Theoretical issues of ecologization and methods of its implementation at a large urban level are actively discussed in the scientific press and at various conferences. But practical activities in this area have not yet reached the urban level.

Examples of the complete transformation of those or other urbanized areas of the city are known worldwide. For example, projects for the reconstruction of industrial zones in England. It was the country of industrial revolution. And, as a result, huge areas in the central parts of the cities were occupied by the machine industry. Now they are being recultivated. Modern business centers, residential areas, park areas are appearing there. In the United Arab Emirates, almost in the desert, skyscrapers and artificial islands are built. And even the most incredible projects, if they are well-founded, including the mechanism of implementation and payback, can be implemented.

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III. MATERIALS AND METHODS

The authors use the following research methods – the system analysis method, content analysis of scientific literature, economic and statistical method, comparative, structural and logical analysis, graphical methods of presentation of information, as well as the method of formalization.

The fundamental work on the theory of the city I. Gruz served as a theoretical and methodological basis for the study.

The objectives of the study are the use of a systematic method that will consider the green economy as an unstable phenomenon from the perspective of system analysis and synthesis. The use of the system method in this study will allow the authors to undertake a comprehensive assessment of the green economy in the modern city as a whole, as well as to identify the variety of cause-and-effect relationships and relations that take place both within the system and in its interaction with the external environment. The system method in this study will allow applying various interdisciplinary methods of different sciences. Thus, in order to achieve the results of the study, it is planned to use a conceptual analysis in combination with a systematic approach, which will help to solve the problem of developing a methodological strategy for the study of the socio-economic space of the modern Russian city. On the basis of the method of analysis and synthesis, it is possible to define a city as a natural-adapted model formed with the use of a sociodynamic multiplier.

IV. RESULTS

A new ecological and economic model of the city is innovative and allows people to form adequate modernization imperatives of modern conditions of urban economics. The importance of this approach is due to the fact that many cities are in crisis and need some care of the state. In accordance with this, an adequate assessment of the stability of the city, which should be used to distinguish crisis cities from the entire population of urban settlements, acquires a new scientific and applied character.

The city acts as a center of government in economic, political, cultural and ideological terms. Accordingly, the city concentrated on its territory the most educated, creative and intelligent part of population, which determined the development of science, technology, business, education and art.

Taking into account the differentiation of the level and specificity of the development of modern Russian cities, from a practical standpoint it seems appropriate to develop a set of adaptive models designed to calculate the stability assessment.

Stability assessment of the city should be carried out at all stages of the development and implementation of city programs. In this case, the assessment will be the result of an analytical study of the problem of city development on the basis of modern techniques, including the consideration of the modern city from the perspective of a systematic approach. For each subsystem of the urban development model, a minimum set of characteristics and factors necessary for the analysis of urban development is considered.

Recently, the city rating has been calculated to determine urban stability assessment. The city rating allows us to determine the most favorable in terms of the ratio of indicators of “cost” and “quality” of living in the country. This

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is the first attempt in the country to evaluate the city as a kind of "product" or "service" that every resident consumes. In addition, the rating allows evaluating the effectiveness of urban policy to increase the attractiveness of the city for lives of its citizens [8].

In 2012, UN experts in the report "State of the World's Cities in 2012/2013" considered that various institutions, urban planning and the environment lead to the prosperity of cities, which, in fact, are, according to the authors, the focus of prosperity in human civilization [10].

This report was the first presentation of the countries rating on the legatum prosperity index, which is based on the conceptual matrix "Wheel of prosperity", which is an innovative tool for assessing the sustainable state of cities, which allowed determining the advantages and disadvantages in the process of urban development.

The legatum prosperity index, developed by UN experts, includes various factors and it is presented in figure 2.

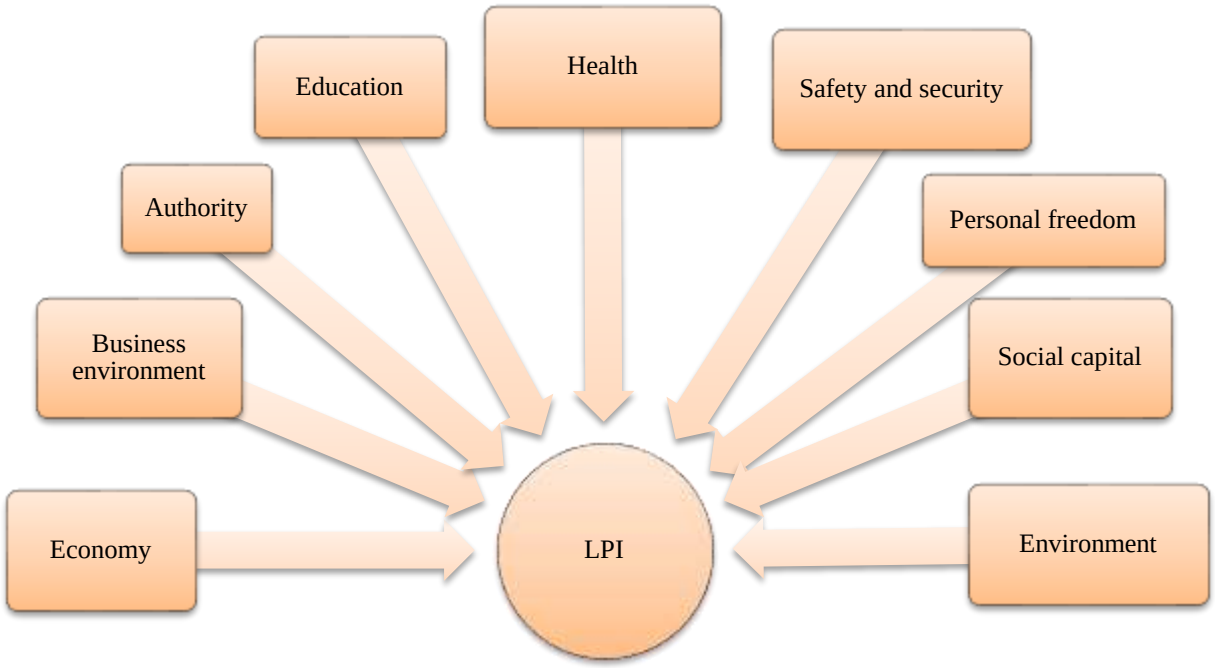

Figure 3: Main Components of the Legatum Prosperity Index

* compiled by the authors based on the research materials

The block "Economy" includes such indicators as the average value of GDP per capita for 5 years, the level of employment, the degree of confidence in financial institutions, the level of inflation, etc.

Indicators of revenue under license agreements, costs of start-up projects, security of Internet servers, etc. are used to calculate the business environment.

Indicators such as the degree of satisfaction with state measures to eradicate poverty, the effectiveness of the government, the degree of society's involvement in political life, etc., were included in the block "Authority".

The degree of satisfaction with the quality of education, educational opportunities, the ratio of the number of

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students to the number of teachers, etc. are necessary for the formation of the block "Education".

The block "Health" is calculated on the basis of data such as life expectancy, human health expenditure, satisfaction with one's own health, etc.

The block "Safety and security" is calculated on the basis of the level of social environment, the number of thefts per year, the level of protection of the population, the degree of political violence, etc.

The block "Personal freedom" includes such indicators as the degree of satisfaction with their civil rights and freedom of choice, the possibility of applying civil rights, etc.

Social capital is calculated from such indicators as the amount of money donated in the last month, the presence of a family, the opportunity to trust the majority of people, etc.

Thus, the calculation of the LPI index consists of 9 auxiliary indices assessment. For each block, each country receives an assessment, they are weighted, and then the calculation of the final assessment is implemented.

Since 2016 the methodology for calculating LPI has been updated. The comparative characteristic of methodology for calculating LPI is presented in table 1.

Table 1: Differences in the LPI Calculation Methodology

Criterion	before 2016	after 2016
Impact of income and wealth	The income and welfare index is calculated separately	No separation between income effect and wealth
Number of cumulative factors	8 blocks	9 blocks (8 blocks + Environment)
Number of indicators	89	104
Standardization of variables	Average subtraction and division by standard deviation	"Distance-to-boarder" method
Source of moving weights	Statistical correlation between variables	Experts estimates

Table 1 shows that the new calculation methodology has both disadvantages, for example, a change in the principle of weights for indicators: from statistical analysis to expert conclusions, and advantages, first of all, the inclusion of the block in "Environment" in the calculation of the index.

After calculating the LPI, all countries are grouped by the welfare rate (table 2).

Table 2: Criteria for the Welfare Rate

Quartile	Welfare rate	The average value of the LPI index
1	Low	< - 1.4
2	Medium-low	-1.4 < LPI < -0.3
3	Medium-high	-0.3 < LPI < 1.1
4	High	> = 1.1

V. DISCUSSION

At the moment, LPI is a strategic tool in many cities. The Mexican Housing Bank (INFONAVIT) and UN-Habitat are working on the implementation of LPI in 130 Mexican cities, where the mortgage loans are concentrated. The LPI is used as a tool to assess the impact of housing sector on prosperities of cities, to develop the housing policy.

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The implementation of LPI in 23 cities in Colombia allowed the authors to obtain accurate information based on LPI for the development of political programs in order to increase the level of citizens' prosperity. Based on the expanded LPI, Colombian cities identify 10 main problems that need to be primarily addressed, with the list of problems varies depending on the specifics of cities.

The Future Saudi Arabia Cities Program will be developed with the help of LPI indicators in 17 cities. Based on an LPI adapted to spatial analysis and support for urban planning, opportunities and potential areas of intervention will be identified to make cities more prosperous. Innovative spatial LPI indicators will be used for urban planning and local management decision-making.

It is possible to conclude that the legatum prosperity index shows that the GDP index is not a sufficient indicator of the population's standards of living, and prosperity is a measure of well-being, which is based on health, education and governance. The legatum prosperity index characterizes the aspect that prosperous countries have an open economy, inclusive societies and creative populations that are more able to realize their creative potential.

According to the authors, it is advisable to add one more block reflecting the level of development of high technologies to the index of urban prosperity. This will make it possible to reflect in a comprehensive assessment of well-being the availability of high-tech products and services that ensure an increase in the quality of life of the population.

VI. CONCLUSION

From the above, it can be concluded that the creation of the eco-friendly urban environment is a complex process. In today's world, it is the ecological economy that should help solve the problems of social ecology of cities. Thus, existing urban models are unable to respond to the transformation of the modern economy. This means that the formation of the process of formation of the city model as a stable functioning socio-economic system is associated with the need to develop and solve a number of complex problems.

According to the results of modernization processes of the modern city model, it can be concluded that currently in many cities of the country, insufficient attention is paid to the environmental factor: the integrated norms of the maximum permissible concentrations of air, water and soil pollution are ten times exceeded. The development of urban areas based on the intensive use of natural resources, as a rule, worsens the environmental situation, which ultimately leads to a slowdown in the socio-economic development of cities.

Now that the environmental situation in cities is an acute problem that calls into question not only the effectiveness of further concentration of population and productive forces in cities, but also the preservation of cities in the existing size, especially in demand models that include economic, demographic and environmental components.

The development of complex simulation models, reflecting the various components of urban development, serves as an effective tool for its analysis and forecasting. The results of modeling allow developing reasonable recommendations to stimulate environmental protection measures, to regulate the scale and proportions of production and non-production activities, in which ecological and economic balance is achieved.

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