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Modern Dynamic of Ecosystems: Environment, Society, Governance

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Abstract: The first quarter of this century was marked by a series of events on a global scale: global climate change, intensification of social processes in the world - a pandemic posed by the spread of the COVID-19 virus, etc. However, despite the significant amount of accumulated information about changes on our planet, such as global climate change, spatial and temporal changes in ecosystems, unfortunately, there are still no distinct explanations of such changes. Most publications do not reflect the attempt to search for a scientific explanation of these changes but rather our reaction to such changes. Most often, publications on the manifestations of global climate change are presented in political and economic terms. It is necessary to conduct thorough studies of climate change, for example, at the local, regional, and global levels, which will allow the development of activities, programs, and action policies of the countries of the world on governance of this problem. In this case improving the knowledge of the population of countries and the skills of residents of local communities, including in the field of microfinance, will contribute to improving the quality and quantity products of social capital and social partnership. Unfortunately, in practice, the development of social partnership in society between its various components clearly and quite often there is a problem of mistrust of the population to the ongoing projects of the state and social development, which is usually generated by the mismatch of the content of social activities and implemented in practice, the political and legal control circuit. Currently there is a shortage of professional, "explaining" that integrating management.

Keywords: Global Climate Change, Ecosystem Changes, Management

1. Introduction

It is known that studies on the manifestations of global climate change in different countries and in the whole world are focused on the development of different strategies. This includes set of measures to control and reduce harmful emissions, the impact of climate change on different ecosystems, the adjustment programs for sustainable development of countries, taking into account the manifestations of these changes, and adaptation to such changes as a whole. Ultimately, scientists and practitioners come to a common conclusion that these changes will be resisted in the form of various risks that should be studied and managed. Addressing socio-economic issues in global climate change should focus on local and regional levels that will promote the adoption of measures for institutionalization and consolidation of efforts of citizens and communities to meet the challenges of adaptation and management of various risks [1]. To adapt the economies of countries to changing conditions, it is necessary not only to change and propose new mechanisms for state support of business and entrepreneurship, it is also necessary to manage such changes that put forward the task of changing the overall principles of organization of economic development of the system.

2. Global Climate Change: Hypotheses and Concepts

The peculiarity of global climate change study is closely linked to the expansion of such research and development of reliable forecasts of such changes. Despite the obtained results of basic climate components research, such as air temperature, dynamics of total precipitation, spatial trend patterns of temperature and rainfall [6], they do not always provide a basis for reliable conclusions to identify the relationship of these changes to the economic activity of a society. In this regard, we again return to the assessment of

our ideas about climate changes, which have already been formed or may form the basis of hypotheses on the characteristics of global climate change. The structure of such hypotheses, in socio-economic terms, may need to be formed by the concepts of economic planning and resource management in the future. At the same time, the study of changes in temperature and precipitation indicators and extrapolation of such changes to most of our planet, despite the "attractiveness" of calculations using models, do not always lead to a conclusion about the true cause of global climate change. It is no secret that identifying trends in climate change at the global level requires the need to consider the causes of the global nature of such changes. Dynamics of changes in temperature and precipitation indices which despite the possibility of their use for evaluation and analysis, should still be used only on the level of certain areas. Naturally, modeling and creation of databases for climate components, such as air and water temperature in the ocean, rainfall patterns and their temporal extrapolation look very tempting, but it is not a basis for identifying patterns of global climate change. It is possible that inconsistency of changes in climate indicators with the identification of global patterns of climate change gave rise to the uncertainty of our ideas about trends in climate change and its impact on the economic activity of people. It should be noted that uncertainties in the interdependence of nature and society are associated with differences in their evolution. For example, trends in population growth on the planet, migration, and marginalization, development of new technologies and innovative changes in the economy, etc. are not always predetermined by changes in the environment. Reasons for changes in a set of social parameters of uncertainties arise not so much because of the differences in their study methods, but more because of the contested and political character of the assumed changes [6]. In this case, physical modeling and social forecasting is not always amenable to characterization due to their differences [10, 20].

Climate Change: the features of calculation and evaluation

According to researchers, the quality of climate calculations based on global climate models (GCM) can be considered, if not quite satisfactory, then very encouraging, at least in the scale of a more sub-continental, and from seasonal to intra-secular resolution [4]. However, none of the models and none of the climatic scenarios can be considered best in terms of their higher reliability. It is necessary for any area to have a range of climate scenarios, which describe the full range of possible future climatic conditions [4]. Explanation for this can be found in the fact that anthropogenic climate changes depend on the development of the economy and technology, distribution of the population, and interaction of countries and regions with different levels of development. Integrally, all these factors are expressed in terms of greenhouse gas emission scenarios in the atmosphere and their regional distribution. Unfortunately, current level of world science does not yet allow to predict the climate of the future, even within one century. Climate scenarios derived from global climate models are used to assess it. The spatial resolution in the horizontal model is up to 250 km, the vertical - up to 1 km, which allows to allocate territorial cells in a common matrix of climate change on our planet [19].

Climate change is likely to affect the social consequences of changes in ecosystems on land and in water, the use of natural resources, and the need to cope with the changing regime of extreme weather events. Environmental changes are often reduced to climate change - the process of a gradual increase in the average annual temperature of the Earth's atmosphere. At the same time, the rising temperature of the surface layer of the atmosphere is the most important and visible changes out of all climate variables. Such a change, however, is not the only one. Climate change can be manifested also by the increase in the temperature amplitude (increase of continental climate), changes in the amount and non-uniformity of precipitation (the level of rainfall increases in the middle and is reduced in dry regions), total reduction in the area of mountain and surface glaciers, as well as melting of permafrost, increase in the frequency and intensity of natural disasters, etc. [19]

Causes of climate change: an overview

After the formation of a dense atmosphere, Earth’s global climate throughout the history varied significantly with the occurrence of climatic disasters and ice sheets. However, despite the availability of certain research results, there is no definitive answer to the following questions: how great are climate changes over a certain period of time and with what certainty such changes can be estimated. It is important to understand which part of the changes may be related to climate change and which one to other factors, as well as the extent to which such changes can be predicted. In other words - how can we explain variations in climate?

Among the reliable theories explaining the reasons and factors of such changes is the theory developed by M. Milankovich. The essence of the theory is that movement of the Earth around the Sun occurs in a weakly elliptical orbit and is disturbed by the Moon and other planets of the solar system which are constantly changing their mutual position. Although this does not impact the overall annual amount of heat coming to Earth, but the amount of heat that comes in different seasons of the year to different latitudinal zones changes. This insignificant heat impulse, obviously, plays the role of a "trigger" as it causes a chain of climatic changes leading to strong climate variability with the emergence of ice ages. However, these very climatic mechanisms remain unknown. It is not known with what certainty such changes can be estimated or what factors underlie such changes. To obtain information about the changing parameters of the Earth and its orbit, we use the indicators underlying the above mentioned theory [19]. There are three such parameters: 1) the angle of Earth's axis α inclination, which is understood as the angle between its axis and the normal to the equatorial plane, equal to about 23.5° in the present epoch, 2) precession, or anticipation of equinoxes, and 3) eccentricity of the orbit ε. The angle of inclination of the

Earth's axis α is very slowly but constantly changing. Over the past 30 million years, it has fluctuated within the range of 22.07°–24.57° with a main period of 41,000 years. When the inclination angle decreases, Polar Regions receive less heat and when it increases – more heat. If the angle reached 0°, the poles would not receive heat at all. If the angle α were 54°, all points on the Earth's surface would receive the same amount of heat. At the same time, the Earth's axis not only slowly changes its inclination with respect to the orbital plane, but also describes very slowly a taper in space with a corner radius of about 23.5°. This is caused by the gravitational pull of the Sun and the Moon to Earth's equatorial bulge, which is an irregular ball of a spheroid shape. As a result, Earth moves like a child's spinning top, the axis of which describes a funnel into space. One rotation of the axis occurs in 26,000 years. The phenomenon is called precession. Besides, the elliptical orbit of the Earth slowly rotates in the same plane, but in the opposite direction. Due to addition of these movements the four remarkable points of Earth's orbit (20.03; 21.06; 22.09 and 21.12) slowly rotate along it against the direction of the Earth's movement. Thus, the change in luminosity of the Sun in the process of its stellar evolution and changes in the orbital parameters of the Earth should be included in the list of main astronomical factors (external, in relation to the planet), which could change the global climate.

The main conclusions that have been obtained so far by various climate researchers can be formulated as follows:

1. Climatic changes in the Northern and Southern Hemispheres occurred almost simultaneously, that is, they were caused by one cause.
2. The main climatic cycle has duration of about 100,000 years, which is superimposed on by other, shorter, but less intense cycles of about 40,000 and 20,000 years.

These findings make it possible to arrive at the following general conclusion on the assessment of climate change: a) Over the last half-million years, Earth's climate pulse fluctuated with the basic period of about 100,000 years, when glacial epochs followed one another, some more intense and other weaker, and between them between there were short warm interglacial periods of 10,000 - 12,000 years. b) Present time is climatically the last interglacial period, which began 9,000 - 10,000 years ago [15]. At the same time, the exploratory studies conducted [16] revealed that climate warming can also have a significant impact on various spheres of life of human society: water and land resources, energy and transport, forestry and food production.

Adaptation as a necessity and component of Climate Change Management

Since climate is inherently variable for quite natural reasons, human societies everywhere had to always develop strategies for coping or adapting in the face of changing climatic or weather extremes. Some of these coping strategies are more technologically adapted, better resourced, or more resilient than others. The vulnerability of communities and societies depends not only on the availability of resources, but also the opportunity to use these resources [5]. Vulnerability is therefore a reflection of social protection of the population and the community, which is closely dependent on institutional and economic structure of the organization of the community and society as a whole. The vulnerability of a community system to climate change can be determined by the categories of its physical condition and sensitivity (level of exposure to change), as well as the ability and opportunity to adapt to change. For example, sensitivity will be high if the community system under consideration consists of settlements built on river floodplains or mountain slopes. In this case adaptation of the communities may be presented as a form of reducing dependence on vulnerability [6]. The main result of climate change research and adaptation to these changes is the fact that the need to adapt to these changes is an inevitable conclusion.

However, vulnerability of communities and society in general to climate change is not strictly synonymous with poverty. It is well known that poverty and marginalization of the population are the main causes of vulnerability and an obstacle to long-term adaptation [8]. During development of adaptation strategies researchers' attention is usually given to analysis of climate change trends in the last century in order to predict future climate change [12]. However, a retrospective analysis of data on climate change in various regions of our planet shows incomplete availability and insignificance of such data in terms of volume and quality, which allows to make a conclusion about low probability and uncertainty of such data being able to provide a reliable basis for economic planning and resource management for the future [14].

Quantitative estimation of this uncertainty is the subject of studies and discussions, the inability to accurately simulate physical climate system and to assess the evolution of human society and its systems related to production of greenhouse gases. Perhaps, the reason for discrepancies in air and water temperature data and other variables is due to a lack of knowledge on how the climate system reacts to greenhouse gas emissions or how natural ecosystems, especially the world's oceans, respond to climate change.

Differences between climate models in changing climate parameters often create obstacles to effective use of climate change information by managers and stakeholders due to uncertainties associated with evolution of human society. Development of technologies with low or no carbon emissions and their global use is largely linked with economic achievements of countries and trends in population change. In this regard, possible expectation of fertility decline and the impact of sharp reduction of world's population can be attributed to threats of a global nature.

Based on research results [21], there will be a change in population factor in this century and starting from 2100, there will be a sharp decline in population. According to researchers, there will be 2 periods in the dynamics of population change. In the first case, by 2060 Earth's

population will increase by 2 billion. However, after several decades birth rates will fall and some countries (e.g. Italy, Japan, and others) can lose up to half of its population. These changes are associated with an increase in the number of elderly people and reduction of proportion of children under the age of 5 years in the overall population of the planet, which will contribute to a decrease of total population against the backdrop of natural population decline: in 2064 the population will reach 9.7 billion, and by 2100 will decrease to 8.8 billion.

To calculate the dynamics of population change an improved model was used, which is based on cohort fertility rate: the average number of children born to a group of women of a certain age (50 years). According to this model, birth rate will fall significantly in Africa. By 2100, Japan's population will shrink from 128 million to 60 million and China's will drop below 1 billion. Overall, the number of people older than 60 years will increase by 6 times worldwide. This will require additional resources to support healthcare and social services [21].

One of the ways to solve this problem can be through correct immigration policy and support for large families. Countries of the world need to reorganize, since in 183 out of 195 countries birth rate today is below the level of natural reproduction. That is, if the current trend in population dynamics continues, by 2100 the number of children under the age of 5 will decrease from 681 million to 401 million. At the same time, there will be an increase in the number of those who are over 80 years old and this figure will grow from 141 million to 866 million people [21].

As a conclusion of expert assessments it has been suggested that one of the main causes of the current situation are changes in the current generation of women, who pay more attention to education and life of independence, as well as accessibility to contraception, which will accelerate the decline in birth rate and slow reproduction. Recognizing the importance of research results and expert assessments of the dynamics of population change on the planet, we believe that the conclusion about expected trends in demographic processes and their social interpretation of the causes of such changes are not entirely consistent with the ecological situation on our planet. Apparently, physical and mental condition of the new generation, including women who are willing and able to have a family and children, can be included in the list of main causes of changes in the natural fertility of the population.

The solution of demographic problems of the world will require will require the adoption of comprehensive measures to support the population. These should not only be social measures in the field of supporting families, but also, as it seems to us, the transformation of the current economic system of capitalism organization. It is the economic component of modern society which can provide or restrict people in choosing the most favorable and optimal scenarios for living in the current century.

3. Paradigm Shift of the Economic Development System: Not Profit, But Freedom

Most countries in the world, economically, live in the capitalist mode of production, which is characterized by profit for the extraction of surplus value, mainly, for the propertied class to accumulate capital. Capitalism is a system of production and distribution in capitalist societies, based on the use of wage labor and private ownership of the means of production. The capitalist mode of production can exist in societies with different political systems and alongside different social structures. Thus, capitalism is a "production for exchange", driven by personal desire for personal capital accumulation mediated by the free markets.

In terms of impact of this mode of production on the natural environment, it creates the following key environmental issues: volume growth and utilization technologies and the problem of growth of consumption. All these problems stem from the nature of capitalism, as it is centered, above all, on making a profit. Consumption, as the most characteristic feature of capitalism, is concentrated around the accumulation of capital, goods, and neglect of the use value of products. In this context, it is important to note Marx's statement about the transition from the "formal categorization" of production under the rule of capital to the "real categorization" of production under the rule of capital. What he called the "specific capitalist mode of production" as a production technology and social organization of labor was completely reworked and reorganized into commercial capitalism (profit and market-oriented system) during the stage of industrialization of society. In this connection, some historians such as Jair Banaji and Nikolai Vrousalis [22] have argued, that capitalist production relations predate the capitalist mode of production.

As already mentioned, Marx never explicitly summed up his definition of capitalism. This has led to disputes among Marxists on how to assess the "capitalist" nature of society in specific countries. Proponents of theories of state capitalism, such as international socialists, reject the definition of capitalist mode of production given above. In their opinion, the emancipation of the working class itself should be more revolutionary - "socialism from below", which in fact determines the capitalist mode of production. They believe in the following:

1. The means of production located directly with the manufacturer are presented as someone else's power,
2. The existence of a wage-earning working class that has no power,
3. The existence of an elite or ruling class that runs the country, exploitation of the working class in the technical Marxist sense.

Many of the state capitalist theories that actually originated in Germany and have been criticized by F. Engels define "capital" just as the social attitude towards the authorities and the exploitation of the population. This idea is based on some

of Marx's statements. Marx pointed out that capital cannot exist except in the power relation between social classes, which regulates the receipt of the surplus value of labor. It is this power-connection that is most important for the supporters of the theories of state capitalism; all other relationships seem secondary to them. In *Das Kapital* (1867) [17] Marx proposed, that the driving force behind capitalism is the exploitation of laboring people, whose unpaid work is the main source of surplus value. The owner of the means of production can claim this surplus value. He or she is legally protected by the regime through ownership and statutory distribution of shares and can own companies and is a board member. In capital production (goods produced), workers constantly reproduce the economic conditions under which they work.

So, the nature of capitalism is characterized by two main components of this system that must be taken into account when it comes to changing the paradigm of capitalism, the economic system used by most developed countries. Those components are the exploitation of wage labor and making a profit, which again brings us back to the statement that capitalist relations of production originated much earlier than the capitalist mode of production itself [18]. However, despite the existence of private property (natural resources and means of production) as the basis of the capitalist system of production, entrepreneurship as a form of increased economic activity of the population in conditions of private property, in practice, often contradicts the content of such economic system. If the capitalist system of production is aimed at obtaining maximum profit via private ownership of the means of production and exploitation of hired labor [17], then the purpose and content of entrepreneurship is to create conditions for personal freedom of an entrepreneur who created and runs a private business. This means not only the provision of their needs, but also complete independence from the state and state-owned enterprises. Unfortunately, in the subsequent definition of business as a form of human activity it began to acquire a different meaning, aimed at making a profit, which coincides with the definition of capitalism, but is not consistent with the content of entrepreneurship [3].

Changing the paradigm of capitalist development, which should make a bid for the acquisition of personal freedom by extending the enterprise, can create new conditions for the sustainable and safe development of the countries at the present stage. Therefore, comprehensive research and transformation of research results in various sciences will not only allow us to look differently at the state of the problem of global changes on the planet, but will also help develop concepts and policies for adaptation and risk management to sustainable human existence.

According to F. von Hayek [13], the entrepreneur and entrepreneurship are characterized not by their occupation, but by the behavior of an economic entity. The main postulate of his concept is that freedom of enterprise is a prerequisite for the formation of a new type of person. Free enterprise is also a key condition for economic prosperity of all sectors of society.

4. Global Climate Change and Prospects for Equilibrium Management

The turning point in understanding the relationship between the environment, economic development, and social well-being was publication of the book "Silent Spring" in 1962 [9], which contributed, in the future, to the development of concept of sustainable development. Currently, this concept is widely used in various fields of science and practice in solving many problems of the modern world development. Practical implementation of the concept of sustainable development was facilitated by information and communication technologies, which had a greater impact on economic and social development during the last decades of the past and the beginning of this century. This is due to the possibilities of these technologies to generate and disseminate information in order to facilitate coordination of actions of various entities within the country, region and beyond, so that activities of governments and business development have been more effective. These capabilities are used primarily in addressing the adaptation of society's production activity to climate change. The use of information technology to cover consequences of climate change in the development of adaptation measures allows one to explore the relationship between development, forecasting climate change, and appropriate adaptation measures. Recommendations of such studies should lead to the conclusion of harmonization of the relationship between the environment and economic activity of the society. Achieving sustainable development requires a focus on the main economic, demographic, political, and environmental factors that currently limit the ability of communities to adapt and, at the same time, increase their vulnerability to climate change. This situation can be explained by the "reclaimed approach" to the development of human production and environmental protection.

Nature and society: sustainable development and management of equilibrium

One of the features of the current stage of research on global climate change is the possibility of a comprehensive, systematic assessment of processes affecting the relationship between nature and society. This approach allows not only to analyze the current state of nature and society, but also compare the results obtained with past events and even look into the future. This is all the more important, since, despite the relevance of research on global or regional processes, quite often one has to deal with ideas about their opposition or even rejection. At the same time, a global assessment of the ongoing processes allows for a new assessment of the directions and content of regional processes in the field of scientific and political, as well as socio-economic development of certain territories, countries, and natural processes. In this regard, we propose models that can form a conceptual basis for a broad, methodological analysis of the

relationship between nature and society, over the past few centuries, as far as possible, from the 19th century to the 21st century [2].

Principles of the Environment and Society development

The main feature of the stage of development of the world in the 19th century was the intensive development of relations between nature and society. This stage is characterized by the improvement of industry and the beginning of use of industrial food production methods. Based on the discovery of not only new lands, a mineral deposit, etc., but also advances in science, it became possible to generalize scientific knowledge and our understanding of nature and society. This allowed to develop the principle of *Intensities* in the relationship between the environment and society. In other words, the 19th century appears to us as a historical time that made it possible to move from the stage of discoveries and development (new lands, communication routes, deposits, scientific discoveries, etc.) to the intensive development of both nature and society. Summing up all the achievements of the society in the intensive development of nature in the 19th century, we can characterize this historical stage in world development as "...broad and intensive satisfaction of society's needs with a more active development of new horizons..." [2] Unfortunately, the stage of intensive development and use of natural resources to meet the needs of society gradually led to the development of differences between countries. These differences can be characterized as a result of active scientific and practical development of the world, which has shaped different levels of consumption and economic achievements of countries. The systemic representation of processes of the 19th century can be expressed through the following model: *Environment - Development – Society* [2].

In the 20th century society's development has significantly increased the possibilities of humanity due to microcosm studies of atomic structure and the development of nuclear energy, and exploration of the outer space. At the same time, warnings of the negative consequences of the global active but not the regulated development of nature and the use of new types of nuclear energy were made for the first time. The expansion of differences between countries, mainly due to economic reasons, led to competition between economic systems, uncontrollability and crises in the global development. Along with this, the world is also beginning to understand the need to develop collective efforts for stable and sustainable development of the world. The vector of such development led to the idea of *Sustainable Development* of the relationship between Environment and Society, which was expressed as "meeting the needs without threatening future generations" [7]. This development of the world based on the principle of sustainability allowed formulating the following system: *Environment - Equality – Economy* [2]. In real terms, the manifestation of this principle is the development of both natural disasters and socio-economic crises on a global scale, impacting a large number of countries in the world.

The processes of globalization most clearly reflected the problem of the interdependence of Environment and Society. It is necessary to understand the unity of Environment's and Society's development and, as far as possible, to adapt the economic development of the world to the possibilities and laws of the Environment. This idea of our modern development allows us to formulate a system of relationships between the Environment and the Society, in which development should be based on the principle of *Compliance* of society's economic development with laws of the Environment. The model of such a development of the world in the 21st century can be presented in the form of: *Environment - Adaptation – Society* [2].

Speaking about the future, we can say that "satisfaction of needs without a threat to future generations" is often not predictable. Based on the trends in the development of relationship between the Environment and the Society, we must come to the realization of the inalienability of mankind from nature. This view of the relationship of Environment and Society should lead to an understanding of the equilibrium of the world - a harmonious relationship of the Environment and the Society. In this case human society should perceive itself as an integral part of nature, which allows formulating the principle of *Inalienability.* In this regard, the model of the development of the world in the 22nd century can be presented as follows: *Environment - Inalienability – Society* [2].

The principle of sustainable development in practice, unfortunately, does not allow creating a long-term policy of such relationships. This is due to not only the possibility of sustainable development of natural processes, but also their exposure to constant changes. The task of humanity in this case is to study the patterns of manifestation of these processes, the correspondence of economic activities to the development of the environment and the adaptation of the economies of countries to such changes. It is important to distinguish between climate change mitigation and climate change adaptation. Mitigation is an attempt to slow down anthropogenic changes of the negative climate impacts, while adaptation is an attempt to mitigate its effects.

5. Conclusion

The problem of society's adaptation to environmental changes takes on new features when the achieved equilibrium becomes a temporary phenomenon, due to a significant increase in the level of variability and the influence of uncertainty on global climate change. At present, the strategy for development of society in the conditions of an equilibrium state and the transition to a new equilibrium state is significantly converging. Adaptation becomes impossible without organizational and technological innovation, and the transition to a new equilibrium needs to adapt to a changing environment. However, an insufficiently clear understanding of internal mechanisms of development of these processes and absence of stable patterns in the functioning of economies of countries make it problematic to use the old baggage of knowledge to build adequate models and obtain

reliable forecast calculations with their help. In this regard the role of adaptive management of society and the extent of its practical application increase significantly.

It should be noted that the adaptation system is not a panacea, but an opportunity to change something in the sustainable development of the Society [11]. Sustainable development can be not only stable equilibrium, a state of rest of a certain system, but can also represent the development or movement of the system - sustainable development of a cyclical nature. Therefore, management of society's adaptation to environmental changes can represent management of sustainable development of society and the achievement of an equilibrium state between the development of the Environment and the Society. The main objective in these conditions is the adaptation to environmental changes and/or minimization of adverse effects of possible risks which followed any adaptation processes.

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