Sustainable Development of Nature and Society in the Context of a Systems Transdisciplinary Paradigm

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This paper attempts to substantiate the possibility of planning, forecasting, and managing the sustainable development of modern society. Disciplinary approaches have proven ineffective in addressing the complex issue of sustainable development. As a result, sustainable development turned out to be a group of concepts that reflect an idea that can be formulated in general terms. Therefore, it is important to show the possibility of solving this problem using a special scientific approach that has the necessary theoretical and practical capabilities. To achieve the goal of the article, a systems transdisciplinary approach was applied. The results of the study allow us to talk about the opening of a "window of opportunity" (2023-2030). These opportunities will allow the leaders of states and state unions to move on to planning, forecasting, and managing sustainable development based on a scientific approach. It is proposed to abandon the expert approach to solving complex problems, based on the intuition and foresight of disciplinary specialists. Instead of an expert approach, it is proposed to use a systems transdisciplinary approach based on the methodology of a scientific discipline - systems transdisciplinarity. In this case, specialists in systems transdisciplinarity (generalists) will strengthen narrow disciplinary specialists in teams involved in solving high-threshold problems.

Keywords: Sustainability, sustainable development, resilience, systems transdisciplinarity, systems thinking.

1 Introduction

Since the 80s of the 20^{th} century, the term sustainable development has been used in the scientific literature to denote a promising concept of the existence of mankind [1]. In this concept, sustainable development is associated with development that meets the needs of the present without compromising the ability of future generations to meet their own needs [2]. According to many scientists and practitioners, the concept of

sustainable development should combine its three main components: economic, social, and environmental [3].

Reviews of thematic literature indicate that in modern science and society the formation of the main elements of the concept of sustainable development continues, including the development of its conceptual and possible methodological apparatus [4, 5, 6]. The oft-quoted definition of sustainable development presented in the Brundtland Commission report reflects a *strategic goal* but does not indicate a *concrete path* for practical action. Therefore, many modern authors offer their own versions, trying to find a definition that would be convenient in practice. Probably, there will be even more of these definitions, since there is a process of understanding future development, which, according to a number of authors, is in principle uncertain and multivariate [7].

In the absence of consensus in the definition and interpretation of sustainable development, due to the complexity of the concept itself and the discrepancy between the views of representatives of different sectors of society - scientific, political, entrepreneurial, sustainable development may be in a group of concepts that reflecting an idea that can be formulated in general terms, but cannot describe exact quantitative and qualitative categories [8].

Due to the complex, radical and dynamic issues of the Anthropocene, some scholars are proclaiming the end of the concept of sustainability. These challenges are the unprecedented and irreversible rate of human-caused biodiversity loss; exponential growth in resource consumption per capita; global climate change [9].

Based on this information, we can conclude that the problems with the formation of the concept of sustainable development, its concepts and ways for practical actions are due not so much to their complexity as to the lack of an adequate scientific worldview, methodological approach, and practical technologies.

Symposium on long-range forecasting and planning (Bellagio, 1968) drew attention to this deficiency in the concept of sustainable development. This symposium was organized by the Organization for Economic Cooperation and Development (OECD). The participants of the symposium discussed the prospects of planning as a method of approach to solving many problems of modern society. They argued that the development of multinational industrial activity would increasingly influence the political relations between countries. This circumstance will require international planning. The complexity and magnitude of the problems will force decisions to be made at levels where the individual participation of those affected is increasingly remote. This leads to a crisis in political and social development that threatens our entire future. It is in connection with this crisis that we feel that the function of planning and related arts such as forecasting are taking on a new meaning. Planning should be linked to the structural design of the complex system itself and be involved in policy making [10].

In 1970, OECO organized a seminar on Interdisciplinarity—Problems in Research and Teaching in Universities (Paris, 1970). This seminar laid down the main directions for the development of transdisciplinarity as one of the possible approaches to planning solutions to the problems of modern society [11,12,13].

Planning is a type of activity associated with setting goals, objectives, and actions necessary to achieve the desired goal. Planning is based on the fundamental ability to mentally travel through time. It is believed that the evolution of foresight, the ability to think ahead, was the main driving force behind human evolution [14]. Therefore, a transdisciplinary approach should generate reliable information about the promising future of society. Politicians, government officials and narrow disciplinary specialists should see the general picture of the future, get a description of its individual stages and goals. In other words, they must be given a context within which to develop solutions to the economic, social and environmental dimensions of sustainable development. Therefore, the purpose of the article is to substantiate the possibility of planning, forecasting and managing the sustainable development of modern society. To achieve this goal, in the section "General Provisions" an assessment of the current state of transdisciplinarity is given. The section "Methodology" describes a systems transdisciplinary model of a temporary unit of order, which formed the basis for describing the past, present and future. The section "Analysis of the past, present and future" describes the content of the past, present and future of society, which is necessary for sustainable development planning. The section "Discussion of the results" describes the features of the current stage of

sustainable development. And, finally, in the section "Conclusions" the rationale for the inevitability of sustainable development is given.

2 General Provisions

Within the framework of the article, terms are used that need to be clarified in their content. To this terms include: sustainability, sustainable development, resilience, complexity and transdisciplinarity.

Sustainability is a long-term goal towards which development is striving.

Sustainable development is a variety of processes and ways to achieve a long-term goal. Therefore, sustainable development can be compared with a paradigm (general point of view, basis) for thinking about the future, in which environmental, social and economic components are balanced in the pursuit of improving the quality of life [15].

Resilience is the ability of an object to restore its state, which allows it to move towards the goal of sustainable development after a shock or disturbance [16].

The disciplinary nature of science has contributed to sustainability, sustainable development and resilience are considered separately within the relevant disciplines: sociology, economics, ecology.

Figure 1 illustrates a refined representation of the meaning of the terms sustainability, sustainable development and resilience. The refined meaning allows us to apply these terms to all disciplinary types of objects.

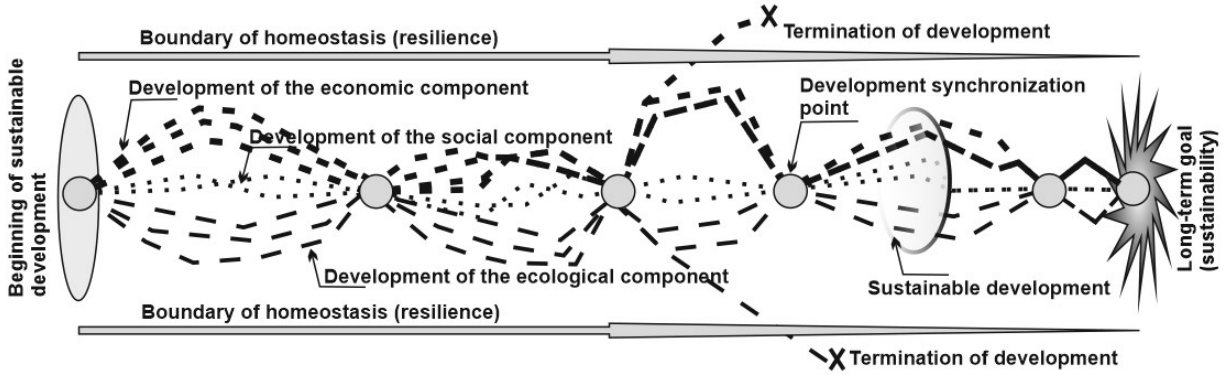

Figure 1: *Illustration meaning terms sustainability, sustainable development, resilience.*

In Figure 1, the terms sustainability as a long-term goal, and sustainable development as a variety of processes and ways to achieve a long-term goal have retained their original meaning. Resilience in this figure is associated with the boundaries of homeostasis (the constancy of the composition of the internal environment and the functions of the object). With a critical change in the state of the internal environment of the object (going beyond the boundaries of resilience), development along this path stops. A fundamentally important term, which researchers of sustainable development pay little attention to, is the term "development synchronization point". Economic, social and environmental components are the facets of a single development process. Therefore, they must synchronize their results periodically. Without such synchronization, these components will not be able to simultaneously achieve the long-term goal with the expected results.

Complexity is a designation of the difficulty of understanding, describing and verifying an object that accompanies the search for a solution to a multifactorial problem. Difficulties arise due to: lack of information about the object; limited analytical potential of the chosen model; an incorrectly formulated idea, assumption or hypothesis. Therefore, the complex problems of the Anthropocene are the distortion of reality near the horizon of the existing scientific worldview. The expansion of the horizon of the scientific worldview is achieved by: strengthening the integration and synthesis of disciplinary knowledge within the framework of academic scientific approaches (from interdisciplinary approaches to transdisciplinary approaches); strengthening the unification and generalization of disciplinary knowledge within the framework of systems approaches (from systems interdisciplinary approaches to systems transdisciplinary approach) [17].

In the context of these considerations, the general definition of transdisciplinarity would be:

Transdisciplinarity is a method of intellectual activity intensification in the area of interdisciplinary interactions contributing to the maximum broadening of the scientific worldview horizon. Such a definition of transdisciplinarity supposes the availability of the tools that ensure the broadening of the scientific worldview horizon. A role of such tools in the area of interdisciplinary interactions is played by the transdisciplinary and systems transdisciplinary approaches.

Considering the generalized definition of transdisciplinarity the definition of transdisciplinary approach will be as follows:

Transdisciplinary approach is a method for broadening of the scientific worldview horizon in the terms of natural-science worldview by implementation of integrative trends of disciplinary, interdisciplinary, and multi-disciplinary knowledge and models of the object.

In its turn the definition of the systems transdisciplinary approach will be as follows:

Systems transdisciplinary approach is a method for broadening of the scientific worldview horizon within the limits of the philosophic picture of a single world by simulation of the object in the form of the transdisciplinary system allowing using the systems transdisciplinary methodology for its research [18].

3 Methodology

In choosing the methodology for research sustainability, sustainable development, and resilience we took into account the following circumstances. Transdisciplinarity researchers believe that despite its increasing popularity, transdisciplinarity is still far from being academically established, and current funding practices do not effectively support it at universities and research institutions. One reason for this deficit is that a universally accepted definition for transdisciplinarity is still not available. Consequently, quality standards that equally guide researchers, program managers, and donors are widely lacking. Therefore, a rhetorical mainstreaming of transdisciplinarity prevails which risks marginalizing those who seriously take the integrative efforts creative collaboration requires [19].

Modern organizers of transdisciplinary research prefer to invite representatives of public organizations and local administration to transdisciplinary teams. It is assumed that the fusion of theorists and practitioners will help in solving complex problems.

G. Lotrecchiano and S. Misra categorically stated the problems of interaction between narrow disciplinary specialists in transdisciplinary teams. They said that one category of systemic complexity pertains to the barriers to transdisciplinary integration arising from interpersonal interactions in transdisciplinary team-based contexts, called interactive systemic complexities. Interactive systemic challenges to transdisciplinary integration include perceived inequitable contributions to the project, unbalanced problem ownership, discontinuous participation, fear of failure, variability in communication types and skills, and overall lack of participant satisfaction with the project processes and outcomes, among others. Structural systemic complexities, on the other hand, are barriers to transdisciplinary integration that arise from characteristics inherent to the makeup of teams. These include differences in foundational training among team members, diverse and changing career paths, geographic dispersion, a lack of awareness of the breadth and complexity

of the problem, perceived insufficient legitimacy of a team to solve the problem, conflicting methodological standards, conflicting epistemological and ontological orientations, and differing levels of transdisciplinary orientation among team members [20].

In turn, many experts note the shortcomings of systems thinking. In certain cases, it is ambiguous and amorphous, systemic sciences are still in the process of formation, and the systemic community is represented by a variety of specializations and a high level of fragmentation in its field of knowledge and understanding of the world [21]. The reasons for these shortcomings are an excessive variety of points of view on the meaning of the concept of "system"; the slowness of progress in the creation of a general systems theory; a variety of terms used within system specializations; the absence of a systems domain model capable of becoming an academic discipline, in the image of which the founders of the systems movement imagined the general theory of systems: L. Bertalanffy, K. Boulding, A. Rapoport and R. Gerard [22].

The shortcomings of transdisciplinarity within the framework of academic scientific approaches and systems thinking have objective (ideological) reasons. It should be noted that in the direction from interdisciplinarity to transdisciplinarity when solving complex problems, the share of expert opinion increases to the detriment of strict scientific methodology. Often, in multidisciplinary and transdisciplinary teams, the final decision is made on the basis of expert consensus and compromise. In such a situation, it became necessary to combine the positive experience of transdisciplinarity and systems thinking into a special scientific discipline "systems transdisciplinarity" [23, 24].

4 Systems Transdisciplinarity: Philosophy, Concept, and Models

The systems transdisciplinarity is based on the philosophic principles of unicentrism. In a broad sense, unicentrism is a position in philosophy and in science that is based on the problem of the correlation between the unity and its fragments. This position is based on the isomorphism (similarity) of the general order of the structure of fragments of space, the attributes of information, and the periods of time that are able to describe the one and only world. Any objects at all levels of the reality of the one and only world are its natural elements and fragments. Therefore, the main condition for the existence of the one and only world is the existence of a general order in it (transdisciplinary system). As the name implies, it follows that this order must manifest itself everywhere: in every element and fragment of this world and in every interaction of these elements and fragments at every level of reality. As a result, the same order should ensure the achievement of activity goals and results of all these elements and fragments. In addition, it should synchronize these goals and results. For this reason, the one and the only world is One Orderly Medium [25].

The major attribute of this One Orderly Medium is the potency, which is naturally present in it, or was put in by the human (for Artificial Orderly Mediums). Potency is the prospective futurity of the One Orderly. Medium. Within the framework of the unicentric concept, the definitions of main philosophical categories are as follows:

Space – as a form of existence of potency of the One Orderly Medium;

Information – as a form of manifestation of potency of the One Orderly Medium;

Time – as a form of transformation of potency of the One Orderly Medium.

The universal order plays the role of a transdisciplinary system in relation to the forms of potentiality of a single world. This particular universal order manifests in the forms themselves, in the interaction of these forms, as well as determines their unity.

Therefore, the order determining unity is not revealed in the course of systems transdisciplinary research of a complex object. It is not formed subjectively as it is done in other types of systems approach. It is postulated through systems transdisciplinary models of the spatial, informational, and temporal units of order.

The model of a spatial unit of order is a logically complete construction of space fragments in a transdisciplinary system, which makes it possible to substantiate the physical boundaries in which the potential of an object exists, manifests and transforms [26].

The model of an information unit of order is a logically complete sequence of main types, subtypes and features of complete information in a transdisciplinary system, which makes it possible to substantiate the content boundaries of the manifestation of the object's potency [27].

The model of temporal units of order is a logically completed sequence of time periods in a transdisciplinary system, which makes it possible to substantiate the semantic boundaries of the duration of an expedient (consistent with the goal) transformation of the object's potency [28].

Models of a spatial, informational and temporal unit of order are isomorphic, that is, they have the same principles of structure. These principles implement the logic of the philosophical substantiation of unicentrism.

Within the framework of the unicentric concept, it is argued that the fact of the existence of any object is due to its belonging to a certain functional ensemble of objects. There are two types of functional ensembles. The vertical functional ensemble consists of horizontal functional ensembles of objects. For example, the planet can be considered as a vertical functional ensemble, which determines the diversity of object types. A horizontal functional ensemble consists of objects of the same type. For example, the human society, the animal community, and also the plant community can be considered as horizontal functional ensembles within a planetary vertical functional ensemble.

The world in the form of vertical functional assembly and the system in the form of the general order, which makes the condition for the unity of this assembly, are close to the vision of L. Bertalanffy with respect to the general systems theory. L. Bertalanffy wrote that a unitary conception of the world may be based, not upon the possibly futile and certainly farfetched hope finally to reduce all levels of reality to the level of physics, but rather on the isomorphy of laws in different fields. Speaking in "material" language, it means that the world, i.e., the total of observable events, shows structural uniformities, manifesting them-selves by isomorphic traces of order in the different levels or realms [29]. In this article, the temporal units of order was used. More precisely, its two subspecies: the staged model and the multiplex model [30].

4.1 Staged Model

A stage is a period of time during which objects, their properties, connections, relations and results of activity undergo quantitative and qualitative changes necessary for the implementation of expedient development. These changes cause a consistent acceleration of the process of expedient development. The staged model demonstrates such an acceleration.

The staged model consists of four stages of different sizes: Identification, Communication, Stabilization and Invariant (see Figure 2).

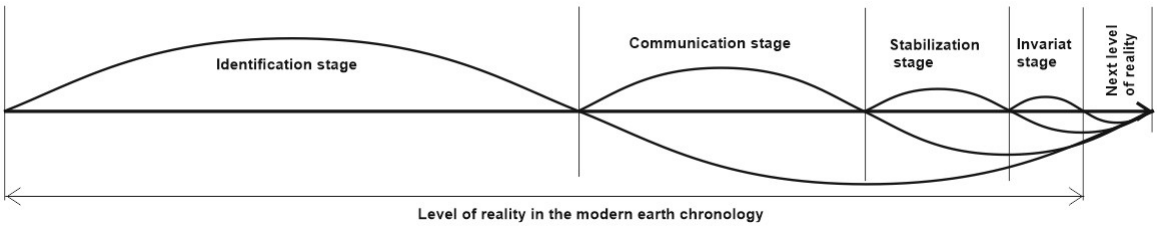

Figure 2: *Staged model.*

Identification stage. Within the framework of the identification stage, the formation of objects takes place, which will take part in the expedient transformation of matter. Under the influence of various factors, objects acquire the necessary properties and functions (identify themselves).

Communication stage. In order to fulfill their purpose, within the framework of the communication stage, objects build special types of connections and relationships. These links and relationships will allow objects to form horizontal functional ensembles. Within the framework of functional ensembles, the objects themselves become more complex, and possible complex types and forms of their activity are realized. At this stage, there is a large-scale accumulation of transformed matter, which is the result of the activity of horizontal functional ensembles.

Stabilization stage. Within the framework of the stabilization stage, only those objects and functional ensembles of objects, as well as their connections and relationships, are further developed that are capable of endowing the overall development of a vertical functional ensemble with a pronounced resilience.

Invariant stage. Within the framework of the invariant stage, the inevitable achievement of the results of the expedient transformation of a certain amount of matter takes place - the goal of sustainable development.

At the end of each stage, there is a synchronization of the results of the transformation of matter within each horizontal functional ensemble, as well as a general synchronization of the results of this transformation within the vertical functional ensemble. Thus, the staged model plays the role of the level of reality. The level of reality is a conditionally isolated period of time with a long-term goal.

4.2 Multiplex Model

The multiplex model demonstrates the fragmentation of the influence of soft and hard programs and the synchronization of the results of the expedient transformation of matter. In the multiplex model, each period is represented by a certain wave or set of waves. Therefore, the multiplex is a "momentary photograph" of a specific unit of physical or historical time. In such a "photo" one can see the entire set of periods of development, demonstrating its meaning, its past, present, and future. The multiplex consists of long and short waves (see Figure 3).

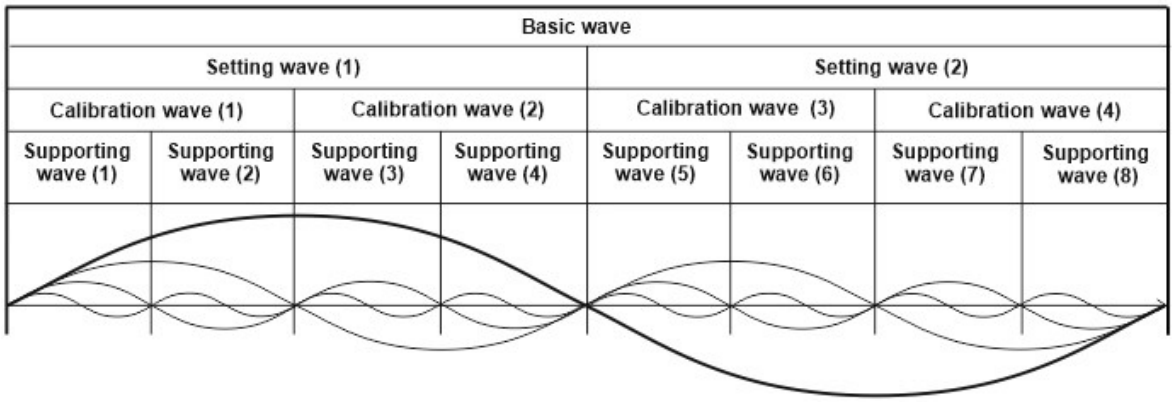

Figure 3: *Multiplex model.*

The long waves of the multiplex include the base and installation waves:

- Basic wave is a reflection of the sustainable development of an object and a functional ensemble of objects, which determines the achievement of a long-term goal (long-term sustainability) within the constancy of the composition of the internal environment and functions (resilience).
- Setting wave is a reflection of the sustainable development of an object and a functional ensemble of objects, which determines the achievement of a medium-term goal (medium-term sustainability) within the constancy of the composition of the internal environment and functions (resilience).

Within the framework of short waves, the development of an object has the character of a *predisposition* (a tendency to show one's individuality in the course of activities). Therefore, the current results of the individual development of objects and the functional ensemble of objects are forced to periodically synchronize and distribute in an orderly manner within short waves, demonstrating obvious signs of development. As such, the multiplex short waves play the role of a soft development program.

4.3 Analysis of the Past, Present and Prospective Future Based on a Staged Model

It should be noted that in our study, the philosophical conceptual concepts of "**existence, manifestation and transformation of potency**", for methodological purposes, are associated with **the expedient transformation of planetary matter.** This goal determines the appearance of objects and the formation of them, earthly horizontal functional ensembles. The accumulation of planetary matter transformed by one horizontal functional ensemble causes the appearance of new horizontal functional ensembles in the hierarchy of the planetary vertical functional ensemble of objects. The movement of the planetary vertical functional ensemble from one long-term goal to another is fragmented by the corresponding levels of reality. In this case, the information provided by the reality level models can be used to refine the sustainability (long-term goal) of sustainable development in the present and in the future. It is important to note that modern earth chronology was used to determine the calendar dates for models of all levels of reality. High accuracy of the calendar dates in models of reality levels is important for substantiating and forecasting sustainable development goals. However, in historical perspective, this accuracy may be approximate.

In accordance with the rules for constructing systems transdisciplinary models of units of order, eight levels of reality were formed. These levels of reality fully revealed the meaning of the expedient transformation of earthly matter by horizontal functional ensembles.

4.3.1 First Level of Reality

The calendar date for the beginning of the first level of reality is the probable date of the origin of the universe - approximately 15 billion years ago [31] (see Figure 4).

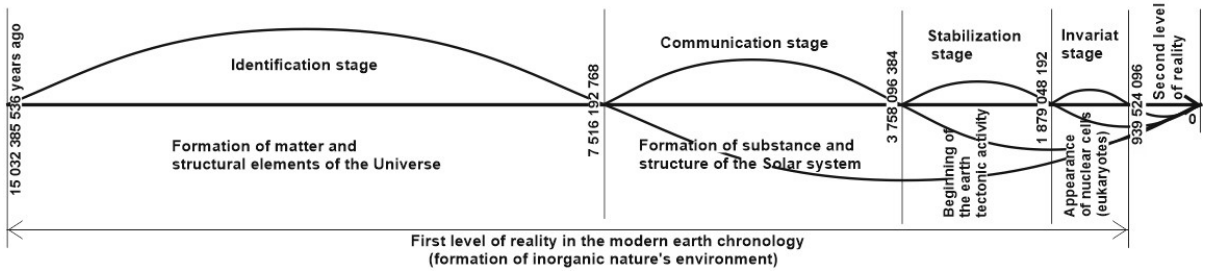

Figure 4: *Staged model of the first level of reality.*

The staged model of the first level of reality demonstrates the logic of the formation of an environment of inorganic nature. In the identification stage, the matter of the Universe (atoms and simple molecules) was formed, as well as its main structures: galaxies and stars. In the communication stage, the solar system and the planet Earth were formed. In the stabilization stage, tectonic activity arose on Earth, which began the process of the expedient transformation of planetary matter. And finally, in the invariant stage, the first nuclear cells appeared.

4.3.2 Second Level of Reality

The calendar date for the beginning of the second level of reality is the beginning of the processes of formation of multicellular organisms - approximately 940 million years ago (see Figure 5).

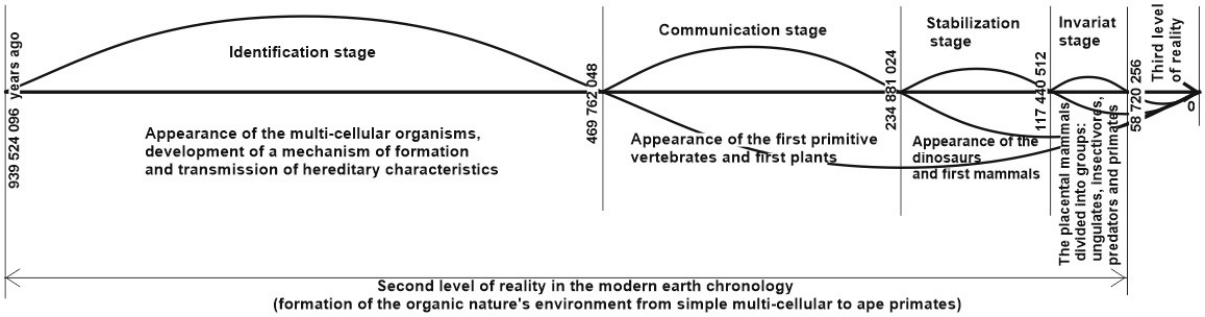

Figure 5: *Staged model of the second level of reality.*

The staged model of the second level of reality demonstrates the logic of the formation of an organic nature environment (from the simplest multicellular organisms to ape primates). During the identification stage of the second level of reality, the formation of diverse primary multicellular organisms took place. During this period, mechanisms for the transmission of hereditary traits of these organisms were formed. At the next stages, primitive vertebrates and the first plants appeared among these organisms, then dinosaurs and the first mammals. And, finally, in the invariant stage of the second level of reality, placental mammals were divided into groups: ungulates, insectivores, carnivores and primates.

4.3.3 Third Level of Reality

The calendar date for the beginning of the third level of reality is the beginning of the separation of the lines of large apes and hominids (great apes) - approximate 58,7 million years ago (see Figure 6).

The staged model of the third level of reality demonstrates the logic of the formation of the environment of great apes. The third level of reality is characterized by the gradual formation of human progenitors, first Ramapithecus, and then Australopithecus, the progenitor of two groups of hominids: paranthropes (monkeys) and humans.

4.3.4 The Fourth Level of Reality

The calendar date for the beginning of the fourth level of reality is the beginning of the process of formation of the genetic line of the Homo species - approximate 3,7 million years ago (see Figure 7).

The staged model of the fourth level of reality demonstrates the logic of the formation of the environment of the predecessors of modern man. The forces of planetary nature caused the great apes to straighten up at first (Man Erectus), then, use the simplest tools (Man Antecessor), learn how to make tools, as well as master the skills of collective action (Heidelberg man). In the invariant stage of the fourth level of reality, the last predecessor of modern man appeared - Neanderthal Man, who began to use fire in everyday life, and also created the first social organization - an early tribal community.

4.3.5 Fifth Level of Reality

The calendar date for the beginning of the fifth level of reality is the beginning of the process of the formation of Man reasonable - approximately 229,000 years ago (see Figure 8).

Milestone model fifth level reality demonstrates the logic of formation of morphological human characteristics of Man reasonable. Simply put, in this level of reality, planetary nature purposefully selected and stored in human genes information about the optimal length of arms, legs, skull and torso sizes, etc. In the future, these morphological human characteristics contributed to the successful development of Man reasonable in a vast geographical environment - the area in which modern humanity will carry out the transformation of planetary matter. This circumstance explains the sequence of important events that characterize the fifth level of reality. Mitochondrial formed first Eve - a woman, the morphological characteristics of the female body, which could be nurtured by modern people. And, Approximately 114,000 years ago, Y appeared - chromosomal Adam is a man whose genetic material contributed to the formation of modern humans. The results of the two previous stages allowed the emergence of Cro - Magnons - European Early Modern Humans. In the invariant period, the resettlement of this type of person, as well as its inclusion in the vertical functional ensembles of various biogeocenoses, contributed to the formation of human races.

4.3.6 The Sixth Level of Reality

For practical purposes from the sixth level onwards, calendar dates are given in years BC and AD. The calendar date for the beginning of the sixth level of reality is the beginning of the process of formation of Sedentary Man - 10752 BC (see Figure 9).

Experts have not established the reason why Man reasonably stopped wandering, began to cultivate the soil, domesticate animals and extract minerals in certain areas. People had to learn to understand the emerging geographic environment. They had to create a social environment - society; create and test its laws; create human culture. Therefore, the sixth level of reality demanded the active formation subspecies of Man truly reasonable and his human peculiarities of higher nervous system activity. These tasks successively decided and decide subspecies of Man truly reasonable: Sedentary Man, Social Man, Humanistic Man, and Liberal Man. It was at this level of reality that all the components of sustainable development appeared, as well as the need for sustainability and resilience. In the invariant stage (1792-2688), this need contributed to the search for ways to organize sustainable development, and ways to predict and manage this development.

It is important to note that in the invariant stage of each level of reality, the inevitable extinction of the dominant species took place. In the invariant stage of the first level of reality (see Figure 4), there was a mass extinction of subspecies of prokaryotes (pre-nuclear cells); in the invariant stage of the second level of reality (see Figure 5) - the extinction of terrible lizards and dinosaurs; in the invariant stage of the third level of reality (see Figure 6) - the extinction of the main subspecies of hominids (apes); in the innovative stage of the fourth level of reality (see Figure 7) - the extinction of the main subspecies of Man Erectus; in the innovative stage of the fifth level of reality (see Figure 8) - the extinction of intermediate lines of Man reasonable, which allowed this species to form the necessary morphological characteristics of the body.

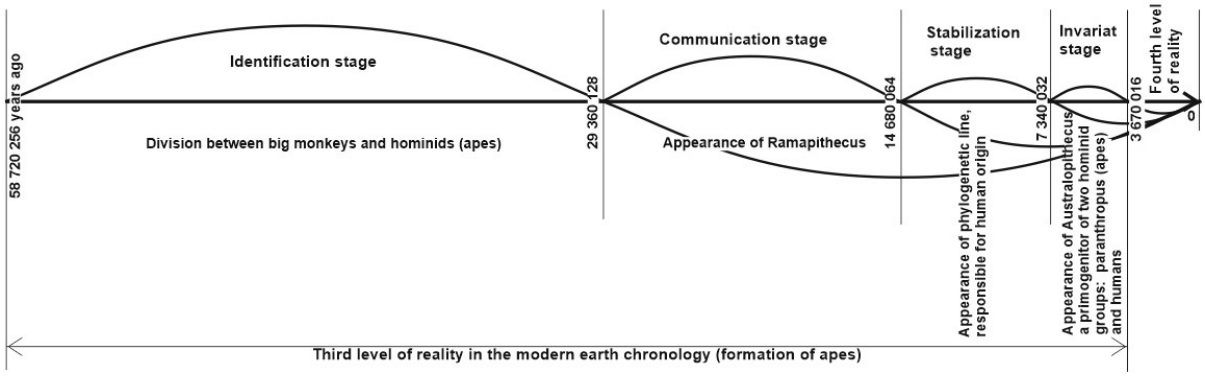

Figure 6: *Staged model of the third level of reality.*

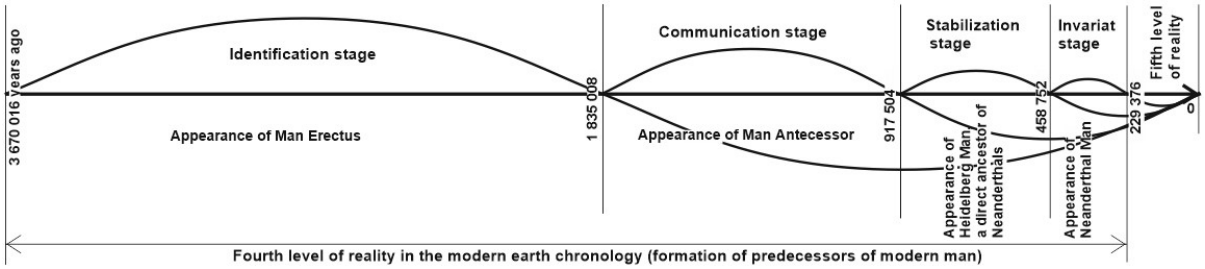

Figure 7: *Staged model of the fourth level of reality.*

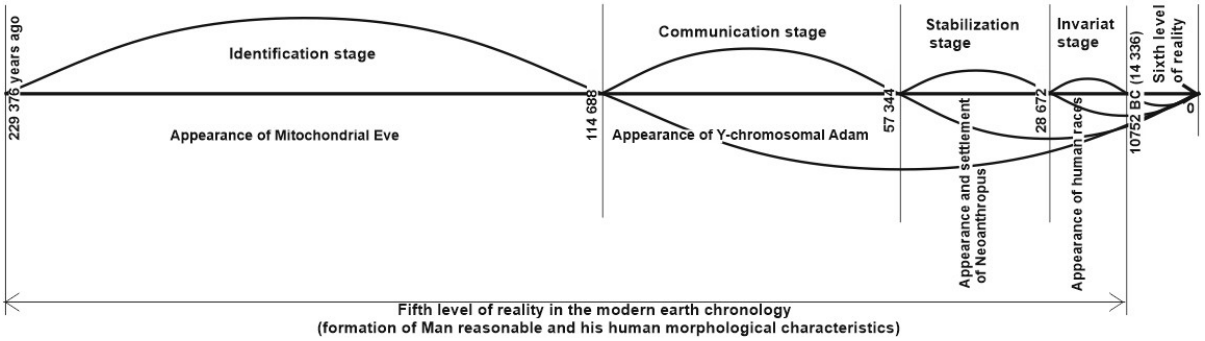

Figure 8: *Staged model of the fifth level of reality.*

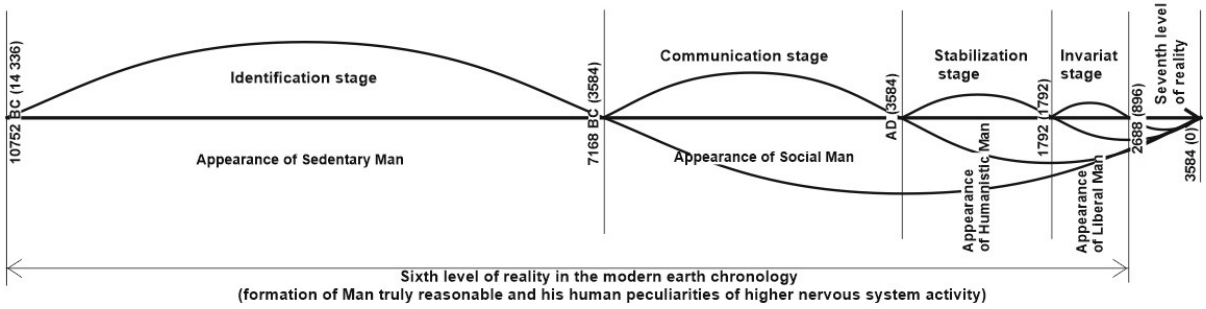

Figure 9: *Staged model of the sixth level of reality.*

These natural extinctions created opportunities for the emergence of new species of plants, animals, and human ancestors, which were intended to achieve the goal of the next level of reality. The manifestation of this general pattern should be expected in the invariant stage of the sixth level of reality.

The invariant stage of the sixth level of reality began in 1792. Consequently, the stage from 1792 to 2688 will be characterized by at least two grandiose evolutionary events. First, there will be a natural extinction of subspecies of Man truly reasonable. Secondly, expedient changes in the social environment will begin, which will form the conditions for the subsequent emergence of the Man ideal type.

4.3.7 Seventh Level of Reality

The calendar date for the beginning of the seventh level of reality is the beginning of the Just Man formation process - the year 2688 (see Figure 10).

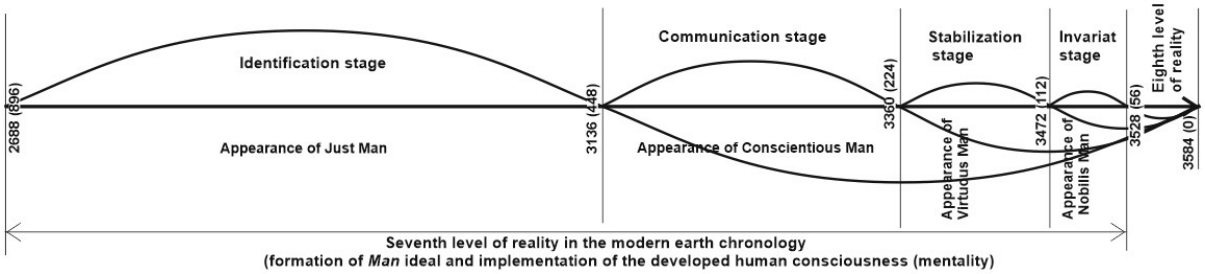

Figure 10: *Staged model of the seventh level of reality.*

Milestone model seventh level reality demonstrates the logic of formation of Man ideal and implementation of the developed human consciousness (mentality).

The seventh level of reality represents the society that utopians describe. It is at this level that a fully conscious understanding of sustainability, resilience, and s sustainable development by all members of society. Possessing fully formed features of higher nervous activity, people will have the opportunity to realize themselves as participants in a planetary vertical functional ensemble. They are aware of the needs of this ensemble and will take a conscious part in meeting its needs.

4.3.8 Eighth Level of Reality

The calendar date for the beginning of the eighth level of reality is the beginning of the formation of Sacral Man - the year 3528 (see Figure 11).

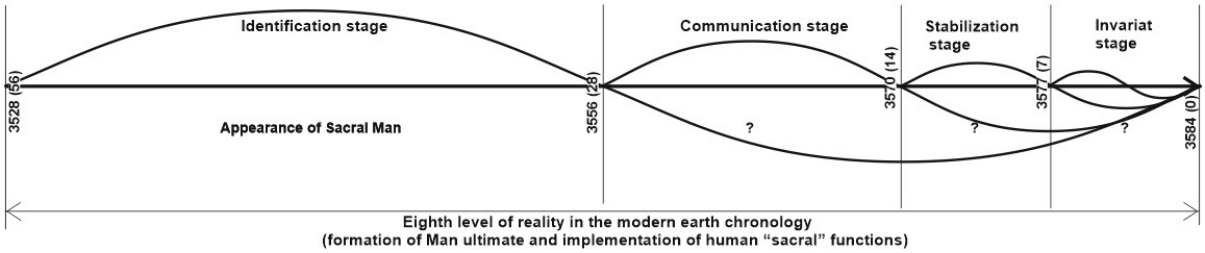

Figure 11: *Staged model of the eighth level of reality.*

Staged model of the eighth level of reality demonstrates the logic of formation of Man ultimate and implementation of human "sacral" functions 56 years before the expected end of the expedient process of transformation of planetary matter by the human horizontal ensemble.

It can be assumed that the process of expedient transformation of the terrestrial planetary matter also has a sacred function. This function consists in the formation of nucleotide molecules and RNA molecules (technological programs) by the participants of horizontal functional ensembles, which ensured the achievement of the results of this expedient transformation. It is quite probable that in 3584 the mass accumulation of such nucleotides and RNA will be completed. Over the next years, the planet will have to melt in magma the entire volume of nucleotide and RNA molecules that have accumulated in the oceanic crust over past levels of reality and form non-biological RNA molecules in the process of forming the last supercontinent on the planet. The remaining nucleotide and RNA molecules can be called sacral molecules. After the solar system ceases to exist, these molecules will become part of the molecular protosolar clouds of fourth and fifth generation stars. In turn, these molecules will set the potential for the emergence and development of biological objects of horizontal ensembles of stone planets of these stars. Thus, the process of evolution of biological objects in the Universe will be continued from a certain level.

The reason why the process of transformation of planetary matter by biological objects in 3584 will be completed will have to do with the formation of the earth's core. Experts suggest that this reason may be an increase in the concentration of oxygen that will occur in the atmosphere due to chemical reactions of the next stage in the formation of the earth's core. You can read more about this in the books [32, 33]. For the purposes of this article, we have used brief information about the events of each level of reality. A detailed description of these events, as well as references to literature that confirms the indicated calendar dates for these events, can be found in the book [34].

In the staged models of the levels of reality, the emphasis is on the expedient formation of a person and a human horizontal functional ensemble. However, in parallel with the development of the human horizontal functional ensemble, a similar development of the horizontal functional ensembles of plants and animals took place. The similarity consisted in the fact that at the same levels of reality, certain species were formed in plants and animals, which, by certain calendar dates, achieved appropriate results in the transformation of planetary matter. New types of plants transformed the substance of rocks and sedimentary rocks more qualitatively. New animal species learned to feed on new plant species and on their fellows in the functional ensemble. And people ate plants and animals. Thus, the sustainable development of the entire planetary vertical functional ensemble was supported. It is important to note that the synchronization of the results of the development of horizontal functional ensembles led to the fact that by the transition of humans to a sedentary lifestyle (10752 BC), plants and animals acquired morphological characteristics that made it possible to begin their domestication and cultivation [35].

Not only man must learn to understand the emerging geographic environment and society. Animals that were domesticated had to learn to understand humans. In turn, the animals that remained wild began to build and decorate their dwellings, use objects as the simplest tools, etc. That is, in the sixth level of reality, in animals, within the framework of a horizontal functional ensemble, the formation of features of higher nervous activity also began.

5 Analysis of the Present and Future Based on the Multiplex Model 1792 – 2688

After determining the calendar duration of the sixth level of reality, it became possible to move on to obtaining the information that is necessary for planning and forecasting sustainable development today. To do this, it is necessary to determine the internal relationship between the long-term goal of the invariant stage 1792 - 2688 (see Figure 9) and the general logic of events that leads to the achievement of this goal. This problem can be solved by the model of multiplex 1792 - 2688 (see Figure 12).

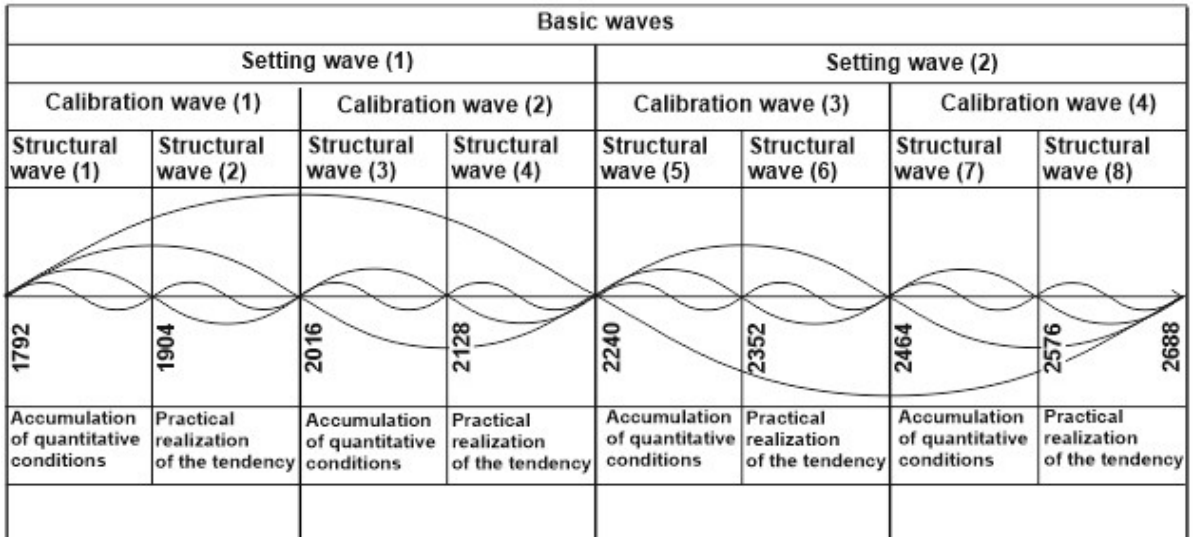

Figure 12: *Model of the multiplex of the Invariant stage of the sixth level of reality.*

The invariant stage 1792 - 2688 has two goals: to complete the formation of the features of the higher nervous activity of Man truly reasonable, and also to create conditions for the emergence of a new kind of man - Man ideal. It is logical that the long-term goal of the development of society in 1792-2688 will be the formation of quantitative and qualitative parameters of the resilience of the rule of law, which, in turn, will ensure the formation in people of a natural feeling and the right to moral responsibility.

The foundations of a modern state of law were laid by the Great French Revolution (1789-1799) [36]. Many of the ideas of the revolution are considered fundamental principles of liberal democracy [37]. The model of multiplex demonstrates the interaction of soft and hard programs for the sustainable development of human society in the invariant period. The results of achieving the medium-term goals of sustainable development, which lead to tough programs, are far from us. These results will form by 2240 (Setting wave 1) and by 2688 (Setting wave 2). Closer to us are the results of the short-term goals that lead to soft programs. These results have already formed by 2016 (Calibration wave 1), and should also form by 2240 (Calibration wave 2), 2464 (Calibration wave 3) and 2688 (Calibration wave 4).

It is important to note that in order to achieve the long-term development goal, the level of rigidity (predetermination) of soft programs increases. In this case, this increase in stiffness will be observed in the direction from Calibration wave 1 to Calibration wave 4. The same increase in stiffness will be observed in the direction from Structural wave 1 to Structural wave 8. An increase in the stiffness of programs will affect the quantitative and qualitative parameters of Resilience. General description of the goals of Calibration wave s that will affect these parameters will be.

Calibration wave 1 (1792-2016): The transition of the state structure from the imperial form to the form of sovereign nation-states, exercising the right of nations to self-determination, including as part of federations.

Calibration wave 2 (2016-2240): Unification of sovereign nation-states into interstate unions based on the same understanding of the content and meaning of the value system (the principle of "sense of moral responsibility").

Calibration wave 3 (2240-2464): Unification of interstate unions within the framework of inter-union social formations that ensure the effective implementation of a system of true values and moral norms. Calibration wave 4 (2464-2688): Unification of inter-union social formations in a single legal state based on the principles of "the right of moral responsibility".

After determining the long-term and medium-term goals of sustainable development in the invariant stage of the sixth level of reality, it is necessary to move on to models of multiplex that correctly reveal the

content of the sustainable development of modern society. In our case, the Structural wave 3 (2016-2128) model of multiplex was formed (see Figure 13).

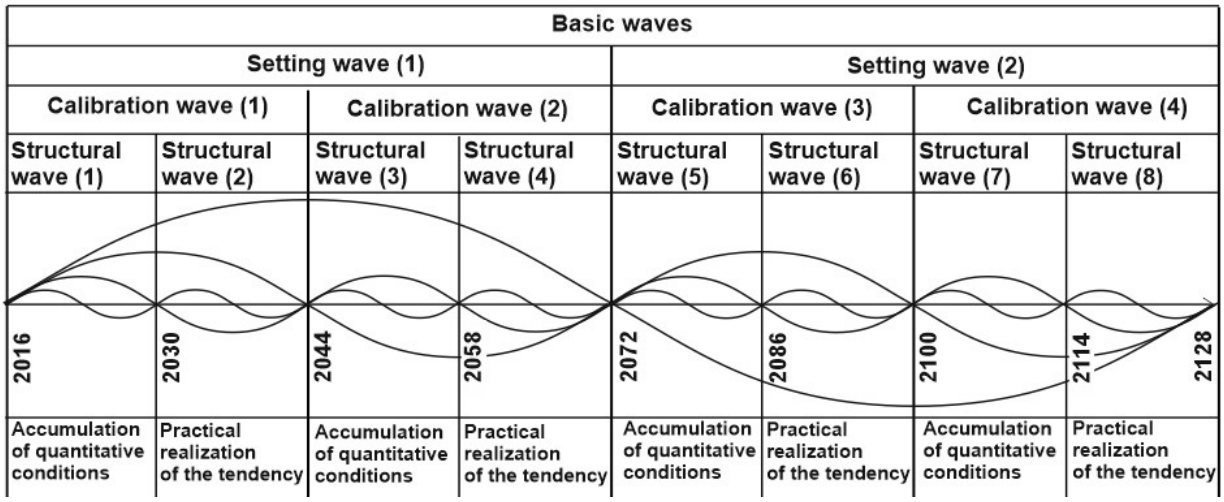

Figure 13: *Model of multiplex of Structural wave (3) 2016-2128.*

On this model of multiplex, we are interested in Structural wave 1 (2016-2030). It is important to note that the events accompanying Structural wave 1 (2016-2030) will set the stage for achieving the long-term goal of 2128.

At the end of the differentiation, a model of the multiplex Structural wave 1 (2016-2030) was built. This model of multiplex made it possible to describe the content of everyday events that will contribute to the achievement of the 2030 goal (see Figure 14).

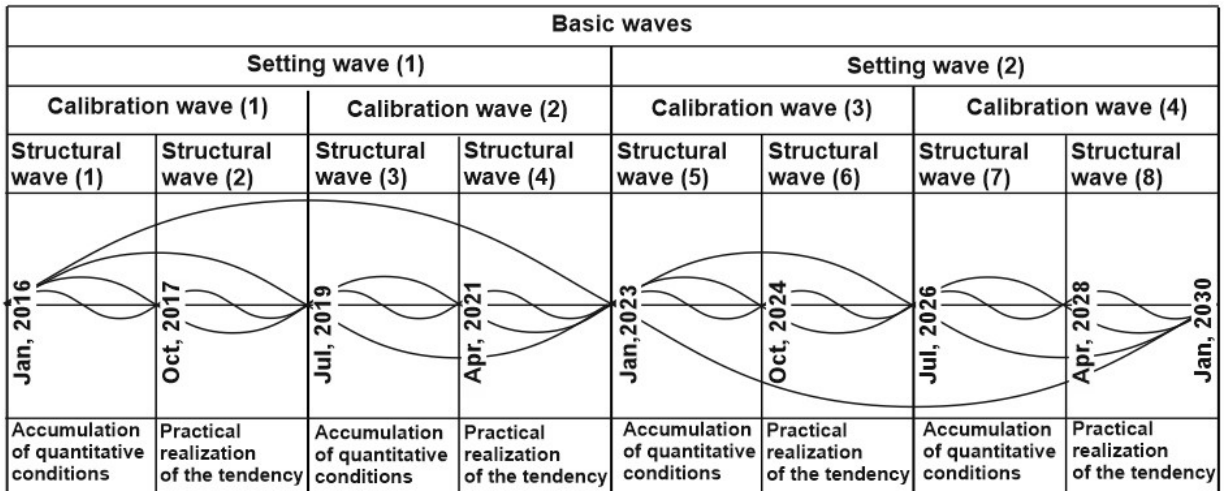

Figure 14: *Model of multiplex of Structural wave (1) 2016-2030.*

Recall that since 2016, the process of unification of sovereign nation-states into interstate unions has begun, based on the same understanding of the content and meaning of the moral value system (the human conscience). Therefore, between January 2016 - January 2030 in society, there will be a need for a new model of the world socio-economic order. Under the influence of the tough Setting wave 1 (January, 2016 - January, 2023) program, a statement of the destruction of the old model of the world socio-economic order will be fixed within society. Influenced by the tough program Setting wave 2 (January, 2023 - January, 2030) activities should begin in society to form the main provisions of a new model of the world socio-economic order. This information is essential for sustainable development planning.

6 Discussion of the Results of the Analysis of the Past, Present and Future Based on Staged Models of Levels of Reality and Models of Multiplexes

Systems transdisciplinarity is not the only scientific discipline that studies the general patterns of development of nature and society. This topic is also dealt with by the academic discipline - Big History. This discipline studies history from the Big Bang to the present day [38]. The main task of Big History is to group scientific discoveries and existing knowledge of chemical evolution from the moment of the Big Bang into a big picture, and then, to explore human existence in the context of this big picture [39].

However, this picture only states the fact of events, but does not define their natural long-term, medium-term and short-term goals. It does not provide philosophical foundations and methodological apparatus for the study of the past, present and future. Therefore, the Big History discipline is not applicable for planning, forecasting and managing sustainable development.

In turn, systems transdisciplinarity does not reduce the evolutionary development of the Universe to the appearance of an earthly person. It only reveals the logic of the formation of earthly humanity on the corresponding levels of reality, manifested with the help of modern earthly chronology. In this logic, humanity is just another horizontal functional ensemble of the planetary vertical functional ensemble. Simply put, humanity is a natural instrument by which the planet completes the active transformation of planetary matter, which has already been transformed by other horizontal ensembles. Therefore, the sustainable development of each planet in the solar system should be considered within the levels of reality based on individual planetary chronology. This will make it possible to correctly describe the development of the planets, as well as the goals of their horizontal functional ensembles. It is quite probable that from the standpoint of the participants in these horizontal ensembles the Universe will be perceived differently than it is perceived by modern earthly man.

Such research results allow us to assert that the Universe did not create a person so that he would become its observer. Man was purposefully created by the planet Earth so that he could transform the planetary matter in accordance with the universal law that determines the unity of the Universe [40]. This position undermines the content of the anthropic principle [41, 42]. The application of the stage model and the multiplex model proves this assumption. As a result, it was possible to correctly identify the period in which humanity should begin to consciously plan, predict and manage sustainable development.

As shown above, this period is Calibration wave 2 (2016-2240) (see Figure 12). This wave has a new long-term target. Therefore, approaches and ways to achieve sustainable development goals before 2016 will be ineffective after 2016. It can be expected that under the influence of the Setting wave (2) (January, 2023-January, 2030) there will be calls from the leaders of various groups of states for the formation of the main provisions and principles of a new model of the world socio-economic order. Based on the multiplex model, this period should be the beginning of the practice of planning, forecasting and managing sustainable development. Therefore, in the period January 2023 - January 2030, the world community, a group of interested states or international public organizations need to take the following constructive actions:

- January 2023 to October 2024 – to create an international analytical group of narrow disciplinary specialists (economists, sociologists, ecologists), as well as to acquaint the members of the group with

the methodology of a systems transdisciplinary approach;

- October 2024 to July 2026 - by the members of this group to form a concept of the main provisions and principles of a new model of the world socio-economic order and sustainable development;
- July 2026-January, 2030 – to form complementary concepts of the components of sustainable development and a new model of the world socio-economic order (systems transdisciplinary economics, systems transdisciplinary sociology, systems transdisciplinary ecology), as well as to form short-term, medium-term, and long-term sustainable development goals up to 2072 and 2128.

7 Conclusions

Before the beginning of the invariant period of the sixth level of reality (1792-2688), in 1784, the founder of German classical philosophy, I. Kant, formulated the main provisions of the "Ideas of Universal History in the World-Civil Plan". I. Kant argued that manifestations of the will, human actions, like any other natural phenomenon, are determined by the general laws of nature. A history which studies these manifestations could reveal its regular course, and what appears to be confused and unruly in individual people could be recognized in relation to the whole human race as an unchanging development of its primary inclinations. Someday the human race will reach that state when all its natural inclinations can fully develop and its purpose on Earth will be fulfilled. This justification of nature, or rather providence, is no small motive for choosing a particular point of view of the world [43].

Such a "special" point of view, generalizing the knowledge of the natural, social and human sciences, is systems transdisciplinarity. With the help of systems transdisciplinary models of the temporal unit of order, it was found that the concepts of sustainability, sustainable development, resilience have a consistent meaning. This meaning is consistently manifested in eight levels of reality. Each level of reality is associated with the era of the evolutionary development of the near space and planetary nature.

The invariant stage of the sixth level of reality (1792-2688) completes the development of one of the "natural inclinations of man" - the features of higher nervous activity. Higher nervous activity includes not only physiology, but also mental functions: thinking, consciousness, and mind. These functions provide adequate human behavior in changing natural and social conditions. Improvement of higher nervous activity occurs in the learning process. As a result, a person acquires the ability to justify and choose the best possible options, to foresee the results of their activities, to change the conditions surrounding it, to create new, unparalleled material and spiritual values, that is, to carry out mental activity. Contemporary humanity consists from subspecies Man truly reasonable: Sedentary Man, Social Man, Humanistic Man and liberal man. Each subspecies has formed a unique content of the concepts on which mental activity is based. These concepts are: needs, benefits, values and goals. In the states of the Sedentary type, State of the Social type, State of the Humanistic type, State of the liberal type has accumulated experience in their practical use. Today, sustainable development and a new model of the world socio-economic order are impossible without the generalization of this content and experience [44]. Thus, a natural need arises in society for new scientific approaches to solving complex problems, for scientific forecasting, planning and managing the sustainable development of individual countries and the entire human community in the short term (until 2072) and in the long term (until 2128). Today this need can be satisfied.

It is important to note that every modern scientist, specialist and politician is the bearer of a certain (disciplinary) worldview. This worldview is effective in solving low-threshold current (trivial) problems. Such problems constitute the bulk of the problems in every state. For that reason, they can be addressed by the bulk of professionals who have a bachelor's degree. Philosophical knowledge does not play a decisive role in the worldview of such professionals. The problems of sustainable development and the new model of the world socio-economic order are high-threshold problems. To solve such problems, a new level of scientific worldview is required [45]. Systems transdisciplinarity can provide a new level of scientific worldview. It is systems transdisciplinarity training that will make it possible to form specialists (generalists) - carriers of the necessary level of scientific worldview, capable of solving high-threshold problems. Different types of states will not accept a solution to the problem of sustainable development and, moreover, a new model

of the world socio-economic order, if such a model is proposed by narrow disciplinary specialists from one state. In this case, in addition to the International Analytical Group, it is advisable to create by 2026 at the universities of different countries the discipline department - systems transdisciplinarity. This will allow create an international standard of transdisciplinary education and systems transdisciplinary competence. In the near future, specialists in systems transdisciplinarity (generalists) will strengthen of narrow disciplinary specialists in teams involved in solving high-threshold problems [46].

Thus, it can be stated that in 2016 the era of a disciplinary expert approach to solving high-threshold problems, based on intuition and foresight of brilliant specialists, ended. The era of a systems transdisciplinary approach has begun, based on the methodology of systems transdisciplinarity.

It should be recalled that if the problems of sustainable development and the new model of the socio-economic order are solved by narrow disciplinary specialists, then the near future will be associated with large material and human losses. Modern mankind has the opportunity to take advantage of the objective moment of the evolutionary development of the planetary vertical functional ensemble and ensure a promising future. For this, as physicists say, it is necessary to create a center of crystallization of such a future. We are talking about the desire of a group of interested states in 2023 (see Figures 13, 14) to create a special International Analytical Group. This group will have until 2030 to form complementary concepts of the components of sustainable development: systems transdisciplinary economics, systems transdisciplinary sociology, systems transdisciplinary ecology; the main provisions of the new model of the world socio-economic order; non-coercive ways to enforce peace in the international relations of groups of states. In this case, for the first time, it will be possible to comprehensively scientifically substantiate the general complementary quantitative and qualitative parameters of sustainability, sustainable development, and resilience of a promising future until the year 2688. Society must take advantage this chance.

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