Introduction.
Reconsidering the Limits to Growth

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We live in a rapidly changing world. It is changing politically, socially, technologically, economically as well as environmentally and the changes taking place are fundamental and long-term. This is a significant challenge for humanity to deal with.

In this situation, forecasts are needed to inform us about possibilities and probabilities. However, the main point of forecasting is not whether we anticipate how the future will look exactly. The main point is to project trends in play now forward so that we do not simply wait to see what 'fate' has in store for us. What are the alternative paths to the future? How can we tell which trajectory is most likely? How can we facilitate the preferred paths and limit the non-preferred tracks? (Grinin *et al.* 2023).

The present issue, subtitled *Political, Demographic, and Environmental Dimensions*, is the eleventh in the series.

The present Yearbook consists of four sections: (I) Social-Political and Civilizational Aspects; (II) Demography; (III) Climate and Environment; (IV) Reviews.

This issue consists largely of the revised chapters of a report to the Russian Association of the Club of Rome *Reconsidering the Limits to Growth* such as 'Africa's Dynamics: History and Possible Futures' by Andrey V. Korotayev, Sergey G. Shulgin, Vadim V. Ustyuzhanin, Julia V. Zinkina, and Leonid E. Grinin; 'Life Quality Index' by Sergey Yu. Malkov, Stanislav E. Bilyuga, and Jameelah M. Musieva; 'Toward Optimization of Global Demographic Processes' by Andrey V. Korotayev, Sergey Yu. Malkov, and Jameelah M. Musieva;

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and 'Climate and Energy' by Askar A. Akaev and Olga I. Davydova. The information about this project is presented below.

Section I 'Social-Political and Civilizational Aspects' includes five articles.

The article by **Leonid E. Grinin, Stanislav E. Bilyuga, Andrey V. Korotayev, and Anton L. Grinin** ('The Age of the State and Sociopolitical Destabilization: Preliminary Results of the Quantitative Analysis') provides a qualitative and quantitative analysis of the correlation between the age of state and statehood as a whole and the risk of state destabilization. On the whole, an inversely proportional relationship has been revealed. All things equal, the longer a state exists, the lower the risk of its destabilization. A quantitative analysis of the correlation between the logarithm of the age of states and the integral CNTS index of socio-political destabilization is presented. In the paper the decile correlation analysis is used as the main method, as simple parametric linear regression in this case greatly underestimates the real strength of the relationship. In general, the decile analysis shows strong correlation between the logarithm of the age of statehood and the mean value of the aggregate index of socio-political destabilization (r = 0.81) and statistically significant (p = 0.004). Overall, the logarithm of the age of statehood explains about 66 % of the variance of the aggregate index of socio-political destabilization by deciles. An explanation for this correlation is presented. It is shown that a particularly high level of sociopolitical instability is characteristic of very young states under the age of nine years. But the transition to the next time period (9–25 years) results in a significant reduction in the average level of sociopolitical instability. An especially marked increase in the level of stability of states occurs during the transition to the time period of 25–35 years. Overall, the average level of socio-political instability for the oldest states (with an age of more than 200 years) appears to be more than 30 times lower than for the youngest states. The analysis shows the high potential of sociopolitical destabilization inherent in any kind of separatism/independence struggle. Even if the struggle for independence is conducted under absolutely just slogans, it is still associated with serious long-term risks of socio-political destabilization simply because the creation of any new state significantly increases the risks of sociopolitical destabilization in the respective territory for coming years.

The article by **Andrey V. Korotayev, Sergey G. Shulgin, Vadim V. Ustyuzhanin, Julia V. Zinkina, and Leonid E. Grinin** ('Africa's Dynamics: History and Possible Futures') presents forecasts for the emergence of large-scale political and demographic collapses and for the economic growth of some countries in Sub-Saharan Africa (SSA) where the likelihood of armed civil conflicts and population impoverishment is the highest in the coming decades. The authors apply several advanced mathematical models: (1) to forecast the risks of armed conflict, where population, median age, and education are the main explanatory factors; and (2) to forecast economic growth, which is a function of the same

variables and risks of large-scale armed civil conflicts. It is important to note that mathematical models consider the interaction of explanatory factors with each other, thereby creating feedback effects. Using these methods, the authors calculate three possible development scenarios for each of the countries under consideration in the 21st century: (1) a pessimistic one, (2) an inertial one and (3) an optimistic one assuming the achievement of sustainable development goals (SDGs) by 2030. The modeling results suggest that the Sahel could become the most disadvantaged region. The four countries of this region are characterized by: (1) a negligible difference between the inertial scenario and the pessimistic scenario; (2) extremely high risks of full-scale civil wars in the close future; and (3) reaching the level of middle-income countries only by the end of this century, even under the most optimistic scenario. The authors conclude that the main way of mitigating the risks of sociodemographic collapses is rapid progress towards achieving the SDGs in the very near future, which seems impossible without an adequate support of the world community.

According to **Sergey Yu. Malkov, Stanislav E. Bilyuga, and Jameelah M. Musieva** ('Life Quality Index'), it is quite natural that in the current global transition from the 'era of growth' to the 'era of stability', the importance of qualitative changes in all spheres of life is increasing. It is indicators of the quality of life in different countries of the world that play an important role among the indicators characterizing these changes. Quality of life depends on material, social and psychological factors. Taking into account the existing approaches to determining the quality of life, the authors make an attempt to create an integrated index that considers both subjective (psychological) and objective aspects of its assessment. The idea that the higher the quality of life, the more basic material, social, and spiritual needs are met, is used as a methodological basis for the construction of the index. When constructing the index, Malkov *et al.* use Maslow's theory of the 'pyramid' of needs (the first, basic, hierarchical level within the 'pyramid' is physiological needs, the last level is the need for self-actualization). For each type of needs, indicators characterizing the degree of their satisfaction (or, conversely, dissatisfaction) have been selected. The paper contains a description of the methodology used and some calculation results.

The article by **Karen Rasler, William R. Thompson, and Hicham Bou Nassif** ('The Extent of Military Involvement in Nonviolent Civilian Revolts and Their Aftermath') deals with the analysis of the role of military's position in the outcomes of civilian uprisings and revolutions. Civilian protest campaigns (or revolutions) that appear to drive autocrats from office are dramatic affairs. However, in most cases it is not civilian protestors alone who can be credited for the regime change outcome. The military serve as significant veto players. They can work to keep the autocrats in office, they can support the civilian uprisings, or they can participate in some negotiated compromise that

may be worked out. Whatever the case, the authors contend that the more significant and overt the military role in these affairs, the less likely it is that the post-revolutionary outcome is democratic in nature. How and to what extent they play a role is assessed through an investigation of 36 nonviolent civilian revolts that brought about successful regime change since 1945. In each case, we measure, albeit crudely, the breadth of civilian participation and the nature of the military involvement. These indicators are then compared with democratization levels five and ten years after the nonviolent, civilian revolt. The authors find that protest campaigns can certainly bring down regimes, but in most cases, only if the military permits it. When the military is least involved in toppling the regime, the new subsequent regime is likely to be more democratic. When the military is highly involved, the nature of the new regime is predictably less democratic.

Antony Harper in his contribution ('A Survivorship Pattern of Civilizations and Its Consequences') supposes that biological entities, particularly cohorts of individuals and, as will be suggested here, entities above the level of the individual and including that of civilization also exhibit characteristic survivorship. It will be demonstrated that a cohort of civilizations existing between 3000 BCE and 1000 CE exhibit Type I survivorship. Further, the consequences of that mode of survivorship will be discussed, including the potential for further survival with respect to a given civilization age. The significance of civilization half-life, the energy relationships with respect to civilization age, and the relationship between Type I survivorship and changes in urban distribution characterized by the periods of stasis and punctuation exhibited by the population of maximum urban areas will also be discussed. Some attention will be given to transitions from stasis to punctuation and vice versa with respect to survivorship mode.

Section II 'Demography' includes two contributions.

This section opens up with the article by **Andrey V. Korotayev, Sergey Yu. Malkov, and Jameelah M. Musieva** ('Toward Optimization of Global Demographic Processes'). It analyzes one of the most important factors in world development – the dynamics of global demographic growth, which demonstrates that the fears of uncontrolled population growth expressed in the framework of the report to the Club of Rome 'Limits to Growth' were partially justified and were typical for the period before the 1980s. However, statistical evidence after more than half a century demonstrates that the situation has changed and in the 1960s and early 1970s there was a peak of global demographic growth, after which a slowdown began. According to the UN forecasts, by the end of this century the population of the Earth will reach its peak, and its decline will begin. The authors provide an explanation for the change in the dynamics of the global demographic transition – most of economically developed states and a significant part of developing countries have moved to the

second phase of the demographic transition, in which the birth rate falls to a level corresponding to a simple replacement of generations or below that level. At the same time, a new problem has arisen associated with a decline in fertility to the 'lowest-low' level – a tendency is formed to the negative natural population change in many countries, which is sometimes compensated by migration processes. Along with that, the process of population aging is developing in many countries of the world with an increase in life expectancy (LE) alongside low fertility. The indicated trends in the stabilization of the world population occur unevenly, with a fairly significant number of countries (mainly the countries of Tropical Africa) in which the second phase started not long ago, and fertility rates are still very high. At the same time, there is an acceleration of urbanization of the population in many developing countries. The paper also notes mutual influence of demographic processes and developments in various spheres of society and provides scenarios for their possible subsequent evolution, highlighting as a possible optimum scenario in which the stabilization of the Earth's population will reduce the degree of negative anthropogenic impact on the environment, but will also avoid a significant global depopulation. Given the unevenness of demographic processes, different approaches to stabilization have been noted: stimulating birth rate in countries with the lowest-low fertility and acceleration of fertility transition in the countries with very high birth rates.

According to **Sebastian Ascui Gac** ('Hypotheses Testing for the Structural-Demographic Model for Political Instability and Social Unrest'), Western societies are increasingly facing higher levels of political polarization and social unrest. Scholars seek to examine variables that may drive or predict political instability using comparative political theories that typically involve extensive use of inferential statistical methods. This paper explores a different path which shows the use of mathematical modelling to forecast the political unrest in Chile, the Latin American country. The model is based on the structural-demographic theory proposed by Goldstone (2017) and subsequently refined by P. Turchin and A. Korotayev (2020). In short, the main contribution of this paper is to apply and test other hypotheses that can explain the rise of political stress, such as dissatisfaction with austerity policies reminiscent of neoliberal orders followed by most Latin American countries, and/or the intense competition for surplus caused by rapid social mobility.

Section III 'Climate and Environment' contains two articles.

The article by **Arno Tausch** ('The Greening of the Global South? Analyzing World Values Survey and European Values Survey Data on Environmental Movements in 88 Countries and Territories from 2017–2021') focuses on the analysis of public opinion survey data on trust and participation in environmental movements from the World Values Survey and the European Values Survey, covering 88 countries and territories from 2017 onwards. Are we witnessing a greening of the Global South? Most of the existing, highly influential

studies on this topic are based on earlier waves of the World Values Survey and the European Values Survey, with only a limited number of countries from the Global South covered in the surveys.

The author's multivariate analysis suggests that, in today's world it is rather the Global South that is 'greening' and where environmental movements enjoy the highest levels of participation and confidence. He also shows that, holding human development indices constant, this greening of the Global South has overall positive effects on the socio-economic development of the countries concerned.

The article by **Askar A. Akaev and Olga I. Davydova** ('Climate and Energy') is devoted to the analysis of climate change issues and the transition to renewable energy sources. The features of the current climate situation are associated with a general increase in the average global temperature as a result of an extremely high concentration of carbon dioxide (CO_2) in the atmosphere, the amount of which is increasing and posing a threat to the stability of the global ecological system as a whole. Taking into consideration the fact that the main share of CO_2 emissions is accounted for by energy consumption (which experienced over the entire timeline of history transitions from one type of energy resources to another – from biomass to coal, from coal to oil and from oil to natural gas), the authors analyze the possibilities of transitioning to renewable energy sources (RES) forecasted to take place by the second half of the 21st century. They carry out mathematical modeling of this transition with various scenarios for the future of the fuel and energy balance in the 21st century. For this, the authors have developed a specialized mathematical model that takes into account current trends in energy consumption based on the data from the largest energy companies and international organizations in the energy sector, such as BP, Equinor, Shell, International Energy Agency (IEA), International Renewable Energy Agency (IRENA), and others. Three scenarios for the increase in the average global temperature of the surface atmosphere in the 21st century are proposed: the conservative scenario, the ambitious scenario, and the Net Zero scenario. The conservative scenario assumes that government policies, technologies and social preferences continue to evolve in the same way as in the recent past. The ambitious scenario envisages the introduction of measures leading to a significant reduction in carbon emissions from energy use, which in turn makes it possible to limit the increase in global temperature in the 21st century. The Net Zero scenario, which the authors consider the optimal one, assumes that the measures proposed in the ambitious scenario are complemented and reinforced by significant changes in the behavior and preferences of society. The paper details modern energy-efficient technologies and methods of using renewable energy sources, the implementation of which is envisaged in the framework of the optimal Net Zero scenario.

Section IV 'Reviews' contains a review by **Antony Harper** of 'Handbook of Revolutions in the 21st Century: The New Waves of Revolutions, and the Causes and Effects of Disruptive Political Change', edited by Jack A. Goldstone, Leonid Grinin, and Andrey Korotayev published by Springer International Publishing in 2022.

On the Report to the Russian Association of the Club of Rome *Reconsidering the Limits to Growth*

This report (see Sadovnichy, Akaev, Ilyin, Malkov, Grinin, and Korotayev 2023a) is the result of more than ten years of work on modeling and forecasting world dynamics, and it reflects the views of Russian scientists on the future of global development.

Its main goals are to do a preliminary work for the following tasks: (1) To give an analysis of changes through which the World System has come to its present state, based on an integrated approach (that incorporates the world-systems, historical and evolutionary approaches), on mathematical modeling, as well as on a systematic view of society, in which changes in one subsystem cause transformations in others; (2) To define the main vectors of transformations of the World System; (3) To make a detailed forecast of the development of all the main subsystems of society and the World System, while presenting three or four horizons of changes (from short-term to ultra-long-term up to a hundred years); (4) To present different development scenarios and make recommendations on how to switch to the most favorable development scenario (see Sadovnichy *et al.* 2023b: 1–2, Ch. 'Introduction: Hoping for the Future'). Since the publication in 1972 of the first report *The Limits to Growth* by Donella and Dennis Meadows, Jorgen Randers and William Behrens III (Meadows *et al.* 1972), which first drew attention of the world community to the problem of limitations to the possibilities of a secure world development, the views of the Club of Rome experts on the factors that negatively affect the dynamics and nature of global development have significantly evolved.

The transformation of the tone and logic of reports to the Club of Rome over the past 50 years reflects the epoch-making changes taking place in the world. These changes need to be thoroughly thought about in order to identify their underlying causes; they require an answer to the question: what should we expect in the future? (Sadovnichy *et al.* 2023b: 1–2, Ch. 'Introduction: Hoping for the Future').

The authors of the report believe that, at present, the evolution of the World System has reached a new critical milestone. The World System and humanity as a whole are currently moving into a fundamentally new phase of historical development when the old economic and social technologies no longer work as efficiently as before or even begin to function counterproductively, which leads the World System into a systemic crisis. There is a transition of

human society to a new phase, the shape of which has not yet been determined. Therefore, the authors of this work insist that new approaches are needed both to the analysis of the global situation and to forecasts. The title of the report to the Club of Rome, *Reconsidering the Limits*, certainly echoes the famous *The Limits to Growth*. The title should not give a misleading impression of where the thinking of the Club of Rome is today, especially in connection to the 50th anniversary of the famous report. What is more, the authors entirely recognize the presence of objective limits to growth. However, these limits are different in different periods, and besides the borders of limits are not frozen. So they might be expanded significantly as a result of special planning and efforts (Sadovnichy *et al.* 2023b: 2, Ch. 'Introduction: Hoping for the Future')

It consists of an Introduction, three parts, Mathematical Part, and Conclusion. The names of these parts speak for themselves. Part I ('Looking into the Past and the Future') contains two chapters, which outline the general approach of the volume's team. Chapter 'Macrohistorical Approach' (Sadovnichy *et al.* 2023c) provides the macrohistorical background, whereas the other chapter of that part presents some assessments of modern processes arising against that background, as well as some forecasts (see Sadovnichy *et al.* 2023d). The main content of the report is presented in Parts II and III, which together consist of ten chapters. These chapters cover all the main subsystems of modern and future society. Part II – 'Problems, Forecasts, Solutions (Climate, Ecology, Demography, Aging)' – consists of four chapters. Part III 'Problems, Forecasts, Solutions (Technology, Economics, Sociopolitical Development)' consists of six chapters devoted to the analysis of modern and future technologies, forecasts of economic development, as well as sociopolitical development, including an analysis of the possible impact that aging can have on the sociopolitical structure of the future society. Of particular importance are the chapters devoted to the analysis of differences in the development of advanced and catching-up countries, with a particular focus on African countries. This allowed refining forecasts and recommendations on optimizing the development of different groups of countries in terms of their economy, demography, and attitude to climate. The authors aimed to title the chapters in Parts II and III in a 'self-explanatory' way so that the main idea could already be obvious from the title. But these are chapters of different authors, and sometimes different authors offer different scenarios for the development of society in the future, since, obviously, the future is not predetermined, it depends on many factors, including our own efforts. In chapter 'Conclusion. Reconsidering the Limits. Suggestions (Come on!)' (Sadovnichy *et al.* 2023e) the limits (challenges) are summed up that the authors of the report are talking about and briefly summarize how the humankind might be able to reconsider them. The contributors to the report focus on the fundamental idea that the more actively we fight for the future, the

more likely it will be closer to our ideal, although, of course, we must simultaneously remain realistic.

There are also eight methodological/mathematical chapters in the report and an introductory chapter to them. They cover certain issues in more detail and show the mathematical apparatus that is used. They demonstrate how the authors see combining of the world-systems, historical and evolutionary approaches, a systematic view of society, and mathematical modeling within a single research program. The chapters of the Mathematical Part are independent, as they consistently set out the main elements of the system of mathematical modeling of world dynamics. This Mathematical Part is titled 'Modeling Social Self-Organization and Historical Dynamics – from Agrarian to Cybernetic W-Society'. This name reflects both its structure, since in its specific chapters, the previous types of society (agrarian, industrial), as well as the future society and its types, are considered, and it implements the specified methodological assumption: the changes taking place in the world are fundamental and long-term, therefore they should be considered in a broad historical context (and not just as a continuation of the trends of the 20th century). Accordingly, when modeling world dynamics, historical approach should be implemented, which implies viewing the current situation as a certain phase of macrohistorical development, as a certain stage of the historical transformation of the World System. It also stresses an uneven character of the historical process which proceeds sometimes in gradual evolutionary way and sometimes in uneven jerks (taking the form of revolutions) occurring from time to time.

The Mathematical Part of this report mostly presents the results of mathematical modeling of various aspects of historical, present and future reality and forecasts, but it also includes important verbal qualitative sections. It implements important methodological assumptions. In accordance with these assumptions, the objects of research and modeling in the Mathematical Part are the basic processes (including social and political ones) that determine the features of interaction between various spheres of life at respective phases of historical development. The logic of this Part leads us from ancient societies to modern and future ones, through understanding how phase transitions occur from one type of society to another, and allows us to make forecasts about the future society. Its chapters demonstrate how we see the combining of the world-systems, historical and evolutionary approaches, a systematic view of society, and mathematical modeling within a single research program.

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