I.

GLOBAL SIMULATION OF QUALITY AND SECURITY OF HUMAN LIFE

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Abstract

A system of factors (indices and indicators) and a new method of quantitative and qualitative evaluation are developed. This system, named "Sustainable Development Gauging Matrix" (SDGM) and data presented by reliable international organizations culminated in a Global Simulation regarding quality of life and security of the world population. Specifically, this study focuses on the analysis of the Systematic Regularity of World Conflicts over the Course of Time. A prognosis is detailed of the next world conflict, labeled the "Conflict of XXI Century", and an analysis is provided of its nature and main characteristics; duration, main phases of the conflict and intensity. This prognosis details a set of basic global threats that spawn this conflict. Using cluster analysis, its influence on different countries of the world is accurately defined. These results were obtained by applying the capabilities of the world data centers network as a tool for providing a variety of scientific interdisciplinary data.

Keywords: noosphere, sustainable development, interdisciplinary data, global simulation, gauging matrix, global threats, conflict, cluster analysis

JEL Classification: Q01, C02, C15, C69

1. INTRODUCTION

We will consider the concept of "sustainable development" based on the theory of noosphere created by Vladimir Vernadsky. In the middle of the last century, in his work (Vernadsky, 1944) he declared that the Homo sapiens with his mind and activities has began to influence strongly the natural development of the environment or biosphere. The theory and practice has confirmed that after several decades the noosphere doctrine proves to be a necessary platform for the development of the "triune" concept of sustainable ecological, social and economic development. In 1996, the United Nations formulated this concept in the following way: "System coordination of economic, ecological and human development in such a way that from one generation to the other the quality and safety of life should not decrease, the

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environmental conditions should not worsen and the social progress should meet the needs of every person".

This concept was generalized by a number of international organizations, among them the Rome Club, International Institute for Applied System Analysis (IASA), Institute for System Research (USSR), International Federation of Institutes for Advanced Studies. The problems of environment and sustainable development were discussed at the UN conferences and summits, (UN Summit, Rio de Janeiro, 1992, UN Summit, Johannesburg, 2002). Thus, the new concept has united the three main components of the sustainable development: economic, ecological and social. It is recommended to carry out transition from one-dimensional development to its harmonization with respect to three constituents: economic; ecological; social/institutional. Thereby, the purpose of this research is working out a sustainable development measuring system based on the use of interdisciplinary data characterizing each of its three dimensions. By using this measuring system which we call Sustainable Development Gauging Matrix (SDGM) we carry out global simulation of sustainable development in the context of quality of life and security of population. Also, we analyze the impact of the totality of global threats on this development.

2. Development of SDGM Mathematical Model

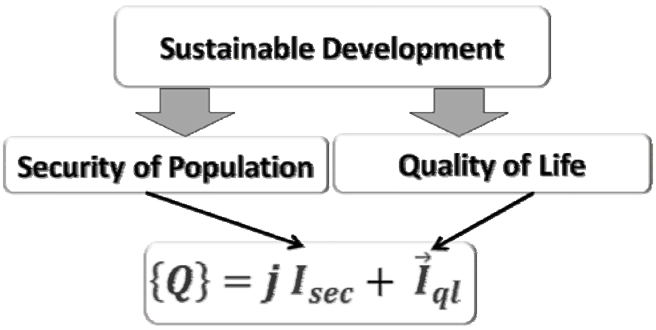
We characterize sustainable development by two main constituents: security of population (Isec) and quality of their life **(Iql),** as in Figure 1. Then the generalized sustainable development measure (Index) may be presented by a quaternary **{Q}** with imaginary scalar part j(Isec**),** describing security of people and real vector part **(Iql),** describing quality of life in the space with three dimensions: economic (**Iec**), ecological (**Ie**) and social-institutional (**Is**):

$$\{Q\} = j\, I_{sec} + \vec{I}_{ql}\ ; \qquad (1)$$

$$j = \begin{cases} 1 & ;\ \text{for real positive values of } I_{sec} > 0 \\ \sqrt{-1} & ;\ \text{for zero valuation of } I_{sec} = 0\ (conflict) \end{cases}$$

Figure 1

Quaternary Approach for Sustainable Development Representation



In this space, for each country we have the sustainable development radius-vector **(Isd)** with the Euclidean norm:

$$I_{sd} = \left\|\vec{I}sd\right\|\sqrt{I_{ec}^2 + I_e^2 + I_s^2}. \qquad (2)$$

which we define as a sustainable development index **(Isd)**. Quality of life component **(Iql)** is the sustainable development vector **(Isd)** projection on the ideal vector with coordinates **(1; 1; 1):**

$$I_{ql} = \sqrt{I_{ec}^2 + I_e^2 + I_s^2} \cdot \cos(\alpha). \qquad (3)$$

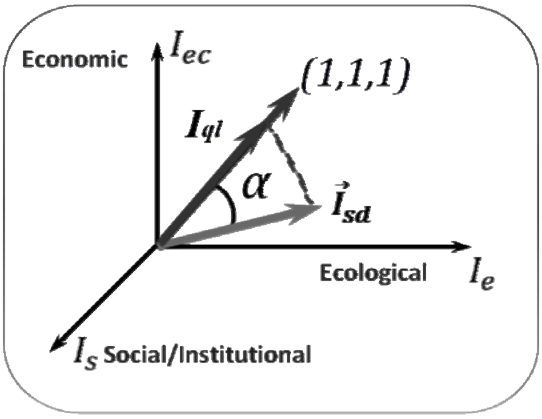
The angle **(α)** is defined as a degree of harmonization:

$$\alpha = \arccos\left(\frac{I_{ec} + I_e + I_s}{\sqrt{3}\sqrt{I_{ec}^2 + I_e^2 + I_s^2}}\right);\ 0 \leq \alpha \leq \arccos\left(\frac{1}{\sqrt{3}}\right), \qquad (4)$$

as in Figure 2.

Figure 2

Quality of Life Component (Iql) and Harmonization Degree (*α*)



Since simulation of security and quality of life is carried out using different methods and different initial data, it seems reasonable to fulfill it separately in three stages. At the first stage, we will carry out Data Analysis of Quality of Life Component of Sustainability. In order to perform this simulation, we have to select data by means of which each of the three sustainable development dimensions can be presented most adequately. These data are also to be prepared by reputable international organizations or research centers annually on the permanent basis.

To present the **economic dimension**, two global data bases were used: *Global Competitiveness Index* **(Ic),** annually developed by the World Economic Forum (The Global Competitiveness Report, 2007-2008), and *Index of economic freedom* **(Ief)** developed by Heritage Foundation (The news of intellectual centre of Heritage Foundation, 2008).

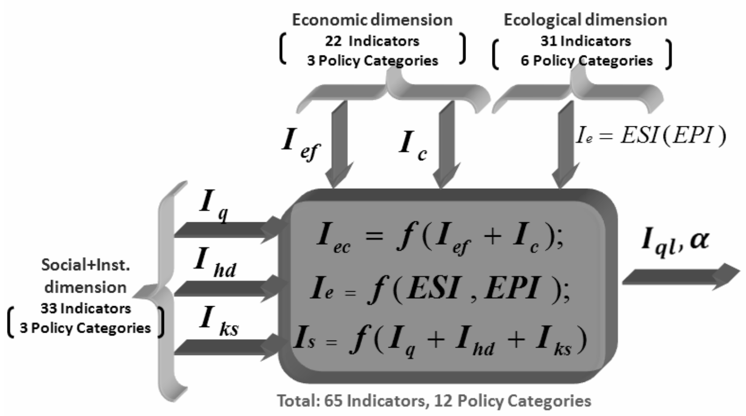
Ecological dimension (Ie) is defined by the well-known *Environmental Performance Index,* which is annually formed by the Center on environmental legislation and policy of Yale University together with Columbia University (EPI Beta, 2007/2008).

Social dimension is formed by three global indices*: Quality of life Index,* developed by the International Living organization (Quality of Life Index, 2008), *Human development index,* annually calculated in the framework of United Nations Development Program (Human Development Report, 2007/2008) and *Index of knowledge society,* created by UN Department on economic and social development (The publications of the United Nations on economic and social affairs – UNDESA, 2005). All together these six indices are defined by 12 policy categories and 65 indicators and accumulated at the Ukrainian branch of World Data Center (WDC for Geoinformatics and Sustainable Development, 2008).

Based on the description of interconnections between these factors, their transformation to the unified computational platform, the mathematical model for Quality of Life Simulation, named "Sustainable Development Gauging Matrix" (SDGM) was developed as in Figure 3.

Figure 3

Mathematical Model "Sustainable Development Gauging Matrix" (SDGM)



This interdisciplinary model is a large scale matrix compression. It combines data of various natures and reflects the balance between three inseparable spheres of the society – economic, ecological and social/institutional. Under such conditions all data, indicators and indices, which are included in the SDGM model, are measured in different units and have various interpretations. This is why they are reduced to the normal form in such a way that their changes and the changes of their indices themselves were in the range from 0 to 1. In this case the lowest values of the above indicators will correspond to the numerical values close to 0, and the highest – will approximate these values to 1. Such normalization allows one to calculate each of the indices **Iec, Ie, Is** and **Isd** in the form of an algebraical compression of its constituents with the corresponding weighted coefficients. In turn, the weighted coefficients in the calculation formula of the sustainable development index (**Isd**) are chosen in such a way that allows one to provide the same weights of economic, ecological and social measures in this index.

Data Analysis of Quality of Life Component of Sustainability

The mathematical model SDGM was used for calculation of quality of life components of sustainability for 2005-2008, which are represented in Table 1 (table columns 4-9). These components are: the Euclidean norm of sustainable development radius-vector **(Isd),** Harmonization Degree (**α,** table column 6) and Quality of Life Component **(Iql,** table column 5).

We see that among the five leaders (Switzerland, New Zealand, Finland, Sweden and Norway) there are no superpowers with dominating ideologies and economies. The basic industries of these countries are not oriented to the usage of considerable natural resources and cheap labor. These countries are leading in the ecological dimension index. They are very active in innovation activities; invest about 4 % of their GDP for R&D.

G8 countries are placed from the 6th to 23rd position by quality of life component of sustainable development (except Russia). In particular, Canada ranks 6th position, France - 11th, Germany - 12th, Japan - 13th, United Kingdom - 16th, United States - 16th, Italy – 21st, Russia - 56th. Nevertheless, they are world leaders in GDP absolute values, but their quality characteristics of economic development, renewal of natural resources and development of social capital move these countries in the second-third dozen.

The BRIC countries (Brazil - 45th, Russia - 56th, India - 78th and China - 76th) are characterized by rapid growth of their economies, which reach 8-12 % annually. In spite of this BRIC countries by the quality of life component of sustainable development are ranked from the 45th position for Brazil to 78th position for India. It is connected with low level of sustainable development harmonization at the expense of priority economic development and, at the same time, lagging in ecological and social fields.

In the lower part of the list there is a group of African countries (Benin - 87th, Cambodia - 88th, Zimbabwe - 89th, Zambia - 90th, Nigeria – 91st, Ethiopia - 92th, Mozambique - 93th) which are in miserable conditions in regard to almost all indicators of quality of life component of sustainable development.

The verification of adequacy of the SDGM model was accomplished by matching sustainable development and night lights world maps. The Nighttime Lights of the World Dataset contains the first satellite-based global inventory of human settlements, derived from nighttime data from the Defense Meteorological Satellite Program – DMSP (2007), collecting at the network of world data centers. It has made possible to check and to adjust adequacy of the SDGM model.

Table 1

The results of sustainable development global simulation (dimensionless quantities)

Country	Sustainable Development Index $\{Q\}=jIsec+I_{ql}$		Quality of Life Component						Security Component	
	Rank	{Q}	Rank	I_{ql}	α (rad)	I_e	I_{ec}	I_s	Rank	I_{sec}
1	2	3	4	5	6	7	8	9	10	11
Very High										
Switzerland	1	3.275	1	1.462	0.1394	0.680	0.955	0.898	8	1.813
Canada	2	3.258	7	1.377	0.1127	0.668	0.866	0.851	1	1.881
Sweden	3	3.250	4	1.382	0.1564	0.629	0.931	0.833	2	1.868
Norway	4	3.244	5	1.380	0.1729	0.605	0.931	0.854	3	1.864
Finland	5	3.222	3	1.382	0.1378	0.649	0.914	0.831	5	1.840
New Zeland	6	3.218	2	1.383	0.1319	0.650	0.889	0.857	6	1.835
Australia	7	3.201	14	1.353	0.1089	0.669	0.798	0.876	4	1.849
Denmark	8	3.167	13	1.353	0.0970	0.674	0.840	0.830	7	1.814
Austria	9	3.148	11	1.357	0.1556	0.612	0.894	0.844	10	1.791
Luxemburg	10	3.139	15	1.350	0.1416	0.625	0.831	0.882	11	1.789
France	11	3.138	8	1.365	0.1799	0.586	0.878	0.901	14	1.773
Germany	12	3.133	9	1.364	0.1389	0.632	0.863	0.868	15	1.769
Japan	13	3.128	16	1.343	0.1282	0.634	0.845	0.847	12	1.785
Netherlands	14	3.124	18	1.324	0.1074	0.654	0.787	0.852	9	1.800
Ireland	15	3.109	17	1.326	0.0941	0.664	0.827	0.805	13	1.784
United Kingdom	16	3.099	12	1.353	0.1054	0.668	0.863	0.813	20	1.746
United States	17	3.062	6	1.379	0.1050	0.687	0.810	0.891	32	1.683
Spain	18	3.054	19	1.309	0.1618	0.582	0.831	0.855	21	1.745
Belgium	19	3.043	21	1.293	0.1299	0.613	0.784	0.843	18	1.750
High										
Portugal	20	3.035	25	1.283	0.1852	0.546	0.858	0.819	16	1.751
Italy	21	3.025	22	1.290	0.2004	0.531	0.842	0.861	23	1.735
Slovenia	22	3.020	29	1.270	0.1983	0.527	0.863	0.809	17	1.750

1	2	3	4	5	6	7	8	9	10	11
Costa Rica	23	3.017	27	1.278	0.2081	0.530	0.905	0.778	22	1.739
Chile	24	3.000	24	1.288	0.1082	0.638	0.834	0.759	27	1.712
Lithuania	25	2.999	23	1.289	0.1602	0.579	0.862	0.791	29	1.710
Latvia	26	2.995	26	1.278	0.1801	0.562	0.888	0.763	25	1.718
Uruguay	27	2.995	33	1.246	0.1761	0.539	0.823	0.796	19	1.749
Hungary	28	2.992	31	1.263	0.1706	0.554	0.842	0.792	24	1.729
Slovakia	29	2.980	30	1.269	0.1666	0.566	0.860	0.772	28	1.711
Estonia	30	2.968	20	1.298	0.1240	0.626	0.852	0.770	35	1.670
Greece	31	2.939	36	1.224	0.1992	0.505	0.802	0.813	26	1.715
Czech Republic	32	2.932	34	1.233	0.1391	0.572	0.768	0.796	31	1.699
Poland	33	2.910	41	1.211	0.1875	0.512	0.805	0.780	30	1.699
Medium										
Israel	34	2.891	32	1.252	0.1284	0.591	0.796	0.781	39	1.639
Croatia	35	2.878	42	1.209	0.2193	0.483	0.846	0.765	36	1.669
Argentina	36	2.873	43	1.208	0.2276	0.469	0.818	0.805	37	1.665
Korea, South	37	2.866	28	1.270	0.1184	0.610	0.794	0.796	52	1.596
Bulgaria	38	2.861	45	1.188	0.1790	0.511	0.785	0.762	33	1.673
Malaysia	39	2.855	38	1.221	0.1509	0.578	0.840	0.696	44	1.635
Mexico	40	2.849	40	1.211	0.1568	0.545	0.798	0.755	41	1.638
Panama	41	2.845	39	1.218	0.1764	0.533	0.831	0.746	46	1.627
Albania	42	2.841	48	1.170	0.2089	0.491	0.840	0.696	34	1.671
Colombia	43	2.818	37	1.222	0.2121	0.512	0.883	0.721	51	1.596
Thailand	44	2.803	50	1.164	0.1442	0.553	0.792	0.671	40	1.639
Brazil	45	2.785	46	1.181	0.2135	0.479	0.827	0.740	49	1.604
Jamaica	46	2.782	54	1.145	0.1604	0.529	0.791	0.663	42	1.637
Tunisia	47	2.775	53	1.146	0.1570	0.526	0.781	0.678	45	1.629
Jordan	48	2.767	58	1.130	0.1457	0.531	0.765	0.662	43	1.637
Ecuador	49	2.749	47	1.173	0.2362	0.456	0.844	0.731	58	1.577
Bosnia and Gerzegovina	50	2.744	61	1.123	0.2248	0.446	0.797	0.702	47	1.621

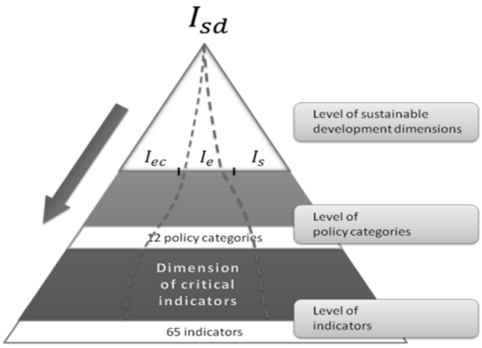
1	2	3	4	5	6	7	8	9	10	11
El Salvador	51	2.728	55	1.137	0.1381	0.549	0.772	0.648	53	1.591
Romania	52	2.717	56	1.136	0.1606	0.506	0.719	0.742	55	1.581
Turkey	53	2.705	59	1.128	0.1532	0.517	0.759	0.678	57	1.577
Georgia	54	2.700	49	1.167	0.1708	0.538	0.822	0.662	69	1.533
Ukraine	55	2.698	66	1.097	0.1979	0.455	0.741	0.704	50	1.601
Russia	56	2.692	57	1.131	0.2334	0.459	0.839	0.661	63	1.561
Peru	57	2.677	60	1.125	0.1682	0.511	0.781	0.657	65	1.552
Guatemala	58	2.670	67	1.096	0.1731	0.496	0.767	0.635	60	1.575
Moldova	59	2.653	76	1.068	0.1640	0.474	0.707	0.669	54	1.585
Egypt	60	2.651	73	1.074	0.1762	0.494	0.763	0.604	59	1.576
Viet Nam	61	2.650	83	1.040	0.1937	0.451	0.739	0.612	48	1.610
Philippines	62	2.646	65	1.099	0.1877	0.484	0.779	0.641	66	1.547
Trinidad & Tobago	63	2.643	62	1.118	0.1100	0.545	0.704	0.687	71	1.525
Low										
Armenia	64	2.629	52	1.147	0.1459	0.540	0.778	0.668	80	1.483
Namibia	65	2.625	77	1.062	0.1399	0.498	0.706	0.635	62	1.563
Morocco	66	2.605	80	1.048	0.1573	0.486	0.721	0.608	64	1.557
Nicaragua	67	2.596	75	1.069	0.1737	0.473	0.734	0.645	70	1.527
Botswana	68	2.595	74	1.074	0.0968	0.541	0.687	0.632	72	1.521
Venezuela	69	2.588	71	1.090	0.2557	0.407	0.800	0.681	77	1.497
Honduras	70	2.557	69	1.094	0.1659	0.496	0.754	0.645	82	1.463
Algeria	71	2.555	79	1.060	0.1962	0.474	0.770	0.592	78	1.495
Indonesia	72	2.547	87	1.009	0.1280	0.482	0.662	0.604	68	1.538
Azerbaijan	73	2.510	81	1.048	0.1621	0.480	0.722	0.613	83	1.462
Bolivia	74	2.498	86	1.010	0.1672	0.444	0.647	0.658	79	1.488
South Africa	75	2.496	70	1.091	0.1052	0.537	0.690	0.662	95	1.405
China	76	2.496	82	1.044	0.1343	0.488	0.651	0.669	85	1.452
Nepal	77	2.466	92	0.968	0.2085	0.443	0.721	0.512	76	1.498
India	78	2.459	94	0.950	0.0857	0.488	0.603	0.555	74	1.508
Kazakhstan	79	2.457	84	1.035	0.1037	0.510	0.650	0.632	89	1.423

1	2	3	4	5	6	7	8	9	10	11
Uzbekistan	80	2.439	91	0.984	0.1319	0.468	0.650	0.586	84	1.455
Tadjikistan	81	2.419	88	1.002	0.1965	0.441	0.723	0.572	91	1.417
Pakistan	82	2.397	100	0.887	0.1032	0.473	0.587	0.476	73	1.511
Senegal	83	2.368	95	0.924	0.1266	0.472	0.628	0.500	87	1.444
Kenya	84	2.362	93	0.967	0.1664	0.479	0.690	0.506	96	1.395
Tanzania	85	2.323	97	0.902	0.1588	0.460	0.639	0.464	90	1.421
Bangladesh	86	2.303	102	0.861	0.1462	0.402	0.580	0.509	88	1.442
Very Low										
Benin	87	2.260	103	0.852	0.1001	0.450	0.561	0.464	94	1.408
Cambodia	88	2.237	101	0.874	0.0745	0.452	0.538	0.524	99	1.363
Zimbabwe	89	2.227	106	0.839	0.3260	0.293	0.693	0.467	97	1.389
Zambiya	90	2.206	105	0.849	0.0902	0.447	0.551	0.472	100	1.357
Nigeria	91	2.179	104	0.851	0.1018	0.462	0.562	0.450	103	1.328
Ethiopia	92	2.022	107	0.823	0.1671	0.430	0.588	0.408	104	1.199
Mozambique	93	1.982	108	0.805	0.1125	0.434	0.539	0.422	105	1.176

The important application of the SDGM model connects with decision making at national level and policy development. For this purpose the 4-levels inverse analysis procedure was developed as in Figure 4.

Figure 4

Inverse Analysis Procedure

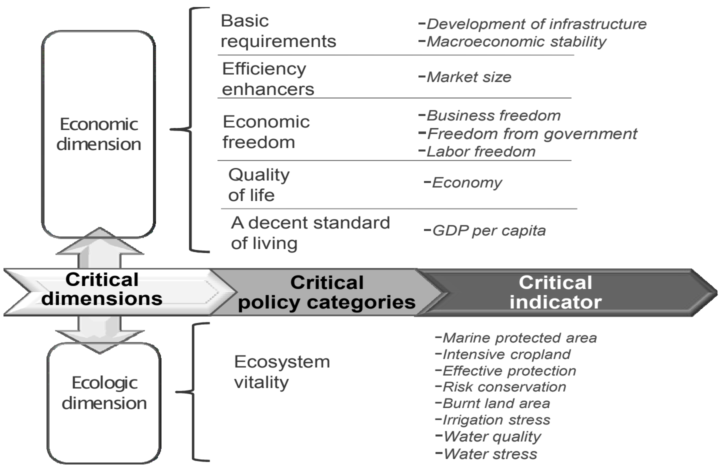


In accordance with it, for a particular country the sustainable development data are analyzed based on sequentially passing the four levels from the top of the triangle to its basis. During this "inverse" movement the "worst" values of sustainable development factors are chosen for the given country. It allows to form "the space of critical indicators" necessary for making decisions aimed to elaborate the strategy of the country's sustainable development.

For example, the application of this inverse analysis procedure for Ukraine makes it possible to obtain 2 critical dimensions of sustainable development, 6 critical policy categories and 16 critical indicators, as in Figure 5. These critical factors may be used by people taking political and managerial decisions.

Figure 5

Critical factors for Ukraine



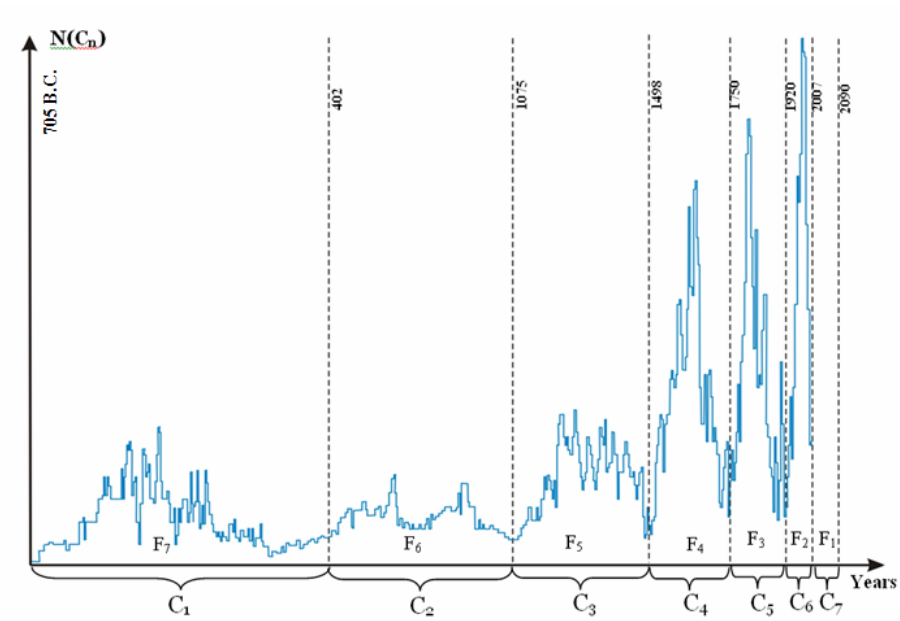
3. Analysis of Security of People's Life Component of Sustainability

Then, we have analyzed the second component of sustainable development – security of people's life. This component in our research is presented by index Isec, which has two statuses: a) Conflict status: j = imaginary unit; Isec = 0; b) Regular development status: j = 1; Isec > 0.

First consider case a) – conflict status. The analysis of historical data on the sequence of world conflicts which took place starting from 705 B. C. up to now with the five year quantization interval has shown that in the analysed data six consecutive evolutionary waves of world conflicts – C_n are vividly recognized, as in Figure 6.

Figure 6

The structure profile of C_n – waves of world conflicts



If the periods **T(Cn)** of identified waves are divided by the greatest common divisor **kc** which is equal approximately 85, then the periods may be presented in the form of a temporal series with coefficients **Fs**, as in Table 2.

Analyzing this series of numbers **Fs** = {13, 8, 5, 3, 2, 1} we see that it is a sequence of Fibonacci numbers with the "Golden section" equal to 1.618. Since six terms of sequence **T(C1)**..,**T(C6)** respond to the law of Fibonacci series, we come up with the hypothesis that occurrence of world conflicts is subordinated to this law. The intensity of conflicts **I(Cn)** depends on a level of technological evolution of the society and increases in time according to the hyperbolic law.

Table 2

Main characteristics of Cn waves of world conflicts

Cn	Time	T(Cn)	N(Cn)	I(Cn)=N/T	Fs
C_1	705 B.C.-401 D.C	1106	1218	I(C1)=1.101	F7=13
C_2	402-1074	674	756	I(C2)=1.122	F6=8
C_3	1075-1497	422	1618	I(C3)=3.981	F5=5
C_4	1498-1749	252	1543	I(C4)=6.123	F4=3
C_5	1750-1919	170	1485	I(C5)=8.735	F3=2
C_6	1920-2007	87	1035	I(C6)=11.897	F2=1
C_7 (F)	*2008-2092*	*85*	*>1400*	*I(C7)>16*	*F1=1*

$$I^*(C_n) = \frac{N(C_n)}{T(C_n)} = \frac{N(C_n)}{F_{8-n} \cdot K_c}. \quad (5)$$

From the analysis of the revealed regularity, we see that the next element of this series will correspond to the seventh wave of world conflicts with the length of the 80-85 years. We call it "the conflict of the 21st century". This conflict has the time interval approximately from 2010 to 2092 with the probable phases: 1 – the 10's years of 21st century- *origin*; 2 – the beginning 20's, the extremity of 40's of XXI century – *growth; 3* – 50's - of 21st century - *the culmination,* I * (C7)> 16; 4 – the beginning of the 60's – *the extremity*; 70's of 21st century - *recession;* 5 – 80's of 21st century - *attenuation*.

Now, we pass to the analysis of the security status b): Regular Development (j = 1; **Isec** > 0). For this status, we analyze the risks of "the conflict of 21st century" emergence. Based on the study of the totality of threats generating this conflict, we will analyze its nature. We consider the 10 threats defined as the major ones for the 21st century by the UN, World Health Organization (WHO), Transparency International and the UN Child Fund (UNISEF).

1. The first important threat is the global reduction of energy resources, which is stipulated by a rapid decrease in organic fuels resources, accompanied by an increase in their consumption, first of all, in economic giants countries. In the beginning of the 20’s of this century, there will be the intersection of consumption and production curves of energy produced from oil. Similar phenomena will be observed for the balances "production-consumption" of the energy produced from gas - in the beginning of 30’s and for uranium - in the beginning of 50’s, respectively. Ttherefore, until the mankind have found sources that could fully substitute organic fuels and nuclear power, the energy security both of a separate country, and the world as a whole will decrease.

2. The gap between the planet's bio capacity and ecological footprint is a second global threat. By the mid of 2008, our planet's population constitutes 6.65 billion people living in the territory of 510 million square kilometres. Its demand in biosphere, or in the global ecological footprint, is 14.1 billion global hectares. Therefore, at present the global ecological footprint exceeds the bio capacities of the Earth by 5 billion global hectares. It means that the planet's resources are being used up quicker than nature can recover them. By 2050, the gap between the people's needs and the Earth bio capacities will be 14 billion global hectares. This threat is strongly correlated with the changes in the planet's population demographic structure. For example, the greatest increase in the population within the next fifty years is expected in the poorest regions of the world: in Africa it will double, in Latin America and the Caribbean basin the population will increase by 1.5 times, while in Europe it will decrease by 0.8 times.

3. Global warming as a next threat is the process of gradual rise of average annual temperature of the Earth atmosphere and the World Ocean. As a result, natural cataclysms would become more frequent, the harvests would become poorer and many biological species may disappear. The major part of the warming observed in the last 50 years is caused by human activity. First of all, it is due to emissions of the gases causing greenhouse effect, such as carbon dioxide (CO_2) and methane (CH_4).

4. According to the World Health Organization and UNICEF, one more global threat is connected with **reducing access of people to clean potable water** and sanitary means. The fifth part of mankind (more than 1.1 billion people) has no access to potable water, and 2.4 billion persons are not provided with minimum sanitary conditions. Especially critical is the situation in the urban regions of poor countries.

5. The next global threat is Income Inequality. According to the World Bank, in 1973 the gap in profits between the richest and poorest countries was defined as 40:1, and now it is 75:1. This threat is rather serious from the point of view of growing number of conflicts in the world, spreading of corruption, terrorism, crimes, worsening of education, ecology and health care.

6. Among **new threats to the mankind**, the World Health Organization (WHO) points out such global diseases, as cancer, cardio diseases, cerebrovascular disease, HIV, tuberculosis and malaria in connection with their dramatic global spreading. During the following twenty two years they expect a considerable growth of mortality as a result of all global diseases, especially by cancer and HIV.

7. Corruption becomes the next global threat. Now it is a big obstacle to economic growth and social evolution. It has become the major reason for poverty and pulled up any positive transformations. Its "explosion" occurred at the end of 20th - beginning of 21st centuries in the course of the globalization. In the recent years, this phenomenon has been spreading into all countries of the world, and, thus, corruption has gained global, international character. The forecast of "Transparency International" shows the growth of corruption in the next three years.

8. According to UNICEF, **infant Mortality is the next global threat**. 11 million children under five years of age die annually all over the world. The reasons are rooted in poverty resulting in mothers' poor health, bad sanitary conditions, infectious diseases and conflicts.

9. The next global threat, which we included in our model, is the vulnerability of the countries to the natural disasters. In our study, we consider earthquakes, droughts, cyclones and floods as main natural disasters. In the simulation we take into account the UNDP data on the total number of human losses resulting from the four above indicated natural disasters.

10. State Fragility is the last global threat, which we consider in the course of simulation. It looks paradoxically, but after the end of Cold War the new geopolitical system has been expanded by the big totality of unstable, unsuccessful and poor countries. Weakening of restrictive mechanisms of bipolar world stipulated escalation of the new wave of confrontations, terrorism, violence, territorial claims and unequal development. Uncontrollable spreading of nuclear weapons, wide-scale nuclear power production in such unbalanced world increases a threat to sustainability and the global security of mankind. In this study, for quantitative estimation of this threat we use the State Fragility Index taken from (Monty G. Marshall and Jack Goldstone, 2007).

Now, we define the summarized impact of the totality of examined ten global threats on different countries grounded on cluster analysis method with the purpose of selecting groups of the countries with "close" performances of summarized threats. To do it, for each country **j**, we shall put the vector **Trj** with the coordinates which characterize the corresponding threats.

$$\overrightarrow{T_{rj}} = (ES, FB, GINI, CD, CM, CP, WA, GW, SF, ND). \quad (6)$$

where: ES – Energy Security; FB – Footprint and Biocapacity Balance; GINI – Inequality; GD – Global Diseases; CM – Child Mortality; CP – Corruption Perception; WA – Water Access; GW – Global Warming; SF – State Fragility; ND – Natural Disasters.

The initial data on each threat are taken from the mention above International organizations data bases. This data are normalized, so that its values vary over the range (0-1).

$$ES^{\circ} = 1 - \frac{ES - ES_{min}}{ES_{max} - ES_{min}} \Rightarrow [0, 1].$$

$$\overrightarrow{T^{\circ}_{rj}} = (ES^{\circ}, FB^{\circ}, GINI^{\circ}, CD^{\circ}, CM^{\circ}, CP^{\circ}, WA^{\circ}, GW^{\circ}, SF^{\circ}, ND^{\circ}). \quad (7)$$

After such normalization, the security index **Isec** for each country is defined as the Minkovsky norm:

$$I_{sec} = \left\| \overrightarrow{T_{rj}} \right\| = \sqrt[3]{\sum_{i=1}^{n} (T^{\circ}{}_{rj})^3} \quad (8)$$

Then relationship of order between clusters of countries has been introduced, as:

$$K_k \prec K_j \Leftrightarrow \left\| \overrightarrow{T_{rk}} \right\| \le \left\| \overrightarrow{T_{rj}} \right\|. \quad (9)$$

Actually, the Security Index **Isec** is the aggregated degree of remoteness of the country **j** from the totality of ten presented threats. Here, the maximum danger for the country corresponds to **Isec** = 0 in terms of closeness of the totality of threats to a country, and the minimum danger corresponds to 1.

Global simulation with the application of the presented method shows, as in Table 1 (columns 10, 11) that 10 most secure countries also have very high values of the sustainable development index and degree of harmonization. Thanks to their peaceful policy they are minimally involved in international conflicts and controversies.

The positions of G8 countries, except Canada, in their security rating are different. It is explained by the lower degree of sustainable development harmonization as compared with the first group of countries and their more aggressive economic and political behavior in the world.

Post-socialist and BRIC countries are scattered in the ranking table of security in connection with quite different internal situations and different groups of external factors influencing them.

The most vulnerable countries from the point of view of their security are characterized by low and very low values of the index of sustainable development and degree of harmonization, high values of state fragility, bad ecological indicators, very wide spreading of global diseases, corruption, and drastic inequality of people.

To facilitate the analysis and make it easier we use the method of Principal Compound Analysis (PCA), which allows reducing variables with many properties to several hidden factors. Analysis shows that currently the most considerable threats for most countries are the reduction of energy security, worsening of balance between bio capacity and human demands and the growth of corruption.

Now, when we have the computed values of the quality of life index **(Iql)** and security index (**Isec),** it is possible to compute the summarized quaternary of sustainable development, as in Table 1, columns 2 and 3.

We see that leaders are countries with high degree of sustainable development harmonization, good ecological indicators, high energy security, low values of state fragility, low level of corruption. And vice versa, worsening of this group of indicators lowers the ranking of countries in regard to quality and security of life.

From the presented results of simulation and from the revealed regularity of global conflicts occurrence important questions arise: why the seventh element of Fibonacci series degenerates? What will happen with the world civilization in the course of "the conflict of 21^{st} century" and after it's over? Maybe here is a closing cycle of some evolutionary chain C1->C2->… ->C7?

The answer to these questions can be found in the works of two outstanding scientists of the past century. In particular Vladimir Vernadsky wrote (Vernadsky, 1944): "In the geological history of biosphere human beings will have great future, if they do not use their mind and labor for self-destruction". The other Russian scientist Nikita Moiseyev, the creator of the computer program for global climate simulation "Nuclear winter" noted (Moiseyev, 2000): "If the mankind is not going to radically change its behavior on the Planetary scale, then in the middle of 21^{st} century there may appear conditions under which people cannot exist".

These conclusions were made for the mankind existence paradigm which can be described by the formula "to meet people's own interests". If we assume that the mankind will change the paradigm of its existence for another, for example, for the paradigm of "harmonious coexistence". Then, the systemic regularity of world conflicts determined for the previous paradigm, obviously, will lose its validity. Thus, the mankind will find new prospects for prolongation of its mission on the Planet. The main responsibility of scientists and, in particular, of the participants of our conference is to make a contribution in this important goal.

4. Conclusion

The new Sustainable Development Gauging Matrix (SDGM) was developed and argued. This tool allows obtaining quantitative estimations of the quality of life component of sustainable development process depending on the groups of economic, ecological, social and institutional indicators and datasets. The list of most essential global threats to the future of mankind has been selected and cluster analysis of dependence of sustainability on these threats is held. On the basis of usage of SDGM model, the foresight of the future global conflicting has been executed. The created mathematical model allows developing recommendations regarding the ways of improving the standards of quality and safety of life in particular countries and regions of the world by the global computer simulation of sustainable development process.

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