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#### SUSTAINABLE DEVELOPMENT ASSESSMENT THROUGH INDICATORS EVOLVING

*The article devoted to analysis of sustainable development indicators (SDI) evolution and peculiarities of designing the set of SDI for Ukraine, Moldova, Georgia and other countries. The paper provides an overview of evolution and application experience of sustainability measuring practice. Researchers analyze the directions of measurement approach progress. Modern trends of indicators' using are explored. Ways of overcoming the lack of harmonization in variety of conceptual and organizational frameworks which are used by different countries are viewed.*

Keywords: sustainable development, environmental policy, indicators, assessment, pressure – state – response model, data accessibility.

**Introduction.** The sustainable development nowadays is not only the popular philosophic theory of future of human being but the contemporary framework for social and economic development. The common development cannot be imagining only as economic one (or even like industrial and urban) anymore. The wide range of factors is influencing these changes in understanding of our common future and ways of further development. The complex of natural (hazards, climate warming and environment devastating ctr.), social (e. g. spreading of diseases including inborn one, starvation, changing of values and lifestyles), economic (ineffectiveness of old way manufacturing, inefficiency of modern managerial approaches and development of Blue Oceans strategies, spreading of innovations, etc.) factors substantiated by practical and theoretical research eventually made postulates of sustainable development as the basis for evolving and balance between environment, society and economy as key factor in politics, programs and policies working out. Simultaneously implementation of sustainable development principles through policies could not be the same in different countries, regions, continents. At the same time, the community of interests and goals differed from country

to country because of mental, economic, historical and other peculiarities. Eventually, each country chooses its own way to sustainable development which was assign in official documents and programs. The above mentioned is determined the development of the set of tools for “level” of sustainability evaluation and the progress in achieving the goals.

**The main aim of the article.** Our research devoted to the analysis of sustainable development indicators (SDI) evolution and peculiarities of designing the set of SDI for Ukraine, Moldova, Georgia and other countries.

**Basic materials.** The problems of working out, adoption and improvement of a set of indicators for sustainable development are represented in the wide range of research papers, official documents and international reports. The scope of our research is determined by the aim of research and includes researching about the analysis of sustainable development indicators evolution and specific information about designing the set of sustainable development indicators for some countries. The baseline documents and scientific papers for purpose research could be divided into three main groups:

1. National and international researchers, that include:
  - general approaches for indicators calculation, viz. Sala-i-Martin, Xavier and Elsa V. Artadi [1], Mannis A. [2], Stiglitz J., Sen A., Fitoussi J-P. [3];
  - problem-oriented and gap-illuminated research, viz. Bartelmus P. [4], Robert P. Blauvelt [5], Pintér L., Hardi P., Bartelmus P. [6];
  - national vision of the problems that represented by program research [7], collective research [8], institutions like The National Institute for Strategic Studies [9] and independent publications, viz. Melnik L. [10] and others.
2. Official documents and methodologies.
3. Statistical information.

In the framework of research, we attempted to combine scientific vision and practical restrictions for highlighting problems and gaps in measuring the sustainable development in general and find out specific regional approaches for improving a set of SDI. Hereby we divided materials into several logically connected parts that are altogether assuming conclusions of our research.

*Sustainable development and countries ranking.* The set of wide use and well-known indicators for ranking the countries due to their successfulness and perceptiveness exists. We analyze four of them – one that is the most relating to sustainable development, one that represents the social wellbeing, one which is popular for economic ranking countries and the last one – for the description of institutional background of development. There are:

1. The Environmental Performance Index (EPI) [12] ranks countries’ performance on high-priority environmental issues in two areas: protection of human health and protection of ecosystems. Within these two policy objectives, the EPI scores national performance in nine issue areas comprised of more than 20 indicators (see EPI Framework). EPI indicators measure country proximity to meeting internationally established targets or, in the absence of agreed targets, how nations compare to one another.
2. The Global Competitiveness Report (GCR) is yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index [13], developed by Xavier Sala-i-Martin and Elsa V. Artadi [1]. The report assesses the ability of countries to provide high levels of prosperity to their citizens. This, in turn, depends on how productively a country uses available resources. Therefore, the Global Competitiveness Index measures the set of institutions, policies, and factors that set the sustainable current and medium-term levels of economic prosperity [14].

3. The Index of Economic Freedom (IEF) is an annual index and ranking created by The Heritage Foundation and The Wall Street Journal in 1995 to measure the degree of economic freedom in the world's nations [15].

4. Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of three dimensions [16].

The results are represented in Table 1. For comparison we took the most sustainable country by the ranking – Switzerland; five big world economies – USA, China, Japan, Germany, and France; Ukraine, Georgia and Moldova as associated EU members with a lot of similarities (more in [11]); Poland as one of successful examples of development; Somalia and Guinea as the weakest and the most unsustainable economics.

*Table 1 – Ranking of countries* (composed by authors)

Country	EPI (2015) Overall rank out of 178 (1 is the best)/10-year trend, %	GCR (2015) Overall score out of 7 (7 is the best)/7-year trend	IEF (2015) Overall score out of 100 (100 is the best)/change from previous year	HDI (2015) Overall score out of 1 (1 is the best)/change from previous year
Switzerland	1 / +0,8	5,7 / +0,09	80,5 / -1,1	0,93 / +0,002
USA	33 / +2,23	5,6 / -0,14	76,2 / +0,7	0,915 / +,002
China	118 / +2,6	4,9 / +0,2	52,7 / +0,2	0,727 / +0,004
Japan	26 / + 2,17	5,5 / +0,12	73,3 / +0,9	0,891 / +0,001
Germany	6 / +1,89	5,5 / +0,04	73,8 / +0,4	0,916 / +0,001
France	27 / +3,29	5,1 / -0,12	62,5 / -1,0	0,888 / +0,001
Poland	30 / +2,67	4,5 / +0,22	68,6 / +1,6	0,843 / +0,003
Ukraine	95 / +5,44	4,1 / +0,01	46,9 / -2,4	0,747 / +0,003
Moldova	74 / +6,04	4,0 / +0,25	57,5 / +0,2	0,693 / +0,003
Georgia	101 / +4,28	4,2 / +0,34	73,0 / 93	0,754 / +0,003
Somalia	178 / +6,62	NA	NA	0,285 / NA
Guinea	162 / +63,4	2,8 / -0,2	52,1 / -1,4	0,411 / NA

Undoubted that sustainable countries demonstrate success in economic and social development and in institutional support of developing. From the other point of view, ranking juxtaposition illustrates the price of economic success. The striking example is China. Chinese economic development is based on the unstable use of natural resources and devastating of human resources. That is why high competitiveness and fast economic growth, known as “economic miracle”, could not be long-term. Further development requires changing at least in environmental policy. Moreover, we sure that long-term progressive development and economic growth should base on sustainable development and Table 1 conclusively illustrates it.

We realized that ranking mentioned above cannot be used for precise evaluating of sustainability or competitiveness because of several reasons. The one of it is availability and validity of primary information and differences in methodic of measuring. At the same time, ranking could express the general picture and confirm our conclusions. Besides that, it stressed the necessity of the unified set of sustainable development indicators for planning and evaluation.

*Definitions and signs.* In Oxford Dictionary the most general definition of the term

“indicator” said that it is a sign that shows you what something is like or how a situation is changing. In the framework of our research, the term “indicator” taken to determine the mark, that points to the certain properties of the object, modification of the controlled process's parameters, in a useful form. Indicators that characterize social processes are based on statistical data and used in the assessment the efficiency of activity, identification of causal relationships in the decision-making process. The implementation of the state policy of sustainable development causes the need for a system of indicators in areas that reflect different aspects of social life: economic, environmental and social.

The sustainable development indicators (SDI) are quantified information which helps to explain how the economic, environmental and social factors interact over time and how that affect society in the long run. Environmental indicators are an essential element of SDI system. According to the European Environment Agency's an environmental indicator is a measure, generally quantitative, that can be used to illustrate and communicate complex environmental phenomena simply, including trends and progress over time – and thus helps to provide insight into the state of the environment [17]. Organization for Economic Cooperation and Development (OECD) defines environmental indicator as a parameter or a value derived from parameters, which points to, provides information about and describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value [18]. Indicator as a measure must meet the criteria of clarity, availability, is quantifiable, clear and straightforward to interpret. An important criterion is that the sustainable development indicator should be constructed from well-established data sources. It must be in line with quality standards of official statistics. Indicators are statistics directed specifically towards policy concerns and which point towards successful outcomes and conclusions for policy [2]. Creation of measuring system for quantitative and qualitative assessment is one of key challenges in realization of sustainable development concept.

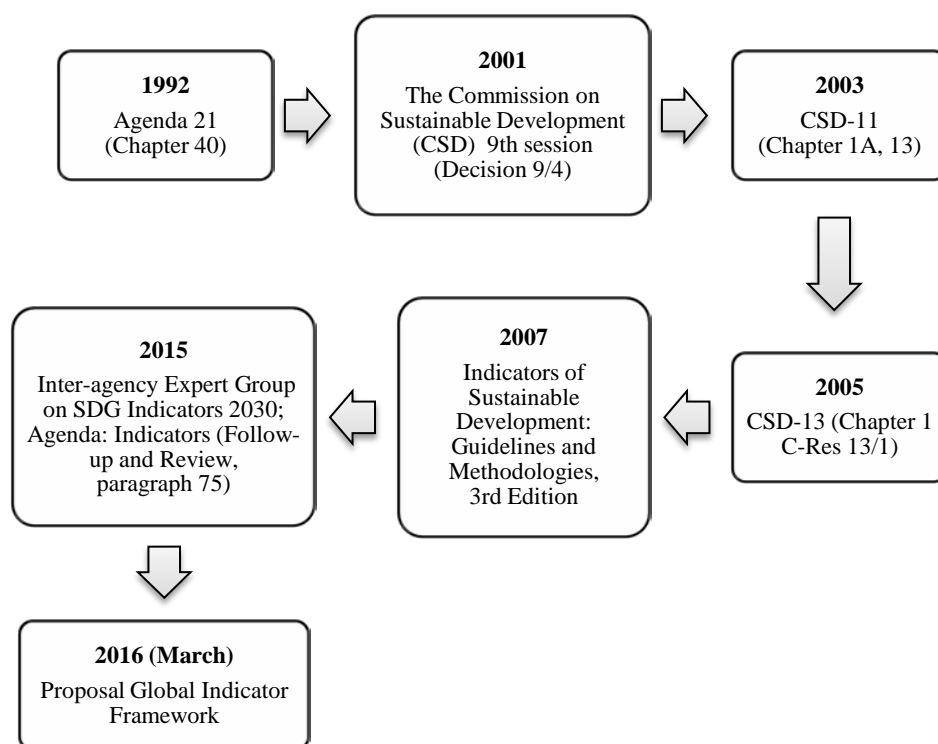
Paragraph 75 of Transforming our World stated that the Goals and targets will be followed up and reviewed using a set of global indicators. These will be complemented by indicators at regional and national levels which will be developed by member states, in addition to the outcomes of work undertaken for the development of baselines for those targets where national and global baseline data does not yet exist [19].

*Evolution and application experience.* The beginning of sustainability measuring practice was marked by the appeal of the United Nations Conference on the Human Environment in 1971 to prepare periodic international, regional, and sub-regional reports on “the state of, and the outlook for, the environment” [20]. The main trends in state-of-the-environment reporting in 1970-1990 were: showing of interconnections among environmental, economic, social and institutional issues; reducing of comprehensive lists of indicators into core sets for better communication; progress measuring towards achieving targets and objectives; building of environmental reporting into government decision-making and business and industry plans [21].

The United Nations Conference on Environment and Development in 1992 pioneered the development of indicators that could help countries to make informed decisions concerning sustainable development. At the international level, the Commission on Sustainable Development (CSD) develops the first two sets of indicators of sustainable development between 1994 and 2001. They have been extensively tested, applied and used in many countries as the basis for the development of national indicators of sustainable development.

The measurement of sustainable development since the mid-1990s has progressed in two alternative directions: using of composite (aggregate) indicators and forming of indicator sets [22]. At present, nearly all international organizations and national statistical offices use indicator sets. Thus, a joint United Nations Economic Commission for Europe (UNECE) proposes three sets of sustainable development indicators: a large set based on conceptual categorization (60 indicators), a large set based on the thematic categorization (90 indicators) and a small set based on the thematic categorization (24 indicators) [22]. European Environment Agency's Indicator Management System (IMS) currently contains 127 indicators, covering 22 environmental topics [23]. In this approach, broad ranges of indicators that provide information on the various aspects of sustainable development encompass different dimensions of an issue without losing information through aggregation.

The retrospective of developing the set of indicators for sustainable development progress evaluation initiated by UN represented in Figure 1. The evolving and improvement of indicators, their compositions, interconnection and regional correlation is the continuous process. The latest event will be 46th Session of the United Nations Statistical Commission in collaboration with Inter-Agency Expert Group (IAEG), the Economic and Social Council and the General Assembly.



*Figure 1 – Milestones of developing the set of indicators (based on [24])*

Indicators often interpret statistical information in an arbitrary way or use information

partly. That is creating a field for data manipulation or different interpretation of the same sets of data or ignoring some pieces of information. It could be done consciously or unconsciously, as the cause of defects in methodology or procedure. The result of such incorrectness and manipulations is default decisions. The illustration of such types of potentially manipulative information could be social data, e. g. baby mortality as an indicator of population health; ecological data, e. g. level of greenhouse gas emission reduction as an indicator of economic modernisation; even usage GDP as an indicator of economic wellbeing is criticized nowadays.

The alternative is an aggregation of statistics and indicators into compound indices. Aggregation methods include the calculation of weighted or unweight averages, summation in accounts and balances and mathematical reduction of correlated indicators by factor analysis [4] and data availability (e. g. system of national accounts, material flow accounts, driving force and pressure state response framework).

A composite indicator (CIs) is formed by aggregating individual indicators into a single index, taking the averages or applying a more complex mathematical approach. Such indicator should ideally measure multidimensional concepts, which cannot be captured by a single indicator, e. g. competitiveness, industrialization, sustainability, single market integration, knowledge-based society, etc. [25]. For instance, the World Bank uses composite monetary indicators (genuine savings / comprehensive wealth) in its research on sustainable development [26]. An example of positive practice of composite indicators' using is the U.S. Environmental Protection Agency's Air Quality Index (AQI) [27]. The AQI aggregates hundreds of hourly measurements for four pollutants and ranks the air in a particular region as Good (AQI Scores of less than 50) through Hazardous (AQI Scores of greater than 500). Each of six AQI levels is assigned a color code so that an interested party can make a quick visual assessment, say a television broadcaster. The AQI meets all of the communication criteria for an effective environmental indicator: it is scientifically sound, meaningful and simple to understand [5]. CIs have the advantage of giving more concise picture of complex phenomena in a simple way. At the same time if they are poorly constructed or misinterpreted, if the construction process is not transparent composite indicators can trigger erroneous political decisions or may be misused.

Nevertheless, the sustainability measuring practice shows the impossibility of utter rejection of CIs and indicates the growing demand for them. This has reflected in several political initiatives, as GDP and beyond the Stiglitz-Fitoussi-Sen Commission [3], which has supported the trailing of composite and aggregate indicators that might be considered alongside GDP.

The matter of the fact measuring sustainability is a task not only for the specific community, region or country; presently collecting and interpreting data for sustainable development assessment is the task for the international community. Generally we will succeed in sustainable development as a desired state of the world only if world society creates the united methodology for measuring sustainability which will be applicable for all countries (in a case of usage different procedures for collecting, interpreting and disclosure of the data) and make possible to conduct unitary strategy. Obvious, that mentioned above is required a combination of political will, intergovernmental coordination and inter-institutional collaboration that is difficult and sometimes almost impossible. The simultaneously aspiration for communication and strengthening the political will should become keystones for sustainable development policy and the basis for improvement the sets of indicators.

Besides this higher level rationale, there may be other reasons that support the need for common frameworks such as [6]: developing shared terminology; easier comparability of SDIs, targets and performance; more opportunities for institutional cooperation.

Nowadays the more commonly used frameworks for evaluation sustainability of human development are:

- Pressure-State-Response (PSR) and its variations, limited mostly to the environmental pillar;
- human well-being/ecosystem well-being;
- issue- or theme-based frameworks;
- capital accounting based frameworks, centered on the economic and environmental pillar of sustainable development.

*Contemporary situation and the latest trends.* SDI performs an essential function of incorporating knowledge about the development of human society into decision-making at all stages of planning and application to evaluation of the policy impacts. In the process of adjustment of the policy to the sustainable development goals, three trends of indicators' using can be noted during the last decade. These trends are the arranging indicator sets under different organizing frameworks; the integrating environmental, social and economic indicators, the developing models for the new aggregated indicators; globalization of indicator-based policymaking.

Structuring thinking about the interplay between the environment and socio-economic activities Statistics Canada developed in later 1970 s an "ecosystem" approach that evolved into the pressure-state-response (PSR) model. The pressure state response reporting framework implemented by the OECD in the 1980s was derived from this. On the base of this model, EEA developed the DPSIR (driving force, pressure, state, impact, and response) framework, which is coherent with those used by other organizations.

More complex, systemic challenges have created demands for more integrated indicators across the DPSIR chain. In the context of EU environmental policy targets 2010-2050, the revision of the EEA CSI was provided. In the scope of this process were elaborated new indicators such as emissions of main air pollutant (based on merging indicators "emissions of acidifying substances", "emissions of ozone precursors" and "emissions of primary particulate matter and secondary particulate matter precursors"; passenger and freight transport demand (based on merging indicators passenger transport demand and freight transport demand); EU and national total greenhouse gas emission trends and projections development (based on merging indicators greenhouse gas emission trends and progress to greenhouse gas emission targets) [17]. Eurostat has also developed a model for the aggregated EU-27 to estimate raw material consumption, in order to provide an additional perspective to resource efficiency indicators. As mentioned earlier, in recent years, the EU in response to considerable political demand has focused on supporting of experimentation with composite and aggregate indicators that might be considered alongside GDP.

Indicators are mostly developed bottom-up from countries using data sets drawn from national monitoring systems, established because of legislation. Globalization of indicator-based policymaking manifests itself in the expansion of the SDI system of indicators in the regions where indicators are used little or not used at all. Thus, the project "Towards a Shared Environmental Information System (SEIS) in the European Neighbourhood" is being implemented over the period from 2010 to 2014. The overall objective is to help protect

the environment in the European Neighborhood region by improving capacities of relevant authorities in environmental monitoring, data collection and management, assessment and indicator-based reporting on the environment. In 2012, the Statistical Division of the United Nations Economic Commission for Europe (UNECE) has launched a project “Strengthening the statistical capacity of countries with economies in transition to assess progress in achieving the UN Millennium Development Goal (MDG) on Environmental Sustainability and provide data on environmental vulnerabilities”. The target countries were the twelve countries of Eastern Europe, Caucasus and Central Asia (EECCA): Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The desk study under the project revealed that there are data for two-thirds of indicators proposed as an example of the UNECE questionnaire in the statistical systems of eight of the EECCA countries while 11 countries have available the data for at least half of the indicators. The international comparison in terms of whether the countries are on a sustainable path is, currently not possible due to lack of common approach to measurement: existing SDIs differ in terms of metadata, methods of calculation, frequency of measurement, units, etc. This is also true for the composite SDIs: it is not possible to compare them as their content varies from country to country [28].

Undoubtedly that existing of wide range of indicators and approaches to their interpretations and differences in procedures of data collecting faced the necessity of indicators validation and systematization. There are a lot of programs and studies trying to unify the set of indicators on various levels from regional till international and with different success. In general, these programs and studies include some or all of the following topics:

- population (growth, migration, refugees);
- human needs (health, food, housing, education, equity, security, etc.);
- renewable and non-renewable natural resources;
- environmental quality (air, water, land);
- ecosystems (acidification, eutrophication, biodiversity);
- economic sectors (and their impacts, including emissions, natural resource use, production and consumption patterns, technologies);
- natural and man-made disasters;
- global environmental problems (climate change, ozone layer depletion);
- globalization;
- institutions.

**Conclusions and perspectives for further researches.** The current state of sustainable development indicators reflects the evolution of policy concerns over the last decades. The variety of conceptual and organizational frameworks used by different countries and organizations demonstrate the lack of harmonization. The main reasons for it are diverse policy priorities, variant academic approaches and data availability, cultural, religious and philosophical viewpoints. The lack of harmonization can be overcome by streamlining of SDI system. Modernization can be carried out in the following areas: identifying of universal small set of indicators that reflect the crucial points and transboundary aspects of sustainable development; elaboration the unified approaches of measuring; identifying of indicators that are available for a large number of countries and enable international comparison. Basing on this approach can be developed official uniform SDIs Metadata Catalogues and international guidelines that will serve for national indicator sets. The National set of SDIs should be



developed taking into account the data availability as an important criterion for indicator selection and should reflect the specificities of the countries' situation. Such a set needs to be complemented with a set of indicators for international comparison.

Most indicators are developed for using at the national level. Measuring of sustainable development is a challenge because of different scale levels: local, regional, enterprise and household levels, finding a meaningful indicator to represent conditions within the various sub-regions of a country.

Important challenges relate to the division of responsibilities of national authorities managing environmental data, data quality and data accessibility. The main task in this area is further institutional arrangements to support data flows. An additional challenge for more established policy areas is that of providing better analysis of cross linkages between indicators, so as to help to identify synergies and trade-offs between policy options and their management, and contributes to enhanced policy coherence.

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**Дослідження сталого розвитку крізь призму еволюції індикаторів**

*У статті доведено, що показники сталого розвитку виконують важливу функцію використання знань про розвиток людського суспільства у процесі прийняття рішень на всіх етапах від планування і втілення до оцінювання впливу політики, планів та програм. Авторське дослідження узагальнює погляд на набори індикаторів сталого розвитку на основі еволюційного аналізу досвіду їх застосування. Сформульовано шляхи подолання недостатньої уніфікації кількісного та якісного складу індикаторів в межах різних концептуальних і організаційних рамок, що використовуються різними країнами. Запропоновано напрямки модернізації системи індикаторів сталого розвитку. Доведено важливість вимірювання сталого розвитку на різних рівнях: місцевому, регіональному, підприємства і на рівні родин. Підкреслено, що основоположним завданням при створенні набору індикаторів є поділ відповідальності національних органів управління, а також якість та доступність даних. Зроблено акцент на такій проблемі, як забезпечення якості аналізу перехресних зв'язків між показниками, для підвищення якості та уніфікованості набору показників сталого розвитку.*

**Ключові слова:** сталий розвиток, екологічна політика, індикатори, оцінка, модель «вплив – стан – відповідь», доступність даних.

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**Исследования устойчивого развития через призму эволюции индикаторов**

*В статье обосновывается, что показатели устойчивого развития выполняют важную функцию в использовании знаний о развитии человеческого общества в процессе принятия решений на всех этапах от планирования и внедрения до оценки влияния политики, планов и программ. Авторское исследование обобщает подходы к оценке наборов индикаторов устойчивого развития на основе эволюционного анализа опыта их применения. Особое внимание уделено краеугольным подходам к оценке устойчивости развития и основным трендам в использовании индикаторов. Сформулированы подходы к упорядочению недостаточной унификации количественного и качественного состава индикаторов в рамках различных концептуальных и организационных подходов, используемых различными странами. Предложены направления модернизации системы индикаторов устойчивого развития. Доказана важность измерения устойчивого развития на разных уровнях: местном, региональном, предприятия и на уровне семей. Подчеркнуто, что основополагающей задачей при создании набора индикаторов является разделение ответственности национальных органов управления, а также качество и доступность данных. Сделан акцент на такой проблеме, как обеспечение качества анализа перекрестных связей между показателями, для повышения качества и унификации набора показателей устойчивого развития.*

**Ключевые слова:** устойчивое развитие, экологическая политика, индикаторы, оценка, модель «влияние – состояние – ответ», доступность данных.

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