

## The Essence of Sustainable Development and its Measuring via Three-Dimensional System of Indicators

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**Abstract:** The purpose of this study is to examine theoretical and conceptual frameworks of sustainable development. The urgent necessity of creation of sustainable development concept had been determined. Key policy goals of sustainable development had been defined. Differentiation of sustainability between strong and weak one had been substantiated. It had been considered that methodological basis of a modern economic mechanism of sustainability should be based on conservative or progressive changes approaches and four groups of factors had been determined like dominants of economic mechanism. Functioning of mechanism and factors of sustainable development had been examined via its integral interaction and the main features. It had been elucidated that different approaches of sustainable development measuring belonged to macro level. The essential features of indicators measuring sustainable development had been observed. It had been proposed to measure the level of sustainable development via. The sustainable development index taking into consideration economic, social and environmental elements of sustainability where the key role belonged to ecological index. Countries of the world according to the sustainable development index had been classified. The level of Ukraine sustainable development had been analysed. To achieve sustainable development the measures had been proposed for Ukraine.

**Key words:** Sustainable development, triad of sustainability, indicators, sustainable development index, environment, economic mechanism

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### INTRODUCTION

Globalization and integration of economics combine not only the countries of the entire world. They also combine the problems of all countries and the main of which is ecological one. The triad “environment-economics-society” attracts scientist’s attention more and more. Rapid economics processes of each country influence both on social development and environmental changes. Water and air pollution, chopping of forests are the results of human activity to be more detailed, these are the results of economic activity of society. All three elements, i.e., economic, ecological and social ones are to develop in balance way and take into account the changes of development of each other. Thus, we can say about sustainable development of economics,

society and environment. Moreover, the absence of sustainability in the conditions of increasing anthropogenic pressure and worsening of life quality in Ukraine is actual problem of 21st century. Especially, this urgent problem is present in countries of extensive type of development where disproportions of state and local interests, backward of economic and social potentials are expressed very strikingly. Ukraine belongs to such countries that don’t have proper national transformation model and strategy of going across to the principles of sustainable development and its measuring.

**Literature review:** The national and foreign scientists pay more and more attention to the sustainable development. Sustainable development concept was created in the 9th decade of 20th century (Zaccai, 2012).

Dozens of sustainable development definitions have been offered since the publication of the Brundtland commission report "Our Common Future: in 1987". In it the term sustainable development was determined as development which fulfills the needs of the present without risking the possibility for future generations to fulfill their own needs. Many of these definitions single out one of the following three aspects of sustainable development, i.e., the triad "environment-economics-society".

During last 20 years significant effort has been made to find out single method of sustainability measurement (Pearce and Atkinson, 1993; Stockhammer *et al.*, 1997; Krotscheck and Narodoslowsky, 1996; Barrera-Roldan and Saldivar-Valdes, 2002; Ciegis *et al.*, 2015). Triple bottom line accounting which appeared in the 9th decade of 20th century, presents a serious attempt to expand traditional frame of accounting reports of countries' companies so that it takes environmental and social performances into consideration, apart from economic ones (Kinsley and Lovins, 1997).

Deeper understanding of sustainable development became possible via its principles observing, the main of which are inter-generational equity, precaution, proportionality, life cycle approach, prevention, substitution, internalization of costs (polluter pays principle) public participation, right to know, confidential business information, good governance, cooperation, partnerships, liability (Wiser and Magraw, 2015).

Goals of sustainable development are being changed because of rapid changes in economics, society, environment but the main of them are remained the same. Vastola A. generalized the goals of sustainable development that have been mentioned by UN secretary general's synthesis report. The road to dignity by 2030. They are: to end poverty and fight inequality; to ensure healthy lives to provide knowledge for women and children; to grow a strong, inclusive and transformative economy; to protect ecosystems for all societies and children; to promote safe and peaceful societies and strong institutions; to catalyse global solidarity for sustainable development (Vastola, 2015).

The measuring of sustainability is also necessary approach to deepen the concept of sustainable development. A large number of countries had developed their own national indicator sets. The most wide used indicators are economic, social and environmental ones (Ivanov and Muras, 2006). The points of view of scientists are differing because of peculiarities of development of countries' economics. Thus, the approaches to sustainable development measuring are to be further studied that will take into account the all the elements of sustainable development.

## MATERIALS AND METHODS

**Research objectives:** The objective of this study is substantiation of methodical approaches to measuring of sustainable development. Thus, our study is based on three specific and related research tasks:

- To determine the essence of sustainability, the goals of sustainable development and economic approaches of sustainability achievement
- To summarize methodical approaches to the measuring of sustainable development
- To propose the using of general indicators reflect the level of sustainable development of any country

**Methodology and data:** This study sets out to develop a comprehensive general framework for measuring of sustainable development. To achieve the goal set, the following methods were used for this study: economic and statistic research methods including monographic, comparison, generalization, grouping and formalization. The analytical survey was based on statistical data published by:

- State committee of statistics of Ukraine
- International institute for sustainable development
- The world bank
- World economic forum

The data include period of 2015 year in Ukraine and in the world. The database is represented by the following indicators:

- Current GNP per capita (USA thousand dollars)
- Social dimension index
- Life quality index
- Human development index
- Information society index
- Sustainable development index
- Economic dimension index
- Ecological dimension index
- Competitiveness index
- Index of economic freedom

## RESULTS AND DISCUSSION

Since the 1980s, the term "sustainability" has been applied to the human capacity to live on the planet. It was the energy crisis in the 1970s which underlined the fragility of global economic development after which awareness of sustainability issues began to grow slowly. In 1987, the UN World Commission on Environment and

**Table 1: The basic characteristics of strong and weak sustainability**

Weak sustainability	Strong sustainability
Overall (natural, human-made and natural) capital stocks should be non-declining over time	Some (called 'critical') amount of natural capital stocks should be non-declining over natural capital should be conserved
Broad spectrum of substitutability of different kinds of capital is allowed (e.g., can fossil resources be replaced by solar energy sources)	Limited possibilities of sustainability between natural and human-made (physical) kinds of capital are admitted
There is a firm belief in technological innovations that would adequately solve the problems of natural resource depletion and environmental pollution	Less reliance on the capability of technological innovations to successfully solve increasing environmental problems
Fundamentals of neo-classical economics prevail	Ecological economics prevails prevail
Researchers's generalization of literature information	

Development (WCED), commonly known as the Brundtland Commission, gave in its report our common future the first and most widely quoted official definition of sustainable development which “is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. This broader definition emphasizes the importance of people’s aspirations for a better life of global preservation and the essential relevance of future generations to the goals of current actions (Vastola, 2015).

From this definition there emerged the widely accepted idea that sustainable development is based on three pillars: economic, social and environmental. Economic sustainability concerns the capacity of an economy to support a certain level of economic production. Environmental sustainability is the ability of the environment to support a certain level of natural resource extraction rates. Finally, social sustainability is related to the ability of a social context to function at a certain level of social well-being and harmony (Hofkes, 1996).

So, we can suggest that sustainable development includes the following three elements-economics, social sphere and ecology. Another words, the system of sustainable development includes a man as a biological organism and as a social being, ecosystem and biosphere in general and economic system. Now a days, the understanding of sustainable development main goal, objectives and problems plays a great role. It wouldn't be a new position that humans can only survive under the conditions that prevail in the ecosystems. In turn, these parameters depend on the physical and chemical properties on the natural environment. Therefore, the main problem of sustainable development can be seen as deviations from a balanced equilibrium in ecosystems as a result of rapid and destructive human activity.

The complexity and difficulty of solving the problems of sustainable development relates to the complexity of the human nature itself. Human is a unified system (whole) which includes three interrelated and interconnected systems: a man as a biological creature is a part of the natural environment in physiological

constitution; a man as a social creature (personality) is a part of the society and its social nature; a man as a component of the economic system is a workforce, labour resource (Lejano and Stokols, 2013).

Environmental factors influence a human via the following four groups of functions: functions that support a person’s life as a sociological constitution (“bio-person”); social functions support development of a person’s personality (“socio-person”); economic functions determine activity of the economic system, including the labour resource reproduction (“labour-person”); environmental functions form, support and govern the state of ecosystem where person lives.

Actually, sustainability means the ability to be faced with future needs while maintaining a good quality of life. The most points of view describe a sustainable development as providing goods and services (outputs) using a set of inputs to provide a necessary quality of life while sustaining the ecological basis for this activity (Mirovitskaya and Asher, 2001).

In our opinion, human factor is the key element of sustainable development. This thought implies that human capital which is an integral part of national wealth is also non-declining. However, for adequate interpretation and assessment of this concept it is necessary to determine which capital (human-made, natural or human capital) should be kept non-declining and to what extent these kinds of capital are substitutable and how to value them, especially it concerns natural capital. In this case, two kinds of sustainability exist. “Weak sustainability” refers to a non-declining sum of natural and human-made capital (thus admitting the substitutability of the two) while “strong sustainability” refers to the necessity of keeping natural capital as non-declining (to achieve this it is suggested that part of income from sales of nonrenewable resources be transferred to raise the overall value of natural capital) (Table 1).

We have defined that the principle goal of sustainable development is associated with predominantly infinite existence of human civilization and its evolutionary development. This goal has two levels:

- Necessary level is based on simple physical survival of biological human being
- Sufficient level which means intellectual development of a social human being

Among the main objective of sustainable development there are supporting objectives and providing objectives. Last ones are aimed at preservation of biosphere in a very narrow sense when human biological being can exist. The existing of humanity depends on such parameters of environment as key climate characteristics and physical parameters (temperature, electromagnetic features, cosmic emanation), atmosphere and water composition, the composition of soil used for agricultural production; preservation of the entire landscapes as informational basis for development of a personality (a social human being). Supporting objectives stipulate the creation and maintenance of the conditions when biosphere and its components can exist which actually provides some vital conditions for a human being.

Sustainable development envisages two major changes in economic development. The transition to nature saving economies aimed at reducing or leveling-off natural resource consumption, pollution loads, on the one hand and economic growth based on clean, low, waste, recycling technologies, including alternative energy sources, on the other. A third direction is gaining momentum, namely the increasing interest in natural, especially living capital and emphasis on ecosystem goods and services with their inclusion in the world market system and improvements in property rights (Peskin, 1998).

It is well known that social and economic system is the only element that can and must transform rapidly. It is necessary because at first, satisfaction of social needs of a human being that change very quickly at second because of improvement of the social and economic system itself. The latter is based on production that satisfies ever-increasing human needs. In order to be able to accommodate constantly growing population and to stay within the capacity of ecological system, production needs have to become more efficient to achieve resource preservation, particularly in terms of reduction in material and energy consumption. So, contrary to a biological human being and biosphere, management of the social-economic system should be a target of progressive change in homeostasis instead of just its preservation. In this regard, positive feedback mechanisms should be developed.

To our mind, methodological basis of a modern economic mechanism to achieve sustainable development should be based on two approaches (Fig. 1).

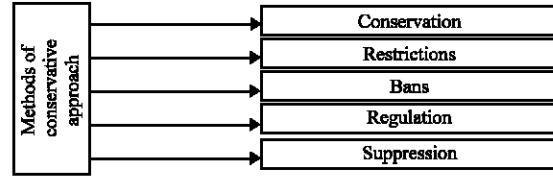


Fig. 1: Forms of conservative methods (Researcher’s generalization of literature sources)

Conservative approach means the use of negative feedback mechanisms. In environmental sciences, this approach is realized in the following forms:

- Preservation methods: creation of reserves, national parks, etc.
- Restricting methods: licenses for the use of natural resources; environmental standards; regulation of hunting and fishing; birthrate regulation and so on
- Prohibitive methods: bans on hunting of certain animals; bans on cloning, bans on production and use of some substances (pesticides, ozone harmful substances)
- Regulating methods: soil cultivation, use and transportation of biological species and biologically toxic substances
- suppressive methods: economic sanctions, fines, increased prices, taxes

Positive (progressive) changes approach is associated with incentives to stimulate changes on condition that they help reduce destructive pressure on the environment and is based only on the use of positive feedback mechanisms that can be represented by the use of different favorable terms, materials and moral incentives for innovations. Progressive changes approach also includes legislative support, information support, economic instruments, state support of a market, mass-media promotion, public opinion creation.

In countries with a market economics an economic mechanism is the basis for sustainable development. Economic mechanism includes the whole complex of economic structures, institutions, forms and methods of management with the help of which current laws are implemented in accordance with social and private interests (Hezri and Dovers, 2006). In Ukraine basic components of such a mechanism are: legislative basis of economic activity (rights, duties, licenses, restrictions and procedures) property rights; formal institutions; informal institutions (traditions, moral, religion, spiritual values) economic instruments.

Conditionally economic instruments can be divided into four basic groups: administrative redistribution of funds (mostly fines and subsidies). This group of economic instruments is a system of well defined and well addressed cash flows which is used in cases of environmental emergency when the consequences of environmental impact are not conventional and specific evaluation is needed; financial transfers. This is a well-regulated and controlled system of redistributive mechanisms (taxes, payments, credits). In 2014, it was put into practice a new procedure of tax accumulation in Ukraine. It has been changed the proportion of tax dividing between state and local budgets. The bigger part of taxes, such as land tax, single tax is accumulated in local budget. It was done to stimulate the development of rural territories; free market mechanisms of funds redistribution. A good example of this instrument would be the so-called tradable emission permits that have become widely spread in some states of USA; promotion in the market. This instrument is related to the use of non-monetary forms of economic promotion (rewarding with special incentives; free of charge advertising) which gives additional competitive advantage (Reid, 1995).

All processes of systems functioning and development happen due to the interaction between three natural origins: energy potency, information reality and synergetic phenomenon. Energy potency stipulates system's ability to fulfill work (change). Information reality means the ability to store or change different parameters of the system: form, colour, scent, vibrancy and other movements, etc. Synergetic phenomenon stipulates the interactions of the separate parts of the system. As a result, they begin to behave as a whole unit.

We would like to mention, that reproduction processes mean the unite of energy, information and synergetic phenomenon factors. The reproduction of every natural essence, including the biosphere (which guarantees necessary life conditions for human beings) is a very complex task. Human being will never be able to completely understand this reproduction mechanism. Moreover, human being will never be able to totally control these processes.

As any phenomenon, sustainable development can and should be measured. All these efforts to understand and if possible, precisely quantify and integrate environmental and social sustainability dimensions in mainstream perception of development were possible due to current attempts to improve indicators in these fields which are still not widely available (Hezri and Dovers, 2006).

Quantifying sustainable development, we need an aggregate indicator takes into account the level of economic and human development and environment

defence. So, to measure sustainable development its necessary to operate by some partial indicators characterize the main three components.

Thus, indicators can be divided into such categories as social ones, environmental (health) indicators and economic. To our mind, essential features of indicators are to be the following: indicators must be relevant, serving their purpose, capturing and measuring the essence of the issue; they must be understandable for all members of the target group; their conception must be well founded and easy to interpret; they should be easily adaptable to new developments, thus responsive; they need to show the link between economical, social, environmental and institutional aspects of society; they should embrace a long and wide-range view and show trends over time; indicators should be global; they must be reliable (based on reliable data) although not necessarily precise; data should be reliable at a reasonable cost-benefit ratio, adequately documented, of known quality and regularly updated. They must provide information in a timely fashion, so as to be able to prevent or solve problems in due time (Anderson *et al.*, 2012).

We have defined that indices are often used to measure sustainable development. Indices differ from indicators. An indicator provides information on a "simple" event in a SD context. An advantage of an index is that these complex phenomena (e.g., sustainability) of different variables (e.g., countries of the world) can be compared to each other (motivators also allow comparison on the countries). There are a massive amount of different types of indices. Let's name the most important of them.

**The ecological footprint:** The term 'Ecological Footprint' was first coined in 1992 by Canadian ecologist William Rees and his PhD student Mathis Wackernagel. The concept is nowadays the most widely spread index of environmental sustainability. The ecological footprint measures people's natural resource consumption. The footprint can be compared with nature's ability to renew these resources. A country's footprint is the total area required to produce the food and fiber that it consumes, to absorb the waste from its energy consumption and to provide space for its infrastructure. People consume resources and ecological services all over the world. Their footprint is the sum of these areas wherever they are on the planet (LPR, 2004).

The ecological footprint is the summation of six components: the cropland footprint, the grazing land footprint, the forest footprint, the fishing ground footprint, the energy footprint, the built-up area footprint.

**The Human Development Index (HDI):** The Human Development Index (HDI) was developed in 1990 by the Pakistani economist Mahbub UI Haq. It is allows to

Table 2: The list of aggregated sustainability index measure

Measure of sustainable development	Global index	Components	Source
Economic (I <sub>ECD</sub> )	GCI-Global Competitiveness Index	113 variables	World Economic Forum/www.weforum.org
	IEF-Index of Economic Freedom	10 indicators, 50 data sets	Heritage Foundation/www.heritage.org
Ecological (I <sub>ED</sub> )	ESI-Environmental Index	25 indicators	Yale University USA [www.yale.edu/esi]
Social (I <sub>SocD</sub> )	LQI-Life Quality Index	2 indicators	Economist Intelligence Unit/www.en.wikipedia.org
	HDI-Human Development Index	3 indicators	United Nation Development program/www.hdr.undp.org
	IDC-Information Society Index	23 indicators	UNDESA//UN Publication. 1, 2005

Researcher’s generalization of literature information

classify countries as developed, developing or least developed. The HDI relates the average of the education index, the life expectancy index and the gross domestic product index:

$$HDI = \frac{EI + LEI + GDPI}{3} \quad (1)$$

Where:

EI = Education index

LEI = Life expectancy index

GDPI= Gross domestic product index

**The Environmental Utilization Space (EUS):** EUS is a quantitative estimate of acceptable development and these pressures are the extraction of scarce materials and the emission of waste which can damage the quality of the environment.

Basically, one can stick to a simple model to focus on the environmental pressure exerted by material flows as well as on the distribution of these flows among economic sectors and populations. This model is known as the next Eq. 2:

$$EI = C \times P_1 \times P_2 \quad (2)$$

Where:

EI = Environmental impact

C = Consumption (USD dollars)

P<sub>1</sub> = Production (USD dollars)

P<sub>2</sub> = Population

Measuring sustainable development is important for science and policy. Science for sustainable development necessitates quantification. Policy for sustainable development necessitates trend analysis. These trends can be expressed using indicators and in dices.

**The Index of Sustainable Economic Welfare (ISEW):** The ISEW was developed by the friends of earth (United Kingdom) in association with the Centre for Environmental Strategy (CES) and the New Economics Foundation (NEF). It recognizes that Gross Domestic Product (GDP) takes no account of increasing inequality, pollution or damage to people’s health and the

environment (Stockhammer *et al.*, 1997). It is assumed in GDP that any economic activity is good regardless of whether this activity improves or directly damages our quality of life. In this regard, the ISEW corrects GDP over a range of issues such as income inequality, environmental damage and depletion of environmental assets.

Let us analyze the system of sustainable development measures proposed by the Institute of Applied Systemic Analysis of Ukraine (Zgurovskiy, 2008). In this system, it is suggested to measure the level of SD with the help of sustainable development index which is calculated as the sum of three-dimensional indexes: economic (I<sub>ECD</sub>: Economic Dimension Index), environmental (I<sub>ED</sub>: Ecological Dimension Index) and social (I<sub>SocD</sub>: Social Dimension Index). Each index is calculated on the basis of six global indexes (Table 2).

As we can see from Table 2, each global index is calculated using a large number of indicators as well as qualitative and quantitative data sets. For example, the global competitiveness index is made up of over 113 variables. The variables include separate indicators of infrastructure and macroeconomic stability level, the level of institutions activity, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market sophistication, technological readiness, market size, business sophistication, the level of innovation (Bohringer and Jochem, 2007).

Index of economic freedom is based on 10 quantitative and qualitative factors, grouped into four broad categories such as rule of law (property rights, freedom from corruption) limited government (fiscal freedom, government spending) regulatory efficiency (business freedom, labour freedom, monetary freedom) and open markets (trade freedom, investment freedom, financial freedom). Analysts Pearce and Atkinson (1993) suggest that economics of a country is free if index of economic freedom is from 1 till 0.8 when index is 0.799-0.7 the economics is mostly free. We will get moderately free economics if Index of economic freedom is 0.699-0.6 and we have mostly unfree economics if index is 0.599-0.5.

Table 3: Rating of efficient world economics in 2015

Ratings	Country	GNP per capita at purchasing power parity (USA thousand dollars)	Economic Dimension Index ( $I_{ECD}$ )	Global Competitiveness Index (GCI)	Index of Economic Freedom (IEF)
1	Hong Kong	57.650	0.629	5.5	0.886
2	Singapore	81.190	0.583	5.7	0.878
3	Kuwait	79.970	0.579	4.6	0.627
4	Switzerland	61.930	0.575	5.8	0.810
5	Finland	40.840	0.566	5.5	0.726
6	Denmark	47.810	0.562	5.3	0.753
7	USA	56.430	0.561	5.6	0.754
8	Iceland	46.120	0.560	5.1	0.733
9	Luxembourg	70.750	0.555	5.2	0.739
10	Ireland	46.410	0.551	5.1	0.773
11	United Kingdom	40.550	0.541	5.4	0.764
12	Sweden	47.390	0.536	5.4	0.720
13	United Arab Emirates	70.570	0.532	5.2	0.726
14	Norway	64.590	0.530	5.4	0.708
15	Netherlands	48.400	0.529	5.5	0.746
16	Germany	48.260	0.526	5.5	0.744
17	Austria	47.510	0.524	5.1	0.717
18	Australia	44.570	0.523	5.1	0.803
19	Belgium	44.100	0.521	5.2	0.684
20	France	40.470	0.520	5.1	0.623
-	-	-	-	-	-
113	Ukraine	7.810	0.109	4.0	0.468

Data of international institute for sustainable development. The world bank, world economic forum and state committee of statistics of Ukraine

And finally, a country has repressed economics if index of economic freedom is 0.49-0.4 (Pearce and Atkinson, 1993).

Environmental index includes 25 indexes of such spheres as environmental burden of disease, water and air pollution, biodiversity and habitat, productive natural resources and climate change. The life quality index consists of two indicators: the expectancy of healthy life at birth and the real gross domestic product per person. Human development index combines three sub-indexes such as education index, life expectancy index and gross domestic product index per capita.

To calculate information society index it's necessary to have information about infrastructure of four spheres, i.e., computer, information, internet and social ones. These four pillars are measured by 23 indicators. Of course, all indicators and data sets that influence components of the indexes mentioned above as well as indexes themselves are measured in different units and have different interpretations. That is why, they were normalized to be in the interval between 0 and 1. In such a case, the worst values of the above mentioned indicators will be close to 0 while the best values will be close to 1. Such design allows us to calculate each index  $I_{ECD}$ ,  $I_{ED}$ ,  $I_{SOCD}$  and  $I_{SD}$  as a mean of its components with appropriate weight coefficients.

While analyzing the most economically efficient world economies (Table 3) we should take into account economic dimension index. Economic dimension index includes sub-indexes in four areas such as employment,

entrepreneurship, structure of the economy and macroeconomic environment). In total, 17 indicators were used to calculate economic dimension index (Ivanov and Muras, 2006).

Thus, in 2015 Hong Kong had the most efficient economics among twenty countries of the world. In comparing, Ukraine took 113 place in the world according to the level of economic dimension index.

It has been mentioned before that second component of sustainable development is social one. We have grouped countries of the world according to the social measure index (Table 4). The data of Table 4 showed that Sweden had the best level of social development according to the meaning of social dimension index (it was 0.839). Social dimension index was calculated in seven areas, such as health, work and life security, education, dwelling conditions, demographic structure, social cohesion and social activeness (Ivanov and Muras, 2006). The level of social development in Ukraine is too low because social dimension index is only 0.155. We would like to mention that any economic measures would be efficient if indicators of diseases, disability, mortality, decreasing of physical and mental state of health increase.

Finally, ecological dimension index is the third part of sustainable development index. Polish scientists propose to calculate sustainable development index, taking into account social dimension index and economic dimension index (Ivanov and Muras, 2006). We can't agree with Polish researcher's opinion because ecological part is not taken into consideration.

Table 4: Countries of the world according to the social measure index in 2015

Rating	Countries	GNP per capita at purchasing power parity (USA thousand dollars)	Social Dimension Index ( $I_{SDCI}$ )	Human Development Index (HDI)	Information Society Index (ISD)
1	Sweden	47.390	0.839	0.907	0.774
2	Iceland	46.120	0.837	0.899	0.770
3	Norway	64.590	0.828	0.944	0.717
4	Denmark	47.810	0.827	0.923	0.760
5	Switzerland	61.930	0.819	0.930	0.705
6	Luxembourg	70.750	0.814	0.892	0.698
7	Finland	40.840	0.803	0.883	0.704
8	Japan	38.870	0.790	0.891	0.697
9	Australia	44.570	0.788	0.935	0.629
10	New Zealand	35.680	0.786	0.913	0.694
-	-	-	-	-	-
139	Ukraine	7.810	0.155	0.747	0.492

Data of international institute for sustainable development. The world bank, world economic forum and state committee of statistics of Ukraine

Table 5: Rating of countries of the world according to the sustainable development index in 2015

Rating	Countries	GNP per capita at purchasing power parity (USA thousand dollars)	Sustainable Development Index ( $I_{SDI}$ )	Economic Dimension Index ( $I_{EDP}$ )	Ecological Dimension Index ( $I_{ED}$ )	Social Dimension Index ( $I_{SDCI}$ )
1	Finland	40.840	0.744	0.566	0.9070	0.803
2	Iceland	46.120	0.751	0.560	0.9050	0.837
3	Sweden	47.390	0.741	0.536	0.9050	0.839
4	Norway	64.590	0.725	0.530	0.8690	0.828
5	Switzerland	61.930	0.743	0.575	0.8693	0.819
6	Luxembourg	70.750	0.731	0.555	0.8658	0.814
7	Denmark	47.810	0.746	0.562	0.8920	0.827
8	Canada	43.970	0.690	0.497	0.8510	0.777
9	Ireland	46.410	0.719	0.551	0.8660	0.779
10	Australia	44.570	0.698	0.523	0.8240	0.788
-	-	-	-	-	-	-
154	Ukraine	7.810	0.192	0.109	0.507	0.128

Researcher's calculation based on data of International institute for sustainable development. The world bank, world economic forum and state committee of statistics of Ukraine

We propose to calculate sustainable development index like average geometric indicator of economic, ecological and social dimension indexes (Table 5). In 2015 the highest level of sustainable development index had Iceland among 154 countries of the world, Ukraine had the worst level of index mentioned above. By the way in 2015 Ukraine also had the worst status of state environment policy. So, such countries like Ukraine have to take measures in order to increase economic state to improve the level of quality of people life to maintain the proper state of environment.

Moreover, accordingly to the economic indicators problem regions of Ukraine are almost all regions except Dnipro, Zaporizhyya, Kyiv, Lviv, Odesa, Kharkiv ones. Zakarpattya, Zhytomyr, Chernigiv, Sumy, Ternopil and Kirovograd regions have social and institutional problems. It is obvious that industrial regions have ecological problems. Dnipro, Zaporizhyya and Kyiv regions belong to the last group (Shkarlet *et al.*, 2013). So, we can say that all the regions of Ukraine are problem ones. Another words it is necessary to take measures in order to achieve sustainability, because Ukraine is faced with the problem of sustainable development.

## CONCLUSION

We can conclude that this study examined the essence of sustainability, the main goals, approaches and factors of sustainable development; the existing system of indicators of sustainable development measuring; applying of integral index of sustainable development measuring.

Problems of sustainable development deal with management of three interrelated systems: human biological nature ("bio-person"), the biosphere and socio-economic system. That's why, the index of sustainable development should be determined like average geometric indicator of economic, ecological and social dimension indexes. The key role of sustainable development index belongs to ecological index. It means that if society doesn't take care of environment, it would be impossible to get high economic results, to develop, to provide a good life for descendants, etc.

Clear and consistent measures are to be taken in order to get high quality of environment which is the most important feature of sustainability achievement. While having economic transformations in Ukraine acting measures depend on big amount of factors and the most important of them are:



- Organization of pollution monitoring
- Valuation of negative influence of pollution the people and ecosystems
- Valuation of ecological, economic, social and aesthetic damage harmed to environment
- Forecast of dynamic of influence the biosphere
- Substantiation of priorities of environment safety activity
- Solving the problems of ecological safety and effective resource using
- Substantiation of technical safe decisions
- Optimal and ecological safe placing of enterprises and production
- Determination the ways and methods of modernization of ecological dangerous enterprises

So, ecological criteria while researching the sustainability are more important than economic ones. Our findings can help both local administrations and government of Ukraine to measure the level of sustainable development and put into practice programs of environment defence. Moreover, some approaches of measuring the sustainability can be used while teaching the discipline "Conceptual basis of the sustainable development of agrarian sector" for master degree students. Moreover, ecological education is very important now a days (Mavlyudova and Shamsuleyeva, 2015).

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