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Construction Principle and Method of Human Sustainable Development Index

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Abstract The Human Development Index, which evaluates sustainable development proposed by the UNDP, does not cover the environment factor that is important to sustainable development, and not reflect the “green” concept of sustainable development. In this paper, some important evaluated models for human sustainable development are compared and analyzed. Then, a Human Sustainable Development Index is proposed based on the HDI model. The construction principle, method and index system of the model are discussed.

Key words sustainable development; human development index; human sustainable development index

1.A brief analyze about the model of sustainable development

For realization sustainable development needs science evaluation to human society economy activities. After the United Nations Conference on Environment and Development (UNCED) in 1992, it has become common sense to construct an index system for evaluating sustainable development. Up to now, some important evaluated models are signal index evaluation model, Human Development Index model, Development Diamonds Index models, and other models.

1.1 Signal index evaluation model

Based on the GNP and GDP, people raised the evaluation models for economy sustainable development such as Environmentally Adjusted Domestic Products (EDP), Genuine Savings (GS), Ecological Footprint, etc.

The first one is EDP model. EDP standing for Environmentally Adjusted Domestic Products, that means Domestic Products net value after the environment adjustment, also called Green Domestic Products net value. The EDP index was raised firstly in 1993, $EDP = GDP - \text{manufacture capital wastage} - \text{resource environmental cost}$.

Using the EDP index to measure the development status of an area have two advantages, one is Overcome the limit of GDP, another one is can better measure the capital quantity in a certain time of a certain country, then indicate the foundation of sustainable

development.

The second one is Genuine Savings model. This method developed by World Bank for measuring sustainable development. This index system divides a national wealth into 4 parts: social capital, producing capital, natural capital and human capital. This method replaced the traditional methods that measure the development level by producing capital singly. Under this measurement, if one country's average fortune is keeping on increasing, this country is under the sustainable development state. Genuine Savings pioneered the avenue that measures the sustainable development state by currency.

The third method is Ecological Footprint, also called Ecological engross, it was brought forward and developed by Rees, a Canadian famous Ecological economist and his students Wackernagel and Wada in the 1990s. It converts all the natural resources to 6 types: lowlands, grass field, woods, construction, fossil energy sources and ocean area, offered a simple frame of natural capital using, and also introduced equivalence gene and fertility modulus, realized the addition and competition of all the ecological manufacture area.

But the meaning of ecological engross is not rest with insisting How Bad the Things Are, but consider "to know the limitation of ecology can help people making choices by the nature", it deduce the possibility of sustainable development by comparing the consumption and bearing ability of the natural resource. It is a kind of static state estimate method, and its function for forecasting the sustainable development is not much.

1.2 Human Development Index model

The United Nation Development Program (UNDP) brought the concept of Human Development Index in 1992 for measuring the develop status of a country or an area. Human Development Index is a integrate index accounting by three basic subentry index: (1) anticipate life level; (2) citizen educational level; (3) creditable standard of living, showed by per capita US dollar GDP index which counted with the purchasing power party(PPP) . Before counting the human development index, should figure out the three indexes, and select the max. and min. Through the standardization, express as the numerical value among 0 to 1:

$$X = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}} \quad (1)$$

In (1), X is subentry index; Xi is practice value, human development index is the average value of the three subentry index.

Human development index is a integrate index that count easily. It contains not only economic index, but also the basic status of citizens' educational and healthy level, imaging citizens' basic rights and insurance circs, being a brief method of measuring human overall development. Hence, GDI and GEM were proposed in 1995. The concept of human poverty was brought in 1997, then human poverty index (HPI) was proposed. HDI, GDI, GEM and

HPI offered the brief information of one country or area, HDI can entirely and truly reflect the achievement of development in the people’s center.

1.3 Development Diamonds Index models

According to the per capita GNP, World Bank first divided the world countries into 4 kinds: low income, middling income (including mid-low individual income, mid-high individual income), and high income. However, by this method, some countries such as Kuwait and United Arab Emirates belonged to high income country, but their economic configuration and social development were far from the developed country. Hence, a new index system was produced---- Development Diamonds Index.

The 4 selected indexes are expectation life cycle, primary school(middle school) entrance rate, safe drinking-water acquire rate and per capita GNP, expressed in every axes, and then link to a polygon with thick line. The form of this diamond can easily be compared with the polygon called “collate diamond”. The collate diamond showed 4 equal index, every index denoted with percentage. (See the green and blue diamonds). Any beyond part shows the better value, any inner parts shows the under value.

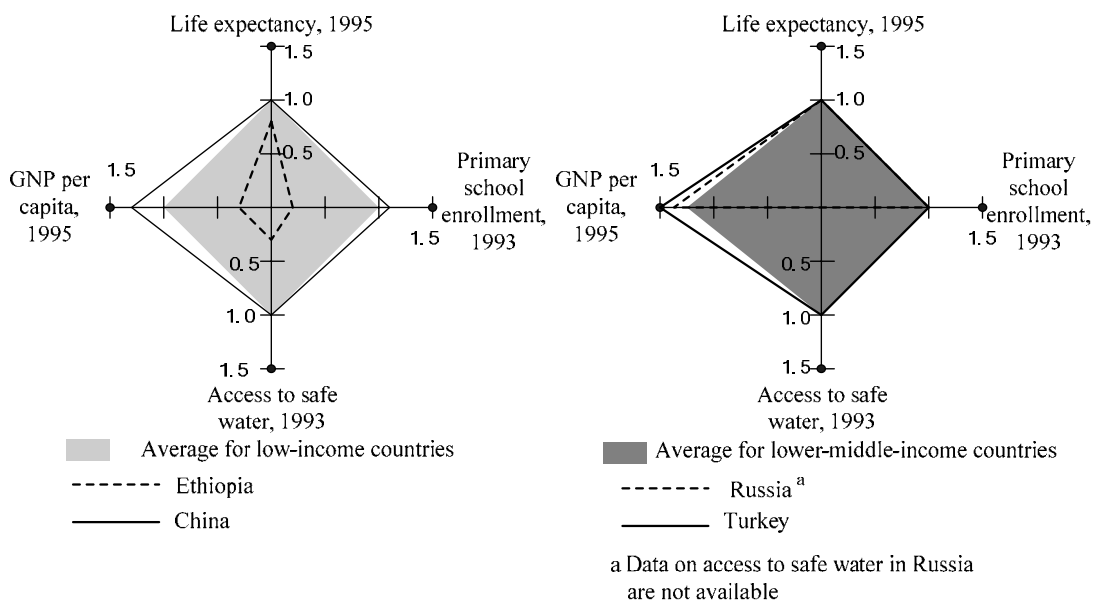


Fig.1 Development Diamonds Index

1.4 Sustainable development of other indicators evaluation model

The Commission on Sustainable Development in 1996 on the framework of "driving force - Status - response" concept model developed by the European environmental organizations launched a sustainable development indicators model system, which include society (41), economy (23), environment (55) and System (15) four evaluation systems, and total of 134 indicators. In this model, the driving force of impact indicators for monitoring the sustainable development of human activities, consumption patterns and economic process; state of sustainable development indicators used to monitor the process of the

status of the system; response indicators used to monitor for the promotion of human Sustainable development adopted by policy choices. For example, in the economic assessment system, the driving force indicators, including per capita GDP, energy consumption, and so on; status indicators include mineral proved reserves, after deducting the loss of environmental resources net output, the share of exports of manufactured goods; response to environmental indicators, including the expenditure of GDP Proportion of the establishment of the Sustainable Development Fund and so on. Only to 1997, more than 150 countries have established the Commission on Sustainable Development, or similar institutions [6], respectively put forward their own model of sustainable development indicators.

China in 1998, Niu Wenyuan, academicians from the Chinese Academy of Sciences, presided over the strategy of sustainable development task force issued the first "China's sustainable development strategy report." The task force designed a set of indicators of sustainable development model of sustainable development capacity broken down into "survival support systems," "the development of support systems," "environmental support systems," "social support system" and "intellectual support system" Five subsystems with a total of 47 variables, and more than 240 indicators. Annually starting from 1998 "published by China's sustainable development strategy report" through the country and 31 provinces, autonomous regions, the various systems of different indicators and analysis of the reasons for evaluation, national or regional capacity for sustainable development of a system, capacity and the accumulation of Ability to overcome the "shortcomings" factors, such as the system explained that the organization formed to help the relevant policy recommendations and countermeasures.

2007, the State Council Development Research Center, and regional economic development strategy research department task force issued a " China regional scientific development Study", through indicators the report studied the Chinese four major sections and 31 provinces and autonomous regions making progress by implementing the scientific development concept ,and deeply discussed the industrial division of labor and cooperation of inter-district, and development results sharing and coordinating, and regional development gap and other issues. In this report the task force proposed a "regional scientific development comprehensive index" concept. The comprehensive index comes from four first order indexes, respectively for economic growth, environment-friendly index, and the potential for coordinated social promotion index; 4 1 16 index also by a two index; some of these two indices by a three-tier index (24); part by the three indices for a number of four.

Construction of the use of expert analysis at all levels index score on an index of the importance of further determined at all levels on an index of the index weighting, the final step by step weighted synthesis.

In addition, China's National Bureau of Statistics Institute of Science in 1998 also raised a sustainable development indicators system with 6 large field and 29 categories indicators.

According up said, we could find the bigger differences between all the sustainable development evaluation methods mainly lie in major indicators selecting. One is relatively simple but with the comprehensive evaluation system and the other is more overall but complex evaluation index system. The former Seize the most core indicators which can reflect simply the level of development, and has highly operability, but its shortcoming is not comprehensive enough; the others cover a very comprehensive target, but the difficult is data obtaining, the part data based on the survey has more subjective.

2.The meaning and purpose of constructing of sustainable human development index

2.1 The meaning of constructing of sustainable human development index

For a long time, people simply equate "development" with "economic growth", and are used to measure a country and regional development level by per capita gross domestic product (GDP) as the primary indicators, for the unilateral pursuit of economic growth, the direct result from the extensive mode of economic growth caused by environmental pollution, resources depletion, the deteriorating natural environment and many other serious social problem. As scholars of the continuous development of in-depth research, the research focuses of attention gradually from a purely economic growth have gradually shifted their attention to human development. In this view, under the guidance of the United Nations in 1992, proposed a "human development index" concept, and the annual publication "Human Development Report" to measure the world over 170 countries and regions in the human development level. Construction of this paper, the model of sustainable human development index is based on comprehensive in its consideration of environmental factors put forward in further consideration of environmental resources, construct a can of "comprehensive sustainable development" and its connotations of a more comprehensive index, More systematically and comprehensively reflect the level of development of different regions, with a view to compensate for the lack of HDI index system to enhance its meaning.

2.2 The purpose of constructing of sustainable human development index

The concept of sustainable development put forward by the main derived from the blind pursuit of economic growth and neglected the coordinated development of society brought about by the increase in social problems and the increasingly serious ecological problems, to more far-reaching and from a broad perspective to address Environment and

development issues.

It stressed that various socio-economic factors and the ecological environment the close ties between for the population, economy, society, resources, environment coordination among the various elements of the development, including three aspects: economic, social and the environment. Among them, environmentally sustainable development is a comprehensive basis for sustainable development, sustainable economic development is the core of a comprehensive sustainable development, and the people-centered sustainable social development is the pursuit of comprehensive sustainable development the ultimate goal. China's government since April 2003 the first official presentation of "people-oriented", the "concept of development" defined gradually clear, defined the "scientific concept of development, the first is the essence of development, the core is people-centered, basic requirements Is comprehensive, coordinated and sustainable, it is balanced, "the new era for the development of man and nature, pointing out the direction.

Comprehensive, coordinated sustainable development concept highlights the people-oriented, pay attention to the development of the individual, stressed that development must ultimately be implemented in improving people's lives and welfare of the promotion, implementation in health care, education, employment and other areas, reflected in the public service , Referred to the development of people-oriented, social equity, justice, embodies the comprehensive development and overall social development and environmental resources of the high degree of sustainable development.

To this development program to implement the regional development of the practice, needs to be translated into the corresponding index system to assess the level of development of all regions, and guide the policies focus on the adjustment and change. Sustainable human development index of the structure was to achieve this strategic goal of a try.

3.The Construction Principle and Method for Sustainable human development index

3.1 The Construction Principle for Sustainable human development index

To achieve these objectives, construction of sustainable human development index, to observe the following principles. First, a comprehensive sustainable development as the guiding ideology. In the 1980s the theory of sustainable development, from a more coordinated, more fair interpretation of the angle of the "development", meaning people to correct the past for the "development" not appropriate knowledge, guide people from one-sided focus on GDP The growth of those important to take into account the social and environmental objectives of achieving the objective of quickly by the international

community generally agree that, and have been gradually developing countries, including most of the governments around the world to guide its domestic and foreign policy practice. China's government put the "scientific concept of development" is the scientific interpretation of this theory. Therefore, the structure of sustainable human development index should be sought to reflect the coordination between man and nature, environmental protection and economic growth as well as the coordination of individual development and social development coordination. To this end, when the index structure will focus on the above considerations will be reflected in the indicators into the building system.

Second, extrude the important index of environmental factors. In a country's industrialize tenor, the most harm and direct influence to the environment are caused by the industry production and human living, this kind of index is also the most marked index for reflecting a country's environmental status. Serious pollution, exceed energy waste Serious pollution, exceed energy waste are the consequence of extensive economic rise mode, the accomplishment of energy saving and let reducing need the supervise from all levels of local governments and public policies' induct, enterprises' understand conversion and social consensus. Hence, based on environment resource factors, pollution and energy consume will be emphasized when human sustainable development index is constructing.

Third, adopt the authoritative date. In order to let the human sustainable development index has veracity, comparability and maneuverability; we gather the date on the basis of yearbook of Chinese Stat., stat yearbook of Chinese population, stat yearbook of Chinese education, instead of the way of questionnaire which has more subjectivity.

3.2 The Construction Method for Sustainable human development index

The doubt of scaling the level of the development of different countries by GDP can be dated back to the report of UN in 1954, but till 1970s, it was still a normal way to scale the level of the development of a country. The theory of human sustainable development came into being in the 1980s, which resolved the problems between environment and development in a far-reaching and wider view. It insisted on the relation and harmony between the social economy and environment, looked for the harmonious development between population, economy, and environment. For a country, a region or the whole world, it thought the sustainable development of the environment is the basis of the sustainable development, and the economy is the kernel. And the final aim of the social development was the sustainable development whose hypostasis was people. Because of these, the human sustainable development index which was brought forward by UN had considered the three parts, health, knowledge and income, and it was a very simple and integrative one. The guide line of the income can reflect the economic status of an area or a country. The guide line of the health and knowledge can reflect the social status. Obviously, there is not a kind of guide line can reflect the sustainable development of environment. Today, the problem of environment is much more serious than before, and it is taking much more care.

In order to make the human sustainable development index much more consummate and it can reflect the sustainable development status better. We should consider including the factor of resource and environment

When considering the new or improved human sustainable development index which included the factor of environment, the scholars have two kinds of ideas: one is to take the guide line of environment as the forth one on the basis of HDI, second is to take the guide line of environment as the revisable one by revising the guide line of income. In the account of the present National economy, pollution would be the added value of the GDP, in other word, pollution add the value of the nation. But in fact, this part of GDP reflects the poor of the ecosystem. So, this paper take the second one, it change the guide line to the revisable factor by revising the income guide line, in order to reflect the idea of Comprehensive sustainable development.

The meaning of indicator of environment source is very wide, including the pollution of air, water, solid, noise, the felling of forests, energy consumption, the waste of the source, the increasing of population in big cites and so on. In the view of theory, the main theme of this paper is trying best to include the factors of the source, such as the per capita emissions of all types of pollution, per capita energy consumption, the status of water resources per capita, per capita land resources, per capita forest resources, etc. When standardize them respectively, they become a comprehensive and "Environmental Performance Index". So they can reflect the real level of the development in different areas.

What to need to be explained, until 2004, in "Chinese statistics yearbook", "environmental protection" just is an independence item to appear, "energy" and "environmental protection" two big index signs attain respectively in the covariance yearbook for two years 16 with 35, among them since include a reflection can consume and each kind of index sign of pollution emissions, also include an all levels government to used for manage pollution and ecosystem protect of devotion index sign. And previously, the index sign concerning environmental protection all includes in "other social activities and environmental protection" item, be also say, the data of the environment index sign is abundant 2004 ago opposite and not enough. Therefore, in consideration of the physically applied hour data can get sex and outstanding economy energy to reduce to line up index sign of the angle set out, this text while apply HSDI tried to select per capita solid waste emissions, per capita waste gas emissions, per capita industrial waste water emissions, and per capita electricity consumes to measure four index signs and get an environment results that synthesize index number through the conversion, it is to revise factor and put forward to United Nations of the income index number in the mankind development index number carry on correction and get thus 1 transplants environment sensitivity a factor of the mankind can keep on development index number HSDI(the Development Index of the Human Sustainable), its structure path sees figure 2. In aftertime's research, along with

statistics day by day enrich of the data, can gradually person all water resources, person all land resources, person all forest resources etc. the index sign account into the index number.

In the specific process of application, when we calculate the index of all part, we need to standardize various quantity and then transform them into the correspondent index whose value changes from 0 to 1 ,therefore we first need to make sure the maximum and minimum value of all indexes. For the sake of international comparison, the expectation life span ,adult's literacy rate, comprehensive hair for population to be born enters school rate, and GDP per capita all use the maximum and minimum which taken by UNDP, as shown in Fig1. In addition, through the analysis of industrial waste water, industrial air, industrial solid waste and the data of electrical consumption. According to the changing trends of the four indexes, we choose the maximum and minimum respectively, through standardization then transformed into correspondent environment resource wastage index(PI_1, PI_2, PI_3, PI_4 , as shown in Fig2). We should consider comprehensively the relative importance of industrial waste water, waste gas, solid waste and energy wastage in the process of human sustainable development. If we give the same balance, the comprehensive wastage index of the four indexes is the average value of arithmetic.

Further more, because exhausting index is an anti-index, environment result index ($EPI = one - PI$). At last, through drawing lessons from a kind of method which passes establishment social welfare function to measure inequality that the Atkinson(1970) put forward, lead to carry on correction to the original income index number into a parameter ϵ which reflects "unfair abhorrence degree", environment results the index number(EPI) synthesize an original comer development index number(HDI) in the middle(see type 3, type 4), get thus can keep on development index number $HSDI$ according to the mankind of environment sensitivity.

Above-mentioned in two types, $H1, H2, H3$ differences get for the method calculation which puts forward according to the UNDP of healthy index number, education development index number, income index number; EPI for consideration of four kinds of environment results that environment resources index signs get behind index number; $H3P$ is the income index through the correction put forward by this text. The $HSDI$ can keep on development index number for the mankind who revise to get behind.

We need to choose the value of ϵ in this process. According to the correction method put forward by Atkinson^[10], the ϵ is a parameter which measures opposite and unfair sensitivity and be ϵ to enlarge gradually, meant to give larger power to the low income heavy. BE can know by the formula (3), be $\epsilon = 0$, H_3P is the average of H_3 and EPI ; When the ϵ enlarges gradually, mean to compare with the small, the number in the H_3 and the EPI gave larger power heavy namely the H_3 take of EPI , that is the value of H_3P lets up gradually; When $\epsilon \rightarrow \infty$, the value of H_3P tends to the H_3 and the EPI both win of smaller value.

According to reflecting completely the deeper meaning of the sustainable development , and emphasizing on the important index of the environment factor , HSDI mainly adopts the principle of the authoritative statistics , can reflect the basic inner meaning of “the sustainable development” from a more systematic and complete angle , and as a more simpler and comprehensive index used to measure the level of sustainable development in different regions.

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