

Analysis and Measuring Seventh Goal (Assuring Sustainability of Environment) Millennium Development Goals of Selected Countries by Using Composite Indicators

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Abstract. At the threshold of 3rd Millennium increasing destruction of environment, widespread poverty and underdevelopment as one of the most important problem attracted attention of world society. Thus, U.N. Millennium manifesto, in terms of millennium development goals in 2000, provided by U.N and approved by majority of world countries, obligate all countries to try most, for alleviating poverty, promotion of human dignity ,equality, reaching peace and democracy and at the end preserving environment. Goals of millennium are time consuming goals which all UN members have agreed to achieve by the year of 2015. Seventh goal of millennium, “Ensure environmental sustainability” was the main cornerstone of millennium development goals and reaching other goals and objectives of millennium development goals needs protecting environment and assuring its sustainability. By approving these goals, especially 7th goal, various countries of world made widespread actions to promote goals and evaluating plans and policies of each goal and designed models and methods for determining actions and activities in terms of quantitative models. In this survey first we introduce indicators and indices of millennium development goals, especially 7th goal. Then, information related to performances of 6 indices of 65 countries of world in years 1990, 1995, 2000 and 2005 extracted. After extracting indices and processing them, indices were standardized. In the next step and after standardizing, using McGranahan method, correlation of matrix of indices was calculated by SPSS software and weight of each index was determined. After this step, weight of each index was multiplied on each standardized index and at the end composite index for each country was calculated for 1990, 1995, 2000 and 2005. Then, these composite indexes were sorted by descending. Results show acceptable increase in average of sustainability index for the 65 countries, during years 1990 to 2005.

Keywords: Millennium development goals, Ensure Sustainability of environment, Composite indicators, McGranahan method

1. Introduction

In past years the international community witnessed several meetings to address problems of economic, social and specially environment, among them are 1972 summit on human environment in Stockholm, Sweden and earth summit in Rio De Jeneiro on environment and human development in 1992, however, many issues and problems on the eve of the third millennium still has glaring and therefore international community came to believe that it shouldOn this basis the millennium development goals (MDG) raised and passed in largest heads of state meetings in September 2000 in New York. The objectives of these goals are a series of timed and measurable targets including combating hunger, poverty, disease, illiteracy, environmental degradation and gender inequality and also create a global partnership for development which has been approved by the countries (Millennium development goals 2007).

2. Materials and Methods

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In order to prepare compiled indexes, first we extracted and classified millennium goals indexes for a number of countries from millennium goals index database of United Nations. since the indicators used in seventh goal of millennium development goals are not in the same scale and some are in percent (such as access to safe and healthy drinking water) and some in tons (such as per capita consumption of ozone depleting substances or carbon dioxide emissions), thus adding these indicators with different scales to achieve a combined index is not possible. Therefore it is essential to convert these indices to standard units so it is possible to collect them. Although the methods for achieving standard scales, which is called normalization, are not without problems, but they are ways used for achieving combined indices. In this research, for normalization we used "Division by Mean" method. In this method, after extraction of selected indicators and countries, values of each indicator was divided by the mean of all indicators in the column, resulting a new indicator without scale. To implement this method, the following formula is used (kalantari 2002):

$$Y = \frac{X_{ij}}{X}$$

Y =the amount fixed by the scale

X_{ij} =value of index i in country j

X =mean of each index in every column

After normalization of each column, it is necessary to calculate appropriate weight of each indicator. In this study, we used McGranahan method (1970) for weighting which calculated using SPSS package. After calculation of weight of each indicator, it was multiplied by previously calculated scale-less indices. Then, calculated values in each row were added to get combined indicator (sustainability number) for each country. Combined indicators are sorted in descending order based on which we can determine the ranking of selected countries.

2.1. Statistical analysis and Calculation of Composite Indicators for MDG Goal Seven, for Selected Countries in Years 1990, 1995, 2000 and 2005

In the present study, first, eight indicators of seventh MDG goals (Ensure environmental sustainability), some with positive relationship with sustainable development and some with negative relationship were chosen as follows:

- ratio of area of land covered by forest to area of the country
- ratio of area of protected land (for biodiversity conservation) to The total area of the country
- Energy consumption(per kg of oil equivalent) per dollar
- GDP based on "purchasing power parity"(PPP)
- Per capita carbon dioxide emissions and consumption of ozone depleting substances
- Proportion of population using solid fuels
- ratio of urban and rural populations have a stable source of clean water and sanitation
- ratio of urban and rural population have good health of the environment
- ratio of population have adequate housing (in the form of ownership, rental, the purchase of housing, community or secondary tenant)

Among the factors mentioned above, the use of some indicators, due to lack of data for many countries and remote data for some of them, also due to different definitions of the indicators(For example, the ratio of population have adequate housing) was not possible and for this reason among 8 indicators above, 6 of them were chosen as follows:

- X1: ratio of area of land covered by forest to area of the country as a percentage (positive relationship with sustainable development)
- X2: ratio of area of protected land (for biodiversity conservation) to The total area of the country (positive relationship with sustainable development)
- X3: energy consumption(per kg of oil equivalent) per dollar of GDP on a purchasing power parity(PPP) (negative relationship with sustainable development)

- X4: the tones total carbon dioxide emissions per year(negative relationship with sustainable development)
- X5: ratio of urban and rural population have sustainable sources of clean water and sanitation as a percentage (positive relationship with sustainable development)
- X6:ratio of urban and rural population have good health of the environment (positive relationship with sustainable development)

After selecting indicators, the raw data for each of the indices were collected for 65 countries from different regions of the world from Millennium Development Goals database, in the four-period 1990, 1995, 2000 and 2005. After extracting the data, the table (countries in rows and indicators in columns) was prepared. As from six indicators, tow was in negative relationship with sustainable development, first we transform them so that they have positive direction. For this purpose, the values of each of the indicators were deducted from a constant. After this, related indicators for each country standardized by dividing each value by the average to allow comparison. After standardization, the weight of each indicator should be calculated for each of the years studied. In this study, McGranahan method for weighting indicators is used. The McGranahan method assumption is this that the weights should be indicative of importance of an indicator among other indicators which is determined through the correlation of each indicator with others. In other words, in this method the more the correlation of a variable with other variables is, the more it weighted and vice versa. On this basis, to determine the weight of each indicator, correlation matrix was calculated for each of the indicators and the average correlation coefficient, as an indicative of importance of each indicator was calculated (Tables 1, 2, 3 and 4).

Table 1: Correlation matrix of indicators in 1990

Mean weight	x6	x5	x4	x3	x2	X1	
0.28867	0.202	0.145	0.178	-0.171	0.378	1	X1
0.29983	0.142	0.082	0.341	-0.144	1	0.378	X2
0.10383	-0.099	-0.025	0.062	1	-0.144	-0.171	X3
0.30383	0.213	0.029	1	0.062	0.341	0.178	X4
0.32217	0.702	1	0.029	-0.025	0.082	0.145	X5
0.36000	1	0.702	0.213	-0.099	0.142	0.202	X6

Table 2: Correlation matrix of indicators in 1995

Mean weight	x6	x5	x4	x3	x2	x1	
0.244167	0.128	0.15	-0.167	0.08	0.274	1	x1
0.218	0.158	0.065	-0.322	0.133	1	0.274	x2
0.224	0.098	-0.023	0.056	1	0.133	0.08	x3
0.071833	-0.146	0.01	1	0.056	-0.322	-0.167	x4
0.313167	0.677	1	0.01	-0.023	0.065	0.15	x5
0.319167	1	0.677	-0.146	0.098	0.158	0.128	x6

Table 3: Correlation matrix of indicators in 2000

Mean weight	x6	x5	x4	x3	x2	x1	
0.278167	0.111	0.115	0.197	-0.081	0.327	1	x1
0.317833	0.221	0.118	0.372	-0.131	1	0.327	x2
0.123167	-0.097	0.04	0.008	1	-0.131	-0.081	x3
0.284167	0.12	0.008	1	0.008	0.372	0.197	x4
0.325667	0.673	1	0.008	0.04	0.118	0.115	x5
0.338	1	0.673	0.12	-0.097	0.221	0.111	x6

Table 4: Correlation matrix of indicators in 2005

Mean weight	x6	x5	x4	x3	x2	x1	
0.268167	0.084	0.102	0.193	-0.103	0.333	1	x1
0.3295	0.234	0.122	0.401	-0.113	1	0.333	x2
0.145	-0.076	0.086	0.076	1	-0.113	-0.103	x3
0.307167	0.116	0.057	1	0.076	0.401	0.193	x4
0.3375	0.658	1	0.057	0.086	0.122	0.102	x5
0.336	1	0.658	0.116	-0.076	0.234	0.084	x6

After an average weight of each index was calculated, obtained numbers was multiplied by standardized indicators. After these steps, sustainability number of each of the countries based on six indicators in four-peroid 1990, 1995, 2000 and 2005 was calculated by adding the numbers in each row. In order to better comparison the final numbers was multiplied by 100 .

2.2. Analysis of Results

Base on analysis of combined indices of 65 countries in 1990, three countries Venezuela, Germany and Austria with respective sustainability numbers of 356, 324 and 290 have the highest sustainability numbers and three countries Tajikistan, Mongolia and Egypt with respective sustainability numbers of 95, 99 and 102 have lowest sustainability numbers and were at the bottom of the list. Average number of sustainability for these countries was 167. In 1995 the three countries, Venezuela, Germany and Austria have also topped the table and sustainability numbers for them respectively were 317, 238 and 219. Bangladesh, Egypt and Syria, respectively with sustainability numbers 81, 90 and 92 have lowest numbers. Average sustainability number of these countries in 1995 was equivalent to 139. In 2000, still Venezuela, Germany and Austria, with sustainability numbers 364, 294 and 271 were at the top of the list and three countries Uzbekistan, Bangladesh and Libya, respectively with sustainability numbers 99, 102 and 103 were in the bottom of the list. Average sustainability number for the mentioned countries in 1995 was 166. In 2005, Venezuela and Germany still maintained their position and sustainability number for them are respectively, 358 and 304. In this year, Austria which was at the top of the list in the previous section, declines four steps down from the third to the seventh rank. Also in 2000, three countries, Bangladesh, Libya and Uzbekistan has been the worst performance and the sustainability number for them are 109, 110 and 112 respectively. Average of 65 countries is 172. As you can see, the average "sustainability indicators" have decreased in 1995 compared to 1990 (the number has reached 167 from 139) Bu tin 2000 and 2005 the number will increase (first 166 and then the number is 172) which expresses the fact that steps are taken toward seventh goal indexes by the countries and we hoped to achieve these goals.

3. Conclusion

In this paper we tried to analysis and compare constituent indicators of seventh goal using composite indexes in four-peroid 1990, 1995, 2000 and 2005. On this basis, for 65 countries which have complete data, combination index was calculated for the four sections mentioned above. Based on these rankings, developed countries (except Venezuela due to the high surface area of forests and protected areas) due to the higher stability number were at the top of the list and the poor and developing countries were at the bottom of the list. Therefore, paying attention to environmental policies and programs and review of past development policies and programs, which typically only have economic growth targets is critical and it is necessary for environmental protection, in the framework of goals the Millennium Development Goals, to be supported more in the planning and policies of countries. Establishment of national committee and the provincial MDGs, promote popular participation and strengthening pro-environmental NGO, insert the Millennium Development Goals in various economic, social and environmental development programs, strengthen systems to collect statistics and information on the Millennium Development Goals, holding training courses and national conferences, facilitate communication of national organizations with international organizations, review policies and utilization of natural resources and environmental programs, etc. are among actions that

countries can do to promote the goals of the seventh MDG goal. In response to international and regional challenges related to seventh goal of the Millennium Development Goals, new letters of agreement for coordination of national policies with international programs should be developed and the principle of shared but differentiated responsibilities, should be followed seriously by the United Nations in a way that the obligations of developed countries for environmental protection (due to their high share in the exploitation of earth resources and more pollution emissions) take more practical aspects and on the other hand, developing countries should also mobilize the resources in a way that these resources can be used best in line with goals of the Millennium Development, especially goal seven. This issue, especially about environment, which is a public commodity, and therefore less incentive to invest in by people and countries are more important and need more support than other goals from the governments.

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