THE HUMAN DEVELOPMENT INDEX: A CRITICAL EVALUATION AND A NEW PROPOSAL

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1. Introduction

The Human Development Index (HDI) was introduced in 1990 as a complementary index to GDP, to consider socio-economic aspects in the evaluation of countries development. The mission of the HDI was to initiate a measurement that considered not only the economic aspect, but also the quality of life and social progress.

The HDI is a composite index; it consists of the geometric mean of three different dimensions: health level, educational level and living standard. However, in the 21st century, climate change and new ecological policies show several gaps in HDI; in this perspective, HDI does not consider any environmental dimension. The climate change has caused criticism to this indicator, because a complete determination of human development requires, also, a full comprehensive measure related to the ecological dimension, which are not analysed in the HDI. This deficit was highlited also by Biggeri and Chiappero Martinetti (2010) which proposed the integration of this index with environmental indicators by the introduction of CO2 emissions.

In its first introduction, the HDI proposes a development model that is empirically incompatible with sustainable development. Analysing development in a perspective of sustainability require a combination of different aspects, such as environment and economy, green economy and economic growth and the relationship between environment and social objectives (UNEP, 2011). According to Gupta and Vegelin (2016) is important to identify the factors that strengthen the relationship between social factors and human development.

The integration of environmental, economic, social and political variables can be essential to identify which dimension needs to be strengthened to increase human development.Due to its specific characteristics, human development can be considered a multi-dimensional and multi-perspective concept that requires both theoretical and empirical study.

In the first part of the paper is introduced the theoretical debate on the HDI's multidimensionality, highlighting the criticism made to it. In the second part of the paper we propose a possible integration between the HDI and some environmental indicators; in this study CO2 emissions are interpreted as an explanatory variable, fossil fuel energy consumption and renewable energy consumption as a proxy.

2. Literature review

From the 2000s, the concept of development has been conceived as consequence of economic growth. Cornia (2004) shows an analysis of well-being in relation to growth.The author highlights the high rates of poverty in the presence of economic growth. His aim is to interpret development by focusing on citizens and their needs. In this perspective it is determined the environmental dimension, where individuals can satisfy their desires, allowing them to live a healthy life (Biggeri and Chiappero Martinetti, 2010). According to Biggeri and Chiappero Manetti the aim is to evaluate relationship between the individual, institutional, natural and social environment. In order to reach a high level of well-being it is necessary to intervene on cultural, geographical, institutional and historical aspects. In addition, Davies (2009) highlights three deficits in the Human Development Index. First, it is a mistaken understanding of the concept of human development; another gap, according to this author, is the wrong equation of the calculation. Finally, the HDI is calculated with inaccurate data.

Sen (1999) says that to start an innovative and relevant research, related to human development, it is necessary to carry out an analysis at micro-meso-macro level. The reinforcement of human development has a strong influence on environmental and social sustainability (Biggeri and Chiappero Martinetti, 2010). Neumayer (2001) argues that there is a narrow relationship between sustainability and human development. Doyle (2018) emphasizes that HDI does not consider global warming, underestimate an important issue.Deneulin and Shahani (2009) argues that development is based on four pillars: equity, productivity, empowerment and sustainability. The authors with the term "sustainability" refer to environmental and social resources and their fair distribution to the population. Schattan et al (2008) argues that human development should be an issue to be considered by policy makers in order to promote human development initiatives.All these contributions can be considered the basis of the numerous initiatives in support of environmental sustainability.

In the perspective of reconciling the environmental dimension in the HDI, O'Neill et al (2018) have integrated the Human Development Index with the ecological impact variable;according to authors the study of human development is

focused only on the distribution of wealth and not on the ecological dimension (Ranis and Stewart, 2012, Neumayer, 2001; Ranis et al. 2006; Biggeriand Mauro, 2018; Hirai, 2017).

From the literature review on the Human Development Index emerges a series of both technical and substantial criticisms (Dervis and Klugman, 2011; Herrero et al., 2012; Morse 2014; Neumayer, 2011; Kovacevic, 2010; Togtokh and Gaffney, 2010; Ranis and Stewart, 2012; Chowdhury and Squire, 2006). The first aspect concerns a technical problem related to calculation. Specifically, it refers to the geometric mean. If the number of variables increases and if one or more elements are close to zero, the index is zero (Klugman et al., 2011). This limit will cause problems in the interpretation of the data obtained. The second criticism about HDI concerns the absence of variables regarding environmental and social sustainability dimension (De la Vega et al. 2001; Togtokh, 2011; Pelenc et al., 2013). Development and environment are not independent dimensions, but there is a relationship between the two aspects. Several studies have introduced the environmental dimension to integrate the Human Development Index (De la Vega et al., 2001; Neumayer, 2001; Morse, 2003). Therefore, the main thesis in the literature is that the HDI is too limited to measure human development with its three existing dimensions (Anand and Sen, 2000; Hirai, 2017). According to Hirai (2017) the HDI does not include, in fact, all the dimensions that indicate the real situation of human progress. In this perspective, Togtokh and Gaffney (2010) introduced a new index, the Sustainable Human Development Index (HSDI). HSDI is an alternative and most complete index to HDI. HSDI takes corrective action to overcome HDI deficits. However, although it is one of the most comprehensive indices, it is still not sufficient because the indicators used are not adequate to show a complete overview of the environmental dimensions and political freedom. The latter aspect is one of the major criticalities that does not allow its use for the study of human development.

3. A statistical study of possible integration on HDI

For the main causes discussed in paragraph 2, we try to strengthen the validity of the HDI considering the environmental dimension. The variables introduce were: fossil fuel energy consumption (% of total energy consumption), renewable energy consumption (% of total final energy consumption) and carbon dioxide emission (KG per 2010 US$ of GDP). For the sample it was decided to consider only the data relating to the main European countries. This choice depends on the desire to have homogeneous and comparable reference benchmarks and a territorial and cultural similarity. The 13 countries considered also have the same legislation

and similar levels of development also following accession, or the next accession, to the European Union.

Table 1 –*Performers on the human development index;fossil fuel energy consumption (% of total energy consumption); renewable energy consumption (% of total final energy consumption) and carbon dioxide emissions (KG per 2010 US$ of GDP).*

ID	COUNTRY	HDI	FOSSIL FUEL ENERGY CONSUMPTION (% of total energy consumption)	RENEWABLE ENERGY CONSUMPTION (% of total final energy consumption)	CARBON DIOXIDE EMISSIONS (KG per 2010 US$ of GDP)
1	ALBANIA	0.789	61.4	38.6	0.12
2	BELGIUM	0.919	75.9	9.2	0.20
3	BOSNIA AND HERZEGOVINA	0.769	77.5	40.8	0.58
4	CROATIA	0.835	70.7	33.1	0.19
5	CYPRUS	0.871	92.9	9.9	0.24
6	FRANCE	0.89	46.5	13.5	0.12
7	GREECE	0.871	82.6	17.2	0.25
8	ITALY	0.881	79.9	16.5	0.16
9	GERMANY	0.939	78.9	14.2	0.21
10	MALTA	0.883	97.8	5.4	0.09
11	UNITED KINGDOM	0.920	80.4	8.7	0.15
12	PORTUGAL	0.848	77.0	27.2	0.17
13	SPAIN	0.893	73.0	16.3	0.16

Source:Data from United Nations Development Programme – 2018 own elaboration.

In this paragraph the correlation between human development, energy consumption and carbon dioxide emissions is studied.

As is possible to see in Table 1, the correlation analysis shows a negative dependence for all three variables, in detail the data highlight a value equal to -

0.129; -0.2884; -0.3752, respectively to fossil fuel energy consumption, renewable energy consumption and carbon dioxide emission. We primary consider the environmental dimension, and its relation to HDI, by the aggregation of these three indicators. From the data shown in the table, the correlation values suggest that an increase in the environmental variable tends not to have a decisive impact on the HDI.

Statistical analysis data show that environmental dimension does not have a strong impact on the Human Development Index. There are countries that register a high level of HDI while maintaining a high consumption of fossil fuel energy and a high level of CO2 (Belgium, Germany and England). All p-values are greater of 0.05. So, the null hypothesis that there is no significant correlation between the level of HDI and environmental variables, has been accepted with a high level of significance.

Table 2–*Descriptive statistics.*

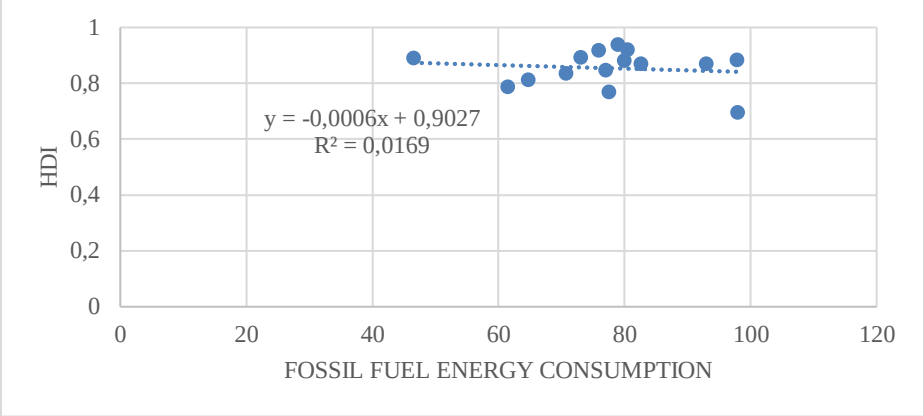
Variables	**FOSSIL FUEL ENERGY CONSUMPTION**	**RENEWABLE ENERGY CONSUMPTION**	**CARBON DIOXIDE EMISSIONS**
R multiple	0,129952525	0,288430471	0,375217964
R squared	0,016887659	0,083192137	0,140788521
Adjusted R squared	-0,058736368	0,012668455	0,07469533
Standard Error	0,066943705	0,064646845	0,062583263
Coefficient	-0,000625364	-0,001519975	-0,215068746
Standard Error	0,001323361	0,001399467	0,14735743
Stat t	-0,472557678	-1,086109596	-1,459503912
P-Value	0,644363749	0,297160031	0,168165615
Observations	13	13	13

Source: own elaboration

The calculation of the R squared has been executed to know the explicative power of the variables. The value of R-squared equal to 0.0168; 0.0831 and 0.1407 represents as respectively 1.168%; 8.319% and 14.078%. CO2 emissions is an

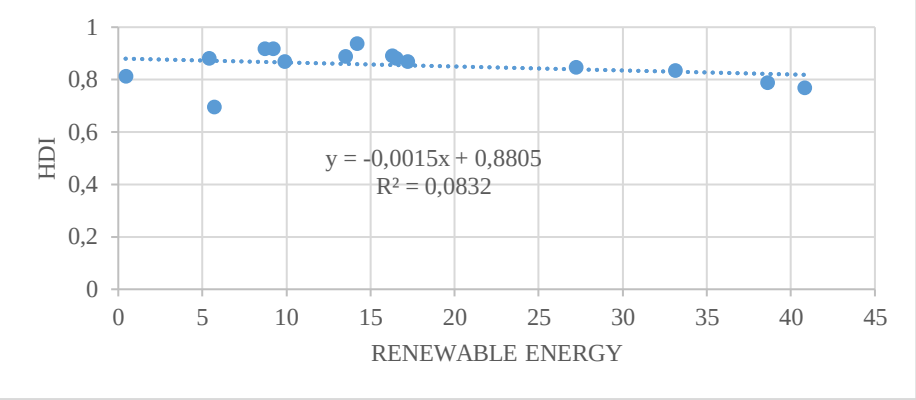
explanatory variable even if it does not have a strong impact on HDI. Fossil fuel energy consumption and renewable energy consumption as a proxy.Weak negative correlations confirm that high levels of HDI correspond to high dioxide carbon emissions.Figures 1, 2,3 show a straight line with decreasing trend; this means that as fossil energy consumption and CO2 emissions increase the HDI value increases.

Figure 1 – *Scatterplot of HDI and fossil fuel energy consumption.*



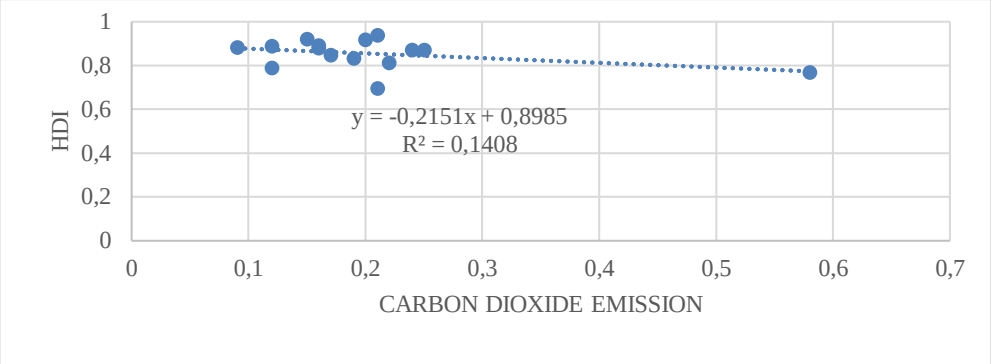
Source: own elaboration.

Figure 2 - *Scatterplot of HDI and renewable energy consumption.*



Source: own elaboration.

Figure 3 – *Scatterplot of HDI and Carbon Dioxide Emissions.*



Source: own elaboration.

4. Conclusion

This paper try to presents a critical assessment of the concepts of human development and weakness in the measurement phase. The current challenges facing human progress underline the need to improve measuring instruments.However, the HDI represents one of the main human development measures adopted.

Currently, the HDI is calculated through the geometric average of three indicators: life expectancy index (HDI), education index (EI) and income index (II). It is argued that the fragility of this index is due to the absence of variables referring to the environmental dimension, but also the absence of variables that explain how a population actually contributes to progress according to development prospects.

Moreover, the combined action of environmental, economic and social perspectives could represent a starting point for policy makers, who will be able to monitor and evaluate the results of their strategies and define new improvement measures.

Although the HDI is the starting point for measuring the degree of development of a country, it should be complemented by indicators that reflect the environmental reality in a sustainable development perspective.

Sustainable development is associated with the ecological dimension. For this consideration, we tried to integrate the HDI considering the three variables as an expression of the environmental aspect.

In this work, from the analysis carried out it can be deduced that the variables taken into account in this study do not have a decisive impact on the HDI, so it may be appropriate to include, also, other environmental variables. There is no

significant correlation between fossil energy consumption, renewable energy and CO2 emissions. Statistical analysis shows that high human development can also be achieved with high energy consumption from fossil fuels and CO2 emissions. Therefore, the reduction of CO2 emissions does not appear to contribute significantly to human development.This consideration assumes that environmental varibials should be further extended in order to determine what impact environmental quality has on human development.

Therefore, it would be opportune a better analysis both from the point of view of the data and the size of the sample examined in order to be able to decisively support the scientific debate on HDI and produce a direct contribution to the estimation and measurement of Human Development also in relation to the environmental aspect.

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SUMMARY

THE HUMAN DEVELOPMENT INDEX: A CRITICAL EVALUATION AND A NEW PROPOSAL

The Human Development Index is used as an alternative indicator to GDP to measure development. This index shows a theoretical and empirical revolution. It representsone of the most popular composite indices for socio-economic analysis and measurement of development. Nervertheless, the climate change has highlighted one of the main limitations of this index, i.e the absence of variable related to environmental sustainability.

The introduction of the environmental dimension significantly increases the potential of HDI. This paper tries to propose an extension of the HDI, including an environmental aspect in the evaluation. However, it is a synthetic and systematic indicator, so that studies show limitations and gaps in terms of measurement related to the environmental dimension, but also the absence of variables that explain how a population concretely contributes to progress according to development prospects.

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