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e-ISSN: 2501-0425; ISSN–L: 2284–5984

Logos Universality Mentality Education Novelty, Section: Economy and Administrative Sciences
2018, Volume III, Issue 1, pp. 5-14

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https://doi.org/10.18662/lumeneas/01

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How to cite: Bostan, I., Clipa, F., Clipa, R.I. (2017). Is Romania a Sustainable Developed Country? An Analysis of Ecological Footprint (EF) in Correlation with Human Development Index (HDI). *Logos Universality Mentality Education Novelty, Section: Economy and Administrative Sciences, 3*(1), 5-14. https://doi.org/10.18662/lumeneas/01

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Is Romania a Sustainable Developed Country? An Analysis of Ecological Footprint (EF) in Correlation with Human Development Index (HDI)

Ionel BOSTAN[1], Flavian CLIPA[2], Raluca Irina CLIPA[3]

Abstract: The paper aims to answer the question if Romania is a sustainable developed country, using the analysis of Ecological Footprint (EF) in correlation with Human Development Index (HDI). EF expresses the ecological goods and services that people need to meet their needs within a given space. It comprises biocapacity, defined as a biological production area, necessary for crops, meadows, built areas, fishing areas and forestry products and the amount of forest required to absorb the excess of carbon dioxide emissions beyond the ocean's absorption capacity. HDI measures national average for longevity, education and living standards. A value that exceeds 0.7 indicates "high human development". Romania has an HDI value of 0.8, an EF per person of 2.63 gha, entering the category of High Human Development Countries. The conclusion of the study is that the ecological reserve of Romania is due to the decline of the industrial sector and not to an efficient management in the field of sustainable development.

Keywords: *sustainable development*, *Ecological Footprint*, *Human Development Index*, *Romania*.

1. Introduction

Searching for indicators to measure sustainable development is a topic frequently encountered in the literature. Researchers and practitioners have made considerable efforts to select groups of indicators, to measure and aggregate them into a complex tool. Several aggregate environmental indices have been developed, but they do not always indicate the same direction of research. For example, the ranking of countries according to the three Sustainability Indicators (World Bank's 'Genuine Savings' measure, 'Ecological Footprint' and 'Environmental Sustainability Index') differs quite

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a bit (Pillarisetti and van den Bergh, 2007). Efforts to assess the environmental sustainability have resulted in the development, by more than a decade and a half ago (Rees, 2002, 2003; Wackernagel et al., 2002; Wackernagel and Rees, 1996), and large-scale application of Ecological Footprint, an instrument designed to determine the level of sustainability/unsustainability of actions, individuals or states. EF is an index expressed in global hectares - hectares of 'biologically productive space with world-average productivity' (Wackernagel and Rees, 1996) - of the resources required to produce the goods that a person, a group of individuals or the whole population consumes. Ecological Footprint is an index that measures the pressure that mankind exerts on ecosystems. It is calculated annually by reporting the surface area of the Planet to the number of inhabitants, resulting in a land area that is needed to ensure the necessary resources and to neutralize the waste resulting from our consumption. This research is also important in the context of the concerns for strengthening the right to a healthy life and a clean environment (Pohoață et al., 2014), taking into account the resources of financial-budgetary nature (Boulescu et al., 2009).

2. Ecological Footprint (EF) as a measure of sustainable development

EF is widely used as a measure of sustainability, but the assumptions on which the fingerprint calculations are based on have not been exempt from criticism. have presented evidence that almost contradicts simple economic principles because the basic hypothesis (zero greenhouse gas emissions, national boundaries, not taking into account intensive production) do not match either the theory or the empirical evidence (Fiala, 2008). Others (van den Bergh and Grazi, 2014) pointed out the fact that does not provide significant information for public policies. However, defenders (Lin et al., 2015) argue that the critics come from the assumption that the Ecological Footprint measures land "use," which can't be true, because land use cannot overshoot land reserve. In turn, they conclude that much of the prior debate reflects misunderstanding of concepts.

But Despite the criticism over the time of the footprint calculation, the index is increasingly being used, and the number of specialty works with EF application has increased exponentially (van den Bergh and Grazi, 2014). Its popularity is due to the fact that it delivers a global index for the stress or repercussion on the environment, and for the fact that it is consistent with the idea that human activities should not be beyond the capacity of the environment to regenerate resources. Also, Ecological Footprint analysis

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(EFA) has been extensively used for assessing urban sustainability in urban planning policies (Gu et al., 2015).

The Living Planet Report 2014 found that high-income countries have, on average, a five-fold higher environmental footprint than those with low incomes. Globally, the footprint has doubled since 1966. The global environmental footprint has already surpassed the planet's 50 percent regeneration capacity. Moreover, while rich countries have improved their biodiversity with almost 10%, middle-income countries have experienced a decrease of 18%, and pour countries have recorded extreme decline of 58%.

Global Footprint Network states that a country presents an ecological deficit if the EF exceeds its own total biocapacity (biological capacity – BC), and an ecological reserve in the opposite case, if BC exceeds its own EF. The footprint is based on six sub-indices: cropland, pasture, forests, fisheries, built space and energy. The national/regional ecological deficit is due to the fact that the country/region is importing biocapacity through trade or exhausting regional ecological capital, or discharges wastes into the water, atmosphere etc. But at the global scale, unfortunately, the ecological deficit cannot be offset by exchanges.

The EF varies with the number of population, consumption per person and resource strain of predominant technologies. The Living Planet Report 2014 shared about 1.7 global hectares (gha) per capita to provide sustainable consumption, taking into account the Earth's productive land and sea area and also existing technologies (WWF, 2014)

3. Evaluating sustainable human development in Romania using EF and HDI

According to Global Footprint Network, sustainable human development will prevail when all people are able to meet their needs without damaging the Earth. To achieve this goal, there are two leading indicators. First, Ecological Footprint indicates that, considering present population and accessible land area, the resources of a country may be replicable for a value of less than 1.7 gha per person. Second, Human Development Index (HDI), expressing a country's average accomplishments in the fields of life expectancy, education, and standard of living, tells us that a value higher than 0.7 is considered 'high human development'. Thus, these two values, in combination, represent the minimum conditions for achieving sustainable human development. The reason for which the two concepts are integrated in one science-based measurement picture is that sustainable human

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development means reaching high standard of leaving, within the resources available. Our well-being obviously depends on healthy ecological assets.

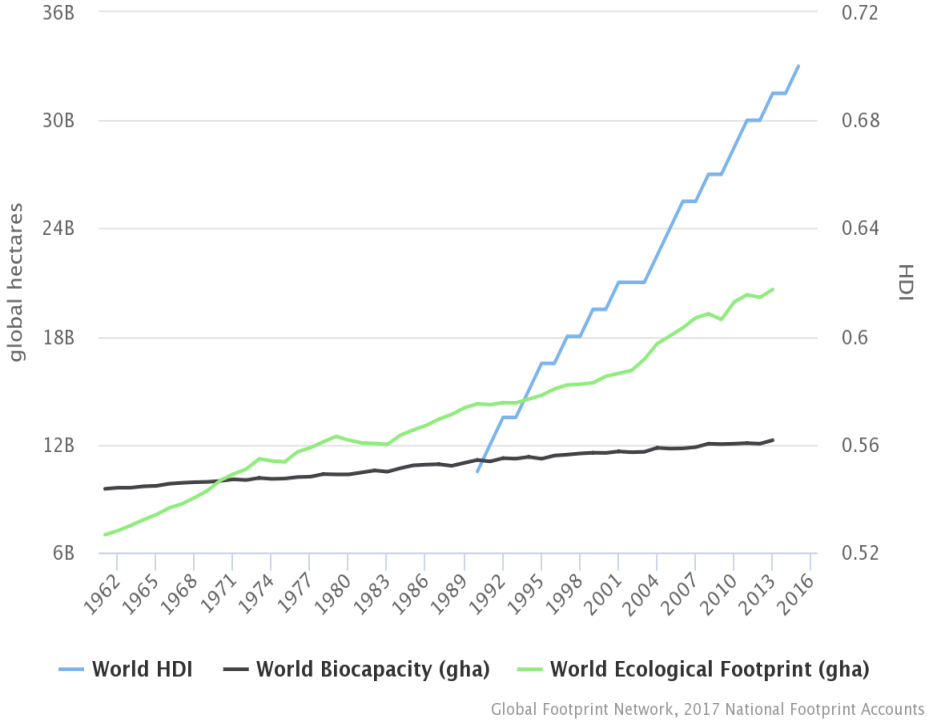
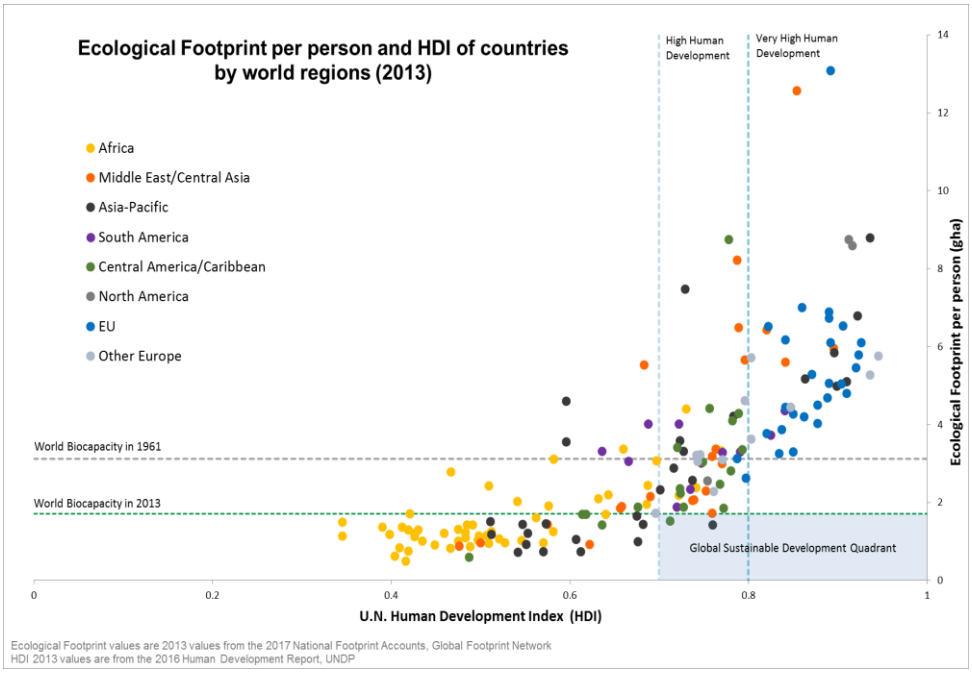


Figure 1. World HDI, BC (gha) and EF (gha), 1961-2016

Figure 1 shows that the grow of the living standard of the world population, expressed in HDI, which rose from 0.55 in 1990 to 0.7 in 2015, resulted in the cost of ecological asset degradation. Since 1970, irreversibly, EF is growing faster than global biocapacity, reaching a global biocapacity deficit of 8369268852 gha.

The analysis of EF per capita and HDI of countries by world regions measured in 2013 (figure 2) shows that high human development, which is the aim of sustainable development, is accomplished in the lower right quadrant. It is called Global Sustainable Development Quadrant. As we can see, very few nations have succeeded in positioning this area.

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Source: Global Footprint Network, 2017 National Footprint Accounts 2017 (Data Year 2013)

Figure 2. EF per person and HDI of countries by world regions, measured in 2013

All UE countries are characterized by High Human Development, but almost all of them have the EF per person above its own biocapacity. Among these, Romania is the best, with an EF value of 2.6 gha per person, a biocapacity value of 2.7 gha per capita, resulting in a biocapacity credit of 0.1 gha per person. Romania has a HDI of 0.8, which makes it enter into the category of High Human Development Countries.

The Living Planet Report 2014 also states that Romanians pollute less than other European citizens and is ranked 46th in the world and 13th in the European Union in terms of biocapacity, which translates into the possibility of ecosystems in Romania to produce useful biological material and to absorb residues, especially carbon dioxide, produced by over 19 million inhabitants. If we consider EF, Romania is ranked 70th in the world and is the best of all European countries. But is this the result of efficient ecological management?

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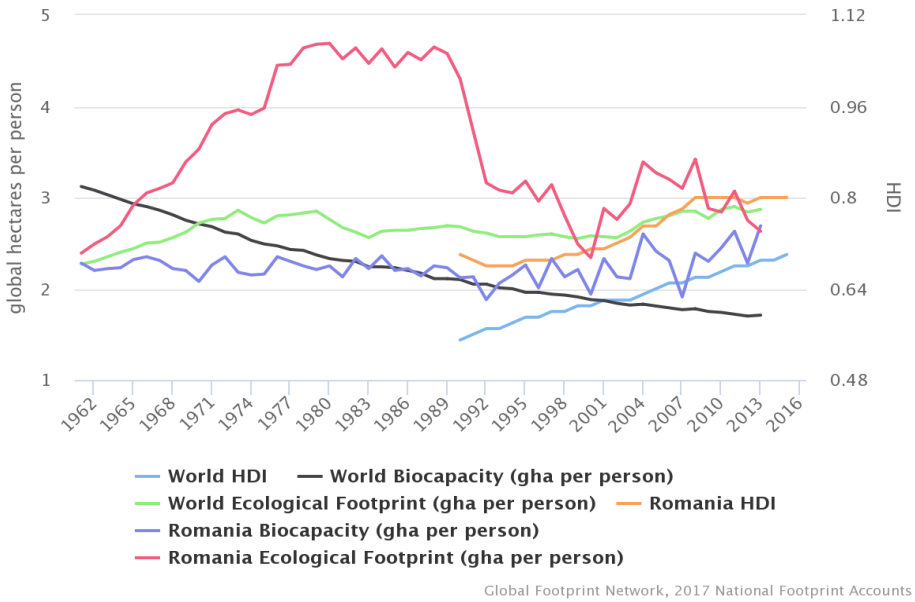


Figure 3. HDI, Biocapacity (gha per person), Ecological Footprint (gha per person), World and Romania

If we are facing a growing bio-capability gap of almost 5 decades worldwide, in Romania the trajectory of EF and that of BC converge, resulting in a small reserve of biocapacity after 2013 (Figure 3). A deeper analysis of Romania's situation leads to a paradoxical conclusion. If the increase of EF is diachronic in correlation with an intense period of industrialization (even forced of Romania), reaching its peak in the 70s and 80s (at over 4.5 gha per capita), after the Communist regime is overthrown it decreases to the value of 2.63 gha per person. The explanation can be found not in a systematic concern of decision-makers in the field of promoting sustainable development, but rather coincides with a process of deindustrialisation, rehabilitation of energy-efficient production capacities, not from environmental considerations, but from a perspective which materializes more capture states. Moreover, even if Romania has a higher level of development compared to the other countries ranked favorably in terms of biocapacity (Sierra Leone, Honduras and Somalia), EF continues to remain low. However, it follows the trajectories dictated by business cycles (e.g. pre-economic growth and post-2008 crisis, but with much lower magnitude than developed economies. The explanation may be orbiting around the view that frequent legislative changes in business matters,

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including fiscal unpredictability, lead to a decrease in the attractiveness of the investment environment.

Analysis of Romania Ecological Footprint by Land Type, presented in figure 4, reveals that Carbon Footprint (CF), which measures CO2 emissions associated with fossil fuel use, has almost the same trajectory as the total EF and makes up more than half of it. The other components of EF have recorded less sinuous trajectories.

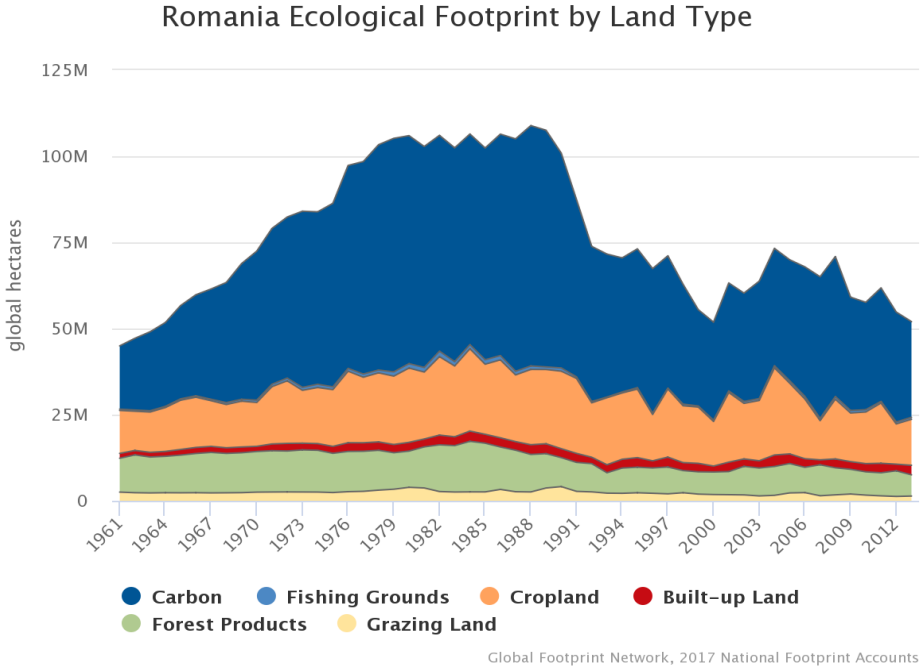
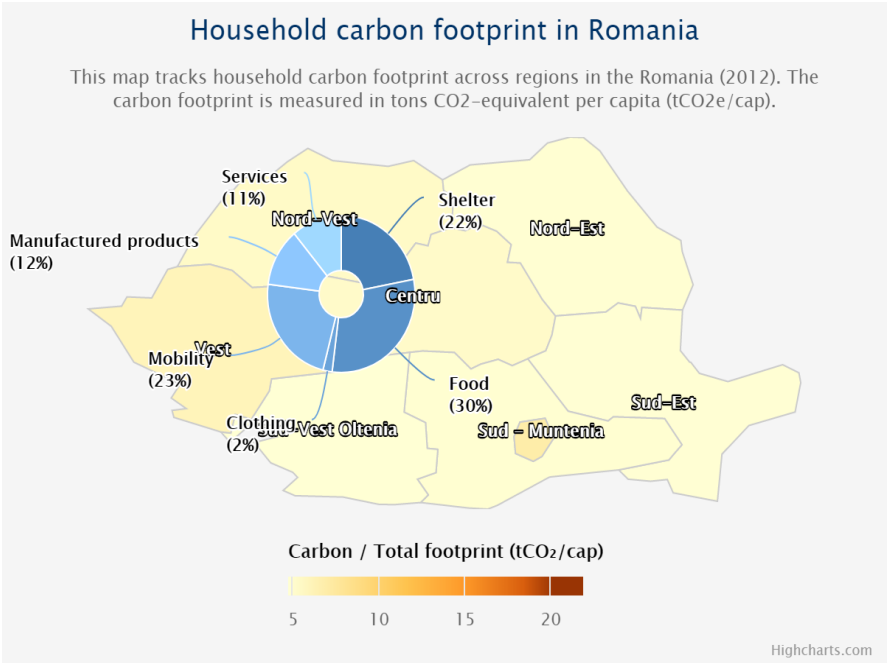


Figure 4.

The policies to reduce CO_2 emissions are developing in Romania, and that is possible through following the appropriate directions and strategies (such as subsidies for producing renewable energy, reduction of taxes for slightly polluting cars, providing public transport with vehicles that use renewable energy). All these made possible accomplish European directions for the use of renewable energy and adoption of effective policies on waste management (Cioca et al., 2015).

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Source: Ivanova et al., 2017

Figure 5.

The factual evidence (figure 5) shows a distribution of the carbon footprint in Romania as follows: manufactured products 12%, mobility 23%, clothing 2%, food 30%, shelter 22% and services 11%. In the future, given the legislative changes to the abolition of the environmental tax for passenger cars, it is foreseeable to increase carbon emissions in the Mobility sector, which is also supported by the fact that in 2017 the number of second-hand imported cars increased by 500000 units.

4. Conclusion

Despite all the criticisms, EF is a very useful tool for determining sustainable development. Romania has an HDI value of 0.8, an EF per person of 2.63 gha and a population of 19794162 people, being included into the category of High Human Development Countries. But the EF increase is diachronic in correlation with an intense period of industrialization. It is certain that the research does not assert that the Footprint is a comprehensive measure tool of sustainability. It is necessary that the Ecological Footprint be completed by other procedures to attein a whole picture of sustainability. By combining the analysis of EF with HDI,

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the minimum conditions for achieving sustainable human development are outlined.

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