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A comparative analysis between composite indexes of environmental performance: An analysis on the CIEP and EPI

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ABSTRACT

The measurement of environmental impact through composite indexes provides information about the effects of human activities on the ecosystem. Over recent years proposals regarding the environmental composite indexes (ECI) have emerged, suggesting that they can be used to help in decisions about public policies. Due the number of these indicators, issues arise about the asymmetry of information provided, although all ECI seek to measure ecosystem quality or damage. The present paper compares the Composite Index of Environmental Performance (CIEP) (García-Sánchez et al., 2015) and the Environmental Performance Index (EPI) (Hsu et al., 2014) in order to find convergent and divergent characteristics, studying methodological aspects and empirical evidence through statistical analysis, in order to favour the decision-making by stakeholders and to improve the existing ECI in order to determine adequately the environmental impact. The results show that the indexes were developed using different methods and variables, however, they share around 20% identical variables. Despite these differences, the rate of variation in ranking countries between the indexes is 21%, on average. The EPI policy category 'water & sanitation (effects on humans)' has two common variables and explains part of the CIEP performance. The effect dimension of the CIEP has one more identical variable and it reduces the individual variation between rank positions.

1. Introduction

Measuring environmental impacts involves scholars from different fields, including biology, sociology, geography, economic and accounting. The general aim is to count the effects on the ecosystem caused by human activities. An easy approach is via a single variable, but it is a poor choice due to the complex and dynamic ecosystem.

Several proposals for environmental composite indexes (ECI) have emerged, focused on private and public ambit. Babu and Datta (2013) provide evidence for the relevance of ECI with several multidimensional elements used in their construction, covering all possible ecosystem dimensions.

Some examples of composite indexes used to measure ecological quality or impact are: the Composite Index of Environmental Performance (CIEP) developed by García-Sánchez et al. (2015); the Environmental Performance Index (EPI) from the Yale Center for Environmental Law and Policy, Yale University; the Ecological Footprint (EF) and biocapacity; the Environmental Degradation Index (EDI) proposed by Jha and Murthy (2003); and the Environmental Sustainability Index (ESI). Bandura (2008) surveyed a collection of composite country indexes in several fields including those about environmental performance.

Each of these indicators were developed using diverse approaches; methods and variables that make them different (Barnett et al., 2008; Rogge, 2012). Previous research comparing composite indexes is found in the literature. Wilson et al. (2007), Böhringer and Jochem (2007) and Siche et al. (2008) surveyed sustainability indexes. Rogge (2012) compares the optimistic and pessimistic views of EPIs using DEA analysis. Ghisi et al. (2014) contrasted indicators ranked to save potable water in buildings based on energy consumption and financial savings. Chin et al. (2015) compared the biotic integrity of bird species in Canada analyzing the rank. However, no previous studies have compared similarities and differences between two different ECIs, exiting a research gap about what each ECI is measured and what effects

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Table 1
Environmental composite indexes.

Environmental Composite Indexes	Sample	Amount of variables	References
Composite Index of Environmental Performance (CIEP)	152 countries	19 single variables aggregated in 5 dimensions	www.indexciep.org
Environmental Performance Index (EPI)	178 countries	22 single variables combined into in 10 policy categories, grouped in 2 environmental objectives.	www.epi.yale.edu
Living Planet Index (LPI)	ni	ni	http://www.livingplanetindex.org/
Ecological Footprint (EF) and Biocapacity	200 countries	ni	http://www.footprintnetwork.org/
Environmental Vulnerability Index (EVI)	3 countries, preliminary	57 single variables aggregated in 3 categories.	Kaly et al. (1999)

ni – not informed.Source: Own preparation (2015).

have the use of different ECIs on countries' environmental position. So, this is the main point that this work advances on the environmental performance studies.

In this sense, the present article full this gap, comparing and contrasting two ECIs in order to identify possible differences and similarities between them, analyzing theoretical and empirical elements, and considering variation in the rank positions. This comparative analysis is necessary due to stakeholders are involved in this complex scenario with too much information with which to make decisions and plan environmental policies, and thus, it is important to know how divergent and convergent the information provided by the different ECIs.

For it, we selected just the CIEP and the EPI models because they were the only ones that have six years of data freely available on a website. The analysis was run in two phases: the first is a theoretical study based on three elements inherent to the development of composite indexes: i) proposed goals; ii) variable selection; and iii) methodology. The study used statistical methods of empirical analysis. The sample is composed of all available indicators within the composite index used by 129 countries. It was selected taking into account CIEP and EPI dataset limit. Our approach improves previous evidence in two senses; i) it is the first paper that compared different ECIs in relation to their theoretical foundations, the indicators and producers used to elaborate each composite index, as well as the similarities and differences that this ECIs presents in relation to their final output, the environmental impact measure; ii) our work evidences the main variables that determine the countries' environmental impact, observing that although there are greater differences in the individual analysis, the environmental impact does not have strong variation, on average. Moreover, the individual differences found make them complementary and they must be used in order to improve the existing tools and help to develop others proposals.

The remainder of this article is organized as follows. In the next section we summarize environmental composite indexes found in the literature. Section 3 describes the data and methodology used. Section 4 gives the results and provides discussion. Finally, Section 5 concludes this paper and summarizes highlights.

2. Environmental composite indexes: a brief survey

Proposals for ECI developed by some institutions and scholars can be found in the literature (Srebotnjak, 2007; Bandura, 2008). The ECI is a tool that provides information for decision makers (Rogge, 2012), but it is important to understand the outputs provided by these measurement tools.

This section provides brief information on the ECI collection and Table 1 summarizes their main characteristics. The present paper

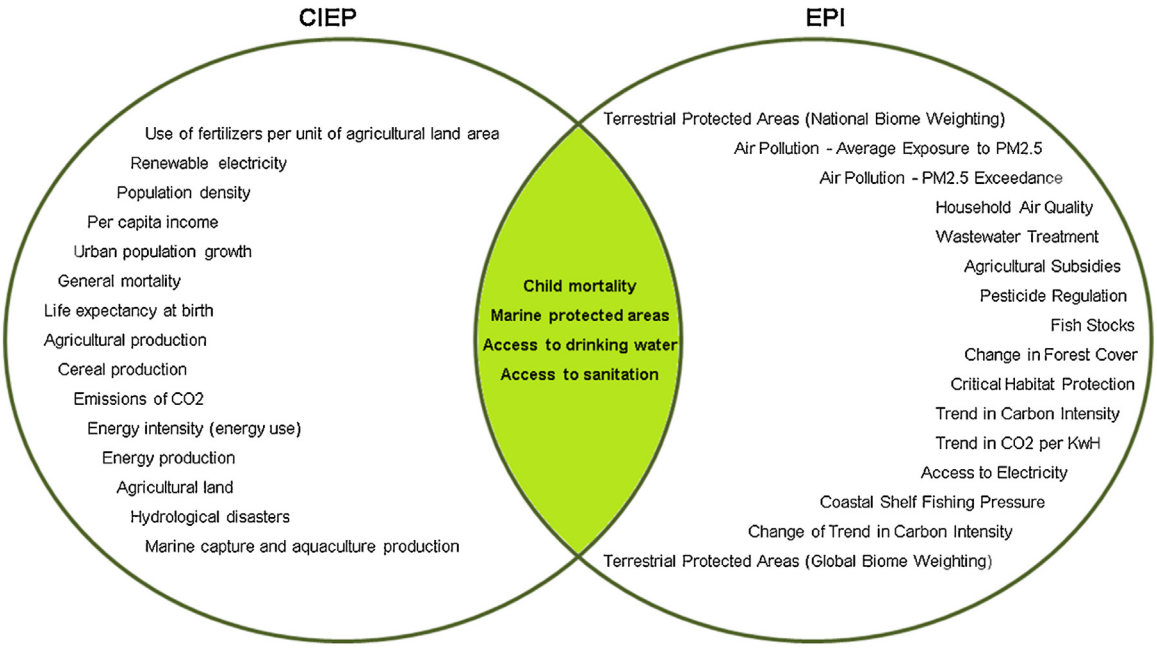

Fig. 1. Variables used in CEIP and EPI models.