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Green Economy and The Dimensions of Sustainability

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Abstract: Green economy is a tool aiming at the development of society; prosperity without draining resources; and return on investment without neglecting the protection of the environment, long-term economic growth, social inclusion, and institutional action towards human well-being. The ecological, economic, social, and institutional dimensions demand ecosystem services, economic resources, social participation, and adaptive management to bring about a healthy and equitable environment, economic progress, prosperity and equitable social opportunity, and participatory governance contributing to well-being.

This work presents a proposal for the assessment of sustainability through the acknowledgment of its multidimensional nature and the interrelations among such dimensions, with the purpose of enabling its application to different production systems based on the resilience of socioecological systems in the geographical area and temporal frame in which they are embedded.

Key words: green economy; sustainability; human well-being

JEL codes: Q

1. Introduction

The goal is to present a broad concept of green economy that can be related to the dimensions of sustainability and their interrelations within a matrix. This matrix is used as a method to calculate the effectiveness of the application of green economy principles to a production system.

Green economy is a tool that aims at enhancing human well-being, reducing *environmental* risks and *ecological* scarcity, increasing long-term *economic* growth, and fostering *social* inclusion and *institutional* commitment.

The focus of interest lies in showing the development of this new branch of economy as a result of global warming and in approaching the issue of sustainability from four different dimensions. The ideal intersection among the dimensions contributes to human well-being and helps improve the sustainability of production systems. To that end, the proposal involves an assessment of indicators of the degree of sustainability companies have when it comes to making investment-related decisions and reducing climate change effects, thus increasing the sustainability of the productive system wherein they are embedded.

Global warming affects us all, regardless of economic status, gender, place of residence, or what we do for a living. The challenge of climate change comes, however, with new opportunities. We do have the tools we need to deal with it, and the proposed method will allow for production systems to assess their sustainability and adjust

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their performance accordingly.

2. Literature Review

We are facing the fourth industrial revolution: the revolution of green economy and new technologies generating new economic activities, transforming the existing ones, and replacing those unable to adapt.[1]

The hottest 15 years in history have been recorded within the last two decades.[2] This led to the signing, in 2015,[3] of an international agreement to stop global warming due to greenhouse gas emissions and to limit the increase in global temperature to less than 2°C. In this context, investments in clean energies grew in 2015 to 329 trillion dollars.

David Levine said, "The time has come for a new economy, for a new paradigm with a new system of values; some call it sustainability; others, triple result; we need to find the balance between the social, the economic, and the environmental".[4]

Pope Francis stated, "climate change is a global issue with serious environmental, social, economic, distributional, and political dimensions, and it poses one of the main current challenges for humanity",[5] thus incorporating the institutional dimension to the sustainable development approach.

3. The Dimensions of Sustainability

Based on a previous study,[6] the approach lies on four dimensions. Figure 1 presents a proposal for the assessment, both qualitative and quantitative, of the sustainability of a production system — in the geographical area and temporal frame in which the system is embedded — acknowledging the multidimensional nature of sustainability and the interrelations among its dimensions according to conceptually determined **components**.

For the calculation of the production system sustainability indicator (ISSP), the dimensions (Ecological, Economic, Social, and Institutional) are initially organized in a matrix whose internal structure contains the relationships among them. It indicates the state of affairs of each dimension and warns about the imbalances within the system.

For instance, if we analyze the components from the intersection between the Social dimension (located in a column) and the Economic dimension (located in a row), they conceptually reflect the demands from the Social dimension to the Economic dimension, for example, corporate social responsibility.

The demands from the Ecological, Social, and Institutional dimensions to the Economic dimension make up the Economic Resources Demands. Thus, each row on the matrix represents the demands posed on each of the dimensions.

[1] Green Economy: Environment, Awareness and Action Summit, held in Córdoba (Argentina) by Advanced Leadership Foundation (US-based on-profit organization committed to the education and empowerment of the next generation of world leaders), 2016.
[2] National Oceanic and Atmospheric Administration (NOAA).
[3] Paris Climate Conference 2015.
[4] Co-founder and Chief Executive Officer of the American Sustainable Business Council (ASBC) https://www.youtube.com/watch?v=dNBgJIQ-4DU (2016).
[5] Encyclical Letter Laudato SI, 2015.
[6] Managed by Argentina's National Agency for Scientific and Technological Promotion (Agencia Nacional de Promoción Científica y Tecnológica de Argentina) (2010).

		Human well-bing				Aggregate demands
		Ecological preservation	Economic efficiency	Social equity	Institutional management capacity	
Demands posed on the different dimensions	Ecological	Water Soil Air Biodiversity	Access (to resources for production)	Access (to resources for life)	Current state of affairs and new scenarios (of environmental resources)	Ecosystem services
	Economic	Eco-friendly practices low-impact production product life cycle	Productivity independence from external supplies competitiveness	Livelihoods corporate social responsibility social mobility	Corporate training regulatory compliance participation	Economic resources
	Social	Awareness and awareness raising about environmental issues responsible use of environmental resources	Instruction labor	Cultural capital Human capital Social Capital	Social organization	Social participation
	Institutional	Legislation participation of social capital education for sustainability	Legislation organization of social capital services	Access citizenship participation	Legislation enforcement oversight	Adaptive management
Contribution to human well-being		Healthy and productive environment	Economic progress	Prosperity and equitable social opportunities	Participatory governance	Direction of the system terms of sustainability

Source: Seiler, R. Vianco, A. (2014)

The demands posed on the Ecological dimension make up the Ecosystem Services Demands; the demands posed on the Social dimension make up the Social Participation Demands, and those posed on the Institutional Dimension make up the Adaptive Management Demands.

These components are originated in the **governing criteria** adopted for each of the dimensions according to consensual agreements on sustainable development: *Preservation, Efficiency, Equity, and Management Capacity.*

The criteria obey to the ultimate goal of **contributing to Human Well-being**, understood as the result of the development process based on the mutual interaction among a Healthy and Productive Environment, Economic Progress, Prosperity and Equitable Social Opportunity, and Participatory Governance.

The **indicators** defined for each component will be contingent upon such criteria. The first can change provided that different production systems are identified, while the latter will change whenever different goals are defined around the assessment of sustainability.

Each column can be thought of as a specific function, where a dimension (located in a column) combines elements taken from the other dimensions (located in rows) in order to contribute to the achievement of Human Well-being. Hence, it encompasses the demands and contributions among the dimensions and shows the relationships between aggregate demands and contributions to human well-being, allowing the assessment of the production system's state of affairs in terms of sustainability.

The criterion for the analysis of the Social dimension is Equity, which consists in a set of practices aimed at addressing and overcoming all forms of exclusion and inequity, in the search of Prosperity and Equitable Social Opportunity. Equity is a precondition for sustainability from both an environmental and a social cohesion perspective. Thus, it demands the Economic dimension (and the Economic dimension provides it with) Livelihoods, Corporate Social Responsibility, and Social Mobility to contribute to Human Well-being under the

Equity criterion.

For instance, a company's actions may influence space, with an impact that can go beyond the business sphere and expand across a greater spatial or temporal scale. These actions are reflected in the Corporate Social Responsibility component, and include, among others, environmental technology, relationships with social organizations, good agricultural practices, job-related training, and non-fossil energy supply.

The description of the dimensions, interrelations, and components of the Sustainability Matrix is not a comprehensive one, but rather a guiding instrument to be taken into account when assessing the sustainability of a given production system.

4. Methodology

In order for the preceding concepts to become operational and to apply a method that allows us to estimate a value with which to assess the sustainability of a production system within a given geographical area and a given time frame, each dimension is assigned a number (1. Ecological; 2. Economic, 3. Social, 4. Institutional). This allows to identify the relationship between any two of them as the position X_{ij}, for all $i, j = 1,2,3,4$.

Thus, the position X_{23} represents the relationships between the Economic dimension (located in a row) and the Social dimension (located in a column). Conceptually, it reflects the demands from the Social dimension to the Economic dimension.

Table 1 shows the demands (D_i) and the contributions to well-being (B_j) for each dimension $ij$and the sustainability of the production system (SSP), along with the relationships among the dimensions (IR_{ij}) shown by the assessment of the Production System Sustainability Matrix.

Table 1 Assessment of the Sustainability Matrix

Relationships		Human well-being				Aggregate demands
		Ecological (preservation)	Economic (efficiency)	Social (equity)	Institutional (management capacity)	
Demands posed on the different dimensions	Ecological	Ir_{11}	Ir_{12}	Ir_{13}	Ir_{14}	D_1
	Economic	Ir_{21}	Ir_{22}	Ir_{23}	Ir_{24}	D_2
	Social	Ir_{31}	Ir_{32}	Ir_{33}	Ir_{34}	D_3
	Institutional	Ir_{41}	Ir_{42}	Ir_{43}	Ir_{44}	D_4
Contributions to human well-being		B_1	B_2	B_3	B_4	Ssp

The Production System Sustainability Indicator ($ISSP$) results from relativizing the value attained by SSP and its maximum potential of 16. The $ISSP$ranges from 0 to 1: the greater the proximity to 1, the higher the sustainability of the production system.

$$ISSP = \frac{SSP}{16}$$

The production system sustainability (SSP) results from aggregating the final demand (D_i)or the well-being (B_j) attained by the four dimensions. It is the sum of the final demand of the Ecological, Economic, Social, and Institutional dimensions, or the sum of the well-being generated by them. It ranges between 0 and 16, and represents a quantification of the state of well-being and of the relative sustainability of the productive system in question.

$$SSP = \sum_{i=1}^{4} D_i = \sum_{j=1}^{4} B_j$$

D_i represents the demand of the dimensions included in rows, and B_j is the aggregated value of the dimensions included in columns, which results in well-being. Both D_i and B_j assume values ranging between 0 and 4.

The assessment of the final demand and of well-being for each dimension of sustainability results from the aggregation of the interrelations among dimensions (IR).

$$D_i = \sum_{j=1}^{4} IR_{ij}\,; \quad 0 \le D_i \le 4 \qquad B_j = \sum_{i=1}^{4} IR_{ij}\,; \quad 0 \le B_j \le 4$$

The Relations Index (IR_{ij}) is the average of the components' index value as per the following relation:

$$IR_{ij} = \frac{1}{K} \sum_{g=1}^{K} I_g$$

I_g is the homogeneous value of each component of dimension *ij*, *K* indicates the number of existing components within dimension *ij* included in the calculation with an equal weight (the calculation may also be done with different weighing, if required by the study). For example, IR_{12} represents the Relation Index for the Ecological-Economic dimensions.

The index for component g is the result of aggregating the variables that make up the component

$$\mathbf{I}_{g} = \frac{\sum_{m=1}^{n} \boldsymbol{X}_{g,.m}}{\boldsymbol{n}}$$

$X_{g,.m}$ is the average value of homogeneous variables of component g as observed at the primary production unit m

$$\mathbf{X}_{g,.m} = \frac{\sum_{l=1}^{L} \boldsymbol{X}_{g,lm}}{\boldsymbol{L}}$$

$X_{g,l.}$ is the average value of the homogeneous measures of variable *l* on component g as observed in the n primary production units: $X_{g,l.} = \frac{\sum_{m=1}^{n} X_{g,lm}}{n}$

To homogenize the quantitative information, the real value –as observed for each variable or indicator existing in each dimension within a given territory– needs to be related to reference measures, as follows:

$$\mathbf{X}_{g,lm} = \frac{\boldsymbol{x}_{g,lm}\, \boldsymbol{real} - \boldsymbol{X}_{g,l}\, \boldsymbol{min}}{\boldsymbol{X}_{g,l}\, \boldsymbol{max} - \boldsymbol{X}_{g,l}\, \boldsymbol{min}}$$

$x_{g,lm}\, real$ is the observed value for variable l of component g, on the survey; $X_{g,l}\, min$ s the minimum reference value for variable l of component g; $X_{g,l}\, max$ is the maximum reference value for variable l of component g. $X_{g,lm}$ is determined as the homogeneous value of variable l for component g as observed at the analyzed production system's primary production unit m. $X_{g,lm}$ ranges between 0 and 1.

Minimum and maximum reference values are determined for each variable of each component and for each considered production system. Information comes from bibliographic references, previous research, or surveys performed, among others. If it is a qualitative variable, an existing category is assigned a value of 1, and a non-existing category is assigned a value of 0.

The generic element $x_{g,lm}$ represents the answer of observation m for variable l of component g, part of a particular dimension ij. The trajectory of m goes from 1 to n (the total number of observed production units in the territory of the system under study); g ranges from 1 to K (the total number of components in the dimension ij); l ranges from 1 to L and shows the indicator or variable to be considered for the component of the dimension ij.

5. Conclusion

The Green Economy tool, designed to take immediate action in response to the effects of global warming, establishes a set of principles based on the ecological, social, economic, and institutional dimensions, as a way to contribute to human well-being. The proposed matrix allows to intersect said dimensions in order to define an indicator of the sustainability of production systems, and to study, at each intersection, the components that each dimension demands from the others under certain criteria. The aim is to enhance the sustainability of the system, providing solutions to mitigate such effects, and contributing to sustainable development with social inclusion, return on investments, institutional commitment, and the protection of the environment.

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