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# Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research

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## ABSTRACT

The intermeshing of disciplines from the natural sciences, social sciences, engineering and management has become essential to addressing today's environmental challenges. Yet, this can be a daunting task because experts from different disciplines may conceptualize the problems in very different ways and use vocabularies that may not be well understood by one another. This paper explores three alternative environmental concepts used in transdisciplinary research, and outlines some of the epistemological and practical problems that each one poses. It pays particular attention to the increasingly popular concept of "circular economy", and contrasts it with the more commonly-used concepts of "environmental sciences" and "sustainable development". In clarifying the nature, meaning and inter-relationship of these alternative concepts, the paper helps trans-disciplinary researchers to understand the opportunities and challenges associated with each one.

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We live in a world with rapid anthropogenic environmental changes. The challenges associated with this make it essential to bring together various disciplines so that we have a detailed and integrated picture of our current predicament as well as the capability to avoid, reduce or mitigate the problems that arise. Many concepts, along with their different vocabularies, have been used to enable this intermeshing of disciplines. Two of the most common are "environmental sciences" and "sustainable development". More recently, "circular economy" has come into currency. While all of these concepts are different, they share two important factors. First, all of them have an over-arching objective of addressing environmental problems. Second, the study of these rely – to some extent – on trans-disciplinary research.

In this communication, we identify some of the challenges and opportunities that are associated with each concept (epistemological and practical) that can either help or hinder inter-disciplinary efforts to address environmental challenges. Our specific objectives are to clarify and contrast the underlying premises of each concept, and to identify how they can be applied as a means of addressing contemporary environmental challenges. Although the purpose of the paper is to highlight the differences in the understanding, by various disciplines, of key terms linked to the environment, we do not cover all the disciplines or all the different interpretations.

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**Table 1**

Alternative environmental concepts in trans-disciplinary research.

	Definition	Core concept	Anthropocentric	Ecological objectives	Economic objectives	Social objectives	Internalization of environmental impacts	The application depends on some authority
<i>Concepts based on the natural environment</i>								
Environment	All the natural components of the Earth (air, water, soils, vegetation, animals, etc.) along with all the processes that occur within and among these components	System essential to and impacted by human activities	No	No	No	No	N/A	N/A
Environmental protection	Search for minimizing or reducing environmental impacts	Societal objective	No	Yes	No	No	Yes	Yes
Environmental sciences	Sciences that study the environment (and, in particular cases, solutions for its protection)	A set of scientific disciplines	No	No (Yes)	No	No	N/A (Yes)	N/A (Yes)
<i>Concepts based on inter-generational sustainability</i>								
Sustainable development	Meeting the needs of the present without compromising the ability of future generations to meet their own needs	Societal objective	Yes	Yes	Yes	Yes	Yes	Yes
<i>Concepts based on the models of economic production and consumption</i>								
Circular economy	Production and consumption of goods through closed loop material flows that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution)	Model of production and consumption	Yes	Yes	Yes	No	Yes	Yes
Linear economy	By opposition to the circular economy, production and consumption of goods that (partially) ignore environmental externalities linked to virgin resource extraction and the generation of waste and pollution	Model of production and exchange	Yes	No (Yes)	Yes	No (Yes)	No (Yes)	No (Yes)

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