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How economic thought evolved in the context of the 20th-century ecological crisis?

كيف تطوّر الفكر الاقتصادي في سياق الأزمة البيئية في القرن العشرين ؟

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Abstract:

Drawing on historical and comparative approaches related to economic challenges and philosophical issues, the purpose of this article is to examine how economic thought evolved with the 20th-century ecological crisis.

The originality lies in the analysis of the evolution process by a broad overview that brings together knowledge from different fields such as economics, ecology, philosophy, physics, and sociology. The main finding underscores that this crisis was an opportunity that allowed a renewal of economic thought by helping it to evolve both in terms of conceptual and methodological aspects.

Keywords: ecological crisis; ecological economics; economic thought; environmental economics; sustainable development.

JEL Classification Codes: A12, Q01, Q5, Q53, Q56, Q57.

ملخص:

بالاعتماد على المنهج التاريخي و المقارن المتعلق بالتحديات الاقتصادية والقضايا الفلسفية، فإنّ الغرض من هذا المقال هو دراسة كيفية تطوّر الفكر الاقتصادي تزامنا مع الأزمة البيئية في القرن العشرين. الأصالة تكمن في تحليل عملية التطور من خلال نظرة عامة واسعة تجمع معارف من مجالات مختلفة مثل علم الاقتصاد، علم البيئة، الفلسفة، الفيزياء و علم الاجتماع. تؤكّد النتيجة الرئيسية أنّ هذه الأزمة كانت فرصة سمحت بتجديد الفكر الاقتصادي من خلال مساعدته على التطور من حيث الجوانب المفاهيمية والمنهجية.

كلمات مفتاحية: الأزمة البيئية، الإقتصاد الإيكولوجي، الفكر الإقتصادي، إقتصاد البيئة، التنمية المستدامة.

تصنيفات JEL : A12, Q01, Q5, Q53, Q56, Q57

1. INTRODUCTION

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The 20th century was characterized by human achievements such as the growth of the world's population, overall improvements in living standards, and unprecedented technological progress. However, these three events were direct causes of the ecological crisis as shown in Ehrlich's equation (Impact = Population*Affluence*Technology or I = P*A*T) describing the anthropogenic impacts on the natural environment.

This crisis affects the whole planet through the problem of climate change, ocean pollution, species extinction, and melting glaciers. A United Nations (UN) report (2005), cited by (Aubertin & Vivien, 2006, p. 11), shows that 60% of ecosystems have deteriorated, while the *International Union for Conservation of Nature (IUCN)* predicts the extinction of 1/4 of mammals in the coming years. According to (Brown, 2003, p. 128), global goods and services production increased from $6 trillion in 1950 to $43 trillion in 2000 and caused environmental devastation on an unimaginable scale.

In the face of this exceptional and disastrous situation, several scientific disciplines were mobilized to seek the best solutions to these problems. Economics was one of them. In sum, economic alternatives revolve around concepts such as externalities, public goods, natural resources, co-evolution, entropy, and degrowth. These alternatives resulted in the emergence of environmental economics and ecological economics. They are joined by a fairly recent famous paradigm, that of sustainable development.

Drawing on historical and comparative approaches, this paper aims to answer the following research question: *how economic thought evolved in the context of the 20th-century ecological crisis?* By evolution, we mean that this science is a field in a perpetual renewal that is closely linked to events or phenomena that affect it.

The interest lies in the analysis of the evolution process through a broad overview that brings together knowledge from different sciences, such as economics, ecology, philosophy, physics, and sociology. Each process step is illustrating by a separate section in the present work (sections 2, 3, and 4).

The first section focuses on environmental economics, which governs nature as a subject to be integrated into the economic sphere and which perceives the environmental issue from externalities, natural resources, and public goods.

The second is devoted to ecological economics, which proposes concepts such as entropy and co-evolution. This branch of economic science is also a society project, which advocates new consumption practices based, among other things, on the dematerialization and the purchase of the most valuable goods.

The third deals with the sustainable development paradigm, which can be understood as a synthesis that encompasses ideas of two previous fields. It represents the final stage related to economics evolution, which sees economic growth, social equity, and ecological sustainability as current and future pillars of a global society.

2. Environmental economics: when the ecological crisis is a result of the market failure

The recurrence and the amplification of human damages on the natural environment have led economists to conceive and propose a scientific project able to find some solutions to the ecological crisis. This project emerged, from the 1960s onwards, under the name of environmental economics, reflecting the opening up of economic thought on an issue long perceived as extra-economic and on which the theme of scarcity was to be applied.

Environmental economics gradually becomes the main economic domain in charge of the environmental concern thanks to a group of economists with a set of tools, theories, and key concepts. Its conceptual and methodological foundations are rooted in welfare economics, which in turn, depends on principles of neoclassical economics. The study of utility is one of its focal points.

If many economists argue that the source of the environmental problem is the fact that the price system simply is not applied to many of society's resources (Baumol, 1971, p. 340), this problem also arises at a time when the market does not compensate for the individual loss of utility. Cited by (Faucheux & Nöel, 1995, p. 177), Godard (1993) affirms that the criterion of the existence of problems does not belong to the environmental sphere; it is exclusively internal to the theory of economic regulation of the market.

The loss of utility is caused by the market system failure that generates negative external effects or diseconomies. Specifically, the economic calculation is wholly or partly biased with the presence of these externalities, leading to poor resource allocation and even less to a state of *Pareto Social Optimum (PSO),* beyond which no one can increase his profits without reducing those of another.

Hence, the concept of externality plays a key role in environmental economics (Bonnieux & Desaigues, 1998, p. 09).

From there, environmental economics seeks formalized alternatives to identify an *optimum* level of pollution by reintroducing multiple anthropogenic externalities -all types of pollution- into the commercial exchange. For (Cropper & Oates, 1992, p. 678), the standard approach in the environmental economics literature characterizes pollution as a public "bad" that results from "waste discharges" associated with the production of private goods.

In addition, it considers two other elements for analysis which are social costs and public goods. The first is defined as the costs borne by the entire community; the second is presented by the two following characteristics:

- Non-rival: the use of a good by one individual does not prevent its use by another;
- Non-excludability: no one is excluded from the consumption of that good made available to all.

Despite its scientific contribution to the environmental revolution that began in the early 1960s, environmental economics has, however, a number of limitations. This would be due to the philosophical origin on which it is based, that of anthropocentrism. According to (Washington & Maloney, 2020, p. 01), neoclassical economics has been dominated by anthropocentrism. In this approach, the environment must be reduced to a simple subject of the economic system, with the man positioning himself as the bestower of orders (master/slave relationship). The business framework regulates all kinds of ecological life.

Environmental economics would be implicitly tempted to see nature as a large reservoir of services and vital assets with instrumental value to humans. From utilitarian thought, biological ecosystems are not useful in absolute terms and have no inherent value; their only value depends solely on their degree of satisfaction with human needs. Economic agents give value to environmental goods in line with their present or future utility.

This unethical aspect of anthropocentrism and environmental economics justifies the use of monetisation practices of nature, as in the Cost-Benefit Analysis (CBA), which attempts to provide a price or monetary valuation of natural assets. It presupposes that everyone maximizes his utility and, under strict conditions, maximizes the well-being of all without considering the losers who bear the costs.

Nonetheless, these assets do not really have a fair price because of their vital importance to present and future generations; CBA can never be socially credible.

The language of economics (and of monetary CBA) is powerful but it is not always powerful enough. Economists claim that all externalities just need to be internalized in the price, but reality shows that not everything can have a price tag (Temper, Demaria, Scheidel, Del Bene, & Martinez-Alier, 2018, p. 575).

This same utilitarian idea allows another device to regulate externalities, namely the Market for Tradable Emission Permits (MTEP). Designed by Dales (1968), it is based on the fact that public authorities grant pollution permits -e.g. CO2 or SO2 permits- to companies. This leads us to ask ethical questions: *how can man define property rights to harm the public goods, such as the air we breathe? Does it have the right to privatize the use of goods belonging to the society? Does this market not pave the way for other practices that are even more unfair to natural ecosystems?*

Environmental economics also has blind faith in the market for potentially better allocation of natural resources and in technological progress, which could reduce or avoid pollution emissions. It is incorrect to believe that technology is the best solution and may even be the only way to reconcile financial profits, economic growth, and environmental protection.

For the reasons mentioned above, environmental economics is not able to effectively carry out its undertaking to find an appropriate perspective on environmental issues. The lack of openness to other disciplines and its selfish approach to the relationship between man and nature are its major weaknesses.

Environmental economics, as it is currently developing after two decades of maturation, has neither the vocation nor the power to solve all problems. Ecology, sociology and, we firmly believe, ethics have to take their full place. The economic criterion is not universal, even though it may seem to be a winning one (Barde, 1992, p. 45).

3. Ecological economics: when the ecological crisis is a result of the economic science crisis:

Ecological economics represents an interesting field in which economic thought evolves by the use of knowledge from heterogeneous disciplines, including ecology, biology, and physics -thermodynamics-. According to (Costanza, 1991, p. 335), it is not a new discipline, but rather a new pluralistic way of looking at

problems which goes beyond the normal conceptions of scientific disciplines and tries to integrate and synthesize many different disciplinary perspectives. Its foundations are justice, sustainability, efficiency, and value pluralism (Bliss & Eglera, 2020, p. 01).

Obviously, this holistic or systemic and transdisciplinary research avenue, which had its first modern foundations around the 70s, is not the result of an intellectual coincidence. As (Ropke, 2004, p. 297) states, it is the consequence of several social changes and related discourses on the new conceptualization of pollution, the dramatic increase in world population, the question of the sufficiency of food and other resources, and the discourse on energy. Among other things, ecological economists emphasized the need to shift from a throughput-based, open-ended economic system to a circular one. (Bruel, Kronenberg, Troussier, & Guillaume, 2019, p. 14)

Ecological economics perceives the environmental crisis as a consequence of failure of the economic science. In contrast to environmental economics, it refutes the premise of standard economic theory which emphasizes that natural resources are free at all times and increasing human consumption can not affect the normal functioning of ecosystem services. It also rejects that only marketable commodities are value generators and that externalities are an exceptional case in the market game.

It is concerned with the interrelationships between the economy and the physical and biological processes of planet Earth on which this economy depends through a general approach called systems ecology (Godard, 2004, p. 03). Adopting the idea of taking into account biophysical stocks and flows that pass through a social system -the metabolism notion- is a way of including the economy in the bosom of life sciences and of considering that economic development is the pursuit, on another level, of biological evolution (Froger, Calvo-Mendieta, Petit, & Vivien, 2016, p. 14). This is the reason why ecological economics is also called "bioeconomics".

In other words, it seeks to identify conditions for the economic sector reintegration in the natural domain. The economy is part of a social organization that must itself be part of all living systems, otherwise, its conditions of the reproduction will be thwarted. Thus, the question of the critical size of the economy is raised. Authors such as Daly and Farley recommend a definition of economic growth following the practical sense of resources and raw materials quantity used

by humans. Growth should no longer be seen as an annual rise in the GDP but as a process causing damages on natural goods.

Additionally, the co-evolution between natural and anthropogenic systems can not last over time; it is, unfortunately, be a kind of zero-sum game where the environment loses out. From there, ecological economists suggest bettering describe the ecological footprint of economic activities. One of the key principles is the integration of physics features within economic scale by means of the law of energy degradation designed by Georgescu-Roegen in his seminal book *The Entropy Law and the Economic Process* (1971). This law postulates that the economic sector extracts energy and matter in low entropy and converts them to high entropy.

The use of thermodynamics rules in economics shows that the cyclical phenomenon of economic growth in a resource-limited world is a myth and it is causing an entropic increase. This indicates that the problem of pollution and resources depletion is just an ever-increasing entropy; depletion is not quantitative as the matter remains, but rather qualitative.

The industrial activity in which a very large part of mankind is now engaged speeds up more and ever more the depletion of terrestrial resources. It must, therefore, come to a crisis. Sooner or later "growth," that great obsession of both standard and Marxist economists, must come to an end. The only question is "When"?. (Georgescu-Roegen, 1977, p. 364).

The alternative comes from the degrowth, the zero growth, or the steady-state predicted, in his day, by John Stuart Mill and included in the report *The Limits to Growth* (1972) published by the Club of Rome. Georgescu-Roegen, therefore, called for a slowdown in the pace of consumption by rejecting useless objects and advocated a new society project based on useful consumption.

Depending upon philosophical roots of ecocentrism, ecological economics aims to introduce certain ecological morality or ethics into economic practices and discourses. Through this approach, ecological economists acknowledge that natural resources have an intrinsic value that gives them the right to exist. For (Bansal & Roth, 2000, p. 733), who draw on various works (Gladwin et *al.*, 1995; Purser et *al.*, 1995; Shrivastava, 1994), within ecocentrism, nature has centrality, and all biophysical systems, including humans, are integrated parts of nature.

Ecocentrism removes from human beings all legitimacy and power to control and to modify biological diversity; every animal and plant species have the right to live. Moreover, inter-generational ethics should take priority over intra-generational ethics: it may mean sacrificing part of today's well-being so that it can be preserved or even strengthened for future generations. The degrowth movement that originated in the 1970s is an ideal example of this.

It is difficult, nevertheless, to implement because it would be associated with unemployment, deflation, and a downturn of economic life. People will never want to live in a precarious situation or risk their jobs for the good of the world. That is the dilemma of ecological economics.

4. Sustainable Development (SD): when the ecological crisis is a result of the development model crisis

In the second half of the 1980s, economic science experienced its third stage of evolution in the context of environmental crisis, with the emergence and dissemination of the sustainable development paradigm that had a major contemporary impact. Needless to say that few concepts have had such a broad echo as SD; for more than 30 years, it was almost impossible to have a social, economic, or political measure that was not justified by it.

As a reminder, SD took over from another concept conceived without success by Ignacy Sachs in 1973, which is eco-development. Historically, it has emerged from the concept of development, which is defined as a structural movement of the qualitative transformation of a society in its institutional, political, socio-cultural, economic, demographic, and technological aspects. Strictly speaking, it is fundamentally the improvement in the life quality of individuals, families, and communities.

Measured by the UN thanks to the Human Development Index (HDI) established through Amartya Sen's work on poverty, SD also is a universal philosophy based on *think global-act locally*. Sustainable development is not a discipline of economic science. Nor is it a theory, but rather a general scientific orientation adopted by heterodox and orthodox economists who have opened up a new research avenue for studying the development phenomenon.

Sustainable development has become the buzzword in development discourse, having been associated with different definitions, meanings and interpretations (Mensah, 2019, p. 05). One of its interpretations is that the standard

of living in highly advanced countries must be maintained and that there must be the improvement in developing or emerging countries while ensuring a global ecological balance, both today and tomorrow.

According to the famous Boulding's metaphor (1966), the SD paradigm could be a middle ground between cowboy economy without limits and spaceman economy, in which the earth has become a single spaceship, without unlimited resources. It is indeed a middle ground between the two preceding disciplines. If, on the one hand, the SD rejects the neoclassical model with its myth of infinite growth present in environmental economics, on the other hand, it rejects the radical vision of the degrowth linked to ecological economics.

The compromise reached by sustainable development is embodied in a long-term global society project that accepts growth as a driver of development, but only on the condition that it is socially equitable and ecologically sustainable. To achieve this, SD depends upon a perfect balance between intra-generational and inter-generational ethics: no generation is led to sacrifice its development mode; it must work only so that this development can be improved and continued over time.

This rightly raises a critical question, which would be that of the compromise between sustainability prospects and, therefore, the stock of capital to be legacies or the degree of substitution between natural assets and manufactured capital. As (Costanza, et al., 1997, p. 254) put forward, the capital stock takes different identifiable forms, most notably in physical forms including natural capital, such as trees, minerals, ecosystems, the atmosphere and so on; manufactured capital, such as machines and buildings; and the human capital of physical bodies.

Ecosystem services are provided by slowly evolving ecological funds, particular configurations of living creatures, water, solar energy, soil, minerals, and so on that are not physically transformed into the services they provide, but whose individual components can be physically transformed into economic products and waste (Farley & Washington, 2018, p. 446). Specifically, economics proposes two ways for non-decay of the capital stock *via weak sustainability* and *strong sustainability*. The first is inherent in environmental economics and believes that generations should transfer to each other with constant or increasing but never declining total capital. This means that any decrease in natural resources must be offset by an increase in manufactured goods.

It admits a perfect substitution between the two forms of capital which is guaranteed by technological progress. As an economist, we firmly believe that the weak sustainability is harmful to the environment in that biological diversity or living ecosystems have economic and extra-economic functions that can never be compensated for by man-made capital. Furthermore, future generations have the same right as the current one to benefit from environmental goods; they should not be subject to a decline in natural capital stock.

In contrast to weak sustainability, strong sustainability follows the spirit of the ecological economics and postulates that generations should transfer to each other non-decreasing natural capital stock. This principle overturns any absolute substitution between manufactured capital and natural assets, any pollution, and, ultimately, any possibility of economic growth. Consequently, while the weak sustainability depends closely on technical reasoning, strong sustainability insists on purely ecological reasoning.

The non-decrease in environmental resources stock can be ensured despite the reduction or disappearance of some of its elements, provided that others can proportionally reproduce themselves. For (Daly, 1990, p. 40), sustainable development must deal with sufficiency as well as efficiency. He establishes three (03) principles:

- Technological progress should be efficiency-increasing rather than throughput-increasing;
- The harvesting rates of renewable resources should not exceed regeneration rates, and that waste emission should not exceed the renewable assimilative capacity of the environment;
- Nonrenewable resources should be exploited at a rate equal to the creation of renewable substitutes.

In spite of its many achievements, the SD should be clearer. For example, setting more precisely the concept of needs that are certainly different from one generation to another, or the principle of North-South solidarity, in so far as maintaining the standard of living in developed countries could mean maintaining the same level of growth, more extraction of natural capital, more pollution, and thus accentuating the environmental crisis.

Table 1. Comparison grid

	Environmental economics	Ecological economics	Sustainable development
Aspect	Economics discipline	Economics discipline & society project	Economics paradigm & society project
Time origins	The 1960s	The 1970s	The second half of the 1980s
Type of knowledge	Economic	Multidisciplinary	Multidisciplinary
Main reference	Externalities theory	Entropy law	None in particular
Key concepts	Externalities, social cost, public goods, utility	Co-evolution, entropy, degrowth	Weak & strong sustainability, capital stock
Philosophical principles	Anthropocentrism	Ecocentrism	Conciliation between both
Economic growth	Fundamental	Not-essential	Conditionally essential
Cause of ecological crisis	Market failure	Neoclassical theory	Development model
Substitution between manufactured and natural capital	Possible	Impossible	Conditionally possible
Co-evolution between nature and mankind	Possible	Impossible	Conditionally possible

Technical progress	Fundamental	Not-essential	Conditionally essential
Time perspective	Short-term	Long-term	Long-term

Source: Author's own work

5. CONCLUSION

Since its birth in 1776, modern economic thought has always grown and flourished itself in times of prosperity and in times of crisis. Even if the crisis appears to be a threat, economic science sees it as an opportunity. The Great Depression of 1929, for example, was a source of criticism of the mainstream (neoclassical theory) and dissemination of the Keynesian revolution, which encouraged the conceptual and methodological renewal of this science.

Similarly, the ecological crisis observed in the 20th century triggered an intellectual movement that began with the emergence of environmental economics in the 1960s. This was followed, some ten years later, by an antinomic discipline, namely ecological economics. These domains were already conceived, in the 18th and 19th centuries, by prominent authors like Smith, Malthus, Mill, Ricardo, and Marx.

Economic science continued to leverage of the ecological crisis by combining environmental economics and ecological economics in the same paradigm, that of sustainable development. Nowadays, it is representing the final stage in the evolution of this science over a *continuum* of more than half a century.

The finding shows that environmental challenges are beneficial to economics by helping it to evolve both in terms of conceptual and methodological aspects. This evolution also highlights the lack of a "one best way"; each stage complements the previous one according to the principle of continuous improvement and accumulation of knowledge.

In the end, we suggest that future studies on environmental concern go beyond the simple economic framework. Using a multidisciplinary viewpoint -theories and concepts from other sciences- will lead to a greater

understanding of the world we live in and, therefore, make it easier to solve many problems of society.

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