APPROACHES TO THE CONCEPT OF SUSTAINABILITY IN ECOLOGICAL AND ENVIRONMENTAL ECONOMY

GÖNCZI József
Doctoral School of Economic Sciences, Faculty of Economic Sciences, University of Oradea, Romania
jozsef.gonczi@rove.ro

Abstract: *In the economy, there are different approaches to sustainability. In this article I want to present the differences of approach of sustainability in the environmental economy and the ecological economy although the line between the two tendencies is not always emphasized. Focusing on differences by systematizing positions on the sustainable dimension of the economy and decision-making procedures related to nature. For this I will present the definitions of the environmental and ecological economies drawing attention to the differences and similarities. Using a high degree of simplification, they are the growth-oriented environmental economy, and the stable (equilibrium), dimension-oriented ecological economy (Turner, 1999). It is particularly tempting to combine these approaches with the two concepts of sustainability that stand out in professional debates, the theory of weak and strong sustainability. Perhaps this is also why this distinction is often used in international literature in relation to sustainability (Schaltegger – Burritt, 2005). Researchers usually see the difference between weak and strong sustainability in terms of natural and artificial capital. According to the theory of poor sustainability, natural and artificial capital are fundamentally substitutable. Thus, in order to meet the sustainability criterion, it is sufficient that the combined value of the two types of capital does not decrease, i.e. the destruction of a natural resource creates an artificial capital of at least the same value. According to the theory of strong sustainability, natural capital is not, or to a very small extent, substitutable for artificial capital, and therefore constitutes an absolute constraint on external sustainability, the minimum level of which must be maintained in order to be sustainable. However, this distinction is problematic in several respects. On the one hand, different authors define - up to four - different theories along the strong / weak sustainability dimension (Goodland – Daly, 1996, Turner, 1988). On the other hand, sometimes different concepts are behind the same names (Goodland – Daly, 1996, Turner, 1988, Gutés, 1996, Kerekes, 2006, Fleischer, 2006). Moreover, the theories of strong and weak sustainability do not necessarily differ in determining the path to sustainability. According to some interpretations, the theory of strong sustainability defines the conservation of the value of natural capital as a criterion of sustainability, which in itself reflects a traditional approach of the environmental economy.*

Keywords: *sustainability; environmental economy; ecological economy.*

JEL Classification: *A10.*

1. Introduction

Environmental economics is a sub-field of economics concerned with environmental issues. It has become a widely studied subject due to growing environmental concerns in the twenty-first century. Environmental Economics "...undertakes theoretical or empirical studies of the economic effects of national or local environmental policies around the world... .” Particular issues include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming.
Ecological economics, also known as “bioeconomics” of Georgescu-Roegen, “ecolonomy”, or eco-economics, is both a transdisciplinary and an interdisciplinary field of academic research addressing the interdependence and coevolution of human economies and natural ecosystems, both intertemporally and spatially. By treating the economy as a subsystem of Earth's larger ecosystem, and by emphasizing the preservation of natural capital, the field of ecological economics is differentiated from environmental economics, which is the mainstream economic analysis of the environment.
Nicholas Georgescu-Roegen was one of the first economists to argue that an economy faces limits to growth as a result of resource depletion.
Nicholas Georgescu-Roegen in his 1971 work "The Law of Entropy and the Economic Process", in which he argued that all natural resources are irreversibly degraded when used in economic activity.
In the economic debate, sustainable development is most often described as the need to maintain a permanent income for humankind, generated from non-declining capital stocks (Hicksian income).
"Sustainable development is that development process that responds to current needs without jeopardizing the ability of future generations to meet their own needs. (.....) In order to achieve the goal of sustainable development, environmental protection will be an integral part of the process development and cannot be approached independently of it. " Source: Declaration on Environment and Development, Rio de Janeiro, 1992.
In addition, the environmental economy and the ecological economy are practically unified in the fact that nature (natural capital) is the basis of the whole economic activity (Turner, 1999). Thus, differences of opinion regarding sustainability in these tendencies are not primarily (or at least not only) determined by the debate on the relationship between artificial and natural capital linked to poor or strong sustainability. Rather, the difference is found in the starting points of the approach of the environmental economy and the ecological economy.
Several studies have examined the differences between the interpretations of the environmental economy and the ecological economy of sustainability (and the two disciplines in general), indicating that there are actually different approaches to sustainability in the economy (Munda, 1997), Kocsis, 1999), Spash, 1999), Turner, 1999), van den Bergh, 2001), Pearce, 2002), Gowdy - Erickson, 2005), Röpke, 2005), Venkatachalam, 2007).

The ecological and environmental economic approaches differ in that, while the first does not necessarily consider economic growth as a sustainable process, the second does not question the sustainability of economic growth. The reasons for this difference are practically three differences of perspective: different perceptions about the nature of the economic process, the role of nature in the economic process and technological change.

2. Methodology of the research

The material aims to analyze the differences regarding the approach of sustainability in the perspective of the environmental economy and the ecological economy. The research methodology for this work was mainly secondary research, the collection of information found from the processing of data from secondary sources, data that were collected, systematized and analyzed by other researchers.
Browse articles were selected from Google Academic by number of citations.

3. Differences of perspective on sustainability in the environmental economy and the ecological economy

3.1 Nature of the economic process

Environmental economy models try to capture the role of nature in the economic process, primarily through the notion of externalities. In the field of welfare economics, the possibility of separating the individual and social marginal costs was known due to the appearance of costs that are not reflected in the price and are not borne by the manufacturer. If these costs caused by external economic effects (such as pollution) are internalized, the market mechanism uses natural resources efficiently, social optimum is ensured (van den Bergh, 2001, Pearce, 2002, Gowdy – Erickson, 2005). In order to ensure an optimal level of social externalities, the environmental economy offers several tools. These are, on the one hand, administrative tools or rules for pollution, which, however, due to their low efficiency, are not usually supported in particular by economic thinking (Gustaffson, 1998).
The research of the environmental economy focuses on the possibilities of reducing pollution at an efficient, economically optimal level. According to this approach, the sub-optimal transformation of nature is primarily a problem of market failure, that is, efficiency. In this process, nature (natural resources) traditionally appears as a production resource, an environment that absorbs pollution and offers a direct value of pleasure (this is the role of nature in the economic process in this trend) (Röpke, 2004), that is, the purpose of the environmental economy is to extend the neoclassical methodology developed to the recently recognized problems.
In comparison, the ecological economy, examining the economic process from a physical point of view, concludes that it is not necessarily inseparable from the biosphere's growing transformation. The economy does not create or destroy matter and energy, but only absorbs and releases them continuously. Consequently, the important effect of economic growth (more precisely, the increase in the value of physical goods produced in today's economy) in our subject is that the amount of

material and energy absorbed by the environment increases. According to this approach, resource extraction and waste disposal - essentially biosphere transformation - are not exceptional events, but rather integral parts of economic activity, almost necessary at the same time (Röpke, 2004, Vitousek et al., 1997, Takács-Sánta, 2004). Translated into the language of the environmental economy, every economic moment necessarily involves a transformation of the biosphere, that is, an external influence.
As a result, an important area of research in the ecological economy is the evolution of the absolute extent of the transformation of the human biosphere. To this end, indicators such as net primary production (PPN) or proportion of net primary onshore production (PPNO), expropriated by humans, are used (Rojstaczer et al., 2001, Haberl et al., 2007a, 2007b). A second group of methods tries to take into account material flows at different levels of territorial units. These include material flow analysis, which already has a standard methodology and is also used in environmental economics (Hinterberger et al., 2003), and input-output analysis of material flows (Hubacek – Giljum, 2003). Included is the method of ecological footprint, which aims to capture sustainability in relation to land use.
Although the increase of the size of the economy (which is usually identified as a growth of GDP) can, in principle, be separated by the extension of the biosphere transformation, according to the ecological economy, there is no evidence in this regard in practice. Moreover, based on available empirical data, we tend to see the opposite (Stern, 2004).
Thus, according to the ecological economy, the problem of changing the biosphere is not a consequence of a major or minor deficiency of a possible efficient mechanical mechanism, but an integral part of the economic activity and potentially growing continuously as the size of the economy grows. Thus, if nature is a "resource" necessary for all economic activities and human needs and cannot be replaced by others, then the question arises as to the size of the economy that the biosphere can still support. In order to do this, however, it must be examined whether nature really offers "services" irreplaceable to the economy.

3.2 The role of nature in the economic process

In the economy of the environment nature has emerged as a productive resource, an environment that absorbs pollution and offers a direct value of pleasure (Röpke, 2004). However, this position seems to change, as natural capital and its properties are also increasingly cited by environmental economics (Turner, 1999), Pearce Researchers agree that nature provides different services for the functioning of the economy. and society, for which there are several different groups (Ekins et al., 2003, MEA, 2005, Fisher et al., 2009). One of the most common definitions of ecosystem services to date is the definition of Ecosystem Assessment. of the millennium, which refers to the tangible and intangible benefits that society offers to society from natural and man-made ecosystems (MEA, 2003). The most accepted typology of ecosystem services to date is also the Millennium Ecosystem Assessment. This functional typology distinguishes four groups: these are production-related services (such as food, raw materials, forages), regulatory

services (such as climate regulation, flood protection, pollination), cultural services (such as education, recreation, artistic inspiration) and support services (such as the nutrient cycle). (MEA, 2005).
All groups agree that nature provides essential services to the economic system and human life (ecosystem services) through ecological processes (ecosystem processes) maintained by biodiversity. The relationship between ecosystem services and ecosystem processes can be defined in such a way that the former can only occur as a result of the latter - while ecosystem processes are the result of biodiversity.
Due to the more severe damage to biodiversity and ecosystem processes (UNDP et al., 2000, WWF, 2004, 2006, MEA, 2005), human biosphere transformation activities that threaten ecosystem services are increasingly much a cardinal problem in the social economic system. This is due to the fact that at least three major economic problems arise in relation to the change in the functioning of the biosphere by humans (Ehrlich - Wilson, 1991):
- deterioration of the aesthetic quality of nature;
- reducing economic opportunities and
- loss of vital services of the ecosystem
These effects occur because the human modification of the biosphere affects the quality of ecosystem processes. This change can greatly reduce the future possibilities of tangible goods, increase the uncertainty about their availability, since natural processes are direct or indirect sources of human welfare, goods provided to human societies. On the other hand, according to our knowledge, certain ecosystem services (such as ecosystem processes or biodiversity) are virtually irreplaceable to one another or to human technology on a larger scale (UNDP et al., 2000, Gustafsson, 1998, Daily, 1997).
Environmental economics and ecological economics are united in that as the rate of human biosphere transformation activity increases (through loss of biodiversity and damage to ecological processes), ecosystem services may be lost, leading to a large reduction in human potential.
This is also indicated by the large-scale survey already mentioned on environmental economists and ecological economists (Illge - Schwarze, 2009), according to which both environmental economists and environmental economists reject Solow's utility-based approach to what regards sustainability and sustainability as a conservation of development capacity. There is also a consensus that the resources that will be essential to humanity for a very long time will not be identified at present.
However, this does not mean that followers of both tendencies would draw similar conclusions about nature and the quantity and quality of natural resources that should be preserved for future generations. On the one hand, it can be concluded that as a result of uncertainty, as many natural resources as possible should be conserved, in accordance with the precautionary principle. On the other hand, it can be concluded that it is not necessary at present to limit the use of resources, because the lack of key resources currently encourages technological innovation to replace them.

The "prudent" position of sustainability is characteristic of the ecological economy and the "techno-optimistic" position of the environmental economy, and this difference is due to the different perceptions of the technological change in the two tendencies.

3.3 The role of technological changes

Technological change is important for sustainability, if it is very receptive to start-ups, starting with the valid growth and sustainability of technologies in the form of the main movement.

1. the problem of replacing eco-efficiency,
2. the uncertainty related to the reflexivity of the technological change and
3. the effect of recoil.

Traditional economic thinking highlights two basic aspects of technological change: increasing productivity (changing the shape of the production function) and new possibilities for substitution between factors. It is clear that market processes encourage the conservation of natural resources, that is, increasing the ecological efficiency, based on the same mechanisms as the labor-saving innovations. By increasing the environmental efficiency, the innovator will be able to obtain a lower unit cost than its competitors and will offer more favorable solutions to consumers (such as a very significant reduction in the energy consumption of the bulbs or the fuel consumption of the vehicles). However, even with large increases in eco-efficiency, it may be necessary sooner or later to replace some resources with others. The technological change that allows the replacement is mainly generated by market processes (changes in relative price ratios). The effect of relative price ratios on the direction and speed of thirteen changes is examined in detail by induced innovation theories (Ruttan, 1997). Basically, I return to Hicks's 1932 hypothesis that "changes in the relative price of resources are themselves an incentive for an invention or a certain type of invention - to make it more economical to use a factor that has become relatively expensive" (Jaffe et al., 2003, P. 470).

Therefore, the market mechanism allows for an increased energy supply and a greater role for economic operators. And we can achieve continuous sustainable growth as well as through our ability to increase ecological efficiency.

At the same time, the ecological economy is based on quite skeptical changes, while the evolutionary economy is hereditary. There are two fundamental sets of critical observations against induced innovation theories.

The first critical criterion comes from the use of technology, which comes from positive feedback and starts from its dependence on changing path. Choosing a particular technological solution can bring additional benefits to both the producer and the consumer, as well as creating negative externalities compared to other competing solutions. Thus, the world of technological change is characterized by positive feedback and dynamic increasing returns (David, 1985, Arthur, 1989, 1990, 2006). Therefore, the various properties of the technologies are completely transparent and subsequently create main allocation problems (Arthur, 1989, 1990):

- unpredictable: long-term holdings are unpredictable, some uncertainties are not mediated.

- inflexible: a single technology allows support or benefits if everyone is able to influence future choices.
- path dependent (non-ergodic / path dependent): different series (optional) can be directed to different outputs.
- inefficient route: it may be the case that it is only worth choosing one solution because it has already been chosen by several people. In other words, it can happen as a "shutdown", this solution will be better than another, because many people have already chosen it.

In addition, the resulting structure can not only screen out incompatible innovations, but also influence the direction of the search for novelties. (Nelson, 1995) A general opinion is formed about the desired development directions, the significant problems, a technological regime or paradigm is formed. (Dose, 1982, Kemp et al., 1998).

In this way, there may be a number of obstacles to the spread of technological solutions that are more eco-efficient or offer new possibilities for substitution; historically established structures and systems can be a very serious obstacle to the replacement of existing (possibly less favorable) versions. Thus, changes in price ratios are only one - and not necessarily the most important - influencers of technological change.

Another fundamental set of critical remarks against theories of induced innovation calls into question the implicit assumption that economic actors would in all cases be able to anticipate their needs, to force the creation of a solution with optimal productivity. According to the evolutionist explanation of technological change, the global objective function, a defined set of choices, maximization, and rational decision-making are unsustainable assumptions about innovation processes (Nelson – Winter, 1982, Dosi – Nelson, 1994).

Uncertainty is an essential element of technological change. It is not just a problem of cognition, but an inseparable element of the process (Hronszky, 2005). This is clear from the positive feedback mechanisms analyzed earlier, but it is also central to theories that discuss the innovation process in depth (Marinova – Phillimore, 2003, Fagerberg, 2005).

Uncertainty is not only about the direction of technological change, but also about the social and environmental impacts of individual innovations. The previously explained systemic operation of the biosphere and the multitude of factors influencing the given technical conditions (Ropolyi, 2004) make it theoretically impossible to predict the effects of new solutions. In addition, a new technological solution can change the conditions under which it was created and thus its own potential effects (reflexivity). A significant portion of today's new technological solutions seek to remedy the (often unforeseen) problems caused by previous solutions (Beck, 2003).

With regard to the introduction of new technological solutions, there is therefore good reason to assume that they will have effects (for example on the natural environment) which cannot be foreseen. In addition, as a result of increasing innovation activity, the time available for possible adaptation is decreasing.

It is further complicated by the fact that many of them are not detectable in the usual way (by the senses). These, to use Beck's, 2003) terminology, are modernization

risks and are based on causal interpretation and are created in the (scientific) knowledge that applies to them. In this way, however, social processes and institutions significantly influence their recognition (recognition of their existence at all) and the search for solutions.
This is well illustrated by the change in the discipline of technology assessment, which studies the future effects of new technologies. Initial hard (expert) methods have been confronted with limitations, so the focus has increasingly been on channeling the widest possible range of possible perspectives and interpretations (Schot, 2001, Hronszky, 2002). The emphasis on evaluation has become more and more influential (even in the early stages of development), as at the time of impact recognition, due to the positive feedback mechanisms analyzed earlier, the scope for change may be limited.
Examining the relationship between technological change and sustainability, we considered the phenomenon of rebound effect to be the third fundamental topic. This suggests that an increase in the productivity of a natural resource does not, in most cases, reduce factor use to the extent that would be expected from the extent of efficiency gains. Moreover, in many cases it is directly related to the increased use of the resource (the latter case is called the Jevons paradox).
For example, an increase in the fuel efficiency of motor vehicles has been accompanied by an increase in the number of cars and kilometers traveled (Kemp et al., 1998, York, 2006). In parallel with the introduction of energy-saving solutions in households, we observed an increase in the size of residential units, higher room temperatures, and increased use of electrical household appliances (Hanssen, 1999).
The articles dealing with the rebound effect are relatively uniform in that some of the savings that can be gained through efficiency gains are “taken back” by users. There can be many direct and indirect channels for this (Alcott, 2005, York, 2006, Sorell, 2009):
- The relatively cheap factor becomes attractive, so the number of consumers may increase compared to the previous one, and the actors prefer technologies based on the given factor in investment decisions. It can also help develop previously unknown applications for the resource.
- The savings gained through efficiency gains can be spent by consumers on increased consumption of a given product or on the consumption of another (sometimes more resource-intensive) product. By reducing unit costs, companies can gain a competitive advantage that can result in increased sales volumes.
However, the literature on the extent of the rebound effect and the causal relationship between efficiency gains and increasing use is far from uniform. The extent of the rebound effect should be expressed as a percentage of the expected resource savings based on the efficiency increase.
This is greater than zero in almost all cases, but some authors say only more than a hundred in special cases (so it actually causes an increase in use). It is currently difficult to resolve this debate, as the cases supporting the Jevons paradox mostly concern energy-intensive technologies with a wide range of applications (Sorell,

2009), while empirics are necessarily limited to a certain period, sector, or country / group of countries (Alcott, 2005).
However, many of the previously mentioned examples and other empirical data (e.g. Polimeni – Polimeni, 2006, Herring – Roy, 2007) show that it is not uncommon to move together to increase the efficiency of a resource and increase its absolute use. However, proof of causation poses a number of problems, as on the one hand, increasing use may be due to many other factors, and on the other hand, the methodology of studies supporting the Jevons paradox is not conclusive in this respect (Alcott, 2005, Sorell, 2009).
In any case, however, the savings that can be gained through increasing eco-efficiency can almost never be fully realized. In particular, in the case of resources that can be widely used and the strong dependence of the technologies associated with them, it is expected that the absolute use of resources for a given resource, but even more so for the economy as a whole, will actually increase. In terms of the rebound effect, it can therefore be assumed that increasing eco-efficiency alone is not enough to increase sustainability, and may even have the opposite effect.
In this chapter, we have identified radically different positions in all three areas related to the sustainable size of the economy. While research topics and positions in the environmental economics literature do not fundamentally question the sustainability of economic growth, the literature on ecological economics clearly does so.
The reasons for this difference are mainly to be found in the fact that environmental economics is typically market- and money-centric (i.e. treats environmental characteristics as external), while ecological economics shows that empirical studies so far show that economic growth is increasingly transformed by the biosphere. which can lead to the loss of vital ecosystem services. Moreover, according to ecological economics, we are / will be much less likely to be able to replace these ecosystem services with artificial capital through technological change than according to environmental economics. Contrary to the latter's "techno-optimistic" approach, ecological economics takes a kind of "cautious" view of sustainability, which is why the most important thing today is to become aware of what we do not know about sustainability (O'Hara, 1996). Thus, contrary to Bartus's, 2008) statement, it does not seek to determine the optimal size of the economy, in fact, it seeks to avoid or go beyond the instrumental optimization-centric approach of environmental economics, given primarily the scientific uncertainty related to sustainability

4. Conclusions

In the study, different economic approaches to sustainability was analyzed, systematizing them into positions of the environmental economy and the ecological economy. Some aspects in which the two tendencies can be considered relatively uniform, was identified, even from these "common points" the two paradigms often draw different conclusions.

The economy of the environment approaches sustainability with the approach and tools of the neoclassical welfare economy, while the ecological economy uses a transdisciplinary, problem-oriented approach. Based on the integration of other social and natural sciences knowledge, important for sustainability, the ecological economy questions the reductionist points of view and the solutions of the environmental economy. The causes of environmental problems are considered to be far deeper than a market failure problem and urges radical institutional changes to be made towards sustainability.

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