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ABSTRACT

The objective of this study is to comprehend the conceptual logic of industrial districts, *milieux innovateurs* and industrial clusters through theoretical perspectives in environmental economics. As a theoretical framework, we used foundations of Productive Agglomerations, Sustainability, the Border Strip subregion, and Environmental Economics (Environmental Neoclassical Economics and Ecological Economics). Regarding the methodological aspects, this study consists of a reflective theoretical essay developed from qualitative research, using bibliographical research and content analysis for data processing and organization. The results show interpretations in the sense that, from a theoretical point of view, industrial districts, *milieux innovateurs* and industrial clusters (productive agglomerations) are aligned with the assumptions found in environmental economics (Mainstream Neoclassical Economics), to the detriment of the theoretical concepts in ecological economics. However, environmental neoclassical economics and ecological economics converge in the understanding that scientific and technological progress are fundamental to increase efficiency, in general, in the use of renewable and non-renewable natural resources. Therefore, rethinking the way in which goods and services are produced and consumed becomes relevant in discussions and in the sustainability of actions incorporated into the development process of regions. Thus, in times of climate change and increasingly urgent concerns regarding the environment, it is essential that scientific and awareness-raising efforts be carried out more effectively by people and institutions, towards more inclusive and sustainable development.

Keywords: Sustainability. Environmental economics. Ecological economics. Productive agglomerations. Development.

RESUMO

O objetivo deste estudo consiste em compreender a lógica conceitual dos distritos industriais, dos *milieux innovateurs* e dos *clusters* à luz das correntes teóricas da economia do meio ambiente. Como referencial teórico utilizam-se fundamentos de Aglomerados Produtivos, da Sustentabilidade, da área sub-regional da Faixa de Fronteira, e a da Economia do Meio Ambiente (Economia Ambiental e Economia Ecológica). Quanto aos aspectos metodológicos este estudo constitui-se em um ensaio teórico reflexivo elaborado a partir de uma pesquisa qualitativa, utilizando-se da pesquisa bibliográfica e a análise de conteúdo para tratamento e organização dos dados. Os resultados alcançados mostram interpretações no sentido de que, do ponto de vista teórico, os distritos industriais, *milieux innovateurs* e *clusters* (aglomerados produtivos), encontram consonância com os pressupostos da economia ambiental (*Mainstrean* da Economia Neoclássica), em detrimento das concepções teóricas da economia ecológica. No entanto, a economia ambiental e a economia ecológica convergem no entendimento de que o progresso científico e o tecnológico são fundamentais para aumentar a eficiência, de modo geral, na utilização dos recursos naturais (renováveis e não renováveis). Dessa forma, repensar o modo como se processa a produção e o consumo de bens e serviços torna-se pertinente nas discussões e na sustentabilidade das ações incorporadas ao processo de desenvolvimento de regiões. Assim, em tempos de mudanças climáticas e preocupações cada vez mais urgentes em relação ao meio ambiente, é imprescindível que esforços científicos e de conscientização possam ser realizados com mais efetividade por pessoas e instituições, na direção de um desenvolvimento mais inclusivo e sustentável.

Palavras chave: Sustentabilidade. Economia ambiental. Economia ecológica. Aglomerações produtivas. Desenvolvimento.

INTRODUCTION

Productive agglomerations and sustainable development are increasingly prominent in research and academic discussions. Issues related to sustainability and climate change also prevail in non-academic environments, impacting the daily dynamics of local, regional, national and global populations.

The current situation of the National Policy for Regional Development – PNDR[1] (Decree No. 11,962/2024) establishes guidelines for industrial development based on its strategic axes, focused on macro-regional and sub-regional geographic areas. In this sense, macro-regional action considers the large Brazilian regions, including the Legal Amazon, the Northeast and the Central-West Regions, while the guidelines for the sub-regional scope consider territories such as the Border Strip and the Semi-Arid Regions.

Since this study includes part of the results of the authors' previous research, which presents geographic sections in the southern border strip of Brazil, it is aligned with the sub-regional geographic scale, defined as "border strip"[2] by the PNDR (2024) in its Section V, art. 5, item II. Therefore, the border strip established here includes the territorial strip of up to one hundred and fifty kilometers wide,

1 *"Política Nacional de Desenvolvimento Regional"* (original text).
2 *"Faixa de fronteira"* (original text).

along the land borders of Brazil.

In this context, this study aims to provide reflections on the foundations of productive/industrial agglomeration models based on schools of thought in environmental economics. These models can serve as a basis for the planning and implementation of Brazilian government policies for the Southern Border Region of Brazil. To this end, we present discussions on sustainable development, the contradictions between the schools of thought of environmental neoclassical economics and ecological economics, and the bases that underpin the models of productive agglomerations (industrial districts, *milieux innovateurs* and industrial clusters).

Although its origins lie in theoretical references that are over a century old, the theme involving industrial districts, *innovative milieux* and industrial clusters has been an object of study in recent decades. In a global context shaped by the industrial revolution, in which large-scale production models with purely economic bias predominates, this theme began to be criticized and questioned from the second half of the 20th century. For Ademar Ribeiro Romeiro (2012), the intensive use of energy from fossil fuels, which has been occurring since the beginning of the industrial revolution, has contributed to global warming and to the reduction of the planet's natural resource basis.

Given these issues, this investigation aims to comprehend the conceptual logic of industrial districts, *milieux innovateurs* and industrial clusters through theoretical perspectives in environmental economics. As a theoretical framework to support the discussions and interpretations of this study, we used two perspectives that discuss sustainability within environmental economics. Both approaches are explored through discussions on sustainability based on the premises of Environmental Neoclassical Economics and the theoretical concepts of Ecological Economics. It is worth noting that this dialogue is carried out within a theoretical perspective.

The methodology adopted in this study allows its classification as explanatory research based on the bibliographic method. We used secondary data sources obtained from publications in scientific books, papers published in higher-impact journals, and theses published by researchers and advanced study groups from universities, available in scientific data repositories of libraries and online. We applied the content analysis technique to organize and process the data, which allowed for the definition of analytical categories and subcategories.

Thus, this research paper is structured based on this introduction, the theoretical framework that addresses productive agglomerations and sustainability, and the methodology. The results are presented in section four, which discusses an understanding of the logic of the concept of Productive Agglomerations and its economic reductionism through the lens of Environmental Economics. Also in this section, there is a reflection on Regional and Sustainable Development. Finally, we present the final considerations and the bibliographical references used.

PRODUCTIVE/INDUSTRIAL AGGLOMERATIONS AND SUSTAINABILITY: THEORETICAL ASPECTS

In the 1980s, studies were conducted in Italy by Becattini, Brusco, Piore and Sabel, and they demonstrated that the so-called "Third Italy" achieved innovative advances in production processes after the end of the Second World War. These advances, according to the results of these studies, helped to revive the concept of industrial district, which originated from the research of economist and researcher Alfred Marshall. Geographical sections of Italy, such as the region of Milan, Turin and Genoa, as well as the southern region of that country, had as objects of study productive experiences, based on small family businesses, which presented a "new" form of industrial production, incorporating an organizational dynamic based on solidarity and cooperation, as well as a capacity to operate in the export market (Cocco, Galvão and Silva, 2002).

The endogenous nature of the development process in the Third Italy region demonstrated that agglomerations formed by small productive enterprises structured their processes by applying knowledge of labor division and cooperation, obtaining results that led the region to overcome the crisis caused by the post-war period. Based on these findings, the conceptual assumptions of industrial districts began to be recognized as the organizational basis for a large number of enterprises that produced goods and/or provided services (Becattini, 1999).

In this sense, industrial districts are an agglomeration of enterprises that operate and consolidate themselves through integration with social and political institutions, but predominantly with economic ones. According to Corrêa (2017), the process of social production is the result of interactions and articulations; however, it is necessary to consider the conflicts that occur among

the various social agents, such as groups of industry investors, commerce and services, landowners and urban spaces, real estate entrepreneurs, excluded social groups, and the State. The unequal conditions in which these agents interact based on the capital and resource interests directly interfere in the dynamics of the occupation process and in space appropriation (Vogt, Silveira, and Vogt, 2024). Such interference results in the definition of part of the influence of the logic of industrial districts on the socioeconomic transformation of the territory.

This interaction among the different social and institutional agents finds a broad and critical reflection based on Dallabrida (2020): territorial development (local/regional), also the result of the confrontation between the different future projects that materialize the transformations of spaces (municipalities, regions), or of the interactions of identity and belonging established in the territory, seeks to contribute to a more egalitarian and sustainable reality (Dallabrida, Büttenbender, Covas, Covas, Costamagna and Menezes, 2022).

In studies conducted in the Third Italy, researchers identified that the elements considered endogenous to development manifested themselves at the time when the cultural component supported the process of formation and union of small and medium-sized companies (Bagnasco, 1999). The cultural aspects incorporated into work became a resistance factor to the industrial logic, with its standardized and impersonal processes, as well as low qualification. The consolidation of a productive agglomeration that incorporates cultural elements brought evidence of the increase in the creative and innovative capacity of the enterprises, in a cooperative environment with strong interpersonal relationships of friendship and kinship that transcended among the institutional agents.

These experiences also demonstrated the importance of horizontal relationships as a means of stimulating learning and creativity as a basis for innovation and cooperation among companies, generating a competitive advantage for the region in the external market (Becattini, 1999; Bagnasco, 1999; Putnam, 2002). It is important to emphasize that, according to Becattini (1999), small and medium-sized production enterprises must maintain the purpose of a productive and technological infrastructure that allows production on a large scale, as well as their capacity to obtain capital credit.

In line with Becattini's ideas (1999), studies developed by Amaral Filho (2022) present the sociocultural environment as an aspect that contributes to consolidating cooperative relations,

which can constitute a territorial productive and industrial system, with an emphasis on what is local and regional. In this sense, it is possible to create an environment that is favorable to innovation, which can positively impact the productive performance of the region.

The notion of *milieux innovateurs* (innovative environment), considered another form of productive agglomeration, is related to the European Association Philippe Aydalot Association, formed by researchers such as Philippe Aydalot, Denis Maillat and Olivier Crevoisier, who were responsible for the study of innovative environments (Amaral Filho, 2022; Lemos, 2003; Benko, 1996). With Pierre-André Julien, the theory of Milieux Innovateurs is also applied to a Canadian reality (Québec). This author explores the relationship between entrepreneurship, innovation and regional development(Julien e Marchesnay, 1996; Julien, 2000 e 2010).

The theory of innovative environments (Aydalot, 1986) brings about a transformation of the organizational structure for productive environments, especially in technology and in the articulations and interactions with the territory, as it proposes constant innovations. This concept does not deviate from the assumptions of the industrial district, since it adds innovation as a basis for maintaining the industrial logic (Benevides, Bresciani, 2014).

In *milieux innovateurs*, Amaral Filho (2022) explains that there is interaction logic and a dynamic method of learning, that is, their processes are always in constant adjustment and transformation. In essence, regions begin to perceive and understand market and technological changes, thus reinforcing their response capabilities through the improvement of knowledge, cooperative alliances, mobilization of resources and institutional learning dynamics.

The endogenous elements of regional development materialize from the union of economic actors and the appreciation of intangible resources (research, training), which would foster the development of skills, know-how and regulations aligned with local specificities. In this way, since the agents are close together, it would facilitate learning and creativity, fostering innovation (Maillat, 1995).

Based on these contributions, a *milieux innovateur* is understood as "[...] the place, or the complex network of social relations in a limited geographic area that intensifies local innovative capacity through a process of synergistic and collective learning" (Lemos, 2003, p. 45). Therefore, we can note that this concept interacts with Schumpeterian and Neo-Shumpeterian discussions, as

well as with other branches that place innovation as a prominent element.

Thus, based on the theoretical aspects discussed thus far, it is clear that the concepts of industrial districts and *milieux innovateur* are similar. These conceptual similarities are also found in another type of productive agglomeration, that is, from the notion of industrial clusters - this concept of cluster, in fact, also rescues the Marshallian model of industrial district and tries to integrate it with *milieux innovateurs*. Its understanding is based on the concentration of interdependent enterprises in a geographic area that articulate interests, opportunities, as well as seek to overcome challenges by sharing efforts (Rosenfeld, 1996).

The concept of Industrial Clusters originated largely from studies by Michael Porter, who revived the premises of growth poles and driving industries. According to Porter (1990), industrial clusters are productive enterprises that are economically interrelated through similar and complementary sectors. The focus of this agglomeration is technical specialization that allows for greater efficiency in production processes, with the establishment of strategic partnerships aimed at increasing the volume and quality of products produced and, consequently, obtaining greater profit and competitiveness in the market. The predominance of instrumental utilitarian logic and competition is the basis for production growth within a market economy.

In turn, the Cluster Theory (Newlands, 2003) consists in the union of enterprises, articulated within the market logic, with a focus on reducing transaction costs in the operational flow of products and services. Logistical sharing and integration are essential, both of information and product flow, as well as the materialization of the relationship of trust among the companies that constitute the industrial cluster (Azevedo, Pereira and Cunha Mascena, 2020).

Based on the discussion presented on the notion of industrial cluster, it can be noted that there are aspects similar to the concepts of industrial district and *milieux innovateurs.* However, the authors who are aligned with this concept of Cluster seek competitiveness. Therefore, the notion of Cluster materializes in many instances in the current global context, establishing purposes that are predominantly linked to market issues at the expense of the search for territorial planning.

By compiling these three concepts of productive agglomeration (industrial district, *milieux innovateurs* and industrial Cluster), it is clear from Lemos (2003) that the basis that sustains them is

found in the theoretical premises of Alfred Marshall. The concept of Marshallian external economies, based on the autonomy of enterprises and public institutions, encourages competitiveness and cooperation among companies in a given territory. Jardón and Martinez-Cobas (2020) address the importance of considering culture and competitiveness in small entrepreneurial communities, taking Latin American forestry companies as a reference. Jardon, Martinez-Cobas and Shakina (2024) explore the challenges of human capital contributions and border effects, taking the border area of the Minho River between Spain and Portugal as a reference.

When addressing interpretations about the productive agglomerations of industrial districts, that is, *milieux innovateurs* and industrial clusters, it becomes necessary to incorporate the theoretical framework of environmental economics and, more precisely, the concept of sustainability through the lens of environmental neoclassical economics and ecological economics. Therefore, this study contributes to the comprehension of the conceptual logic of industrial districts, *milieux innovateurs* and Clusters from the perspective of environmental economics.

Based on this guideline, it is important to revisit the 1970s. During this period, discussions began to place greater emphasis on regional asymmetries and the "pollution of poverty", as warned by researcher Ignacy Sachs. From this moment, sustainability, seen as something multidimensional, that is, considering its economic, social, cultural, political and ecological aspects, has been incorporating an alternative strategic thinking for development (Sachs, 2007).

For Ignacy Sachs (2002), development can only be recognized when it brings a better quality of life for everyone, including future generations. In this sense, Sachs interprets development as something that should provide opportunities for inclusion, be sustainable and sustained, suggesting the social, environmental, territorial, economic and political dimensions as a method for analyzing a given territorial section. Thus, Ignacy Sachs' proposal is critical of development limited exclusively by the bias of economic growth.

Considering the above, it is pertinent to understand that Sachs' interpretation of development has a broad scope, in the sense that it is much more related to an ethical issue than an economic one (Sachs, 1993). In other words, the author's understanding goes further, since he developed the so-called triad of development: inclusive (social point of view), sustainable (ecological point of view) and

sustained (economic point of view) development (Sachs, 2004).

As a result, the theme of "sustainability" has become a "problem" when considering economic development. In fact, the allocation of natural resources has always been a fundamental point for the existence of industry and commerce, since such resources subsidize the entire economic process. Thus, we see a possible conflict between the pure and simple economic view and the ideal of sustainability: "sustainable development is basically defined as that which meets current needs without sacrificing the ability to meet future ones" (Romeiro, 2010, p. 5). In this regard, the State only interferes in order to control market failures of resources that are considered public (air, water, etc.), since there is no value (price) for them.

In this sense, sustainable development cannot be considered only from an economic point of view. Decisions involving the economic sphere must consider social, cultural, environmental and ethical spheres to the same extent. To this end, the debate on the so-called "consumption brake" is evident: "stabilizing the consumption of natural resources per capita will depend on a change in values" (Romeiro, 2010, p. 5). In this regard, one of the institutional innovations considered important in recent years is the "precautionary principle", applicable in decision-making processes under uncertainty.

In the literature, the concept of sustainable development emerged under the name eco-development (Sachs, 2007) in the early 1970s - a context of important debates on the relationship between economic growth and the environment. The publication of the Club of Rome report addressed, at the time, zero growth as a way to avoid environmental catastrophe. In Romeiro's interpretation (2010, p. 8), sustainable development

> [...] emerges from this context as a conciliatory proposition, in which it is acknowledged that technical progress effectively relativizes environmental limits, but does not eliminate them, and that economic growth is a necessary but not sufficient condition for the elimination of poverty and social disparities.[3]

In this study, two main theoretical approaches in economics on sustainability are therefore incorporated: environmental neoclassical economics and ecological economics. The first approach is represented by the so-called environmental economics from the neoclassical point of view and

3 *"[...] emerge desse contexto como uma proposição conciliadora, em que se reconhece que o progresso técnico efetivamente relativiza os limites ambientais, mas não o elimina, e que o crescimento econômico é condição necessária, mas não suficiente para a eliminação da pobreza e disparidades sociais."* (Original text).

considers that natural resources do not represent, in the long term, an absolute limit to the expansion of the economy. This view, in turn, leads to the understanding of the infinity of natural resources, generating, over time, several criticisms:

> Over time, natural resources began to be included in representations of the production function, but maintaining their multiplicative form, which means perfect substitutability between capital, labor and natural resources, and, therefore, the assumption that the limits imposed by the availability of natural resources can be indefinitely overcome by technical progress that replaces them with capital (or labor). In other words, the economic system is seen as large enough for the availability of natural resources (NR) to become a restriction on its expansion, but only a relative restriction, indefinitely overcome by scientific and technological progress. Everything happens as if the economic system were capable of moving smoothly from one resource base to another, as each one is exhausted, with scientific and technological progress being the key variable to ensure that this substitution process does not limit long-term economic growth (Romeiro, 2010, p. 9).[4]

Romeiro's (2010) statement defines "weak sustainability". According to this school of thought, market mechanisms allow for the indefinite expansion of environmental limits to economic growth. With natural resources being used as input for the maintenance and growth of the market economy, any reduction in the availability of resources would cause their price to increase, necessarily forcing innovative increments that would allow them to be saved or even replaced by other resources (Romeiro, 2010).

When environmental elements are considered, which are not priced by the market, but are fundamental as public goods for the maintenance of life (water, air, etc.), the so-called market failure occurs (Romeiro, 2010). To get around this problem (failure), it is necessary to incorporate priced treatment and distribution services in the market in a process that can measure their scarcity index.

According to Mueller (2007), market imbalances should be considered in terms of the need for energy input and materials used for production and consumption, in a cyclical renewal process that generates costs and, consequently, inevitably generates their pricing. Therefore, in the relationship between the environment and the economy, records of imbalances are essential for measuring their magnitude. Thus, it is in this context where the meaning of sustainable development lies.

4 *"Com o tempo, os recursos naturais passaram a ser incluídos nas representações de função de produção, mas mantendo a sua forma multiplicativa, o que significa a substitutibilidade perfeita entre capital, trabalho e recursos naturais, e, portanto, a suposição de que os limites impostos pela disponibilidade de recursos naturais podem ser indefinidamente superados pelo progresso técnico que os substitui por capital (ou trabalho). Em outras palavras, o sistema econômico é visto como suficientemente grande para que a disponibilidade de recursos naturais (RN) se torne uma restrição à sua expansão, mas uma restrição apenas relativa, superável indefinidamente pelo progresso científico e tecnológico. Tudo se passa como se o sistema econômico fosse capaz de se mover suavemente de uma base de recursos para outra, à medida que cada uma é esgotada, sendo o progresso científico e tecnológico a variável-chave para garantir que esse processo de substituição não limite o crescimento econômico a longo prazo."* (Original text).

Environmental neoclassical economics cannot encompass the complexity of the effects of the industrial logic dynamics on the environment. As a result, one should consider another school of thought in environmental economics: ecological economics. This second perspective argues that there is a need for an absolute restriction on the expansion of the economic system, since constructed capital and natural capital (natural resources) are essentially complementary. The concept of "strong sustainability", in fact, is established based on this school of thought.

According to Montibeller Filho (2004), one of the premises of this way of thinking is the redefinition of social and personal values, and one of its assumptions is that there are supplies to meet society's basic needs. The central point of this approach is to identify how to maintain economic working while considering the existence of resource limits. In the perspective of environmental neoclassical economics, these limits are not considered, as it assumes that there are adjustment mechanisms that allow for the unlimited replacement of resources that become scarce with abundant ones:

> In the case of environmental goods traded in the market (material input and energy), the conventional analytical scheme assumes that the increasing scarcity of a given good raises its price, which leads to the introduction of innovations that allow it to be saved, replacing it with other more abundant resources whose stocks are supposedly known to economic agents, together with knowledge of differences in quality, the future course of technological progress and the demand itself. In fact, prices reflect the availability of each resource regardless of the total stock of resources, which prevents them from being used to signal an optimal extraction process from the point of view of sustainability (Romeiro, 2010, p. 12).[5]

From a critical perspective of ecological economics, Souza (2000) makes an important consideration. According to him, ecological economics

> presents a markedly normative and pragmatic style, much more prescriptive rather than analytical. This explains why in ecological economics the Ecodevelopment proposal, which I consider to be the representation of its normative view of society, is the most fundamentally persuasive thing it has. Now, the ecodevelopmentalist proposal represents the prototype of how things "should be" and how one could get there. It has stylistic objectives of society and a strong presence of the planning method (more precisely, participatory planning) focused on local and endogenous development. Thus, the normative derivation of ecological economics (ecodevelopment) assumes a theoretical status and overrides the very theory that underpins it (Souza, 2000, p. 145).[6]

5 *"No caso dos bens ambientais transacionados no mercado (insumos materiais e energia), o esquema analítico convencional pressupõe que a escassez crescente de um determinado bem eleva seu preço, o que induz a introdução de inovações que permitem poupá-lo, substituindo-o por outros recursos mais abundantes cujos estoques os agentes econômicos supostamente conhecem, juntamente com o conhecimento das diferenças de qualidade, do curso futuro do progresso tecnológico e da própria demanda. Na verdade, os preços refletem a disponibilidade de cada recurso independentemente do estoque total de recursos, o que impede que eles possam servir para sinalizar um processo de extração ótima do ponto de vista da sustentabilidade".* (Original text).

Thus, there is an overlap between ecological economics and environmental economics (the neoclassical logic), according to Souza's (2000) interpretation. This finding is also reflected in Cavalcanti's (2010) statement – for the author, traditional economics (classical/neoclassical) does not address the relationships between ecological issues and economic activities (production and consumption). Based on this, the theoretical basis of traditional economics does not support the logic of ecological economics rationale (Franzen et al, 2024).

Therefore, it is necessary to understand the contribution of ecological economics as an important indicator of how economic activities should proceed, considering the limits imposed by nature, under penalty of making economic activity itself unfeasible – and, by extension, also human existence in a perhaps not so distant future.

METHODOLOGY

This section presents the methodology, which is divided into two parts: the first presents a reflection through the lens of the adopted methodological approach, and the second discusses in detail the design method of the study. The considerations regarding the theoretical and methodological approach are based on the foundations of phenomenology, as interpreted by Edmund Gustav Albrecht Husserl (1996).

The critique of and break with the positivist orientation of science and philosophy occur with the phenomenological approach of the aforementioned author (1996). In his interpretation, knowledge always starts from experience; it, however, does not mean that it is constituted as a derivation of experience. Husserl's conception is based on the understanding that truth is not found through the agreement of a phenomenon identified with a given reality or a temporal experience - it is the intention of meaning, generated from the researcher's awareness of the object or the context of the research.

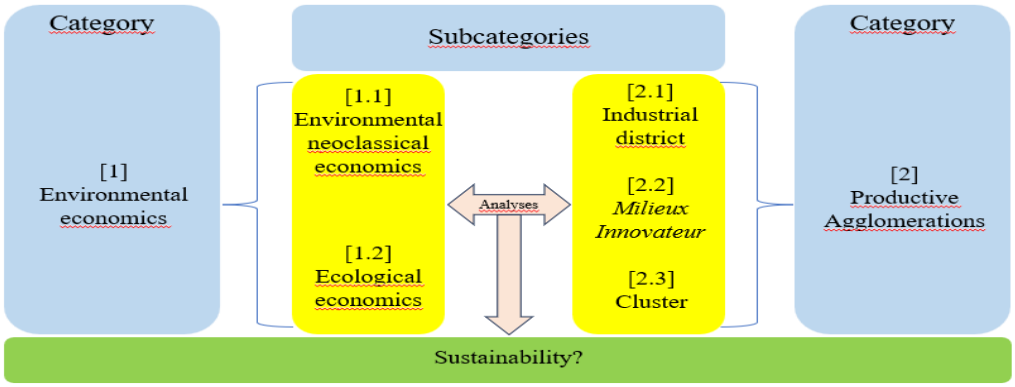
6 *"apresenta um estilo marcadamente normativo e pragmático, muito mais prescritivo do que analítico. Isso explica por que na economia ecológica a proposta de Ecodesenvolvimento, que considero ser a representação de sua visão normativa da sociedade, seja o que ela tem de mais fundamentalmente persuasivo. Ora, a proposta ecodesenvolvimentista representa o protótipo de como as coisas "deveriam ser" e de como se poderia chegar até elas. Possui objetivos estilísticos de sociedade e uma presença marcante do método do planejamento (mais precisamente do planejamento participativo) voltado para o desenvolvimento local e endógeno. Assim, então, a derivação normativa da economia ecológica (o ecodesenvolvimento) assume um status teórico, e se sobrepõe à própria teoria que a fundamenta"* (Original text).

Based on this phenomenological conception (Husserl, 1996), we could critically position the research under the theoretical framework of environmental economics and its schools of thought that consider, on the one hand, environmental neoclassical economics and, on the other, ecological economics. In light of these perspectives in environmental economics, we could list their differences and establish a reflective dialogue with the models of productive agglomerations of industrial districts, milieux innovateurs and industrial clusters. And, from this, we could understand the conceptual logic of industrial districts, milieux innovateurs and industrial clusters through the lens of the theoretical schools of environmental economics.

The second part of the methodology of this research, on the other hand, deals with the design methods of the study. The methodological approaches used to carry out this investigation allow us to state that it is explanatory research, based on the bibliographic method (Lakatos and Marconi, 2010). As a methodological approach, we opted to use a theoretical framework published on studies of productive agglomerations and environmental economics, using, as our object of investigation, publications in books, research papers published in high-impact journals, and published theses, produced by researchers and advanced study groups from universities, which are available in scientific data repositories in libraries and online.

In order to process and analyze the data, we used the content analysis tool (Bardin, 1977), which provided greater flexibility in the relationships and interpretations regarding the logic of productive/industrial agglomerations with the schools of thought of environmental economics, that is, environmental neoclassical economics and ecological economics. Since these are qualitative data, we sought to use content analysis, based on Campos (2004), to understand the meaning of the content analyzed in the published and/or available scientific documents, based on a priori categorization and subcategorization (Figure 01).

Figure 01 | Design of the theoretical-analytical structure of the research



Source: Designed by the authors.

The analysis structure (Figure 01) establishes the theoretical categories of analysis used in the process of building the results, organized as follows: [1] Environmental Economics and [2] Productive Agglomerations. The analysis subcategories were divided into [1.1] Environmental Neoclassical Economics and [1.2] Ecological Economics, and [2.1] Industrial District, [2.2] Milieux Innovateur and [3] Cluster.

Thus, through the methodological strategy defined by this study, we could achieve the objective of comprehending the conceptual logic of industrial districts, *milieux innovateurs* and industrial clusters in light of the theoretical frameworks of environmental economics. This comprehension is expressed in the next section, which presents relevant reflections for more sustainable development.

UNDERSTANDING THE LOGIC OF THE CONCEPT OF PRODUCTIVE AGGLOMERATIONS AND ITS ECONOMIC REDUCTIONISM THROUGH THE LENS OF ENVIRONMENTAL ECONOMICS: A PERTINENT REFLECTION FOR REGIONAL AND SUSTAINABLE DEVELOPMENT

Productive organizations can be explained in different ways in different territories. They emerge in the literature from the results of scientific studies that demonstrate the interaction between social and institutional agents that materialize over time in the most diverse regions (Suzigan et al, 2004).

According to Marshall (1982), dependence on natural resources and infrastructure characterizes the way in which productive/industrial agglomerations function economically. Natural resources serve as input for the production of goods, and infrastructure translates into the logistical apparatus that allows the movement of goods from the production source to the consumer destination. According to Costa (2012), the logistical infrastructure aids the process of economic development of a certain region, as it is the necessary link for the commercialization of products to take place in it and, mainly, for the establishment of an export distribution channel.

From a theoretical perspective, productive agglomerations allow us to understand that the way of producing and structuring the flow of goods in a region is transformed over time in a dynamic process of changes and incorporation of new technologies in different regions. This flow of products, information and technological transformations is favored by the proximity of economic, political and social agents, and has a positive impact on the production and trading of goods (Cassiolato and Lastres, 1999). An optimizing view predominates in the functionality of productive agglomerations, as well as the idealization of a competitive advantage in the competing market. Based on this idea, small businesses are exposed to an increasingly competitive market, that is, in a competitive environment where they must survive and grow.

In this regard, Cassiolato and Lastres (1999) consider that the concept of productive agglomeration can manifest itself in the territory through several models. This study addressed the concepts of industrial districts, *milieux innovateurs* and Clusters, which, based on the theoretical assumptions of productive/industrial agglomerations, exhibit economic reductionism.

Therefore, it is clear that the industrial economic logic predominates in the basis for understanding productive agglomerations. Productive/industrial agglomerations are composed of several enterprises, which act interdependently with high levels of specialization, whether in meeting customer demands and incorporating technologies, or in strategic contracts made with suppliers. Proximity becomes a key element for the concentration of supplies, labor, technological apparatus and innovation mechanisms applied in the industrialization process of products with high added value to be strategically made available in the export market (Anes, Deponti and Arend, 2018).

Production/industrial agglomerations are a set of enterprises with similar and complementary production natures. In some cases, the competitive aspect may predominate at the expense of a dynamic of cooperation between the participating enterprises. This finding, however, applies to established companies, and does not include social and institutional actors linked to technical, educational, development, political support, among others (Cassiolato and Lastres, 1999).

According to Porter (1990), the geographic concentration of production enterprises that are linked to different economic sectors are recognized as an agglomeration. Efficiency is established not only through investments in training and specialization, but also through the execution of contracts between companies aimed at adding value to products and services. In this conception, the understanding predominates that each unit of product produced achieves the lowest possible cost, providing the production agglomeration with greater capacity to compete in the market. And this, in Anes, Deponti and Arend's (2018) interpretation, shows that instrumental rationality (utility and competitiveness) predominates, resulting in a rationale that is reduced to the market economy dynamics.

In the same sense, Cassiolato and Lastres (1999) define productive agglomerations as several connecting links formed by producing companies, in which input for the production of products are traded, and distribution and marketing channels for goods and services are structured. Work activities, organized based on the division of labor, demonstrate the logic of industrial production incorporated into the production process of companies. Furthermore, depending on the level of value added to the products and services traded among the participants of the productive agglomeration, it may not be necessary for some of the participating enterprises to be in the same region or location, thus expanding a dynamic of economic integration that involves geographically distant economic agents.

Since the 1950s, two concepts have helped to reinforce the industrial economic logic of productive agglomerations: Agribusiness and Filière. The first was cited in studies by Davis and Goldberg (1957) and Goldberg (1968) in the United States, while the second was developed based on research carried out in France (Zylbersztajn and Neves, 2000).

In convergence with the term Agribusiness, the concept of Commodity System Approach (CSA) emerged, also based on the assumptions of Neoclassical Theory. Studies related to the

soybean, wheat and orange chains, carried out in Florida, in the United States, allowed the CSA to be translated into sequenced operations, from the input origin, through production, and ending with the distribution of the product or service. In this sense and in consonance, the concepts of CSA and Filière are constituted by the sequencing of value-adding operations to products, carried out by the chaining of a set of interrelated enterprises, which, using the optimizing logic, coordinate their processes towards greater economic gains (Zylbersztajn and Neves, 2000).

In this way, a rationale based on the industrial economy became the basis for the support and origin of the commoditization system, forming agglomerations with instrumental biases for controlling the agricultural supply chain and production, as well as the operational apparatus for storage, processing, distribution, and marketing to the consumer market (Zylbersztajn and Neves, 2000).

In the border strip that covers the entire western part of Brazil, from south to north, called a special sub-region of the sub-regional scale (Decree No. 11,962/2024), there are opportunities for a necessary public policy for industrial development. From this perspective, taking into account the models of productive agglomerations as a possibility for being used as inducers of development in the region, they will become strategic as they are planned and consolidated in the territory. In this sense, and based on Cassiolato and Lastres (1999), understanding that the proximity of the participating agents is fundamental for the materialization of a productive agglomeration. However, it is necessary to consider that, with the technological advancement of industrial operations and logistics, especially when industries incorporate large-scale production processes with a high level of technology, possibilities for economic integration channels between increasingly distant production enterprises emerge.

From this perspective, the participation of social agents becomes relevant, which can take place through private and public entities that are intended to educate and train people, through educational institutions, research, development and engineering centers. Political agents participate through political, promotion and development entities, with the establishment of public and private partnerships through contracts for the implementation of projects that aim to help improve infrastructure, innovative character, human and intellectual training, with the aim of obtaining a greater competitive capacity of the agglomeration in the market and, consequently, providing advances in the

local/regional development process (Cassiolato and Lastres, 1999).

According to Suzigan (2004), the participation of the government is essential in all its public spheres (Federal, State, Regional and Local), both for the consolidation of the agglomeration's production operations, local/regional social capital, access to educational and health services, financing, research centers, logistics infrastructure for transportation and storage, the ability to attract foreign capital investments, connections with external markets, and for coordination with the various entities that constitute the public administration. In this context, Igliori (2001) reinforces that education and training have the purpose of maximizing production and the competitive capacity of the businesses participating in the agglomeration, reducing costs and increasing productivity.

The training and qualification process is facilitated as the productive agglomeration begins to incorporate actions aimed at transferring and accumulating knowledge among its participating agents. These exchanges of information begin to add to the training with specific content aimed at the decision-making process regarding investments, the constant search for new market alternatives, product design and production methods. And all of this is facilitated by the geographical proximity of the social and educational agents involved (Matos, 2004).

Considering the theoretical assumptions referenced here, it is clear that the notion of productive agglomeration is based on the ideas of neoclassical economics, with the rationale of the industrial logic involving productive operations, seeking to optimize resources and maximize results. And this, in its essence, demonstrates the economic reductionism expressed by productive agglomerations in the most diverse sectors of industry, commerce and service provision.

Considering the theoretical review on productive agglomerations, more specifically industrial districts, *milieux innovateurs* and industrial clusters; the theoretical interpretations on sustainability based on environmental economics; the economic reductionism of productive agglomerations; it becomes possible to reflect on the comprehension of the conceptual logic of industrial districts, milieux innovateurs and industrial clusters through the lens of environmental economics. Thus, it is necessary to highlight that these agglomeration models have their bases within the neoclassical conception of economics. In view of this, there is a need to incorporate the relationship between the neoclassical view and the environment into this theoretical discussion .

It is worth highlighting, from this perspective, that modern Welfare Economics gained prominence around the 1930s. At that time, a wide range of possibilities emerged for the use of government policies within the rationale of Welfare Economics, especially with regard to the cost/benefit criterion that constitutes the reference basis for analysis of Environmental (Neoclassical) Economics (Souza, 2000):

> Neoclassical ideas regarding Welfare Economics, and the importance of the cost-benefit approach within the scope of the rationality of maximizing well-being, are central elements in Environmental Economics, and are, together with the principle of utility value and general equilibrium, the philosophical and methodological foundations of such theory (Souza, 2000, p. 140).[7]

It is based on the mechanistic conception, which considers the environment to be neutral and passive, and which can suffer impacts from the economic process that, in theory, can be reversed. According to Mueller (2007, p. 142), "the neoclassical economy that replaced classical thinking virtually ignored nature, treating the economy as an isolated and self-contained system."[8]

In this sense, it can be interpreted that neoclassical thinking attempts to get closer to the concept of sustainable development. The terminology "weak sustainability," proposed by Müller (2007), is the one that most reproduces neoclassical thinking, that is, it is the one that highlights the essence of the theoretical foundations of environmental economics. Based on neoclassical theoretical conceptions, it is clear that the greater the consumption, the greater the environmental degradation, and the lower the consumption, the less the environmental degradation. However, the "sustainable" character is established, at least in theory, through the need for actions that can reverse the impacts caused to the environment.

Thus, it is evident that, apparently, the neoclassical school of thought adheres to and integrates with the concept of sustainable development. In its essence, nevertheless, the need for environmental degradation to sustain the economy still predominates. In this way, the conception of environmental neoclassical economics based on environmental degradation so that it can later be recovered reinforces the understanding of "weak sustainability". On the other hand, the school

7 A*s ideias neoclássicas referentes à Economia do Bem-Estar, e a importância da abordagem do custo-benefício dentro do âmbito da racionalidade de maximização do bem-estar, são elementos centrais na Economia Ambiental, e são, juntamente com o princípio do valor utilidade e do equilíbrio geral, os fundamentos filosóficos e metodológicos de tal teoria.* (Original text).

8 *"a economia neoclássica que tomou o lugar do pensamento clássico acabou virtualmente ignorando a natureza, passando a tratar a economia como um sistema isolado e autocontido"* (Original text).

of thought of ecological economics provides the counterpoint, that is, it completely rejects the neoclassical understanding of a neutral and reversible environment. Furthermore, it argues that the expansion of the world economy based on the school of thought of environmental neoclassical economics threatens the survival of future generations, as it does not guarantee that resources available today can be used in the future. Thus, "strong sustainability" is defined based on the school of thought of ecological economics.

The industrial districts, *milieux innovateurs* and industrial clusters addressed in this research have their origins in the neoclassical conception. Therefore, such contributions, aligned with the concept of "weak sustainability", do not constitute alternatives for truly sustainable development, as they are characterized much more as views that deepen the gap between purely economic development and inclusive development that respects the limits imposed by nature on human activity.

In this sense, natural resources and development have a close causal relationship. There is no development without the use of natural resources, at least based on the conception of neoclassical economics, which underpins the perspective of environmental neoclassical economics. For Ding (2021), the industrial economy gave rise to large-scale production and distribution at the same time that it subjected humanity to the industrial system, influencing consumption, which also began to be demanded on a large scale. The functionality of the industrial system advanced as a result of humanity being led to believe that natural resources were inexhaustible, a fact that resulted in a rationale that is not committed to the environment and, consequently, is not concerned with sustainability.

Finally, it is necessary to rethink the way in which production is processed and how things are consumed. This understanding, despite the limitations of the theoretical framework discussed here, demonstrates that the industrial economic logic of productive agglomerations cannot encompass the demands necessary for more sustainable development.

FINAL CONSIDERATIONS

This research aimed to understand the conceptual logic of industrial districts, *milieux innovateurs* and industrial clusters through the lens of theoretical frameworks in environmental economics. In this sense, we sought to establish a dialogue between the concepts of productive agglomerations and sustainability based on the schools of thought of environmental and ecological economics.

From this perspective, we found that, from a theoretical point of view, one cannot question the neoclassical origin of industrial districts, milieux innovateurs and industrial clusters. This is due to the fact that the view that productive expansion, through these agglomerations, brings a certain degradation to the environment aligns with the theoretical concepts in environmental neoclassical economics (weak sustainability).

The approach based on ecological economics, in which "strong sustainability" is established, proposes the stabilization of consumption and, consequently, of economic growth. The concept of eco-development presents important foundations for the survival of future generations – a topic that must continue to be debated so that the current generation can have the opportunity to mature and rethink its actions, both regarding the simplest attitudes of producing and consuming, and the most complex ones.

Based on the results achieved, it is worth highlighting that although the models of productive/industrial agglomerations are more aligned with the theoretical assumptions of environmental neoclassical economics rather than ecological economics, we identified a point of agreement between these two schools of thought. This convergence point between environmental neoclassical economics and ecological economics lies in scientific and technological progress since both are fundamental to increasing productive efficiency and effectiveness, contributing to the reduction in the use of natural (renewable and non-renewable) resources.

Therefore, the results of this study can help to broaden view on the implementation of the country's industrial strategies, as evidenced by the National Policy for Regional Development (PNDR) (Decree No. 11,962/2024), which highlights the sub-regional geographic area of the border strip as a priority for actions to promote productive/industrial development. For this reason, and because we understand that strategic productive guidelines are essential for territorial development, the

following question remains: Can the models of productive/industrial agglomerations, designed and implemented based on the assumptions of ecological economics (strong sustainability), materialize, in the border strip of Brazil, a strategic productive model that converges with more sustainable development?

Thus, the reflection remains that, in times of climate change and increasingly urgent concerns regarding the environment, it is essential that scientific and awareness-raising efforts be carried out more effectively by people and institutions towards more inclusive and sustainable development.

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