



## THE MATERIALISTIC CONCEPT OF NATURE AND THE “POLITICAL- ECOLOGICAL GLIMPSES” OF MARX IN CAPITAL

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### ABSTRACT

**Objective:** The objective of this research is to deepen the materialist vision of nature proposed by Marxist theoretical analysis, with the aim of incorporating a conceptual contribution to study the relationship between ecology and economy.

**Theoretical Framework:** The starting point of this text is the perception of life in a global, environmental and human system that constantly interacts under the concept of coevolution. In this way, the human subsystem is subject to the conditions of the biosphere, in such a way that if the human subsystem breaks these conditions, it will lead us to a situation characterized by an irreversible and global environmental crisis, which provides a solid basis for understanding the context of the research.

**Method:** The methodology adopted for this research includes conceptual keys to approach the study of ecology from a materialist conception of nature through the analysis of Marx's work. Data collection was carried out through the systematic review of Capital.

**Results and Discussion:** The results obtained reveal that the alleged productivist meaning of his work cannot be affirmed in Marx's political writings either. Marx's political work is contradictory in this regard; Sometimes communism appears as the human scenario of continuous abundance (more typical of the part of his work closest to political agitation), a rhetoric in which we must consider the subject who receives it, the working class of the 19th century, who suffers living and working conditions that can be described as inhuman. However, in other parts of Marx's political work, the author entrusts the future society with the mission of filling the metabolic gap caused by the capitalist mode of production, restoring humanity's interaction with nature in ways that we would today describe as ecological.

**Research Implications:** The results can be applied or influenced in the field of study of Political Economy. These implications could also cover such prominent areas as sustainable development and the circular economy.

**Originality/Value:** This study contributes to the literature by highlighting that the crisis of sustainability and the debate on the physical limits of growth find a material explanation in Marx through the analysis of the functioning of the capitalist mode of production. The relevance of this research is evident in that it is the objective logic of the economic system itself that is at the base of the metabolic gap that currently exists between humanity and nature, being especially valuable for the reinforcement of theoretical and practical approaches referred to raising the need for a new productive and accumulation model.

**Keywords:** Ecology, Capital, Marx, Materialistic, Nature.

### O CONCEITO MATERIALISTA DE NATUREZA E OS “FLASHES POLÍTICO-ECOLÓGICOS” DE MARX NO CAPITAL

### RESUMO

**Objetivo:** O objetivo desta pesquisa é aprofundar a visão materialista da natureza proposta a partir da análise teórica marxista, com o intuito de incorporar uma contribuição conceitual ao estudo da relação entre ecologia e economia.

**Referencial Teórico:** O ponto de partida deste texto é a percepção da vida em um sistema global, ambiental e humano que interage constantemente sob o conceito de coevolução. Dessa forma, o subsistema humano está sujeito

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às condições da biosfera, de modo que se o subsistema humano romper essas condições, nos levará a uma situação caracterizada por uma crise ambiental irreversível e global, o que fornece uma base sólida para a compreensão do contexto da pesquisa.

**Método:** A metodologia adotada para esta pesquisa contempla as chaves conceituais para abordar o estudo da ecologia a partir de uma concepção materialista da natureza por meio da análise da obra de Marx. A coleta de dados é realizada por meio de uma revisão sistemática do Capital.

**Resultados e Discussão:** Os resultados obtidos revelam que o suposto sentido produtivista da obra de Marx também não pode ser afirmado em seus escritos políticos. A obra política de Marx é contraditória a este respeito; Às vezes, o comunismo aparece como o cenário humano da abundância contínua (mais típico da parte de sua obra mais próxima da agitação política), uma retórica na qual é preciso considerar o sujeito que a recebe, a classe trabalhadora do século XIX, que sofre condições de vida e de trabalho que podem ser qualificadas como desumanas. Entretanto, em outras partes da obra política de Marx, o autor confia à sociedade futura a missão de preencher a lacuna metabólica causada pelo modo de produção capitalista, restaurando a interação da humanidade com a natureza de maneiras que hoje descreveríamos como ecológicas.

**Implicações da pesquisa:** Os resultados podem ser aplicados ou influenciar o campo de estudo da Economia Política. Essas implicações também podem abranger áreas importantes como o desenvolvimento sustentável e a economia circular.

**Originalidade/Valor:** Este estudo contribui para a literatura ao destacar que a crise da sustentabilidade e o debate sobre os limites físicos do crescimento encontram em Marx uma explicação material por meio da análise do funcionamento do modo de produção capitalista. A relevância desta pesquisa se evidencia na medida em que é a lógica objetiva do próprio sistema econômico que está na base do fosso metabólico que atualmente existe entre a humanidade e a natureza, sendo especialmente valiosa para o reforço de abordagens teóricas e práticas referentes à evidenciação da necessidade de um novo modelo produtivo e de acumulação.

**Palavras-chave:** Ecologia, Capital, Marx, Materialismo, Natureza.

## EL CONCEPTO MATERIALISTA DE LA NATURALEZA Y LAS “DESTELLOS POLÍTICO-ECOLÓGICOS” DE MARX EN EL CAPITAL

### RESUMEN

**Objetivo:** El objetivo de esta investigación es profundizar en la visión materialista de la naturaleza propuesta desde el análisis teórico marxista, con el objetivo de incorporar un aporte conceptual de estudio en la relación entre ecología y economía.

**Marco Teórico:** El punto de partida del presente texto es la percepción de la vida en un sistema global, ambiental y humano que interactúa constantemente bajo el concepto de coevolución. De esta manera el subsistema humano queda sujeto a los condicionantes de la biosfera, de tal forma que si el subsistema humano rompe estos condicionantes, nos conducirá a una situación caracterizada por una crisis ambiental irreversible y global, lo cual proporciona una base sólida para comprender el contexto de la investigación.

**Método:** La metodología adoptada para esta investigación comprende las claves conceptuales para abordar el estudio de la ecología desde una concepción materialista de la naturaleza a través del análisis de la obra de Marx. La recolección de datos se realiza mediante la revisión sistemática de El Capital.

**Resultados y Discusión:** Los resultados obtenidos revelan que tampoco en los escritos políticos de Marx se puede afirmar el pretendido sentido productivista de su obra. La obra política de Marx es contradictoria a este respecto; a veces el comunismo aparece como el escenario humano de la abundancia continua (más propio de la parte de su obra más cercana a la agitación política), una retórica en la que hay que considerar al sujeto que la recibe, la clase obrera del siglo XIX, que sufre condiciones de vida y de trabajo que pueden calificarse de inhumanas. Sin embargo, en otras partes de la obra política de Marx, el autor confia a la futura sociedad la misión de llenar la brecha metabólica causada por el modo de producción capitalista, restaurando la interacción de la humanidad con la naturaleza en formas que hoy calificaríamos como ecológicas.



**Implicaciones de la investigación:** Los resultados pueden aplicarse o influir en el campo de estudio de la Economía Política. Estas implicaciones podrían también abarcar áreas tan destacadas como el desarrollo sostenible y la economía circular.

**Originalidad/Valor:** Este estudio contribuye a la literatura al destacar que la crisis de la sostenibilidad y el debate sobre los límites físicos del crecimiento encuentran en Marx una explicación material a través del análisis del funcionamiento del modo de producción capitalista. La relevancia de esta investigación se evidencian en que es la lógica objetiva del propio sistema económico la que está en la base de la brecha metabólica que existe actualmente entre la humanidad y la naturaleza, siendo especialmente de valor para el reforzamiento de planteamientos teóricos y prácticos referidos a destacar la necesidad de un nuevo modelo productivo y de acumulación.

**Palabras clave:** Ecología, El Capital, Marx, Materialismo, Naturaleza.

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## 1 INTRODUCTION

The concept of coevolution determines the vision of the human economic system as dependent on the natural system, both of which interact in a dynamic and open process in the sense of including human activity within the economic subsystem open to the environment, whose evolution depends on a "net surplus" of positive energy, necessary for its reproduction and development. Relationship that rests on a global or planetary scale, where the development of the socio-economic subsystem can only continue to reproduce itself within the sustainability of the ecosystem that supports it (Riechman, 2012).

The level of ecological problems reached and the influence of these on the relations between physical medium and society determines that the approach of humans as biological entities must be strictly ecological. It is impossible to speak today of the processes that characterize humankind as a biological organism outside the framework of the environment in which they carry out their activity, the productive reality.

The choice of this topic is based on the understanding of the environmental crisis as a result of the metabolic rift produced by the development of the capitalist mode of production, a fracture that takes on a global dimension as a consequence of the new logic of revaluation of capital and the process of accumulation dominant since the seventies of the twentieth century, through the configuration of a new international division of labour and of the insertion in that international economic structure of peripheral social formations as dependent economies.

Nature enters human history through production. The orthodox economic theory represents the theoretical expression of the capitalist mode of production, and the separation that it advocates between economy and ecology marks, in turn, the separation between social



sciences and natural sciences, separation that is functional to the metabolic rift produced by capitalism.

The starting point of the article is the existence of a double crisis, an ideological one on one hand and a social and environmental one on the other, pointing out both the human and environmental limits of an economic model of production and consumption and the theoretical and ideological expressions that support this model. Crisis that demands assuming a new model that pursues the achievement of an ecological balance at the same time as human equity. The need to adopt a new approach, based on the need, in turn, for the adoption of ecological economics, and therefore, the methodological unity between social and natural sciences, requires a materialist conception of nature from a dialectical analysis of natural history.

## **2 MARX'S MATERIALIST CONCEPTION OF NATURE IN CAPITAL**

### **2.1. UNITY OF MATERIALISM AND NATURE IN CAPITAL**

In *Capital*, the Marxian notion of alienation of human labour linked to the understanding of alienation of human beings from nature develops; double alienation to which a historical explanation is endowed. The materialistic conception of nature elaborated by Marx from the time of his work on the classical materialism of Epicurus, and later specified in the *Economic and Philosophical Manuscripts*, finds its maturity in *Capital* through the concision of the interaction of society and nature through the capitalist mode of production.

Marx's materialist conception of nature acquires its most mature perspective in *Capital* through the formulation of his theory of the metabolic interaction of nature and society, through the analysis of the logic of accumulation and revaluation of capital (Bellamy Foster, 2000). No study of the events and possibilities of history could do without the study of natural physical science; on the one hand, nature cannot be reduced to human history; on the other, it is not easy to divorce nature from human history nor from the productive activity of humankind.

In this way, a close relationship between natural sciences and social sciences is defended, rejecting the separation of materialism from the realm of nature and physical science. This formulation of Marx is clearly expressed in *Capital*, by performing an analysis in which the materialist conception of nature is combined with the materialist conception of history.

The production of life, both of one's own life at labour and of new life in procreation ... appears as a double relationship: on the one hand as a natural relation; on the other, as a social relation (Marx, 1973).



## 2.2 THE LABOUR THEORY OF VALUE AND NATURE. BOOK I, FIRST SECTION, CHAPTER I, THE GOODS

Man can work only as Nature does, that is by changing the form of matter. Nay more, in this work of changing the form he is constantly helped by natural forces. We see, then, that labour is not the only source of material wealth, of use-values produced by labour. As William Petty puts it, labour is its father and the earth its mother. (Marx, 1973: 10).

For Marx, the laws of the market assume the appearance of the functioning of the capitalist mode of production, which, in essence, is regulated by the law of value. In capitalism, all goods assume the historical form of goods, which through exchange, socially validate the individual labour of people. This attribute of being able to be exchanged by others requires an element that allows to compare goods, qualitatively different, by means of a common quality: all goods are the product of human labour. This labour of man, qualitatively different, equals and becomes abstract, which enables the material basis of exchange, in which all goods are an expression of man's equal and abstract labour. This equal and abstract labour is what Marx calls value, which is defined as the time of labour socially necessary to produce a commodity, a reality that determines the different exchange value of commodities, defined as the different proportion by which a commodity is exchanged.

For Marx, the basis of all wealth and surplus, and therefore, the existence of commodities and capitalist production, is the natural productivity of the land, understood in the broad sense of space for living as well as production, where the assumption of the essence of the human being is the productivity of nature, a relationship that appears in the primitive forms of social organization in its most spontaneous expression, reaching the degree of greater complexity in the capitalist mode of production, where the law of value acts as mediator of the relationships between humans, and their access "to the physical and natural environment in which they are inserted" (Foladori, 1996: 134).

This natural productivity of agricultural labour forms the basis of all surplus labour "(Marx, 1973: 434).

As on the first day of production, man and nature converge here, that is, the original creators of the product, and therefore the creators of the material elements of capital. Overall result: capital, joining the two original creators of wealth-the labour force and the land-, acquires an expansive force (Marx, 1973: 813).

In defining his Labour Theory of Value (LTV), Marx contemplates labour, not only as the physical and technical embodiment of human effort, but also in relation to the natural



framework, where nature is defined as a component of that working time socially necessary for the creation of value. In addition to overcoming the reduction of labour to its technological condition, Marx defines that socially necessary labour time through its historical concretion, labour as an expression of the capitalist mode of production, assuming the general form of labour its historical status as a wage earner. The theory of value, therefore, will be the law that allows us to analyse in a scientific way the regulation of production relations within capitalism.

### 2.3 THE SEPARATION OF THE CITY AND THE COUNTRYSIDE. BOOK I, THIRD SECTION, CHAPTER VIII: THE WORKING DAY. SEVENTH SECTION, CHAPTER XXIV: THE SO-CALLED ORIGINAL ACCUMULATION

Marx makes a strong criticism of classical economics in terms of its static conception of economic activity in relation to its physical environment, through the critique of capitalist agriculture and the static perception of ground properties on the part of the economists of that theoretical school.

When studying the passage from feudalism to capitalism, Marx analyses the process of primitive accumulation through the study of the appearance of private property of the land, which allows the appropriation of the surplus by a new social subject, the landowner, material, and social basis on which capitalist agriculture develops. For Marx "the poor are deprived of having any relationship with nature -not even to tend to their own survival- that was not mediated by the institution of private property." In Capital, the private appropriation of the possession of land allows the development of private ownership of the means of production and the emergence of a liberated labour force, elements that appear as the basis of capitalist production relations.

The function that the large estates play in monopolizing the land through private ownership was analogous to the domination of the capitalists of large industries, through the domination of capital over money. In Marx's Capital, both land and people had assumed their historical role as goods, being the cause that in bourgeois society humans and nature are not the sovereign subjects. But if humans are not the subject of study in Capital, it is because in bourgeois reality the sovereign subject is capital, which makes the center of study of Capital, precisely, capital and not the relations between humans and nature.

The appearance of land as private property allows the development of the capitalist relations of production and its intensive character, allowing to explain the degradation of the physical environment, but also, the capitalist production, being the production of surplus value,



constantly seeks the prolongation of the day of labour, establishing a parallelism between the depredation suffered by land under capitalist agriculture, with the decreasing quality of life of workers under the development of large industries. Worsening of working and living conditions (Marx focuses on the problem of housing and on the health quality of the workplace) of the workers, and the degradation of what the author calls the right to eat, because of the search for profit on the part of capital, which leads it to degrade the natural conditions of food.

This process of intensification of labour and land degradation, functional to the very logic of accumulation of capitalism, is embodied in a process that historical geography calls the separation of the city and the countryside. When studying the historical evolution of the division of labour, by means of its communal, slave, estate and salaried form, Marx also attends to the physical and territorial projection of it, taking shape in capitalism in the division of the city and the countryside, separation that is at the base of the metabolic rift that capitalism produces between humans and nature.

#### 2.4 THE SEPARATION OF HUMANS FROM THEIR ENVIRONMENT UNDER CAPITALISM. THE CONCEPT OF METABOLIC RIFT. BOOK I, SECTION FOUR, CHAPTER XIII: MACHINERY AND LARGE INDUSTRIES. BOOK III, SECTION VI: HOW EXTRAORDINARY INCOME IS CONVERTED INTO LAND RENT

Marx develops the theory of the metabolic relationship between humankind and nature as a conceptual expression of his systematic criticism of the capitalist exploitation of the soil, in the sense of the impossibility of preserving the necessary means for the reproduction of the biological balance of soil. In this way, in *Capital*, Marx analyses capitalist agriculture, finding in it the explanation of how large-scale industry and large-scale agriculture "combine to impoverish the soil and the worker" (Bellamy Foster, 2000: 240). The study of capitalist agriculture through the appearance of private property of the land is shaped in Book III, when Marx analyses the rent of the land.

The great estates reduce the agrarian population to an ever decreasing minimum and places it in front of a growing industrial population crowded in large cities. In this way it gives rise to conditions that cause an unreparable fracture in the interdependent process of social metabolism that prescribe the natural laws of life itself. The result of this is the waste of the vitality of the soil that trade carries far beyond the limits of a single country. Large-scale industry and large-scale industrially exploited agriculture have the same effect. If originally they can be distinguished by the fact that the former deposits debris and ruins the labour force,



and therefore the natural force of man, while the latter does the same with the natural force of the soil, in the later course of development they combine, because the industrial system applied to agriculture also weakens rural workers, while industry and trade, on the other hand, provide agriculture with the means to exhaust the soil (Marx, 1973: 849-850).

Both Book I, when studying agriculture and large-scale industry, and Book III, when analysing land rent, Marx defines the relationship between humanity and nature under the capitalist mode of production under the concept of "rift in the metabolic interrelation between man and earth", through the depletion of the constituent elements of the soil that allow its sustainability. Profitability as an element of explanation of the logic of accumulation in capitalism, explains the depletion of the soil of England, which together with the depletion of agricultural land in the United States, is considered by Marx as the two most serious realities of environmental deterioration of his time, together with the lack of reuse of the residues of industrial production, studied by Marx in Book III, First Section, Chapter V. For Marx, the search for profitability and not of utility as a logical objective of capitalist dynamics, is the explanation for the lack of development of recycling and reuse techniques of the waste produced in the big industries.

With the concept of metabolism, Marx analyses the conditions of sustainability of capitalism, by focusing the essential component on which the complex interaction between society and nature is based, a metabolic relationship, to which the objective dynamics of the capitalist mode of production leads to fracture.

## 2.5 THE THEORY OF LAND RENT. BOOK III, SECTION VI, CHAPTERS XXXIX-XLII: DIFFERENTIAL RENT I AND DIFFERENTIAL RENT II

In Section VI of Book III, Marx studies the effects of capital investment in a natural and monopolizable environment, such as soil, through his theory of land rent, in what is "an application of the law of value to that part of nature that can be subjected to monopoly" (Foladori, 1996: 135).

The theory of land rent analyses how the revaluation needs of capital, lead to allocate part of the global rate of surplus value generated to the rent of land, given the location needs of productive economic activity (generator of surplus value). For Marx, the rate of return depends on the rate of profit, which in turn depends on the rate of surplus value, which is the product of the activity of productive capital. However, besides productive capital, there are other capitals that do not generate surplus value but do participate in its distribution, due to their specialization



in activities that allow a more accelerated passage from the circulation process to the production process, the process in which the capacity to generate surplus value resides. Although it does not generate surplus value, the rent of the land does generate profit, constituting a goal for capitals, as evidenced by the process of abandoning the lease of land and instead taking ownership of it, abandoning even its form of productive capital (generator of surplus value ) by the form of capital directed to the rent of the land (unproductive capital and not generator of surplus value), which, when surpassing the average profit, constitutes an attraction for greater amount of capital.

The impartial logic of capital - the production of higher rates of surplus value - leads to its opposite - the specialization of some capital in nonproductive activities (not generating surplus value, such as land rent) - which brings as a consequence the need -by the productive capital- to increase the requirements for the production of surplus value through a greater intensification of the labour and the demand for higher inputs and raw materials, due to the participation in the appropriation of the surplus value generated from non-productive capital, in the form of a distribution of the profit rate.

Marx continues with the development of the theory of the rent of the land by means of what he calls, Differential Rent I and Differential Rent II. Differential Rent I focus on explaining how nature, with its differences in fertility, makes human labour productive. Human labour generates productivity according to the natural fertility of the soil in which it is applied. In Differential Rent II Marx analyses the role of nature in the formation of differentiated incomes, through the conversion of agricultural land into urban land. In Differential Rent II, human labour generates value differences in soils of equal fertility and location, with equal initial capital investments, but executed differently, through extensive forms of investment (house construction), or intensive (construction) of apartments) which allows the release of more free land, generating a higher profit rate (Foladori, 1996: 136).

Marx`s theory of land rent not only contemplated the role of nature in the formation of values, but went further, explaining how these values are the result of multiple combinations, between the fertility and diversity of nature and the different capital investments. Together with the indirect manifestations analysed in this text, the theory of land rent represents the most direct and clear manifestation of the incorporation of nature and physical reality to Marx's law of value.



## 2.6 THE LAW OF THE TENDENCY OF THE RATE OF PROFIT TO FALL. BOOK III, THIRD SECTION

Both Smith and Ricardo are aware, as Marx, of the existence of a decreasing trend of the rate of profit; for Adam Smith this is due to competition, while for David Ricardo it is the decreasing yield of land. Marx analysed this dynamic in a different way, concluding that the decreasing trend of the rate of surplus value is a product of the increase in the organic composition of capital. Marx not only formulated as law the decreasing tendency as long-term dynamics of capitalism, but analysed the mechanisms that serve to counteract this tendency.

Of these elements aimed at counteracting the decreasing trend of the rate of profit, Marx includes the need for capital to intensify the use of raw materials of natural origin and the appropriation of virgin spaces, as priceless elements that tend to lower production costs, and with it, to raise the rate of profit. The impact of these mechanisms causes a counterbalanced effect, through the expansion of capital investments to new areas of revaluation through the appropriation of new natural spaces, where the elevation of the rent of the land assumes the direct effect of a dynamic that contributes to the decrease of the average rate of profit (Foladori, 1996: 135).

Predation dynamics, problems derived from pollution or intensification of the exploitation of natural resources such as the continuous demand of raw materials, are shown as problems derived from the attempt to counteract the dynamic of the falling rate of profit. Marx in Chapter XIV addresses the role of natural resources in the process of capital accumulation, albeit secondarily, against his main intention to expose the ultimate foundation of the limits of capitalism.

While the precapitalist production of use-values has its limit in the satisfaction of needs, the capitalist production of goods to increase profit has no limit. This difference allows us to interpret what is the impartial logic that analyses the material cause of the depletion of natural resources and the basis of the irrational demand for matter and energy.

## 3 CAPITALISM AND ECOLOGICAL CRISIS. THE DEBATE ON LIMITS TO GROWTH IN CAPITAL AND THE CONCEPT OF METABOLIC RIFT

It is usual to argue Marx's refusal to accept any absolute limit to growth because of the controversy of the German author with Malthus. Such a statement does not consider the political context that motivated the controversy, in the sense of challenging any theory that places



capitalism as the "natural state of things", denying any viability to socialism. Marx's concern in his confrontation with Malthus was to demonstrate that inequality and misery are social creations, not a natural condition of society. It is not therefore in the controversy between Marx and Malthus where we may find theoretical elements about the physical limits to growth, instead we must resort to Capital (Navascués, 2001).

For Karl Marx, the relationship between society and nature is established through the mode of production in a given historical moment, which leads to face the study of the physical limits of growth through the understanding of the functioning of capitalist production, through the study of what is its logic of accumulation and revaluation (expansion) of capital, which takes us to Book III, Volumes XIII and XIV, in its explanation of the declining trend of the rate of gain.

### 3.1 THE LIMITS TO GROWTH AND THE LAW OF THE TENDENCY OF THE RATE OF PROFIT TO FALL

In the capitalist mode of production, the logic of revaluation, and therefore of its extended reproduction, stems from the scheme  $D-M-D'$ . The capitalist, as the owner of the means of production, starts the productive process with a monetary capital ( $D$ ), buys merchandise ( $M$ : labour power and means of production) and obtains a production that he sells in the market for a value ( $D'$ );  $D'$  is greater than  $D$  ( $D' > D$ ): that difference is surplus value. Marx asks himself where it comes from, finding the answer in the difference between the value generated by labour and the value of his compensation (salary).

For Marx the value of a commodity is made up of three parts. The first is the value of goods - means of production - incorporated into the production process, a value that receives the name of constant capital ( $c$ ). The second is the value of the labour force, as in the value of the means of subsistence, which are given to the worker in the form of wages, called variable capital ( $v$ ). The third is the additional value that, above that contributed by the means of subsistence, labour incorporates to the value of the goods, being a value that the capitalist extracts from the labour of the worker; it is the surplus value ( $p$ ). Therefore, the value of a commodity is equal to  $c + v + p$ . Once we have established these relations, knowledge of the historical process of operation of the capitalist mode of production provides us with the elements for understanding the relationship between humankind and nature through the economic system.



Marx has a long-term vision of the capitalist economy, where the continuous accumulation of capital exerts as an engine. This accumulation finds its origin in the very functioning of the economy; the struggle of the capitalist to maintain his capital leads him to expand it continuously. This impartial law will cause contradictions in the system by acting on the organic composition of capital, increasing it, thereby depressing the rate of profit.

The competing dynamic between the different individual capitals leads to a constant increase of capital, with the intention of increasing labour productivity, lowering prices and being more competitive. With the increase of the organic composition of capital, the capitalist tries to increase his capital by not using the goods that allow him to obtain value, the employment of labour. If the rate of surplus value remains constant, the rate of profit and the organic composition of capital evolve in the opposite direction, with the decrease in the rate of surplus value, the downward pressures on the rate of profit increase.

This law finds, however, five countertendencies that can nullify, even reverse, the decline in the rate of profit; these mechanisms are grouped by Marx in: the increase in the degree of exploitation of labour, the fall in wages, the decrease in the value of constant capital (machines, raw materials) used by the worker, the intensive production of labour of luxury goods and international trade aimed at cheapening constant capital.

Marx explains clearly how these five mechanisms have a social impact (worsening of the living conditions of the worker) and physical impact (degradation of the natural environment). Except for the second of the mechanisms, in the remaining four Marx finds elements of objective limitation to the mode of growth under the capitalist system.

Regarding the increase in the degree of exploitation of labour, already in the second section a reference was made to the relationship that Marx established between intensification of labour and degradation of labour and living conditions for the worker. The intensification of labour runs parallel to the establishment of large urban centers and the direct relationship, which Marx finds, between large cities and the worsening of living conditions of labour, where pollution, unhealthiness and adulteration of the food consumed by the workers were the main consequences. The basis of this environmental degradation lay in the intensification of land use, via intensification of agriculture and the extension of urban centres, the basis for the rupture of the balance in the natural reproduction of the soil, and therefore, of the possibility of an extensive and sustainable agricultural model. The increase in the degree of exploitation of labour, as a mechanism to counteract the tendency of the rate of profit to fall, only intensifies the exploitation of the use of land and territory, as an objective condition for the logic of accumulation of the capitalist mode of production.



But next to these considerations made by Marx in Book I, and contemporaneous to it, appear studies of the intensification of labour through the study of energy flows, where the figure of the Ukrainian physicist, Sergeii A. Podolinsky (1850 -1891), stands out, considered as one of the founders of the human energetic ecology (Martínez Alier, 1999: 16). For Podolinsky, the natural sciences provided the basis for a rational economy, which makes him study the history of economics as a system of energy conversion. For the Ukrainian author, labour is defined as that activity that contributed to the "accumulation of energy on the surface of the earth" (Martínez Alier, 1999: 89). Podolinsky, sympathetic to Marx's approaches in Capital, tries to integrate the labour theory of value with the second Law of Thermodynamics, the Principle of Entropy.

According to the Principle of Entropy, matter can be recycled, but energy cannot. The laws of economics are subject to physical laws through the Laws of Thermodynamics, which in its Principle of Entropy establishes energy degradation as the engine of the economy, which implies a modification in the law of value. The increase in the intensification of labour results in a decrease in negative entropy, that is, in the increase of low-energy goods. The goods that have the most value are those that have negative entropy, so that an economic system whose material logic is sustained in the increase of positive entropy (states of matter low in energy) lead society to energy degradation, the basis of the irreversible character of the degradation of the physical environment.

This so-called "Podolinsky Principle" establishes the need for the assumption, by socialism, of accounting criteria that integrate energy values, through measurement indicators of the economic equivalent of the relationship established between energy consumption and labour performed. Integrating the labour theory of value of Marx with the Principle of Entropy allows us to analyse the energy waste in capitalist society, because the highest energy consumption occurs while the differences between social classes are greater, motivated by the higher energy consumption of the rich social classes, social position that was sustained by a greater exploitation of labour, which in turn, also required a continuous increase in energy consumption (Martínez Alier, 1999).

Regarding the decrease in the value of the constant capital employed by workers, the logic resides in the attempts of the individual capitalist to increase productivity using greater quantities of machinery and raw materials, in order to achieve a reduction in the unit value per commodity produced, as less labour is needed to produce it. The needs of capital to consume greater quantities of raw materials and inputs is presented by Marx as consubstantial to the own



needs of revaluation of capital, and therefore, to the very logic of accumulation of the capitalist mode of production.

The history of capitalism is the history of the increase in labour productivity, if productivity has no limits, the rate of profit does not have to fall, but Marx points out that this dynamic "in certain circumstances can undermine the mass of profit by undermining the mass of profit-making capital "(Marx, 1973). Behind this argument, Karl Marx hides an implicit argument: the increasing complications for obtaining the elements of constant capital, because of the growing difficulties in obtaining the necessary resources as a result of natural and physical limitations to growth (Navascués, 2001: 63).

When Marx approaches the intensive production of luxury goods as a mechanism to correct the downward trend of the profit rate, he undertakes a pioneering study of the business dynamics of income segmentation as a competitive mechanism in the face of situations marked by underconsumption. Marx faces the study of the production of luxury goods, not from the subjective logic of the demand of the bourgeois class, but from an objective logic, where utility yields to profitability as the material logic of the functioning of capitalism as an economic system. For the capitalist mode of production, the environment is presented as useful goods, which become commodities through the private appropriation of natural resources for their transformation and subsequent exchange in the circulation process. The objective relationship that is established between the environment and the economic system in capitalism is carried out through the transformation of natural goods into goods under a reasoning of profitability, which is ultimately imposed on utility, which in this case is understood as sustainability. Podolinsky himself, studying this passage from Capital, analyses the high impact on energy consumption of the production of luxury goods, which also require the consumption of a greater quantity of natural goods.

Marx does not study the means of production of luxury goods or superfluous consumption from a subjective perspective, he does not analyse it through the market, but as an expression of objective needs marked by the logic of accumulation, where the increase in consumption of these goods would be the appearance of the phenomenon, while the essence is determined in the production process and in the difficulties of revaluation due to the problems of finding greater spheres for accumulation.

Finally, Marx analyses the role played by foreign trade:

To the extent that foreign trade cheapens partly the elements of constant capital, partly the necessities of life for which the variable capital is exchanged, it tends to raise the rate of



profit by raising the rate of surplus-value and lowering the value of the constant capital. (Marx, 1973: 278).

Marx analyses the continuous dynamics of market expansion, already studied by Smith, from the logic of the needs of obtaining greater quantities of raw materials and inputs aimed at achieving a decrease in the value of constant capital, and thus achieving an improvement in productivity. But along with the cheapening of the value of constant capital, Marx points out that foreign trade fulfils a function of obtaining goods aimed at the replacement of the labour force, such as importing food aimed at the consumption of the working class.

The expansion of large industries leads to an increase in the intensification and extension of labour in its salaried form, which requires a physical location around the large urban agglomerations in the shape of large cities, which become growing consumers of food that can no longer be provided by the national market or self-consumption. Added to this situation is the impossibility of self-regulation of the soil, by breaking with the natural cycles that allowed the maintenance of the natural fertility of the land, with the irruption of the capitalist model of agriculture. The environmental impact of intensive agriculture leads to the need for development of fertilizers that, in an artificial way, allow to maintain the productive capacity of agricultural land, through the control of raw materials necessary for the manufacture of chemical fertilizers. This aspect is studied by Marx through his analysis of the Second Pacific War, between Peru, Bolivia, and Chile, where England and the United States were looking for the control of guano, a fundamental natural raw material for the development of chemical fertilizers that would alleviate the productive decline of British and North American agriculture at the end of the 19th century.

Trade experiences an expansion of the market at the international level, which entails the advance of the capitalist mode of production also on a world scale, making these capitalist production relations the global hegemonic, through the development of an international division of labour. Marx studies colonialism as the political and institutional expression of the needs of direct control of raw materials, the expansion of the market for the goods of the metropolis and the needs of natural goods (mainly food), as functional to the logic itself of accumulation. This objective logic of revaluation of capital would be at the base of the plundering of the colonized countries and of the destruction of communal forms of property illustrative of the original dwellers.

In Chapters XXII and XXIII of Book I of Capital, Marx takes colonialism as one of the pillars of primitive accumulation, a historical process that allows the emergence of capitalism. The plunder that colonialism executes serves as the creation of a non-capitalist surplus that is



at the base of the emergence of capitalism as a hegemonic mode of production, and that of a new social class, the bourgeoisie, through the transformation of the merchant in capitalist. The logic of accumulation dominant in capitalism provides a material basis to the interrelation that is established between humankind and nature, on a global scale.

### 3.2 THE METABOLIC RIFT WITHIN THE CAPITALIST MODE OF PRODUCTION

The maturity of Marx's materialist vision of nature comes through the formulation of the concept of metabolism (*stoffwechsel*). In his definition of the labour process, Marx made the concept of metabolism key to his whole system of analysis, basing his understanding of the labour process through his materialist conception of nature and history, where the Marxist abstraction of the unitary vision of the world is summed up in the relationship between humanity and nature through labour.

Labour is, in the first place, a process in which both man and Nature participate, and in which man of his own accord starts, regulates, and controls the material re-actions between himself and Nature (...), he at the same time changes his own nature. The labour process is the universal condition for the metabolic interaction between man and nature, the everlasting nature-imposed condition of human existence (Marx, 1973: 286).

The concept of metabolism provides Marx with a specific way of expressing the relationship that is established by society inserted in the natural environment, by means of an interrelation between the understanding of natural laws and social laws.

This metabolism is regulated from the side of nature by natural laws governing the various physical processes involved, and from the side of society by institutionalized norms governing the division of labour and distribution of wealth. (Marx, 1973: 854).

Marx assigns a central role to the theory of metabolism, allowing us to explain the interdependence and complexity of the link between human beings and nature through labour, by means of this concept (Bellamy Foster, 2000: 246). Metabolism, for Marx, explains the human-natural relationship that occurs through social production. Metabolism appears in Capital as a social system established by the material and energetic flows that sustain the material behaviour of the system. Marx places such regulation through human labour and its development within specific historical social formations. The interrelation between society and the physical medium through the impartial logic of the capitalist mode of production reaches with metabolism its conceptual expression.



The logic of accumulation of capitalism leads to the development of large industries and intensive capitalist agriculture. Marx's analysis of capitalism allows him to confirm that the capitalist mode of production tends to destroy the relationship of the human species with the rest of nature.

Capitalist production collects the population together in great centres and causes the urban population to achieve an ever-growing preponderance. This has two results. On the one hand it concentrates the historical motive force of society; on the other hand, it disturbs the metabolic interaction between man and the earth, i.e. it prevents the return to the soil of its constituent elements consumed by man in the form of food and clothing; hence it hinders the operation of the eternal natural condition for the lasting fertility of the soil...But by destroying the circumstances surrounding that metabolism...it compels its systematic restoration as a regulative law of social production, and in a form adequate to the full development of the human race... All progress in capitalist agriculture is a progress in the art, not only of robbing the worker, but of robbing the soil; all progress in increasing the fertility of the soil for a given time is a progress towards ruining the more long-lasting sources of that fertility...Capitalist production, therefore, only develops the techniques and the degree of combination of the social process of production by simultaneously undermining the original sources of all wealth—the soil and the worker. (Marx, 1973: 290).

Marx's thinking goes beyond the framework of the ecology of labour, analysing how the capitalist mode of production hinders the exchange and relationship between human beings and nature, "capitalist exploitation is not only the art of preying on the worker, but also, and at the same time the art of depredating nature" (Marx, 1973). In this way, the relationship between humanity and the natural environment is related to the predatory nature of the physical environment and the intensification of labour, which the capitalist mode of production requires to ensure growth that guarantees its expanded reproduction. It is the very logic of reproduction of the capitalist mode of production that tends to break the relationship of the human species with the rest of nature. The material basis of the interrelation between society and nature under the capitalist economic system leads to the fracture between humankind and its physical environment.

#### **4 RESULTS AND DISCUSSION**

Karl Marx is often characterized as an anti-ecological thinker. There are many positions that support this statement, which can be grouped into three main arguments.



The first refers to criticisms that focus on Marx's alleged failure to consider the Laws of Thermodynamics, which leads to a lack of attention on the importance of the energy and material flows demanded by the economic system, critiques that are inserted in the context of Marx's rejection of Sergei Podolinsky's arguments through his correspondence with Engels. These criticisms are based on the letters that Engels writes at the request of Marx, where he makes an assessment on the considerations that Podolinsky makes about capital and the need to account for energy expenditure as an element of criticism of the capitalist mode of production. The ecological insufficiencies of Marx are based on the answer given by Engels and not Marx, who fails to answer these letters, received two months before his death.

Beyond the convenience or not of the assumption on the part of Marx of energy accounting criteria of the economy, within the political program of the labour movement of the moment, denying the consideration of the laws of thermodynamics in his economic analysis carried out in Capital, is not correct. Marx's analysis of capitalist agriculture is made from a thermodynamic point of view, the basis for the elaboration of its key ecological concept, that of the metabolic rift.

A second argument against the consideration of an environmentalist thought based on Marx's work focuses on the law of value, which has as its central element labour and not nature. For the defenders of this critical position, Marx takes the physiocratic conception of the environment as a "gift that nature gives to humankind", arguments that are an expression of a certain confusion about Marx's methodology and epistemology in Capital. Marx starts from the abstract to the specific as a method of study, which takes as its object the historically distinct social relations within a particular mode of production, capitalism. In this way, Marx starts from the general, his materialist conception of nature and history, and arrives to the concrete, the capitalist economy regulated by the law of value. The objective development of the relations of capitalist production under the law of value grants nature and the physical environment the consideration of being producer of use-values; the-use-value of wheat, Marx would say, "has nothing to do with the value of wheat, which, like all goods, comes from labour".

This contradiction between use-value and exchange value is typical of capitalism, a true object of Marx's study in Capital, a mode of production that omits nature as a source of wealth (generating value), only seeing in it a source of production of use-values, which within capitalism have no value whatsoever (Schmidt, 1976). For Marx, communism would be the mode of production that by its objective logic would consider wealth from a universal point of view, constituted by the use-values. Marx analyses the objective bases of bourgeois society, which are governed by the law of value, which relegates nature to the consideration of use-



value, which lacks interest within the logic of the capitalist mode of production, centred on profitability and not utility (production of use-values), a reality that can only be overcome, in turn, by overcoming the capitalist mode of production.

Finally there are the arguments that represent the most extended critique to Marx from the ecological point of view, the one of Marx's supposed productivism, based on his "promethean" vision of science and technology through the development of the productive forces under capitalism, vision that would take him to the consideration of the future communist society as the society of abundance, where production would not be put under the physical limits marked by nature. This productivist conception of Marx invalidates, for his critics, the construction of an ecologically conscious socialism based on his work.

The above arguments find their basis in the appearance of Marx's own rhetoric in many passages of his writings, but not in the essence of his scientific work. The critiques of Marx's productivism are based on the non-understanding of Marx's materialist conception of nature, focusing only on the materialist conception of the author's history, materialism that, if not related to the dialectical way of thinking defended by Marx, breaks with the unitary vision of the world that he defends in Capital. The productivist appearance in Marx's political discourse is followed by an antiproductivist base essence in his scientific analysis of the functioning of capitalism, where his critique of the development of capitalist agriculture and of large-scale industries, together with the analysis of the environmental consequences of the metabolic rift based on the separation of the countryside and the city, assumes an evident antiproductivist content.

Nor has Marx's consideration of technology and science in Capital a productivist basis, critique that seems to stem from an understanding of Marx's work from an Aristotelian logic and not from the dialectical way of thinking. For Marx scientific and technological development is a consequence of the objective logic of capitalism itself, but in turn, the social function of technology is determined by the logic of accumulation of the capitalist mode of production. In this way we find the difference that Marx makes throughout his work, between the appearance (the technological and scientific progress that occurs in capitalism) and the essence of the phenomena (the function assumed by technology and science in the capitalism), differentiation that is functional to his scientific method, which starts from abstraction (the role of technology in society) and goes on the specific (the role of technology and science in capitalism), a historical crystallisation that bases the object of study in Capital.

For Marx, science and technology assume the ultimate function, within the capitalist mode of production, of a constant mechanism of cheapening capital, and in this way



counteracting the downward trend of the rate of profit, a dynamic that causes the opposite effect, because the tendency to fall in the rate of profit lies the increase in the organic composition of capital. Therefore, the mechanisms to restrain the fall in profit refer to an objective logic based on the predatory nature of the physical environment, by requiring more and more inputs and raw materials necessary for the constant reduction of necessary capital. Technology appears as an instrument to obtain a higher rate of profit and maintain this way the levels of profitability of capital, but never as a generator of utility, although if its practical application yields utility (such as technologies that reduce environmental impacts or improvement in the conditions of life and labour of man), which, as we have seen, is not part of the objective logic of the capitalist system. Technology as a generator of utility ultimately requires, for Marx, the overcoming of the capitalist mode of production itself.

## 5 CONCLUSION

The object of study in *Capital* is not the environmental crisis, whose scope and current magnitude escapes Marx's perception; it is precisely the critique of political economy, through the scientific study of the mode of functioning of bourgeois society through the study of the capitalist mode of production. This scientific essence is instrumental to his political objective, denouncing the conditions of the working class and pointing out the limits of capitalism; nor does his political motivation reveal an ecological intentionality. However, his method allowed him to see beyond and sense the harmful impacts of the capitalist mode of production on the natural environment (Navascués, 2002), which Marx understood as irreversible, a method where the materialist conception of nature and the dialectical way of thinking conform the very basis of it.

Marx's unitary vision of the world finds its foundation in the materialist conception of nature and history, which lead him to sense the problem of sustainability as a consequence of the metabolic rift that capitalism provokes, and that frames the problem of limits to growth as a consequence of the very logic of accumulation. It is the objective logic of the economic system itself that is at the base of the metabolic rift, which currently exists, between humankind and nature. For Marx, capitalism tends to destroy the relationship of the human species with the rest of nature, seeming to entrust to the future communist society the task of establishing the ecological viability of the species.



## REFERENCES

- BELLAMY FOSTER, John (2000). The ecology of Marx. Materialism and nature. El Viejo Topo, Barcelona.
- FOLADORI, Guillermo (1996). "The environmental issue in Marx", in Political Ecology, nº 12, Icaria-Hogar del Empleado, Barcelona.
- MARTÍNEZ ALIER, Joan (1999). The principles of the Ecological Economy. Visor, Madrid.
- MARX, Karl (1973), Capital. Critique of Political Economy. Books I and III, Fondo de Cultura Económica, Mexico D.F.
- MARX, K. and ENGELS, F. (1974). The German ideology. Grijalbo, Barcelona.
- MARX, Karl (1977). Manuscripts: Economics and philosophy. Alianza Editorial, Madrid.
- NAVASCUÉS, Javier (2002). "Ecology and Marxism, from the classics to the present", in Utopías-Nuestra Bandera, nº 188, Madrid, pp. 59-68.
- RIECHMAN, Jorge (2012). Socialism can only arrive by bicycle. Ecosocialist essays. Catarata, Madrid.
- SACRISTÁN LUZÓN, Manuel (1987). "Some political-ecological hints of Marx", in Pacifism, Ecology and Alternative Politics, Icaria, Barcelona.
- SACRISTÁN LUZÓN, Manuel (2005). M.A.R.X. Maxims, aphorisms, and reflections with some free variables. El Viejo Topo-Marxist Research Foundation, Barcelona.
- SCHMIDT, Alfred (1976). The concept of nature in Marx. SIGLO XXI Spain, Madrid.