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ASSESMENT OF THE CORELATION ECONOMIC STRUCTURE – ENVIRONMENTAL BALANCE

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***Abstract**: Relationships between economic structures and ecological balance can be assessed by three criteria at least: resource consumption – reflected in the pressure exerted on the natural capital fund and stock; volume of polluting emissions – reflected in the quality of the environment; efficiency of economic activity – reflected in the financing capacity of ecological costs.*
The paper endeavors thus to approach and analyze these important aspects, both from an economic and ecological point of view.

Economic structures represent relations of various activities of an industry. Considering that some of the economic activities, through their substance and present level of technical and technological development have a negative impact on the environment, the importance of the problem is obvious.

The dynamics of economic structures is mainly connected to the evolution of two direct factors: capital decommissioning rate and coefficient of capital renewal. Decommissioning rate is the share of technical means decommissioned as a result of physical and moral wear, as well as those kept in conservation (due to various reasons), with a value expressed, out of the total capital. Renewal coefficient (by substitution and accumulation) is expressed as the ratio of investment volume and existing capital (renewal coefficient can thus be higher or lower than decommissioning rate).

To develop the analysis model of economic structures from an ecological perspective, we start from the following elements:

K – technical active capital fund and stock;

Q – gross internal product;

E_p – polluting emission volume.

Correlation of technical active capital fund and stock and internal gross product, and volume of polluting emissions, respectively, leads to two functions:

$Q = F(k)$ and $E_p = Z(k)$

The first being convex increasing, and the second concave increasing.

Evolution of polluting matter volume released during activities, according to a concave increasing function (meaning that any capital increase is accompanied by an increase of polluting emissions) should not be mistaken with that of polluting matter which is of an increasing type, even when the capital level is not modified, since the pollution process is a cumulative process.

Since environment can be polluted both by production and by consume - productive or nonproductive – (for example, plastics pollute both during their manufacturing, due to the technologies employed, and when they are used, many of them cannot be re-circulated after their use), the volume of emissions can be calculated based on the equation:

$$E_p = q_c (Q - S) + q_f Q, \quad (1)$$

where:

q_c – contamination coefficient due to consume (kg waste/1000 GIP);

q_f – contamination coefficient due to production of goods and services (kg waste/1000 GIP);

S – volume of savings for investments.

Environment being assessed by contamination level, D expressed by waste concentration per unit volume (m^3 water, air, etc.)or surface (ha, km^2), annual D variation is determined by the equation:

$$\dot{D} = \frac{dD}{dt} = \frac{E_p}{V} - hI_r - \delta, dt = I, \quad (2)$$

where:

V – affected volume or surface;

h – efficiency of investments for de-pollution (kg waste/lei investment)

δ – “dilution” capacity of the natural system;

I_r – investment volume for de-pollution (or dilution capacity increase of the environment).

To estimate the stationary balance of industry, in an ecological context, besides equation 92), it is necessary to draw up annual average variation of technical capital $\dot{k}$ as well, based on comparing investment volume and decommissioning, that is:

$$\dot{k} = \frac{dk}{dt} = sF(k) - gk, dt = 1, \quad (3)$$

where:

s – average saving rate

g – decommissioning rate.

Ecological-economic stationary equilibrium involves both annual average waste $\dot{D}$ and capital $\dot{k}$ concentration to be zero.

$$\text{When } \dot{D} = 0 \Rightarrow \frac{E_p}{V} - hIr - \delta = 0 \quad (4)$$

When S=0, meaning that, short of loans, no investments can be made to protect environment ($\dot{I} r = 0$),

$$\frac{Ep}{V} - \delta = 0 \Rightarrow (q_c + q_f)\frac{Q}{V} = \delta \Rightarrow Q = \frac{V}{q_c + q_f}\delta \quad (5)$$

Equation (5) shows that *without environment protection installations*, there is a level of Q for which polluting emissions are absorbed by the environment.

The relatively constant character of parameters V, q_c, q_f, , supporting the hypothesis of polluting emission volume dependence on the capital in function, and the existence, however, of de-polluting installations, lead to the following equilibrium equation (6):

$$\frac{Q(q_c + q_f) - q_c S}{V} = \delta \quad (6)$$

where

$Q(q_c+q_f)$ is volume of total polluting emissions, q_c, S is volume of retained polluting emission.

The second condition of stationary economic – ecological equilibrium $\dot{k} = 0$ leads to the equation:

$sF(k) = gk$

This equality means that capital volume invested – sF(k) – will be equal to the capital decommissioned – gk.

Considering that along a year k is relatively constant, in a coordinate system (D; k), $\vec{k} = 0$ curve will be a vertical line. (Fig. 1).

Point A corresponds to the state of balance in an industry, when the quality of environment is in question (quantity polluting matter generated by functioning of capital K are completely absorbed by the environment, and k capital variation is zero).

In Fig. 1, four zones are delimited , corresponding to certain economic structures , each having a different impact on the environment.

Zone I

Means low capital levels, with polluting emission volumes over environment absorbing capacity. The structure of these industries are less prone to mechanization and automation, having a negative environmental impact. "Ecological" evolution of these industries means promotion of capital accumulation, with investment however in those branches, which do not favor pressure increase on natural systems, over their corresponding support capacity.

Zone II include low capital fund and stock industries, with low economic intervening possibilities to support environment, pollution being over maximum admissible concentrations.

Capital infusion should be mostly done in less polluting areas, concurrent with renewal and/or decrease of capital in activities leading to high pollution levels per capital and or per product unit.

Zone III is a critical situation, but with ecological rehabilitation possibilities, however, of balance and of economic structures. Zone III industries have serious capital in function, its structuring per branches favoring, however, the natural system's support capacity. Moreover, to keep up the balance of the economic system, flows in the qualitatively superior energy retro feeding loops should be intensified, that is self-phage phenomenon should be emphasized, with more and more destructive effects on the environment. Therefore, the evolution of such structures should aim at reducing highly polluting activity capitals in function, the volume of investments being strictly sized, and mainly directed towards less polluting activities.

A situation comparable to system homeostasis is found in Zone IV structures, entailing a high capital volume, without environmental support capacity. These structure's dynamics are not directly linked to environmental quality, but sooner to possibilities of maintaining a high accumulation rate, which should provide system stability (even at a stationary level, since decommissioning volumes also depend on total capital volume in function*); in these conditions, entropy level can rapidly increase, therefore renewal level should be less than decommissioning rate,* even if investments can only be done in polluting activities as well.

So far we can conclude that, regarding environment quality, the following economic restructuring types can be pointed out:

1. restructuring by investments with the same technological level, with the following effects:
- increase of technical capital fund and stock;
- increase of polluting emission volume and environment quality decrease;
2. restructuring by decommissioning part of the capital, in which case, the effects are:
- decrease of capital fund and stock, with the perspective of output decrease);
- decrease of polluting emission volumes and environment quality rehabilitation.
3. restructuring by quality changes, having the following effects:
- capital fund and stock is not modified significantly;
- environment quality increases, due to decrease in emission levels, and their structure is changed, with the decrease of noxious matter.

Relationship between economic structures and environment quality will be analyses in both senses. Therefore, assuming that actions are taken to maintain or redo environment quality, in a year's time, investment volumes for de-pollution will increase, and investments for producing goods and services other than associated to environment, will decrease.
Organizing and carrying out environment protection, in the context mentioned above, can lead to a series of effects:

- cutting down economic activity;
- reducing volume of polluting emissions both due to less capital and due to capital increase in areas of pollution control and decrease;
- shift of economic-ecological point A.

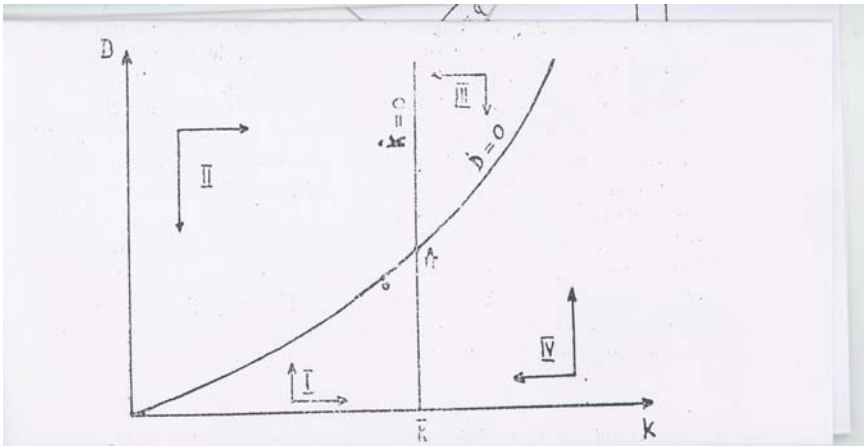

Fig. 1 Stationary economic-ecological balance state

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