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# The Environment and the Development: Between Levels of Harmony and Costs of Distortion

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**Abstract:** The issue of development is at once important and controversial. The former stands on the meaning that the progress is the prime condition of social welfare and human well-being. The second concern stems from the variety of conditions and tips to be respected in order to cope with the development targets. In addition, the development planning strategy is bracketed by the patterns of the ground on which this strategy is applied. These patterns vary according to the specificities of the region- the ground of the development strategy- and its legacies. This assumption leads to think purposefully about the compatibility or the incompatibility of the environment considered as a factor to achieve the development targets. The paper tries to investigate the inter-relationship between the environment and the sustained growth and to explore the level at which the environment is more reliable to get the perceived outcomes.

**Keywords:** Environment, Sustained Growth, Compatibility

## 1. Introduction

The relationship between the environment and the development referred to Burtland Commission Report –Our Common Future- in which the issues of sustaining the environment and thinking about creating a friendly ground for human well-being were explored. This commission forwarded the idea that the best development policy should incorporate in its design three dimensions: the economic dimension, the social concern and the environmental challenge. This triangle according to the commission shapes the policy makers strategy in such a way to ensure the economic welfare (in terms of output creation process), to consolidate the welfare of human being (in terms of food security and decency) and to harmonize the challenges of the surrounding environment according to the two other dimensions (here, much emphasis would be addressed to the efficient uses of energy and the best ecosystem management). The debate expanded to tackle the issue of environment degradation as a result of the increasing trend of the economic development. In fact, the commission by its vision explained the concept of the sustainable development by integrating the environment concern as follow: "The concept of sustainable development implies limits-not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effect of human activities".

The striking evidence of this definition is that it embodies the condition of sustainable environment as an important foundation for development. This supposition is also heightened by the following statement of principle 1 of agenda 21: "Human beings are the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature".

The table below shows the relationship between the environment and the Millennium development goals achievement:

***Table 1.*** *The link between the goals of development and the environment.*

| Millennium Development goal | Selected environment links |
|---|---|
| Eradicate extreme poverty and hunger | Livelihood strategies and food security of the poor depend directly on healthy ecosystems. Climate change affects agricultural productivity. Ground level ozone damages crops. |
| Achieve universal primary education | Cleaner air will decrease the illnesses of children due to exposure to harmful air pollutants. As a result, they miss fewer days of school. Water related diseases such as diarrheal infection cost about 443 million school days each day, and diminish learning potential. |
| Reduce child mortality | Acute respiratory infections are the leading cause of death in children. Pneumonia kills more children under the age of five than any other illness. Environmental factors such as indoor air pollution may increase children's susceptibility to pneumonia. Water-related diseases, such as diarrhea and Cholera, kill an estimated 3 million people/year in developing countries. The majority of them are under the age of five. Diarrheoa had become the second biggest killer of the children, with 1.8 million children dying every year (almost 5000/per day). |
| Combat major diseases | Up to 20 percent of the total burden of disease in Developing Countries may be associated with environment risk factors. Preventive environmental health measures are as important and at times more cost-effective than health treatment. |
| Promote gender equality and empower women | Indoor and outdoor air pollution is responsible for more than 2 million premature annually. Poor women are particularly vulnerable to respiratory infections, as they have high levels of exposure to indoor pollution. |

## 2. The Environment Degradation and the Sustainable Development

The environment degradation may engender barriers for achieving the targets of the development strategy. In fact, the economic literature suggests arguably that the growth is absolutely conducted by necessary resources which are detailed by land, labor and capital. These variables interact between them in harmonized and effective measures to build up the suitable schema upon which the policy maker will get the ability to achieve the goals by respecting the development policy (development management strategy).

The embodiment of the environment paradigm within the economic development strategy stems from the tradeoff between the extents of the environment exploitation as a basic component of the growth model and the ecosystem protection. Here, the question of the environment using degree arises in order to explore the effectiveness of the utilization management and to best fit with the matter of how much the environment using strategy is enough to attain the goals previously stated.

Additionally, the economic literature is well suggesting that the economic growth is based upon the capital accumulation, rate of productivity and the labor using capacity. The heterogeneity of the environment exploitation (energy using, soil degradation, climate change) is also critical in determining the long run trend of the economic growth and this fact led to incorporate these natural variables into new expanded growth models and considered as exogenous or endogenous variables (Cass 1956, Koopmans 1967 among others).

In this context, the energy use poses serious challenges both at local, national and international levels. Emissions from fossil fuels for example are significant to think about the pollution abatement and the costs related to it.

In another sense, the neoclassical economic growth theory postulated that a positive co movement between the rate productivity and the wages rate exists as the growth in long run is strictly related to the saving behavior (management of the increasing wags trend) and the capital productivity. The models of the theory suggested by Solow (1956) and developed by Cass (1965), Maler (1974), and Uzawa (1975) tackled the impact of the environment exhaustion on the capital productivity as major determinant of the growth properties especially in the long run. This consideration takes part in the intermediate trend to have an impact on the growth in long one.

Furthermore, the environment degradation as a consequence of the development increasing trends raises many issues balancing between the economic, ethical and moral considerations. This concern assumed that the emphasis must be stressed beyond the automatic technique of cost-benefit analysis to scratch the justice as the greatest question in this arena. High proof indicates that the negative burden of the environment misuse is not afflicted on those who greatly consume it but rather the people in poor developing countries who are suffering from the severe damages of the nature and hence, the cost of the environment degradation is also subject of causing hard injuries to future generations.

Despite the fact of the importance link between the environment strategy and the environment, there are few attempts to examine this issue seriously and to cope with the imperatives of sustaining the environment in a way to promote the economic growth, ensure the human well-being and to protect nature (Dernbach, 2004).

This attempt led to an abundant flow of economic models that tackled the relationship between the economic growth and the environment quality as the environmental measures has a predictable trend following that of the economic one either in its increase or decrease state (Beckerman, 1992; Grossman & Krueger, 1993; Kuznets, 1955; Mather, 1999; Faiz, 2007; Antoci, 2006)) and intended to explore the controversy of the high level of the economic growth and the high demand of energy and raw materials as pre conditions to ensure the realization of the developmental strategy previously outlined. This situation (high level of economic growth) according to some researchers leads inevitably to a harsh depletion of the resources and large quantities of byproduct wastes, high degree of pollution and an increased extraction of natural resources. These consequences have a

deteriorating impact in environment quality, the human welfare and even the economic activity in general will be at risk (Georgescu-Roegen, 1971; Meadows et al, 1972; Enrlich and Holdren, 1971, 1974; Cleveland, 1984; Daly, 1977, Jansson et al, 1994).

The relationship between the environment and the economic situation is shaped by the inverted "U curve which suggests that pollution increases at first stages of the trend movement then it decreases according to the increase in economic growth. This assumption has been expanded to take another dynamic property in which the interaction among socio economic and environmental variables is taken into consideration (Majid, Burton and Daniel, 2001).

According to Bruno Trezza 2007, The production factors related to the usage of nature such oil and transportation had increased much faster than those named as traditional factors like Zinc, cast iron…These statistics were held between 1952 and 1991 and concluded that the former factors varied increasingly between 1.58 and 3.46 while the latter got an average use above 5.70. This picture leads to say that the economic growth and the economic system in general depend comprehensively on the natural overexploitation, the fact that makes the latter facing a serious and threatening challenge.

The table below summarizes the finding of the study which reveals that the energy uses in the first products exceeds those of the second type of products:

***Table 2.*** *Energy conversion of global photosynthesis and energy from oil, coal and gas.*

| **All figures are expressed in 109 Gcal/year** | | |
|---|---|---|
| Production/year | 1952 | 1991 |
| Crude Oil | 5.76 | 29.80 |
| Coal | 8.48 | 24.16 |
| Natural Gaz | 2.47 | 17.40 |
| Energy/Production/year | 16.71 | 55.70 |
| Global Photosynthesis/year | 26.00 | 26.00 |
| Total energy/year | 42.71 | 81.70 |

A simple glimpse on the table shows that the ecosystem gets much damage in terms of pollution and composed wastes as the major product factors depend heavily on this kind of energy. The latter integrates in the production process according to such economic rules and, consequently, a strong base of pollution and environmental downgrading will be created and hardened with the evolution of the economic system and processes of production.

Maintaining a sustainable and efficient growth strategy which takes into account the imperatives of the environment protection becomes more than a necessity. Related to a study conducted by Stern 2006, the costs of avoiding catastrophic climate change damage are estimated by 1% to 3.5% of the GDP gains, while in case of no adopting a serious strategy to manage the harms of the climate change, the percentage rises from 5% to 20% of GDP.

In the following section, we develop a model which the relation between capital accumulation, the environmental pollution as a proxy of the environment degradation and the growth is investigated.

# 3. Conceptual and Mathematical Formulation of the Model

In this model, pollution is considered both as a joint product (endogenous variable) and a source of damage (exogenous). Propose that a general growth model is given as:

$Y = f(K, AL) / K$ : Capital, $AL$ : Effective labor.

The pollution is measured by flow of emission per unit of time (t) and it is related to the above model as:

$$Z(t) = \vartheta(Y(t))$$

This can be simplified by noting that $Z(t)$ is dependent to $Y(t)$ by a specific coefficient $\gamma$, then the model can be written as:

$Z(t) = \gamma Y(t)$ / $\gamma$ is emission per unit of output at time $t$

As the production increases and more sophisticated process will be adopted (the technology advancement), the capital should take the form of disincentive of the environment pollution (the technology adoption tends to reduce the amount of emissions). This fact leads to decompose the capital into: one generating pollution (productive capital) and other abating pollution (abatement capital), hence:

$Y = F(K_p, AL, K_a)$ /$K_p$ : Capital generating pollution

$K_a$ : Capital abating pollution

$Z(t)$ can be interpreted as:

$Z(t) = \gamma (K_a) Y(t)$?/ $K_a$ is capital abating and depends upon cleaner technology that reduces pollution and is modeled as:

$K_a = \varphi (T(t))$ / $T(t)$? is the cleaner technology that reduces pollution

$\varphi$ : is the coefficient of using the technology at time t

Then:

$Z(t) = \gamma\varphi(T(t))Y(t)$, the $T(t)Y(t)$ aims at maintaining the environment at the appropriate levels of exploitation by respecting the targets of the generative pollution capital (γφ: a coefficient of compatibility).

Suppose that the environmental dimension evolves in time with the technology using and the growth process then the emission takes the following form:

$$Z(t) = \gamma\varphi T(t) Y(t)\ dt$$

The coefficient $\gamma\varphi$ helps the policy maker how to design a policy that maintains the economic and ecological concerns i.e. that the policy works at achieving the desired output by lowering the rate of pollution. Hence the policy maker is conducted as:

$$\frac{\partial Z(t)}{\partial t} < \frac{\partial T(t)}{\partial t}$$

Supposing that the functions take linear trends, so that it is worthwhile to balance between the productivity of capital generating pollution and the capital that reduces it so:

$\varphi > \gamma$ and the multiplication reveals the extent of the compatibility between the economic and the environmental concerns:

$\varphi > \gamma \Rightarrow \varphi\gamma$ covers the costs of the environmental damage, and this is expected by the rate of the two coefficients i.e. as much as φ is higher than $\gamma$, the policy maker has more ability to maintain the environmental conditions to a specific economic target and vice versa.

# 4. Optimal Growth Model Under Environmental Pollution

In this model, we envisage an economy in which firms and households are behaviorally independent and perfectly competitive and they are seeking the profit-maximization (firms) or utility-maximization (households). It is also suggested that the utility function of the consumers depends on consumption function (forward) and stock of pollution (backward). Then the utility function is designed as:

$U\left(c(t),\ P(t)\right)\ /\ c(t)$: the consumption function

$P(t)$: the stock of pollution at time t

According to the utility maximization theory, the curve of utility function according to consumption is increasing and gets a peak when:

$\lim_{c\to\infty} Uc(c,P) = 0$ (Partial derivation of the utility function according to $c$)

The pollution impacts the utility function by decreasing its trend and the lower peak is got when:

$\lim_{c\to\infty} Uc(c,P) = 0$ (Partial derivation of the utility function, according to $P$)

Related to Anastasios 2003, the consumer attempts to optimize his utility function by considering that P (the pollution rate) constant and solves the maximization problem:

$Max_{\{c(t)\}} \int_0^{\infty} e^{-\rho t U(c,P)} dt / \rho$ is the utility discount rate which is subject to intertemporal budget constraint.

$C(t)$ is measured as follow:

$C(t) = K^{*} + w(t)\ dt\ /\ r(t)$: interest rate changes and $w(t)$ wages.

Then, the consumer intends to maximize the following:

$Max_{\{c(t)\}} \int_0^{\infty} e^{-\rho t c(t)} dt$ Under the condition that:

$P(t) = \frac{\partial U(c,P)}{\partial Uc}$ and $\lim_{P\to\infty} U(c,P) = 0$ (the best strategy).

The consumer in this case strives to widen the space between the maximization of consumptive utility and minimization of pollution disutility and then he attempts to solve the following dynamic problem:

$$U^{*}(c,P) = Max_{\{c(t)\}} \int_0^{\infty} (e^{-\rho t U(c,P)} - e^{-\theta t U(c,P)} dt$$

$\theta$ is the propensity of pollution according to the consumption magnitude.

$U^{*}$ is the preferred utility state.

This maximization means that the consumer has two considerations: an economic concern aiming at maximizing the consumption utility and an ecological one which looks for minimizing the damages disutility of the environment damage. Consequently, the economic agent gains a good threshold of consumptive utility whenever the following equation is established:

Consumptive gains=economic gains + ecological gains

# 5. Conclusion: A Way Forward

The human well-being is not restricted only on the magnitude of the goods and services produced and consumed but it combines a wide range of measures which make the challenge of making the appropriate strategy including all the dimensions of the prosperity to achieve the sustainable development more than a necessity. The traditional neoclassical growth models had much emphasis in their analysis about economic growth on two basic factors: capital and labor. Then, they expanded their dimensional views in attempt to explain more the true causes behind a respected level of economic development. However, something important missed: clean air, fresh water, global health, sustained warming level and pollution reduction. All these dimensions are addressed seriously in order to flourish a suitable ecosystem to fit the goals designed and reduced the potential threats and the debate is much more opened for further investigations and analysis.

This paper tackles the subject of sustainable development by taking into consideration the highly esteemed position of the environment in this arena, and tried to make compatibility between both the economic and the ecological fields in the development process. The paper emphasizes the significance matter to establish a sound and appropriate correlation factor between what the economic agents aspires and what surrounds him.

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