

## THE NATURAL RESOURCES AND SUSTAINABLE DEVELOPMENT

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Received May 20, 2010

**ABSTRACT** - The use of natural resources into the productive technological processes means the direct consumption of resources for satisfaction of needs of products and services. The exploitation of natural resources can be performed into a complex, coordinated manner, through the simultaneous satisfaction of more consumption demands. The actual generation evidently supports the degradation and sometimes decreasing of natural resources because of the past generations. The future generation will support not only the actual cost of environment degradation, of natural resources diminishing but also the cost of accumulation into the environment of atmospheric pollutants and toxic heavy metals, of losing the tropical forests and biodiversity. For this reason it is necessary the actual consideration of the needs for the future generation, even if that implies supplementary charges for political institutions that are obliged to satisfy only the economical, social and environmental demands and needs for the actual generation.

**Key words:** Natural resources; Environment, Sustainable development.

**REZUMAT** – **Resursele naturale și dezvoltarea durabilă.** Folosirea resurselor naturale în procesele tehnologice productive are în vedere consumul direct al resurselor pentru satisfacerea cerințelor și/sau necesităților de produse și servicii. Exploatarea resurselor naturale poate fi realizată într-o manieră complexă și coordonată, pentru satisfacerea simultană a mai multor cerințe de consum. Generația actuală suportă, în mod evident, degradarea și, uneori, diminuarea resurselor naturale, datorită generațiilor trecute. Generația viitoare va suporta nu numai costul actual al degradării mediului înconjurător, al diminuării resurselor naturale, dar și costul acumulării în mediu a poluanților atmosferici și a metalelor grele periculoase, al pierderii pădurilor tropicale și biodiversității. Din acest motiv este necesară luarea în considerare a nevoilor generației viitoare, chiar dacă acestea implică modificări suplimentare ale politicilor instituționale, care sunt obligate să satisfacă doar cerințele și nevoile economice, sociale și de mediu ale generației actuale.

**Cuvinte cheie:** resurse naturale, mediu înconjurător, dezvoltare durabilă.

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## INTRODUCTION

The term of *natural resources* includes “all resources” that exist in natural state and all systems that are or can be useful to the man in the actual technological, economical and social circumstances (Flavin, 2002). Frequently, into the economic speciality literature and not only the term of “resources” was associated with the one of “reserves” that indicate well defined resources that are known to exist. Nevertheless, the data concerning the reserves are subdue to frequent changes and, supplementary, seem to support a high level of uncertainty. Therefore, the term of reserves is the most frequently mentioned in the connections with the non-renewable reserves (e.g. fossil fuels, iron and non-iron ores, deposits of stones, marble, uranium).

The most used classification of natural resources is that which divides them into *renewable resources* (i.e. solar energy, wind energy, tidal energy, agricultural lands, forests, air and waters) and *non-renewable resources* (i.e. mineral substances and fossil fuels). The renewable attribute of the natural resources depends more times of the proper use of some unrestrictive administrative methods, as the case of agricultural lands and proper storage of wastes, because some changes in the system of natural resources can be proven to be irreversible.

The supplementation of stocks of *natural resources* is generated as a

result of discoveries by *explorations*. From this reason the process of exploration is highly linked with the administration of natural resources. The renewable resources possesses proper rate of increasing or regeneration. Generally, the explorations supply information concerning the *reserves of resources*. Sometimes these informations are precise, with a high level of certainty, but, othertimes the information can be no more than probable and so subdue to a certain error. Besides, the explorations against the existent stocks are not free but expensive and the information that are supplied must be treated as a ‘poor input’ in the production process of goods from natural resources. In these conditions, the stocks or reserves indicate that are known to be available in the future while the dynamic of goods and services constitutes an indicator of the current usefulness. It must be underlined the fact that, in the case of *in situ* utilization, the distinction is not so clear, because the stock is formed by the itself system of natural resource (e.g. 1000 m<sup>2</sup> of mature oak forest), while the dynamic of services can consist of the interaction with other natural systems or people (e.g. wild life or usual pleasure or advertising activities).

The terminology concerning the *natural resources* was defined and accepted clearly in the case of *mineral resources* and *fossil fuels* (e.g. coal resources, etc.), because of the initiative taken over by Bureau of Mines – An Geological Survey to

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standardizing these terms. At the definition of terms there are taken into account two characteristics of resources: 1- the sphere of geological knowledge; 2- the economical probability of regeneration (Flavin, 2002).

The most complete term is that of *resources* that is referring to the whole existent deposits, both that are already geologically identified or are only presumed to be, both that are exploited from economical point of view and into the conditions of the actual market, with the modern technological means or not.

At the evaluation of reserves of a natural resource is important to be considered the interactions with the other systems as well the potential irreversible changes. For example, the open mining of coals can lead to the complete interruption of ground water motion and the permanent exhaustion of some rivers and wells; the acid formed through the sulphur contact with the atmospheric air and can lead to the pollution of water reserves and the murder of plants and fishes (Zaharia, 2004). From this reasons, the natural resources must be looked as component parts of some more extended systems.

Through the use of natural resources into the technological production processes takes place the *direct consumption* of resources with the goal of satisfaction demand and/or necessity of products and services. The resources' exploitation can be done into a complex, coordinated

manner by simultaneous satisfaction of more consumer demands.

## MATERIALS AND METHODS

This scientific paper proposes a unitary manner of synthesis the information from the scientific literature together with authors' opinions about the principal elements, exploitation, consumption aspects and national importance of natural resources and sustainable development of the environment. Also, there are presented the fundamental problems in the field of natural resources together with the most important interdependences and connections between the sustainable development and the natural resources.

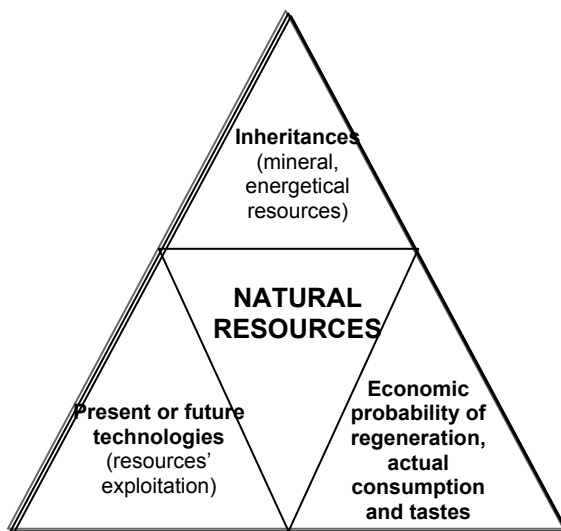
## RESULTS AND DISCUSSION

**Fundamental problems in the field of natural resources.** The principal elements that must be mentioned concerning the natural resources are synthesized in the below figure (*Fig. 1*).

Moreover, in the field of natural resources it must be considered the following fundamental problems interrogatively or globally enunciated as follows:

*1. How much and in what conditions the society exists with finite reserves of 'in situ' stocks, with renewable resources but destructive and limited systems of environment supervision ?*

There are taken into account aspects on:



**Figure 1 - Principal elements concerning the natural resources**

1 – the stock of some specific vital natural resources; this is finite (e.g., fossil fuels);

2 – the consumption rate of reserves; this was emphasizing in last time, having higher consumption rate comparison with the historical consumption rate;

3 – the existence of some important systems of renewable resources.

Concerning the *resources exhaustion* it is known that “when the quantity of certain used resource increases with 5 % per year, his rate of utilization is doubling in 14 years“ (Negrei, 1999).

2. *The placement of known natural resources.*

In the world exists numerous reserves of oil, natural gases, bauxite, ores of iron, chrome and are discovering much more every year,

but these are not placed in accessible places or do not belong to the principal consumer countries. In these conditions, the consumer countries are confronting with the political pressure and exorbitant increasing of the price imposed by the holder countries of such stocks.

3. *The passing of humanity from the utilization of non-renewable resources to the renewable ones and reversely.*

It is permanently imposing the revising and adaptation of the economic and social development strategy of a state based on the production and consumption tendencies from the other states and mainly from the high industrialized states. The behavioural models must be reconsidered and revised in the context of diminishing of non-renewable resources and reduction of

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assimilable capacity of environment for the wastes, emissions and evacuations of pollutants from the productive and consumption technological processes.

In agriculture was already made the passing from the use of animal force to the use of motor power that implies the fuel consumption, from natural manures to the chemical synthesized ones (*i.e.* fertilizers), but the tendencies of returning to the beginnings are already pointed out from ecological and environmental reasons.

The insurance of productive and consumption demands by the use in a higher manner of renewable resources for the need of electric energy and heat is an obvious tendency into the European countries beginning with the 2003 year and the strategies of economic development in EU impose the increasing of the installed capacity that use renewable resources (*e.g.* wind energy, solar energy, biomass) (Zaharia, 2004; Zaharia and Costachescu, 2008; Zaharia, 2008; Zaharia, 2010; Zaharia and Şuteu, 2010). But, in the last times it is ascertained the fact that the use of 'vegetal carbon' (biomass) becomes more expensive both of enormous necessary quantities and surfaces both of the high distances from forests, as well the unwanted effects against the environment, but can be individually applied not as a global solution at a national state level. Thus, the alternative solutions must be taken into account by the majority of the European countries and not only.

*4. The evaluation of behavioural models concerning the utilization of natural resources.*

During the time, there are known in the world numerous examples of irrational, aggressive and/or limited exploitation of some natural resources. These are had permanently in view when there are quantified the economic, social and environmental effects of the productive and human consumption of natural resources. The sustainable development imposes the reasonable consumption of resources and the permanent regeneration of reserves/stocks of natural resources.

*5. The correct understanding of the role and importance of the natural resources and environmental services, as factors of sustainable development.*

The development and, implicitly, the economic increasing underlines the importance of technological increasing and modernization as well of human capital improvement, but in only few economic analysis of the role and importance of natural raw materials and the environment as the purveyor but also depositary of goods and primary and secondary wastes. The sustainable development imposes pregnantly the consideration of *environment protection* as a compulsory demand in performing of each type of economic or vital activity. This fact implies the application of preventive measures, pollution control and minimization in each sector of economic activity, fact that is sometimes expensive but ensures the environment safe and protection.

6. *The emphasizing of increasing dependence of inferior natural reserves.*

The quality of all used ores is more and more diminishing comparison with those exploitive in the past, but their exploitation imposes high energetically consumptions and sometimes unjustified in terms of production costs but also environmental costs or taxes for environment pollution. The use of renewable resources is an alternative solution where is possible physically and financially or/and exist installed capacities of valorisation.

The problem is thus more complex than the continuous decreasing of the quality of natural resources. There exist geological proofs that confirm the fact that more of the poorer ores present high discontinuity in the way in what appear in the terrestrial crust, respectively that, after are exploitive the ores that present high concentrations of useful ores, these can be found into molecular forms extremely different and diffuse, needing energies of 1000 until 10000 times higher for extraction (Surpăţeanu, 2004).

7. *The evolution of global restrictive conditions of environment quality (i.e. climate changes, the exhaustion of ozone layer, acidification, the improper elimination of chemical dangerous substances and dangerous wastes, atmospheric pollution, water pollution).*

In the last time, the importance of reduction of the quantity of CO<sub>2</sub>,

SO<sub>2</sub>, N<sub>x</sub>O<sub>y</sub>, CFC, CH<sub>4</sub> etc. emitted in the atmosphere was remarked and underlined into numerous conventions, directives and regulation acts for the environment quality (Zaharia, 2008). The lack of balance for the normal composition of the atmosphere generated the global atmospheric phenomena that are perceived more and more acute by the whole population of the world (climate changes, acid rains, destroying of the ozone layer, GHG effect).

8. *The role of production and consumption processes in the management of natural resources vs. time*

The market had an important historical role in the intensification of the exploitation activities of natural resources and in the establishing of their utilization rate. Each state adopts a proper, sometimes contradictory behaviour, concerning “the virtues of free market”, but on the other hand controlling the prices and initiating bureaucrat regulations. From that the necessities to find the answer at questions as: Can be functional the market processes in the field of natural resources into a responsible social manner? What are the alternatives? What is the motivation of such market processes?

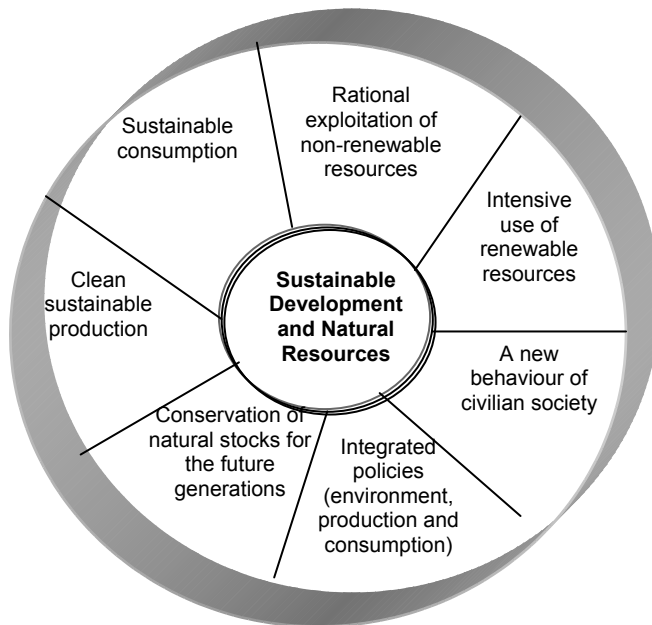
The answer or critical evaluation of these fundamental problems in the field of natural resources at local, national or universal level will respond maybe to existential questions with emphasizing of beneficial aspects or not of the

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scientific, technical, economic and human progress, at the choice and agreement of development direction (*i.e.* one of the three ways of development such as: *optimality*, *sustainability* or *surviving* (Zaharia, 2003)) and, generally, of socio-economic policy and strategy or “the following route” of the actual society. The practical approaching, that can be proven more useful in the decisions’ taking, is ensuring by the concept of maximization of benefits for conservation and protection of the natural resources, as well as the

respecting of environmental demands in any economic productive or human activity.

**The natural resources and sustainable development.** The sustainable development and natural resources are indissoluble linked of the society existence, of development of the economic, technologic, social, human medium, and of ensuring the environment protection (Zaharia, 2008; Negrei, 1999). These interdependences are systematized into the following figure (Fig. 2).



**Figure 2 - Sustainable development and natural resources – interdependences and connections**

At the most simple level, the probability as an agricultural poor country to be capable to oppose to the external shocks (*e.g.* climate

variations) or stresses (*e.g.* international obligations) increases as the reserves/stocks of natural resources increase. The natural

resources help the economies to come back from shocks. In these conditions the increasing of natural resources is the only way to the toleration.

In the case of industrialized countries subdue to ecological shocks or stresses, there are limits of risks more flexible than those of the poor ones, where the rapid demographic increase and the low economic progress have often as effect the narrowing of risks' limits against the external disturbances (Diop, Leautier, 2007).

The industrialized countries possess also a much higher capacity to replace the technologies than the developing countries when are exerting ecological pressures.

The irrational exploitation of non-renewable resources must be avoided if the benefits from the intensive exploitation of natural resources are very high on short time term. This represents a basic rule in approaching of environment conservation using standards of minimal safe.

If a resource is exploited into tolerability parameters, his stock will remain constantly in time. Contrarily, the reserve will be diminishing to the prejudice of future generation.

This future benefit is lost because of a management out of tolerability parameters, quantified into *the sacrifice costs of future use* that represent the user costs or "exhaustion prizes". The basic rule is that the proper price of a natural resource must reflect the extraction costs (or production costs), the environmental

costs and the utilization costs (www.geneva.org, 2002).

By comparing of the concepts of economic and ecologic tolerability it is concluded that it is more suitable to exam the keeping of a set of possibilities to rational exploitation of natural resources, in comparison with the strict conservation to the basic value of natural resources. This fact is due to the fact that the preferences and technologies are not constant during generations, so that the conservation of a basic value can be proven to be excessive.

The diversity of demands and preoccupations on short time term, as well as the targets on long time term existed into the whole world, suggests the fact that *it not exists a "good" or "bad" sustainable development, universally valid*. The maximization concept for the net benefits of economic and social development in conditions of keeping the natural resources and environmental services vs. time can be useful in decisions taking. This supposes the use of renewable resources, especially if these are poor, in small rates or equal with the natural rate of regeneration. The efficiency of using the non-renewable resources must be optimized by mean of the technological progress.

## CONCLUSIONS

The actual generation supports evidently the degradation and sometimes diminishing of natural resources caused by the last



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generations. The future generation will need to support not only the cost of actual environment degradation, of exhaustion of natural resources, but also the cost of pollutants accumulation into the environment, of diminishing of fuels reserves, of losing of the tropical forests and biodiversity. From this reason it is necessary to accept the sustainable development as the only safe way to the actual society development, the implementation and intensifying of using the renewable resources for satisfaction of productive and consumption demands, but also the rational alternative use or 'as time as necessary' of non-renewable resources.

The ensuring of natural resources and sustainable development for the present and future generation must become a strategic national objective gradually applied as a function of tradition, potential and natural, technical, social and human capital from each state of the world as well the evolution tendencies of regional, geographic and environmental development in the world.

### REFERENCES

- Diop A., F.A. Leautier, 2007** – *An adaptable system. Critical for development*, Development Outreach, November 2007, World Bank Institute, SUA, p. 3-5
- Flavin C., 2002** – *Starea lumii (The world state)*, Edit. Tehnică, București, Romania
- Negrei C., 1999** – *Instrumente și tehnici în ingineria mediului (Instruments and techniques into the environmental engineering)*, Edit. Economică București, Romania
- Surpățeanu Mioara, 2004** – *Elemente de chimia mediului (Elements of environmental chemistry)*, Edit. MatrixRom, București, Romania
- Zaharia Carmen, 2003** – *Legislația pentru protecția mediului (Legislation for environment protection)*, Edit. Univ. "Al.I.Cuza" Iași, Romania, p. 17
- Zaharia, Carmen, 2004** – *Energia și mediul (Energy and the environment)*, Edit. Univ. "Al.I.Cuza" Iași, Romania
- Zaharia Carmen, 2008** – *Energia regenerabilă – perspective, tendințe și provocări în România (Renewable energy – perspectives, tendencies and provocations in Romania)*, Volum de lucrări, Conferința Națională organizată de Zilele Facultății de Inginerie Chimică și Protecția Mediului, Ediția a V-a, „Materiale și procese inovative”, 19-21 noiembrie 2008, Iași, 472-477
- Zaharia Carmen, 2008** – *Legislația privind protecția mediului (Legislation for environment protection)*, Edit. Politehnicum, Iași, Romania
- Zaharia Carmen, 2010** – *Environmental impact of renewable energies*, Bulletin of Polytechnic Institute from Iași, series: Construction of Machines, tom LVI (LX), f.2b, 61-72
- Zaharia Carmen, Daniela Șuteu, 2010** – *Some aspects of e-wastes management in Romania*, Bulletin of Polytechnic Institute from Iași, series: Construction of Machines, tom LVI (LX), f.2b, 51-60
- Zaharia Carmen, L. Costăchescu, 2008** – *Solar energy – perspectives, tendencies and challenges in Romania*, Proceeding of the 7th World Energy System Conference, 28 June – 2 July, 2008, Iași, p. 24