MESO-ECONOMIC INDICATORS OF ENVIRONMENTAL COSTS AND BENEFITS FOR THE CEMENT INDUSTRY IN ALGERIA

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BACKGROUND

The aim of the **Meso**-economic approach is to appraise the environmental costs and benefits of an industrial sector or an urban community with respect to its different economic and urbistic activities (industry, agriculture, services, energy and water supply, waste collection, etc.). This evaluation applied to an urban community outlines its environment-economic profile. The **Meso**-economic profile is seized through the impacts of all inflows and outflows of this community, be they environmental or economic, through its metabolism.

Environmental degradation produces direct impacts on human health and quality of life, on economic activity and efficiency, and on the productivity and the sustainable use of natural resources. This result is a drain on the whole economy of a region or a country. Uncontrolled, such costs constitute as many foregone benefits. Therefore, estimating and controlling actual environmental costs lead to identifying potential future environmental and economic benefits. This is the aim of economic analysis; that is, adding light to strategic choices and prioritizing environmental actions.

The economic assessment of such benefits begins by appraising the cost of environmental degradation (damage costs) and resources inefficiencies (efficiency costs). Remediation costs are then estimated according to selected protection measures. Last, an estimate of the net benefits that are expected from environmental protection measures are provided by appraising the benefits stemming from reducing damage and inefficiency costs by means of remediation costs.

In essence, environmental degradation is translated in monetary terms. The intrinsic value of Nature is not taken into account. Estimated costs relate to economic losses like health, utility or productivity losses due to water and air pollution, accumulated waste, soil erosion, or threats on endangered species. Benefits relate to either better health or utility, or productivity gains obtained from a better environment.

An economic *cost* results from the assessment of the supplementary impacts on the economy due to incremental environmental degradation. For the sake of simplicity, this "*at the margin*" definition is replaced by the *annual costs* of environmental degradation (damage and inefficiency costs). These costs are expressed in monetary terms as well as percentage of the value-added of a firm (VA) or of the gross domestic product of a nation (GDP).

This paper provides estimates of damage and inefficiency costs and their related remediation costs, i.e. the costs incurred when remedial action is taken to counter damages. These are calculated by environmental domains (water, air, land, waste…) and by economic categories (health/quality of life, natural resources, and economic inefficiencies). Damages to the global

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environment are also estimated. This paper situates these costs within the national damage costs to the environment and sets a number of environment-economic priorities for the community through the calculation of benefits/costs ratios. The estimates are set as shares of local value added and should be considered as orders of magnitude.

ABSTRACT

Due to persistent environmental problems, the industry worldwide is improving its capacity at capturing the economic of the environment in order to integrate environmental remediation criteria into its decision making process. Indeed, uncontrolled environmental damages constitute as many foregone benefits. Therefore, estimating and controlling actual environmental costs lead to identifying potential environmental and economic benefits.

So far, available studies analyzed environmental issues either at the level of a company (micro), or at the level of a country (macro). As these two levels of analysis are not connected, there is a lack in the environment-economic knowledge at the sector level (Meso). The aim of this applied study is to translate in Meso-economic terms the environmental stakes of industry by bridging environmental diagnoses done at company level and economic analyses done at national level.

Methodological steps and first Meso-estimates of environmental damage costs, costs of resource inefficiencies, and remediation costs are provided for targeted industry sectors in several Arab countries. Although these estimates should be considered as orders of magnitude, this approach provides the industry with useful indicators of environmental costs and benefits that are consistent with other indicators at national, regional, and international levels. In this respect, **Meso-economic** indicators help at grasping the effort needed to protect the environment and give estimates of returns on investments.

METHODOLOGICAL PROCESS

The process of estimating the cost of environmental degradation and inefficiencies involves placing a monetary value on the consequences of such degradation. This often implies a three-step process (Larsen, Sarraf, Pillet 2002; Pillet and Zein 2002):

1. quantifying environmental degradation (ex. monitoring ambient air quality, river/lake/sea water quality, soil pollution);
2. quantifying the consequences of the degradation (ex. health impacts of air pollution, changes in soil productivity, changes in forest density/growth, reduced natural resource based recreational activities, reduced tourism demand); and
3. Putting a monetary valuation on these consequences (ex. estimating the cost of illness, water losses, soil productivity losses, inefficient use of energy and materials, reduced recreational values).

To reach the cost of environmental degradation, various methodologies of economics and of environmental and natural resource economics are applied.

CATEGORIES OF ANALYSIS

In order to estimate the cost of environmental degradation for the various areas of the environment, the analyses and estimates have been organized following several environmental categories:

1. *Water*;
2. *Air*;

3. *Soil*;
4. *Waste*;
5. *Coastal Zones, Cultural Heritage*;
6. *Energy, Materials, Competitiveness*;
7. *Global Environment.*

For each of these environmental categories there are separate analyses and cost estimates by economic categories, as follows:
a) *Health/quality of life;*
b) *Natural resources;*
c) *Resource inefficiencies*.

CONSEQUENCES OF ENVIRONMENTAL DEGRADATION

Different methods are used in order to capture as much as possible the direct consequences of environmental degradation reported in the environmental diagnosis.
Estimating the consequences of environmental degradation on human health is a particular case that must be addressed. This case is a good illustration of the evolution of environmental degradation to a monetary valuation of the consequences previously identified.
The consequences of environmental degradation (air or water pollution) on health are expressed, on the international stage, as «DALY», an indicator adjusting, in terms of the number of years in a person's life, all consequences (from lost days to lost years) due to illnesses and premature death resulting from environmental degradation in a country per year.
Accordingly, in a simplified manner, lost days due to bronchitis are added to lost years as a result of premature death due to air pollution in order to generate a number of DALYs; i.e. a total number of lost years for the country in question. One lost year due to bronchitis or to a premature death represents one DALY; subsequent years, if any, are discounted at a fixed rate.

DAMAGE AND INEFFICIENCY COSTS VERSUS REMEDIATION COSTS

As indicated above, remedial actions should reduce as much as possible the cost of damages and inefficiencies. Ideally, the ratio

$$\frac{\textit{Damage and inefficiency costs (DIC)}}{\textit{Remediation costs (RC)}} \geq 1$$

Should be higher than one:

$$\frac{\textit{Benefits } (B)}{\textit{Costs } (C)} \geq 1$$

Where the «benefits» are generated by the elimination of damages and inefficiencies and the "costs" are the costs of remedial actions.
Nonetheless, taking into consideration available data, it is not possible to have remedial action "correspond" exactly to the damages and inefficiencies to be eliminated.

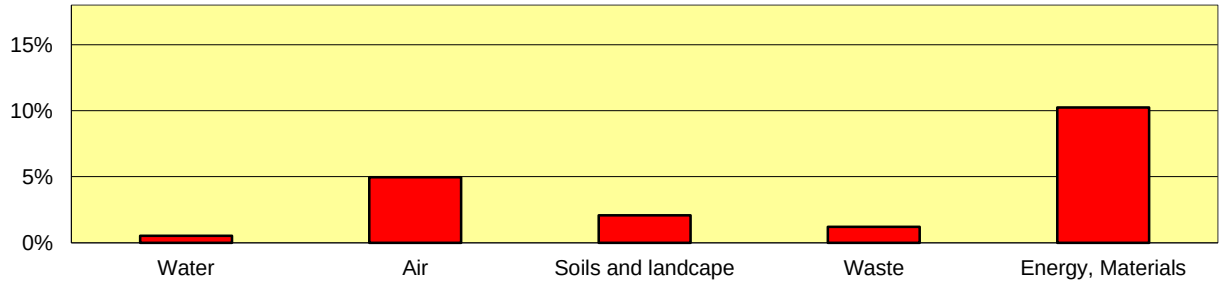
Alternatively, where margins of uncertainty or error are the same on both sides (damages and inefficiencies versus remediation), the ordinal arrangement of B/C ratios (the rankings taking precedence over the absolute values) becomes very interesting and valuable in the process of choosing priority actions.
Finally, an environment-economic analysis of the reality might stem from the idea that the link with applications will be accomplished with respect to optimal situations. As an example, an optimal situation is necessary to determine and measure the existence of distortions in the real world (CEMT, 2000 and 2002), such an optimal situation being the norm (Pillet 2001d).
Such complexities exist and prevail in a closed academic world; they however proved to be extremely inadequate in the real world «since the axiomatic environment required for their application does not exist in practice (…) the real world is constituted of inaccurate, wrong, insufficient, and incomplete data» (Beauzamy, 2002).
Applied **Meso environment-economic** studies are confronted with the real world and in such circumstances optimal situations are often missing. As a consequence, the approach always bears a «heuristic» characteristic on top of its capacity to establish environmental and economic priorities.

Environmental damage and economic inefficiency costs of the Algerian cement sector.
The estimates of environmental costs and benefits applied at the meso level provides the economic- environmental profile of the cement industry in a country by environmental domain, first in terms of damage costs, then in terms of remediation costs. In Algeria, the estimates of environmental degradation costs and economic losses in the cement sector reveal **environmental degradation** of almost 7% of the value-added (VA) and **economic losses** from less efficient use of natural resources of more than 10% of the VA of the sector.Tab1, Fig 1 presents those economic losses distributed by environmental category.

Table1

Year	2008
Environmental categories	
	%VA
Water	0,53%
Air	4,95%
Soils and landcape	2,07%
Waste	1,21%
Energy, materials	10,25%
Total	19,02%
Global Environment	7,15%

Figure 1: Meso-economic Profile of Environmental Degradation Costs and Resource Inefficiencies of the Algerian Cement Sector.2008



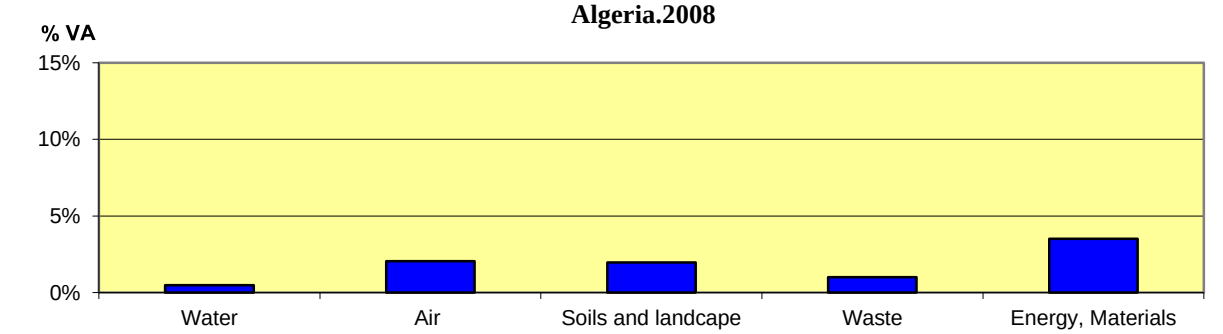
Source: Azzaz larbi ; 2008

In order to appraise the benefits of action over non-action, **remediation costs** of the analyzed situation are estimated. For Algeria, they amount to approximately 9% of the VA of the sector (Tab2, Fig.2).

Table2

year	2008
Environmental categories	
	%VA
Water	0,48%
Air	2,05%
Soils and landcape	1,96%
Waste	1,01%
Energy, Materials	3,52%
Total	9,02%
Global Environnement	0,23%

Figure2: Meso-economic Profile of Remediation Costs for the Cement Sector in Algeria.2008

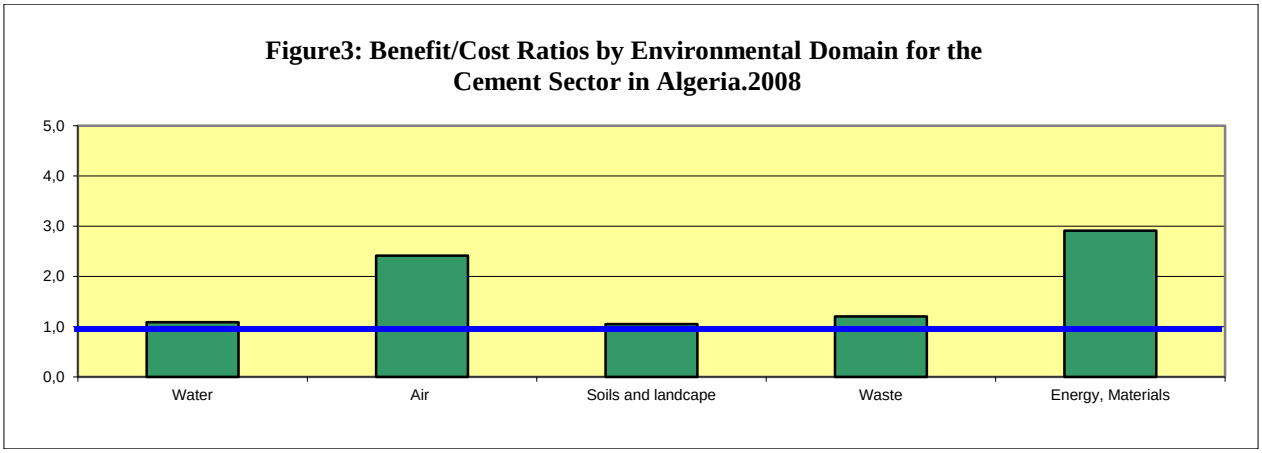


Source: Azzaz larbi; 2008

Accordingly, one can stress that on average, with respect to the Algerian cement sector, the **benefits** of depollution and of improving economic efficiency **are worth twice the remediation costs**. They actually come close to three times for the economic losses from resource inefficiencies and energy and are significantly twice as high for air pollution (see Tab3 and Fig3).

Table3

year	2008
Environmental categories	
	A/C
Water	1,09
Air	2,42
Soils and landcape	1,06
Waste	1,20
Energy, Materials	2,91
B/C Average	2,11



Source: Azzaz larbi ; 2008

A tool for decision-making.

These Meso-economic profiles of environmental costs and benefits provide a background for decision- making by giving benefit/cost ratios by environmental domain.

Thus, they enable to measure the effort needed to protect the environment and give an idea of the expected return on investment (see Fig. 2).

These first meso studies will be followed by technical-economic analyses at micro level to confirm in detail the actions, the techniques implemented and the performances accomplished.

The Meso-economic profiles of environmental costs and benefits enable a given sector to position itself against the overall environmental costs of its country, other sectors of its country and the same sector of other countries.

CONCLUSIONS

Estimated damage costs and resource inefficiencies in Arab countries (**4 to 6% of GDP**) remain substantial (the damage cost to the global environment is estimated at an additional **0.6** to **1.2%** of GDP). In comparison to high- income countries, those estimates are twice as high.
In Algerian Cement Production Sector, damage costs and resource inefficiencies are estimated at about **19.02%** of VA (in comparison, the gross domestic product of a country aggregates the sum of the values added at each stage of production by the industries and productive enterprises of the country). Resource inefficiencies constitute some what more than half of that total cost. The damage cost to the global environment is estimated at an additional **7%** of VA. Overall environmental degradation costs are thus substantial.
In turn, remediation costs at the level of a National Cement Production Sector are estimated at about **9.02%** of VA. As a result, the overall benefit/cost ratio is set at about 2; i.e., estimated benefits might stand twice as high as remediation cost. The overall benefit/cost ratio for energy and materials saving is even **2.5**.
This study thus indicates that the cement sector in Algeria would benefit significantly from remedial actions to protect and restore environmental quality, although estimates are tentative. Further analysis of benefits and costs of selected environmental issues that are considered priority areas by Governments would facilitate the process of priority setting and improve environmental management.

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