MESO-ECONOMIC INDICATORS OF ENVIRONMENTAL COSTS AND BENEFITS FOR THE INDUSTRY IN MASHREQ AND MAGHREB COUNTRIES

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ABSTRACT

Due to persistent environmental problems, the industry worldwide is improving its capacity at capturing the economic value 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.

BACKGROUND

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. *A la lettre*, 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).

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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):

i. quantifying environmental degradation (ex. monitoring ambient air quality, river/lake/sea water quality, soil pollution);

ii. 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

iii. 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:

i. *Water*;

ii. *Air*;

iii. *Soil*;

iv. *Waste*;

v. *Coastal Zones, Cultural Heritage*;

vi. *Energy, Materials, Competitiveness*;

vii. *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.*

COST ASSESSMENT OF ENVIRONMENTAL DEGRADATION IN ALGERIA

Environmental damage and economic inefficiency costs. At the country level, environmental damage and economic inefficiency costs are estimated at 7% of Algerian GDP, including the global environment (1998; PNAE-DD/Algerian NEAP 2002). The degradation of water resources has the greatest economic impact with 1.5% of GDP, followed by the degradation of soils, forests and biodiversity (1.4% of GDP), inefficiencies in energy use and competitiveness (more than 1% of GDP) and air pollution (0.9% of GDP) (see Figure 1). Impacts on the global environment were assessed at 1.2% of GDP.

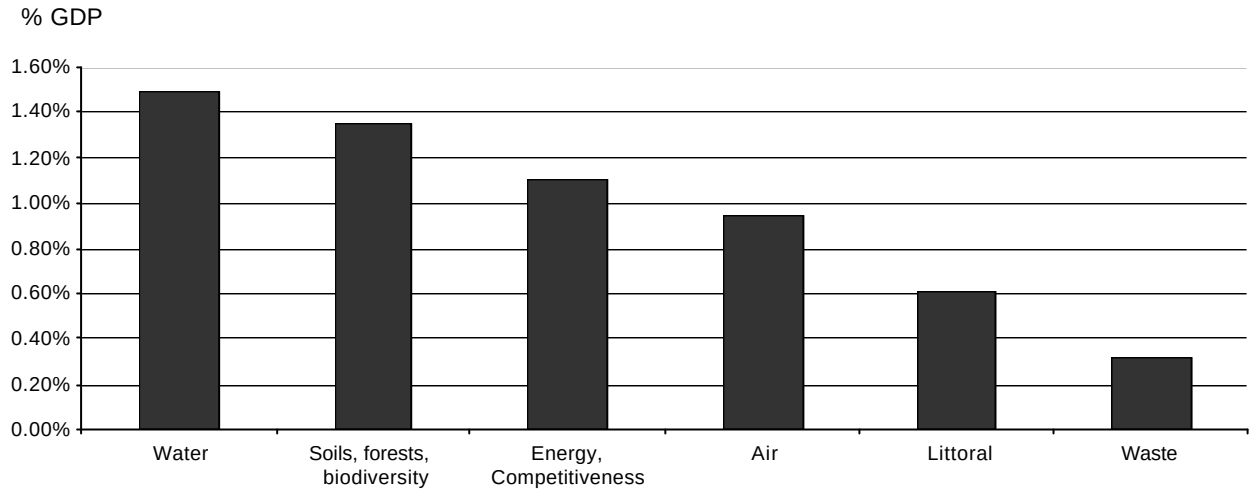

Figure 1 Damage and Inefficiency Costs in Algeria by Environmental Categories as Percentage of GDP
Source: PNAE-DD/Algerian NEAP 2002

Remediation cost. Total remediation cost to reduce environmental degradation and resource inefficiencies in Algeria in 1998 is estimated at 2.8% of GDP. Remediation cost of global environmental degradation is not included in this estimate.

Comparison of damage and remediation. The cost of environmental damages and resource inefficiencies is considered as benefits if remedial actions are undertaken. Therefore, a comparison of these potential benefits and the cost of remediation will help at sieving out the environmental categories for which benefits are likely to substantially exceed the cost of remedial actions. Tentative ratios of damage cost and resource inefficiencies (DIC) and remediation cost (RC) are thus presented as the following ratio:

$$\frac{\text{DIC } \textit{(potential benefits)}}{\text{RC } \textit{(remediation costs)}}$$

A ratio greater than numerical one suggests that benefits of remediation exceed the cost of remediation. For Algeria, calculations indicate that the largest benefits per dollar spent on remediation may come in the areas of energy and materials, followed by air, water, soils, waste and coastal zones.

Conclusion. Such estimates enabled the Government of Algeria to set priority areas and to improve environmental management, as well as to promote multi-sectorial approaches and to implement adequate fiscal and financial measures.

COST ASSESSMENT OF ENVIRONMENTAL DEGRADATION IN EGYPT AND TUNISIA

In 1995, the World Bank published the "Middle East and North Africa Environmental Strategy". The Strategy provided an order of magnitude of the regional cost of environmental degradation as a percentage of regional GDP. The main areas for which the Strategy provided an estimate of the cost of degradation were the detrimental impacts on health from lack of safe water and sanitation and urban air pollution, and the cost of natural resources degradation.

In-depth studies commenced in December 2000 under the auspices of METAP, the EEAA (Egypt) and the ANPE (Tunisia). Results are made available by the World Bank (Larsen, Sarraf, Pillet 2002a, 2002b).

Egypt. The total environmental degradation cost in Egypt in 1999 is estimated at 6% of GDP—out of the costs to the global environment; that is, 4.9% of GDP as damage costs and 1.07% of GDP as

the cost of inefficient resource use. The damage cost to the global environment is estimated at an additional 0.6% of GDP. By economic category, the cost to health and quality of life is about 2.71% of GDP, followed by 2.2% for natural resources and 1.07% for resource inefficiencies.

Total remediation cost to reduce environmental degradation and resource inefficiencies in Egypt in 1999 is estimated at about 3.7% of GDP. Remediation cost of global environmental degradation is not included in this estimate. The overall DIC/RC (benefit/cost) ratio for water is estimated at somewhat more than 2 while the overall DIC/RC ratio for air pollution is about 3.3, i.e., estimated benefits are more than three times higher than remediation cost. The overall ratio for inefficiencies (as an economic category) is estimated at somewhat more than 2.

Tunisia. In total, the cost of environmental degradation and of inefficient resource use in Tunisia is estimated at about 3.4% of GDP in 1999. The damage cost to the global environment comes in addition. By economic category, the cost to health and quality of life is about 1.6% of GDP, followed by 0.9% for natural resources and again 0.9% for resource inefficiencies.

Total remediation cost to reduce environmental degradation and resource inefficiencies in Tunisia in 1999 is estimated at 1.7% of GDP. Remediation cost of global environmental degradation is not included in this estimate. The overall DIC/RC (benefit/cost) ratio for water is estimated at about 1.4 while the overall DIC/RC ratio for air pollution is about 3.3; i.e., like for Egypt, estimated benefits are more than three times higher than remediation cost. The overall ratio for inefficiencies (as an economic category) is estimated at about 2.5.

ASSESSMENT OF ENVIRONMENTAL COSTS AND BENEFITS FOR TARGETED INDUSTRIAL SECTORS IN ARAB COUNTRIES

Cost assessments of environmental degradation at country levels are based on highly aggregated estimates. As a consequence, there is no bridge linking such macro-analyses with micro or sectorial quantification and further monetary evaluation of environmental damages and resource inefficiencies at these levels. The aim of this study is to address micro and meso levels of environmental costs and benefits using the same basic methodology to arrive at a monetary valuation of the consequences of environmental degradation at the level of a production unit and at that of a national industrial sector.

The monetary valuation of the consequences of environmental degradation and natural resource inefficiencies at the level of industrial production units is based on environment-economic analyses completed in various production units. Results are then aggregated at the level of a national cement sector. Typical environmental-economic "footprints" result from the analysis.

Estimates are expressed as a percentage of the annual value-added (VA) of a factory, and then of a national industrial sector. The value-added of a production unit is the value of the firm's output minus that of the inputs it purchases from other firms. In comparison, the gross domestic product (GDP) of a country aggregates the sum of the values added at each stage of production by the industries and productive enterprises within the country over one year.

Environmental damage and economic inefficiency costs of the Algerian cement sector[1]**.** The economic 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. Figure 2 presents those economic losses distributed by environmental category. Effects on the global environment are to be added (see endnote [i]).

[1] Environment-economic analyses of the Egyptian, Moroccan, Syrian, and Tunisian cement sectors are in progress.

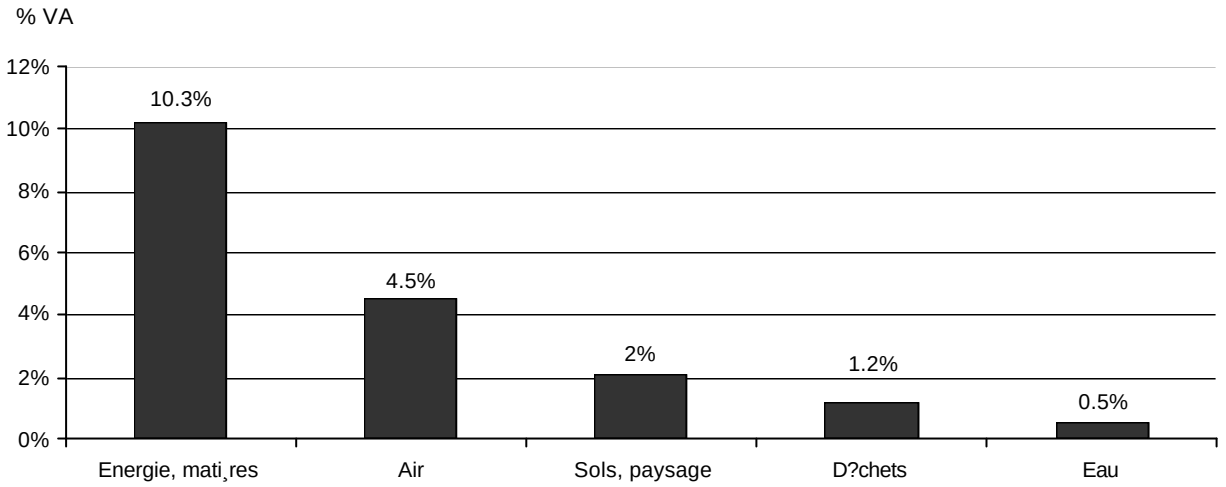

Figure 2 Meso-economic Profile of Environmental Degradation Costs and Resource Inefficiencies of the Algerian Cement Sector
Source: Pillet and Zein 2002

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 (Fig. 3).

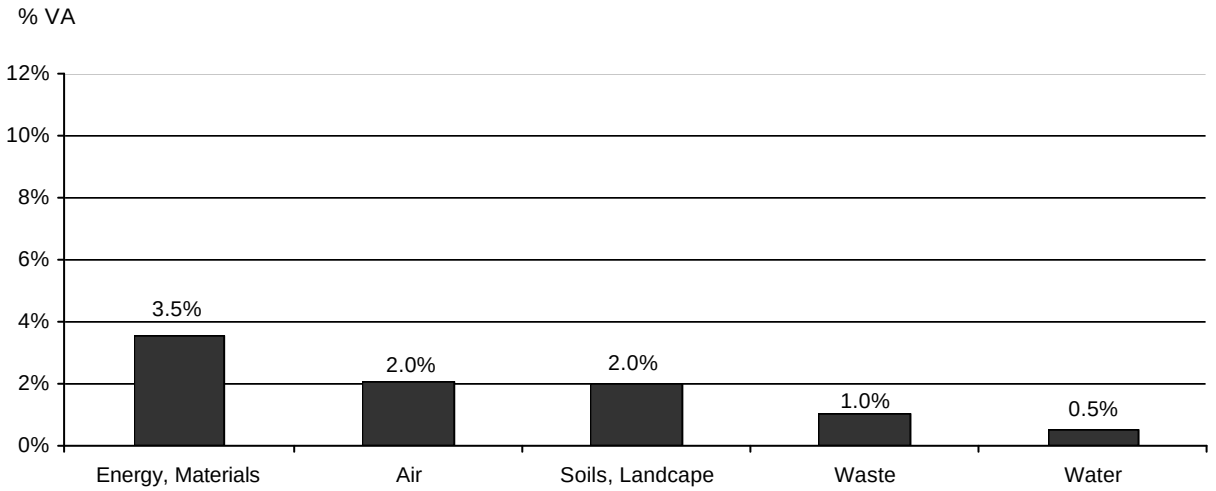

Figure 3 Meso-economic Profile of Remediation Costs for the Cement Sector in Algeria
Source: Pillet and Zein 2002

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 Fig. 4).

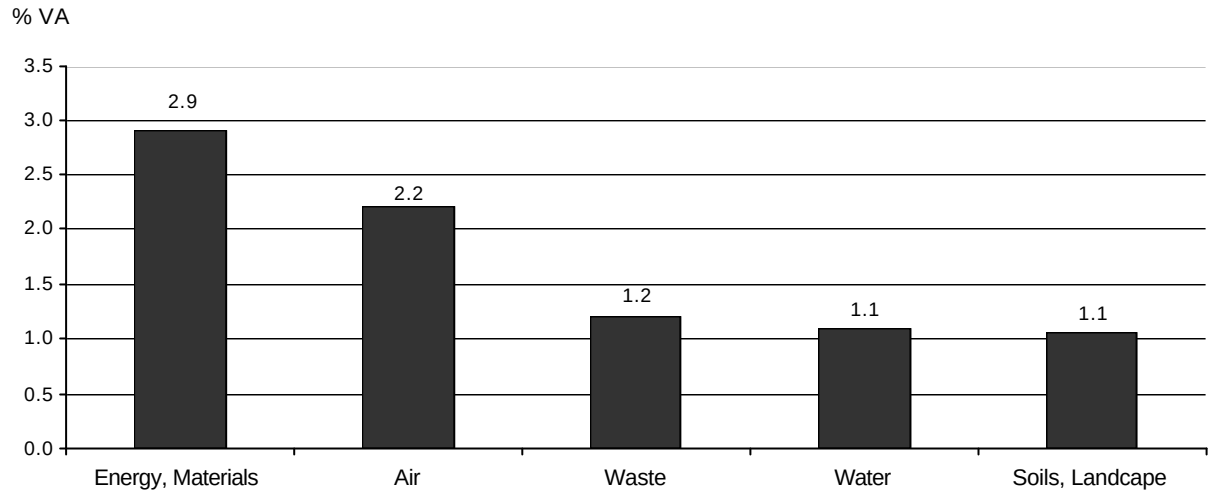

Figure 4 Benefit/Cost Ratios by Environmental Domain for the Cement Sector in Algeria
Source: Pillet and Zein 2002

Meso-economic profiles of environmental costs and benefits are in progress for the cement sectors in Egypt, Morocco, Syria, and Tunisia as well as for energy, mining and tourism sectors in Morocco.

At the level of individual units, it was highlighted that basic technical solutions like repairing a defective electrofilter were comprised in a benefit/cost ratio superior to 3 (the level of environmental costs due to a deficient electrofilter is highlighted on Fig. 5; those costs should then be distributed to air pollution and energy, materials).

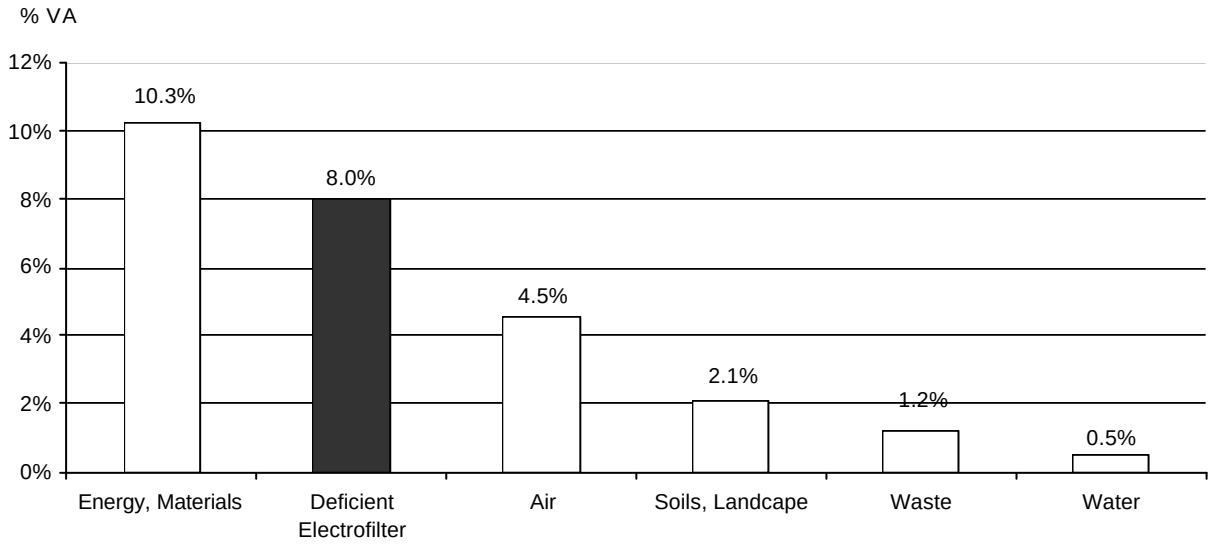

Figure 5 Level of Environmental Costs Associated to a Deficient Electrofilter
Source: Pillet and Zein 2002

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. 3).

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.

Further Applications. The development of the meso-economic profiles for the cement sector of Egypt, Morocco, Syria, and Tunisia is in progress by Ecosys and SBA. This program is undertaken in the framework of the Swiss Co-operation in the Mediterranean, with the support of the Arab Union for Cement and Building Materials and the Cooperation of the Ministry of the Environment in Morocco.

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 a National Cement Production Sector, damage costs and resource inefficiencies are estimated at about 20% 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 somewhat 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 10% 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, and the overall benefit/cost ratio for inefficiencies is as high as 3.

This study thus indicates that the cement sector in Arab countries 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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[i] In the macro and meso studies, unless otherwise, damages to global environment cover the value of CO_2 emissions, meaning the "value" of carbon related to the Kyoto Mecanisms (see the Table below).

Level / Country		Fraction	Sources
Macro	Algeria	0.6% GDP	PNAE-DD 2002
	Egypt	0.6% GDP	Larsen et al. 2002
	Tunisia	0.3% GDP	Larsen et al. 2002
Meso	Algerian Cement Sector	7.0% VA	Pillet & Zein 2002a