

Theoretical Framework for Environmental Accounting- Application on the Egyptian Petroleum Sector

Mohamed A Raouf A hamid, *MSc.*

The Egyptian Forum on Environment
& Sustainable Development (EFESD)

Cairo, Egypt

mhdraouf@yahoo.com

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Abstract

In the last two decades there has been an increasing demand on economic and financial data about environment and natural resources. Environmental Accounting plays an important role in providing the needed data on environment to different users at all levels for various reasons.

The focus of traditional (conventional) accounting profession (and practices) is on the economic aspects only. That is, emphasis is on man-made assets, though taking into consideration the environmental dimensions especially natural resources/assets of great importance. Within this context, the traditional accounting practices can be termed as man-made asset accounting while the more recent trends in accounting practices can be termed as natural asset accounting.

This paper aims to set the conceptual framework for environmental accounting (Environmental, Ecological, Natural resource, green accounting) at all levels for different purposes. In addition, different concepts and terminology associated with Environmental Accounting is also discussed. As well as, a clarification of why to have an environmental accounting. Besides, introducing a system for environmental accounting at Meso (sectorial) level with application on the Egyptian petroleum sector.

This paper suggest introducing an adjusted balance sheet and profit and loss account –as a Satellite Accounts– where a number of environmental issued to be evaluated and included:

- Petroleum reserve.
- Soil and marine (Exploration acreages).
- Health Environmental Liabilities.
- Emissions trading.

Lastly concluding remarks and recommendations as the researcher believes that there is a room introduce a system of environmental accounting in petroleum sector. No doubt that the suggested system will help filling the existing gaps.

Introduction:

There is an increasing interest in environmental protection at all levels. This is clear after the issuance of environmental regulations in most of the countries but, as the quest for new solutions to prevent environmental degradation intensifies, it is clear that the process by which regulatory solutions are designed and enforced by public agencies upon different entities is becoming increasingly outdated. So, economics and more specifically accounting can perform an important role in relation to environmental issues.

The inclusion of environmental dimension in the traditional accounting system at all levels (company, sector, governorate, nation-wide) will result in an adjusted economic indicators which will enable different users at all levels to take sound decisions that support sustainable development.

Environmental Accounting, however, has many meanings and uses. Environmental Accounting can support natural resource accounting at macro level, ecological accounting at local administration level and at micro level related to financial accounting, cost accounting or managerial accounting. This papers discusses the conceptual framework of Environmental Accounting as well as different associated terminology and introduces a case study where an attempt is made to include some environmental issues into the traditional accounting system of the Egyptian petroleum sector.

I. Accounting and Environmental Concerns:

There is no doubt that different organizations, sectors ...etc. have social and environmental impacts which may carry bigger weight than its economic impacts. Accounting has an instrumental role in disclosing about environmental responsibility for different entities whether industrial, commercial, service or even voluntary and at all levels whether micro, meso and macro. Thus, accounting became concerned with achieving new goals such as measuring and evaluating potential or actual environmental impacts of projects and organizations. These new goals are of great importance as they enable many users to take different development decisions which are economically and environmentally sound. The main reasons of accounting's interest in the environment are as follows⁽¹⁾:

- A proper environmental accounting system is a supporting measure for achieving Sustainable Development (SD) in the sense that it is the main tool for measurement, control and decision-making.
- Environmental expenditures whether Capital (CAPEX) or Operating costs (OPEX) increase dramatically day after day.
- Management needs financial data about theses expenditures.
- For strategic cost leadership (Driving Cost).

⁽¹⁾ See for instance: - American Accounting Association, Committee on Environmental Effects of Organizational Behavior. The Accounting Review. Supplement to Vol. XLIII. 1973
- US Environmental Protection Agency (EPA) "**An Introduction to Environmental Accounting As A Business Management Tool: Key Concepts And Terms**", at: www.epa.com , June 1995.

- The need to prioritize these expenditures.
- Environmental costs (and, thus, potential cost savings) may be obscured in overhead accounts or otherwise overlooked.
- There are increasing needs from different stakeholders (government, investors, lenders, banks, non-governmental organizations ... etc) to have financial data on the environmental performance of different organizations.
- If accounting does not provide financial data on the environmental performance of organizations that will help non-complying organizations/entities to pollute environment and spoil resource and yet appear more economic efficient than other which incur costs to protect the environment.
- Many of the environmental activities are of quantitative and accordingly of financial nature and have a major effect on organizations costs, assets and liabilities.
- Naturally any entity have a main outputs and a secondary outputs of which mainly polluters and thus if the entity does not incur costs to mitigate or prevent it a third party in the society have to bear it (the concept of externality).
- Environmental risks may result in huge environmental liabilities and subsequently the organization/entity may be obliged to outlay large payments which may affect seriously the liquidity and the financial position of the organization.
- Many environmental costs can be significantly reduced or eliminated as a result of business decisions, ranging from operational and housekeeping changes, to investment in cleaner production, to redesign of processes/products.
- Managing resources properly in an environmentally friendly way will result in direct returns such as cost savings and reductions and/or indirect returns such better goodwill and image for the organization.
- Many organizations have discovered that environmental costs can be offset by generating revenues through sale of waste by-products for example.
- Environmentally friendly processes, products, and services result in a competitive advantage for such organizations.
- There is a general trend to evaluate the organizations performance according to its social and environmental effectiveness and not only on its economic effectiveness.
- Current practices demonstrates that, no track for environmental costs was available as it was charged randomly. Therefore, there is a need for proper charging and allocation. Distinguishing between environmental costs and other costs will lead to a proper cost allocation of these costs

and thus more precise pricing and will help to develop sustainability indicators.

- Accounting for environmental costs and performance can support a organization's development and operation of an overall Environmental Management System (EMS) and ISO 14000 accreditation.

For the above reasons, the researcher believes that accounting should be responsible for measuring and evaluating and disclosure of environmental performance in financial statements or in its attachments. No doubt that measuring environmental performance depends on accounting systems but needs more data, other than the conventional accounting data, such as pollution ratios. Monetizing environmental issues may not be totally accurate but, economists and accountants have to give best estimates according to the current level of knowledge and techniques used.

II. Environmental (Green) Accounting: Conceptual framework and terminology

The focus of traditional (conventional) accounting practices is on the economic aspects only. Taking into consideration the environmental dimensions, in the accounting system, especially natural resources/assets, depletion ... can be termed as "green accounting".

The term "Greening" has been used a lot in the past thirty years in relation to different environmental issues. In many cases, the term is also used to name organizations such as Green Belt Movement, operations such as Green Contracting ... etc⁽¹⁾. Green Accounting is a general term where it may mean Environmental, Ecological or Natural Resource Accounting. Needless to say that Environmental Accounting is also a general term which may mean the integration of environmental dimension into the macro or micro level despite that it is more applicable to the latter level. However, the four main terms mentioned overlap with each other.

Environmental Accounting, which calls to introduce a system that supports Sustainable Development (SD) that is gaining more interest especially from multinational energy companies⁽²⁾, has many meanings and uses. Environmental Accounting can support national income accounting, ecological accounting at local administration level and at micro level related to financial accounting, cost accounting or internal business managerial accounting. In the following section the different terms is clarified:

(1) Abdel Raouf, Mohamed, "Green Contracting", Financial Correspondent, Shell international, at: www.shell.com/financial_correspondent.

(2) Shell International, "Sustainable Development and Petroleum Industry", at www.shell.com/shell-online/group/issues/sustain

Environmental Accounting

At micro level it means the entire domain of accounting for the environment including: financial accounting, reporting and auditing, and environmental management accounting⁽¹⁾.

Environmental Financial Accounting

aims to the true disclosure in the financial statements in the end of period. That is, include environmental dimension in the published sheets of operations.

Environmental Management Accounting

means the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, benefits assessment, and strategic planning for environmental management.

Environmental Cost Accounting

Deals with environmental costs in order to reach the full cost accounting. i.e. the identification, evaluation, and allocation of conventional costs, environmental costs, and social costs to processes, products, activities, or budgets.

According to the polluter pays principle (PPP)⁽²⁾ each polluter has to pay for the costs for dealing with the pollution resulting from his operation. Failure to bear these costs by the polluter will mean that some other party (a third party) will have to shoulder them - external environmental costs.

The term environmental cost has at least two major dimensions:

- (1) It can refer solely to costs that directly impact "private costs";
- (2) It also can include the costs to individuals, society, and the environment for which a company is not accountable "social costs".

Ecological Accounting

In many cases, the term Ecological Accounting is used to refer to the preparation of accounts according to physical data only. In addition, Ecological accounting is the type of Environmental Accounting (a dedicated type for Natural Resource Accounting at local administration level).

In this respect, Ecological accounting is mainly used to prepare an asset management plans at local administration level⁽³⁾. Such plans provide a tool to evaluate the condition and life cycle of any particular physical asset.

⁽¹⁾ US Environmental Protection Agency (EPA) "An Introduction to Environmental Accounting As A Business Management Tool: Key Concepts And Terms", at: Op Cit..

⁽²⁾ Pearce, David, "**Measuring Sustainable Development**", Earthscan Publication Limited, London, 1994.

⁽³⁾ Osborn, Dick, "**Linking Ecological Accounting to Asset Management Planning for Local Authorities**", at www.lhccrems.nsw.gov/au/eco_acc.

Natural Resource Accounting

The term natural resource accounting is called after inclusion of environmental aspects into the system of national accounts⁽¹⁾. Where emphasis is given to natural assets, deterioration in its quality... in order to get an environmentally adjusted economic indicators such as environmental gross national Income⁽²⁾.

Physical Approach vs. Monetary Approach

It is worth mentioning that two approaches adopted in Environmental Accounting. firstly, the Physical Approach was suggested by the United Nations where a complete guide to be prepared indicating the available resources within a country classified according to it state and uses (for instance, agriculture , desert land...etc). Depending on this approach the environmental operations are presented in a physical terms, the current balance of the resource and the additions and deductions from that resource. No monetary value is assigned according to this approach. Then, the monetary approach emerged due to the fact that the Physical Approach does not fulfill the requirements of the Environmental Accounting. nevertheless, the physical approach is very important to get physical information about the resources which enables to prepare the environmental statistics and is considered the first step in the Monetary Approach. Despite the difficulties associated with the monetary approach⁽³⁾, it gained a lot of interest as such data will enable to know the profit and loss associated with environmental operations and to get an environmentally adjusted economic indicators.

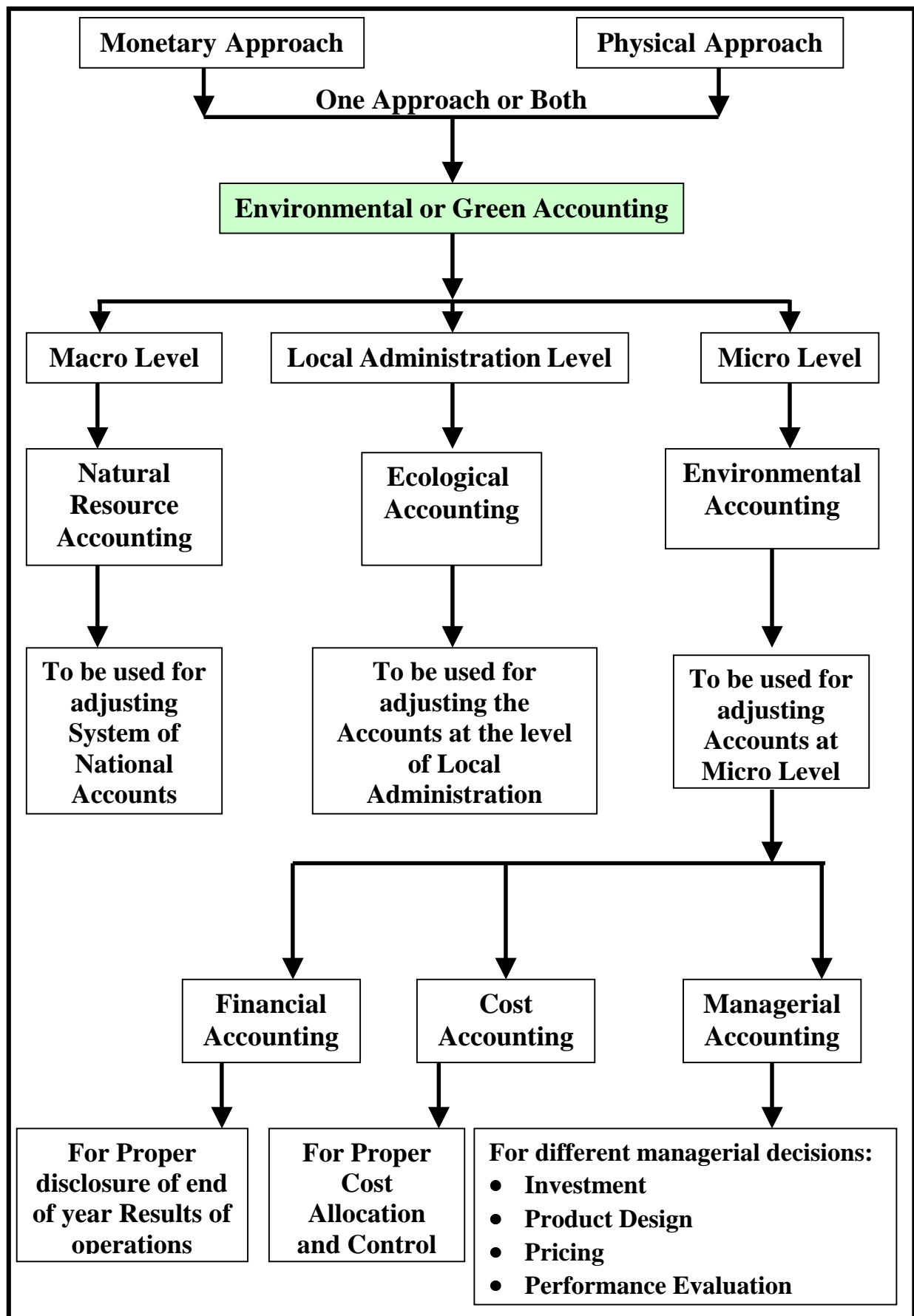
The following figure shows the different approaches an classifications of environmental accounting at all levels.

(1) United Nations, “**System of Integrated Environmental and Economic Accounting**” , New York, 1994.

(2) Leeds ECO, “**Leeds Ecological Footprints**”, at www.gn.apc.org/eco/evievw/lefbref2.

(3) Farghally, Ahmed, “**Future Studies in Environmental Accounting and Natural Resources**”, Future Booklets, Academic Bookshop, Cairo, 1997. (in Arabic).

Figure #1 Approaches and Classification of Environmental Accounting



III. Concepts Associated with Environmental Accounting:

Environmental and Natural Assets:

Traditional accounting introduce terms like fixed, current, Depleteable, normal and even lucky assets. But due to environmental sciences it produces the natural and environmental assets.

In the traditional balance sheet one can realize that the majority of assets are man-made assets and, in some cases, intangible assets like goodwill and patents. Although, many organizations possess environmental assets such as (petroleum, trees ...etc) despite the full control over such assets.

For instance, a hotel overlooking a bay or a river will have a competitive advantage and thus more revenues compared to other hotels downtown in a crowded area. The researcher believes that a separate item for environmental assets should be in the financial statements especially for these organizations who are dependant on environment and natural environmental stock in generating its revenues. In addition, nowadays in many countries it is familiar to see a pollution bond (environmental asset) possessed by an organization that may not be in need for it any longer as a result of complying with environmental regulations so it sells the bond to other organization that need it. According to the previous argument the researcher suggests to distinguish between natural assets and environmental assets as follows:

Natural Assets:

Natural assets are one type of environmental assets which represents a natural capital stock of organizations, governerates, sectors, nationwide. It may represent a renewable asset such as soil or nonrenewable asset such as petroleum. Natural assets may be defined as “natural resources that are discovered and developed through periods by an entity which have control over such resources after extracted and should be shown in financial statements of these entities”. Needless to say that some of natural resources provide man with many services such as recreation.

The natural assets are of great importance as they represent future goods and thus should be depreciated like man-made assets in order to be replaced. i.e. to be protected, resorted and maintained for its productivity.

Environmental Assets:

They represent the environmental assets possessed by an organization as a result of environmental protection, regulations and/or according to environmentally voluntary activities. In fact, such assets are part of man-made assets such as environmental protection equipment, pollution bonds...etc. it is worth mentioning that they might be fixed assets or current assets. Even that the same asset may be considered fixed in one organization while current in the other.

According to the pervious discussion, the researcher may set the following rule **“all natural assets are environmental assets but not vice versa”**. In most of the Accounting and Economics literature, they are mostly referred to as environmental assets.

The Importance of Distinguishing between Environmental and Natural Assets:

- Showing natural assets in a separate category is important as those assets represent the real wealth in some organizations, governorates, sectors, countries. Beside that, they are the wealth of the next generations.
- Showing environmental assets in a separate item gives an idea for all concerned parties about the value of environmental assets and environmental capital for environmental protection at any level (company, sector, governorate, nation-wide).
- knowing the deterioration and/or improving the quality in the volumes and value of environmental assets across different accounting periods.

Thus, Accounting should distinguish between environmental and natural assets and also seek to answer questions like what is the value of the environmental assets? What is its return? Does it value increase or decrease? And so forth.

Environmental Liability

Accounting institutions define liability as a Probable future sacrifice of economic benefits arising from present obligations to transfer assets or provide services in the future as a result of past transactions or events." More simply, a liability is a present obligation to make an expenditure or to provide a product or service in the future.

Liability has an important legal dimension as well. A liability is a legally enforceable obligation, whether it is voluntarily entered into as a contractual obligation, or is imposed unilaterally, such as the liability to pay taxes. The law both establishes liabilities and determines who is responsible for discharging them.

Types of Environmental Liabilities

It is some how difficult to classify environmental liabilities into different categories. However, the one can realize the following types of environmental liabilities⁽¹⁾:

Compliance Obligations

As regulations are enacted that apply to the manufacture, use, or release of regulated substances, organizations find themselves facing future compliance costs. An organization may discover that it is not in compliance with existing regulations. The costs of compliance can range from modest outlays required to conform to administrative requirements (e.g., record keeping, reporting, labeling, training and all that) to more substantial outlays, including capex expenditures (e.g., to pre-treat wastes prior to land disposal or release to surface waters, to contain spills, to treat air emissions). Regulations also impose "exit costs" (e.g., to properly close waste disposal sites and provide for post-closure care.

Remediation Obligations

are sometimes subsumed under "compliance" because some property clean-up requirements have been enacted as part of regulatory programs applicable to operating facilities. Also, it is easy to distinguish between the compliance obligation of routine closure of facilities at the end of their useful lives and the remediation obligation for cleaning up pollution posing a risk to human health and the environment. And meeting current compliance obligations may help minimize future remediation obligations. Remediation tends to be expensive and can include excavation, drilling, construction, pumping, soil and water treatment, and monitoring, and can include the response costs incurred by regulatory authorities. Remediation costs also can include the provision of alternate drinking water supplies for affected community residents, and, in some circumstances, purchase of properties and relocation expenses. Technical studies and the expenditure of management, professional, and legal resources add to the cost of remediation.

⁽¹⁾ US Environmental Protection Agency (EPA), **"Environmental Liabilities"**, <http://www.epa.gov/opptintr/acctg/liabilities/table.htm>.

The remediation obligation is distinctive because an organization may face remediation obligations due to contamination at inactive sites that are otherwise unregulated; at property formerly but not currently owned or used; at property it never owned or used, but to which its wastes were sent; and, at property it acquired but did not contaminate. As large expenditures will be needed in the short-term to remediate existing environmental contamination, particularly at inactive and abandoned sites, these liabilities often dominate and can distort a firm's assessment of its environmental liabilities. Therefore, it is helpful to distinguish between remediation obligations for existing contamination and potential remediation obligations for future contamination because managers can have more impact on ongoing and future activities and releases - whether accidental or not - that may trigger future remediation obligations.

Fines and Penalties

Organizations that are not in compliance with applicable requirements may be subject to civil or criminal fines or penalties for non-compliance and/or expenses for projects agreed to as part of a settlement for non-compliance. Such payments fulfill punitive and deterrent functions and are in addition to the costs of coming into compliance. Fines and penalties (and related outlays for supplemental environmental projects) can range from modest amounts to a few million dollars per violation. Generally, a civil penalty is assessed that is at least equal to the costs a company saved through non-compliance, thus removing any financial incentive to ignore a law. Other factors may add to or reduce the penalty amount assessed for a violation.

Compensation Obligations

Under common law and some state and federal statutes, companies may be obligated to pay for compensation of "damages" suffered by individuals, their property, and businesses due to use or release of toxic substances or other pollutants. These liabilities may occur even if a company is in compliance with all applicable environmental standards.

Distinct subcategories of compensation liability include personal injury (e.g., "wrongful death," bodily injury, medical monitoring, pain and suffering), property damage (e.g., diminished value of real estate, buildings, or automobiles; loss of crops), and economic loss (e.g., lost profits, cost of renting substitute premises or equipment). Compensation costs can be fairly minor or quite substantial, depending on the number of claimants and the nature of their claims. Oftentimes, legal defense costs (potentially including technical, scientific, economic, and medical studies) can be substantial in handling such claims, even when the claims are ultimately determined to be without merit. Moreover, responding to compensation claims can consume management time and require expenditures in order to control damage to corporate image. Compensation liabilities may involve costs for remediation of contaminated property as well as provision of alternate water supplies, thus somewhat overlapping the remediation category.

Because of workers' compensation and employer liability laws, payments to compensate employees for occupational exposure and injury from hazardous

or toxic substances are not generally determined through litigation against the employer or considered environmental liabilities. However, occupational claims sometimes may be brought against another party who is not the employer; for example, workers responding to a train wreck have sued the shipper of hazardous wastes released at the scene of the wreck; for the shipper, these claims can be viewed as environmental liabilities. Managers will want to understand the potential costs of occupational exposure and injuries, because actions taken to prevent or reduce environmental liabilities may also eliminate or reduce occupational liabilities.

Punitive Damages

To supplement compensatory payments to those harmed by the actions of others, the law allows the imposition of what are called "punitive damages" to punish and deter conduct viewed as showing a callous disregard for others. Unlike compensatory liability, the measure of punitive damages is not directly tied to the actual injuries sustained. Punitive damages are often many times larger than the costs of compensation. Punitive damages tend to be more common in product liability than environmental liability cases.

Natural Resource Damages

A relatively new category of environmental liability is best termed "natural resource damages." Established in the United States according to number of Regulatory such as the Clean Water Act, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "Superfund"), and the Oil Pollution Act (OPA)⁽¹⁾, this liability generally relates to injury, destruction, loss, or loss of use of natural resources that do not constitute private property. Rather, the resources must belong to or be controlled by federal, state, local, foreign, or tribal governments. Such resources include flora, fauna, land, air, and water resources. The liability can arise from accidental releases (e.g., during transport) as well as lawful releases to air, water, and soil. To date, most natural resource damage payments have been relatively small.

As a result, there are a wide range of environmental expenditures such as abatement costs, elimination costs, Handling of Wastes Costs ...etc. As well as, environmental capital expenditures as a result of buying a new asset and/or new cleaner technology.

The perception, identifying the environmental costs associated with a product, process, system or an organization is very important for the sound decision making. Goals such as environmental costs optimization, better environmental performance, identifying the true (full) costs and identifying the social costs ...etc all require knowing the different current and potential costs.

However, knowing the environmental costs depends upon the organizational purpose for using such data like(cost allocation, capital budgeting, product designing and all that managerial decisions). It is worth mentioning that the domain and scope of applying the costs if sometimes to be vague whether this costs is environmental costs or not.

⁽¹⁾ Ibid.,

IV. Case Study (Application on the Egyptian Petroleum Sector):

The Egyptian Petroleum sector was the pioneering sector to pay attention to environmental issues within the sector. because as for Egypt the petroleum industry was firstly operated by multinational companies and nowadays there are a lot of joint ventures. These companies aware of implementing Environmental Management System (EMS). The following section is organized as follows: A) The Egyptian petroleum sector efforts in the field of environment protection. B) The basics of measurements and its limitations. C) The annual closing accounts and end of period sheets where the researcher will introduce an adjusted balance sheet with environmental dimension and value number of environmental issues (Petroleum reserve, Soil and water (Exploration acreages), Health Environmental Liabilities, Emissions trading).

A) The Egyptian Petroleum Sector Efforts in Environmental Protection:

The following points represents the some of the efforts of the Egyptian petroleum sector in environmental protection⁽¹⁾:

- The Petroleum sector provided the unleaded gasoline and that is a substitute for petrol aiming for precluding/reducing the air pollution that causes a lot of harmful impacts for human beings especially affecting the intelligence percentage in the childhood.
- Producing improved diesel by reducing the sulfur percentage in it. As mostly known that any increase in the sulfur percentage than a specific limit and in the presence of humidity causes the formation of acids which in turn leads to a phenomena known as acidic rains which have a negative impacts on human and corps.
- Improving the refining process in which unleaded gasoline was produced without any additions as it was followed.
- The Egyptian petroleum sector is the main responsible for providing the economy with natural gas, the environmental friendly fossil fuel with less gaseous emissions, i.e. in line with the international trend and the United Nations framework convention climate change and Kyoto Protocol. So, it is familiar now to see many sectors depend on natural gas as an energy source especially power plants.
- Moreover, the number of vehicles operated by compressed natural gas are increasing daily and petroleum sector also providing the necessary infrastructure and gas service stations.
- Petroleum sector started a pioneer experiment to run air conditions with natural gas instead of the old way which depend on using green house

⁽¹⁾ - Data collected during interviews with environmental officers in the Egyptian general Petroleum Cooperation.
- Ministry of Petroleum, The Egyptian General Petroleum Cooperation, “**The Annual Report 2000**”, Cairo, 2001. (in Arabic).

gases (GHG) which have a very harmful effect on the ozone layer beside reducing the burden on electricity consumption.

- The Egyptian petroleum sector have for specialized centers for marine pollution abatement with oil at Suez, Alexandria, Ras Ghareb and Hurghada. These centers are equipped with high-tech instrument and boats with trained staff to deal with any incident.
- A standard have been set for pollution by natural radioactive materials through the work with atomic authority.
- Industrial waste water to be treated and audited before disposal.
- A list of hazardous chemicals gave been identified by a ministerial decree and any petroleum company poses some or all of these substances should to for license of storing and using such chemicals from the Egyptian General Petroleum Corporation (EGPC).
- Drilling wastes:
 - Water Base-Mud has minor impact. Any way it is reused usually after being cleaned from solid particulars.
 - Oil Base-Mud has a very harmful impacts thus it is treated biologically till it is dry or to extract oil in order to e reused according to its status. It is worth mentioning that some operating companies uses a low toxic Oil Base-Mud as a result of its environmental responsibility although it more costly.
 - Mud cuttings which results from the drilling operations and its used in road or buried in a sealed pits.
 - Production water (Produce water) it either disposed in a sealed ponds where it is evaporated or disposed into the sea according the specified conditions.
- Refining wastes especially the traces of oil used in the refining process and it is separated, purification, treated and recycled.
- Cooling water which is usually reused.
- Petroleum sector participated in a new company in the field of environment (petrosafe) specialized in environmental problems related to petroleum industry in addition to training of their staff in the environmental affairs.
- Natural radioactive materials are periodically monitored by the atomic authority.
- Environmental Impact Assessment (EIA) studies to be conducted before executing any petroleum project ion order to ensure complying with environmental regulatory and taking any necessary mitigation measures require to protect the environment and man.
- Pipelines protection and periodical monitoring.

- Emissions surveys are usually conducted in petroleum companies every two years to ensure its within the accepted limits and standards.

B) Basics of Measurement and its Limitations:

The current accounting system in the petroleum sector does not support the sustainability. This is inspite of the efforts of this sector in the field of environment though it needs to highlighted and prioritized.

The following case study incorporates on the some specific points in order to involve the environmental dimension into the traditional accounting system.

There are a number of economic and accounting valuation methods available in the literature for evaluating environmental assets and impacts despite their limitations and difficulties. Also, there is a wide range of environmental benefits, which are quite subjective to value.

However, the case study will be based on the following principles:

1. Some positive and /or negative environmental impacts will not be estimated due to:
 - Some environmental assets and impacts are difficult to assign monetary values for.
 - Limited resources and/or lack of data on certain impacts.
 - Limited number of case studies exists in this area.

Therefore, the main objective is to introduce a simple model for environmental accounting that can be used after further alternations in the Egyptian petroleum sector as well as other sectors.

2. All avoided costs are benefits and vice-versa.
3. Existence of a cause / effect relationship for each environmental impact.
4. Adopting Conservative estimates based on the lower value of each environmental asset or impact.
5. Using scenarios where uncertainty exists (low, moderate, high).
6. A zero pollution rate is impossible to reach. Though there is a cost for achieving the balanced environmental situation.
7. Valuing impacts and assets related to the biosphere and man-made assets only, i.e. the socioeconomic impacts are not taken into consideration.

The importance of valuing these impacts and assets are:

- Estimating the value of such assets represent the real wealth of the sector, nation-wide.
- Helping management in taking decisions that affects environmental expenditures, prioritize them according to the available funds.
- Providing important data for natural resource accounting.

C) Annual Closing Accounts and End of Period Sheets:

The Egyptian petroleum sector, the EGPC prepares its accounts according to the conventional accounting system (unified accounting system for government and public entities). This system identifies all expenses and revenues types which are classified to suite any public entity regardless of its type or activity and serve the reporting purposes and all that according to the generally accepted accounting principles (GAAP).

Environmental expenditures can be classified into capital expenditures (CAPEX) and operating expenditures (OPEX) whether on micro, meso or macro level (establishing a garden, soil remediation ...etc).

In order to protect the environment and comply with environmental regulations, the same types of expenditures OPEX and CAPEX have to be incurred as per the following:

- Buying a new incinerator (CAPEX), the annual operation and maintenance (O & M) costs (OPEX).
- Laying out a garden (CAPEX), annual O & M costs (OPEX).
- Additives to improve the Octane number for gasoline (OPEX).

All these items represent an asset for the nation to be shown in the national balance sheet.

These items are treated according to the GAAP and thus petroleum entities should take the following points into account:

- A separate account is to be opened for each activity to enable in monitoring expenditures, reporting ...etc.
- All entities which depend on an environmental asset. i.e. it is vital for running its operations and is income generating. Then, this environmental asset should appear on its balance sheet (such as petroleum reserve, trees...etc). on the other hand, the associated liabilities should be shown in the closing sheets.

Environmental accounting support sustainable development, it does not look only into the past or near future. On the contrary, it looks to a more strategic objectives (next generations). As a result, accountants may find themselves not in fully compliance with the current GAAP and thus, the end of period sheets would look unfamiliar. So, it is better to be as a satellite along with the traditional ones.

Consequently, adjusted balance sheet for the Egyptian petroleum sector may appear as follows:

Figure # 2 Suggested Satellite Balance Sheet

Adjusted Balance Sheet (Satellite)	
Assets	Liabilities
<p><u>Firstly: Environmental & Natural asset</u></p> <p>1) Natural (Ecological) Assets</p> <ul style="list-style-type: none"> • Non-Renewable resources Reserves • Renewable resources Reserves <p>2) Environmental assets</p> <p>A) Current</p> <ul style="list-style-type: none"> • Pollution Bonds <p>B) Fixed</p> <ul style="list-style-type: none"> • Environmental Deposits • Environmental Goodwill • Environmental Performance Bonds • Pollution Bonds <p><u>Secondly: Manmade Assets</u></p> <ul style="list-style-type: none"> • Current Assets • Fixed Assets 	<p><u>Firstly: Current & Potential Environmental Liabilities</u></p> <p>1) Current Liabilities</p> <ul style="list-style-type: none"> • Compliance Liabilities • Treatment Liabilities • Compensatory Liabilities • Compensatory Liabilities • Natural Assets Liabilities <p>2) Future (Potential) Liabilities</p> <ul style="list-style-type: none"> • Compliance Liabilities • Treatment Liabilities • Compensatory Liabilities • Compensatory Liabilities • Natural Assets Liabilities <p><u>Secondly: owner's Equity & other liabilities</u></p> <ul style="list-style-type: none"> • Owner's equity • long term Liabilities • Short term Liabilities

N.B. the sheet started with the most liquid assets which is instrumental for the organization current situation as CAPEX already sunk cost.

Petroleum Reserve:

It has become known that next generations have a claim on the petroleum reserves. The petroleum reserve is an environmental asset, which should appear in the sectorial and nationwide as it is considered one of the nation's wealth. The accounting of nonrenewable resources like petroleum reserves clear and straight for the conceptual point of view due to the following:

- As a principle exploring and production of hydrocarbons and minerals in general are a one sided (one direction) flow (depletion).
- In general there are no different uses for these kinds of resources.
- The complete equality between the production of these resources and the final products of petroleum sector give a chance to determine the status of the resource and the current level of economic activity.

However, on the practical level, the picture is very complicated due to the dynamics of the reserves. As a result, the environmental accounting system should show what is added to the current reserves resulting from the new discoveries, the reevaluation of current reservoirs, the change in prices, the effect of replacement and using new technology ... etc. By this method, one can consider the volume of current reserve as assets in the environmental economic accounting.

It is worth mentioning however that, the Financial Accounting Standards (FAS) committee in the United States issued the standard number 69 requiring a systematic measuring for the net cash inflows regarding the proved oil and gas reserves which should be disclosed at the end of each fiscal period. Such information is required to be published as a supplementary information attached to the standard published accounting sheets and data.

For the purposes of determining the cash inflows the following should be taken into consideration:

- The cash inflows to be calculated according to the average price in the last quarter of the fiscal year for the reserve volumes at the end of the fiscal year.
- Future production and development costs for those proved reserves according to the average cost in the current fiscal year taking into consideration the cost of abandonment of the site assuming that the current economic circumstances are the same.
- Accordingly, any other expense to be determined such as taxes and then the expected net cash flows to be discounted by 10% ratio (determined by FAS).

However, such method meets a lot of opposition from the large petroleum corporations.

Table # 1
Economic Valuation of Petroleum Reserve

Description	Quantity/Value
Egypt petroleum proven reserves 2001:	
Oil and condensate	3.7 billion Bbl
Natural gas	51 Trillion square cubic feet
i.e. Bbl equivalent	13.7 billion
Assuming that the Bbl price (precautionary price) and petroleum is the main source of energy for the next 10 years where all other variables are constant.	10 US\$
the Net Present Value (NPV) of the cash inflows (value of petroleum as an environmental asset) using a 10% discount rate	187 billion US\$

Source: Ministry of Petroleum, The Egyptian General Petroleum Cooperation, "The Annual Report 2001", Cairo, 2002. (in Arabic).

Soil and Marine Areas (Exploration Acreages):

The EGPC is the legal entity which has the right to control the exploration acreages whether onshore or offshore and all other related operation on behalf of the Government of Egypt.

It is known that approximately all exploration activities are in isolated and not inhabited areas in Egypt. However, it still may be of a great environmental value and may represent an environmental stock for Egypt. Thus, the protection of these areas are considered value added for biodiversity. Despite that, the valuation of these environmental assets are of a great difficulty due to the following:

- There are no markets for these resources nor do they have other uses (desert land can not be cultivated or instance). Nonetheless, it is very important to determine a value for them in order to know the environmental quality.
- There is a difficulty to determine precisely the acreages which are in the control of petroleum sector. And whether the surrounding areas to be affected or not. For simplifying purposes the researcher considers only the exploration acreages is that under the control of the petroleum sector.

- There may be other resources (e.g. steal) or antiquities discovered in the acreages. In that case it is out of the petroleum sector control.

To determine the environmental value for any environmental asset is not an easy task. In economic literature any asset value whether manmade or natural asset contains both tangible and intangible benefits. This is very clear in the case of environmental assets and the total value of an asset is determined by the sum of both tangible and intangible benefits. The real problem comes when assigning values for the intangible aspects such as using water in recreation.

Beside the above, the petroleum sector distinguish between different kinds of grants (signing, production, extension) and all grants considered front loaded money for the investor and non-recoverable. These grants mean the following:

- There are no specific value for it and criteria for it (area have a grant more than 10 million US\$ but another one no grant at all).
- The grant value is not related to the acreage covered by the petroleum concession.
- Each investor may determine the value according to the petroleum prospects in the area.
- The investors competition.
- The available data about the area.
- Whether the area are near from production facilities or not.
- This grant is not a main item in evaluating different from investor and the priority are for production sharing and work program.

What is the value of losing a rare genes for example?! There are number of techniques suggested to be used in valuing these assets such as⁽¹⁾:

– **The Shadow Project Technique:**

Where an imaginary (alternative) project to be assumed to produce the same products and services provided by the natural asset. The cost of establishing that alternative project is then represent the value of the natural asset. However, this technique is complex and require to know exactly the services and products offered by the natural asset. In most cases these products and services can not be counted.

– **Opportunity Cost Technique:**

In this technique the destruction of the natural asset assumed and thus to be used in other alternative uses (lands to be used in agriculture, industry, tourism) and thus its alternative value in other uses represent its value.

– **Accounting Fair Value of an Asset:**

⁽¹⁾ Dixon, John et al, “**Economic Analysis of Environmental Impacts**”, Earthscan Publications Ltd., London, U.K., 1994.

Means the value of benefits and services to be gained from this asset during its lifetime. Thus, the value of a natural asset equals the value of the net cash inflows which the entity will gain as a result of using and benefiting from the asset.

– **Marginal Revenue and Costs:**

In economics the balancing situation when marginal costs = marginal revenue. The costs incurred to protect the natural asset represent the value of an asset at least.

The researcher may consider the grant paid for each concession as it is an indicator for the environmental sensitivity for the concession areas and thus each concession results in a grant which is equal to the environmental restoration of these exploration acreages.

As a result the researcher may evaluate the exploration acreages as follows:

Table # 2
Economic Valuation of Exploration Acreages

Description	Quantity/Value
Number of exploration acreages 2001 (exploration concessions and exploration and development)	31
Covering an area of sq km	368000
wells to be drilled	188
Grants paid for the above mentioned concessions	66 million US\$
The value of the exploration acreages (This value represents the balancing situation (marginal cost = marginal revenue))	66 million US\$

Source: Interview with the exploration official, The Egyptian General Petroleum Cooperation.

Environmental Liabilities in Petroleum Sector:

If the necessary measures to protect the environment are not applied there will be severe environmental hazards and as a consequence a potential environmental liability for the entity/sector.

Air pollution is one of the serious environmental problems in Egypt generally which may have different economic impacts as follows:

1- Direct impacts that include:

- Health impacts (including treatment costs and death).
- Result in manmade asset deterioration and destruction and thus more expenditures for maintenance and replacement.

2- Indirect impacts that include:

- Less productivity, more absence from work and manpower turnover.
- Deterioration for the surrounding areas and especially corps and agriculture lands.

There are no economic studies in Egypt to tackle such problem. In the United States a study by Harvard university discovered that air pollution result in more cases to turn to hospitals and emergency. About 15000 case entered hospitals and about 50000 turned to hospitals emergency in 13 city covered by the study.

The researcher will not tackle all different direct and indirect impacts resulting from air pollution. The researcher will focus on evaluating the health impacts in terms of medical treatment costs (petroleum staff medical expenses, treatment, operations, medicine ... and all that). This represents an environmental responsibility for the petroleum sector which can be valued in the following scenarios:

- The petroleum sector total manpower reached about 85 thousand personnel in 2000.
- The researcher consider 50% of that staff (about 42.5 thousand) are more likely to expose to air pollution impacts (that represent the staff in fields, refineries).
- The number of potential cases among staff are about 10% of the total expose staff (upon expertise consultation in petroleum sector), i.e. 4100 case need medical treatment.
- The daily medical treatment cost is 100 US\$.
- Thus the researcher may suggest the following three scenarios as shown in the following table:

Table # 3

Economic valuation of potential medical expenditures for the petroleum sector

The case	scenario	Amount in US\$
High scenario	The case requires treatment and hospitalization at least a week	2,870,000
Moderate scenario	Hospitalization from 2 to 5 days	1,435,000
Low scenario	Only one day hospitalization	410,000

In addition to other potential environmental liabilities which may arise due to suing the petroleum entities and /or sector as a result of adverse impacts on health (including death). Environmental financial liabilities may include layers and consultation fees. In addition to, the loss of company's and/or sector good image and the lost efforts in such non-productive active.

Revenues from Emissions Trading:

Petroleum like any other sector plays a role in green house gases and mainly carbon dioxide. Petroleum sector itself is not a major participant in Green-House Gases (GHG) emissions compared to some other industrial sectors and transport for instance. However, petroleum sector (fossil fuel) is the main sector is the primary source for GHG of all other economic sectors emissions within the economy.

The world now is about to establish a market for GHG emissions trading according to the United Nations Framework Convention on Climate Change and Kyoto Protocol. According to the latter there have been a commitment for developing countries to reduce its GHG emissions to a specific emissions target compared to the base year 1991. As a result, the developed countries may execute new low emission projects in developing countries and receive a certified emission reduction that the developed country may trade in a special stock.

There are no doubt that improving the air quality result in a number of current and future positive impacts that can be monetarized. Nonetheless, the researcher will only evaluate the expected revenue from emissions trading assuming that petroleum sector will be able to trade emission reduction and the petroleum sector is the primary source for emission and only carbon dioxide will be taken into consideration.

Table # 4
Bbl Equivalent to Gas – 1991-1999

Description	Quantity/Value
1) Natural Gas (1991) 000 metric ton	6921
2) Natural Gas (1999) 000 metric ton	12910
Difference (1-2)	5989
Petroleum Equivalent – 000 ton	(5989/1.111) 5391
Equivalent – 000 ton crude oil	(.995 X 5391) 5364

Source: Energy Planning Authority, "The Annual Report, Energy in Egypt", 1998/1999, Cairo, 2000. (in Arabic).

- Light Oil as in Western Desert

- Average oil as in the Gulf of Suez area
- Heavy oil as in Balayem area.

The international carbon dioxide ton price is about 31(1) US\$, and the Egyptian average selling price is about 25.5 US\$ (Egyptian marginal cost range from 22 to 29 US\$ per ton of carbon dioxide). Thus, the total revenue is (16814*25.5 = 428.8 Billion US\$).

⁽¹⁾ World Bank, “Certified Emission Reduction Trading Model – CERT Model”, an Excel Sheet Model, New York, 2000.

Table # 5

Scenarios of Evaluating the Emissions Reduction of Carbon Dioxide of the Egyptian Petroleum Sector

Product	Emission Factor Co2 ton/ton	Medium Oil %	Quantity	Emissions Quantity	Light Oil %	Quantity	Emissions Quantity	Heavy %	Quantity	Emissions Quantity	Average
Potagaz	2.9837	1.2	64	192	1.6	86	256	1.4	75	224	224
Benzine	3.1046	16.7	896	2,781	27	1,448	4,496	12.3	660	2,048	3,109
Kerosine	3.216	10.5	563	1,811	17.6	944	3,036	14	751	2,415	2,421
Deisel	3.2093	13	697	2,238	25	1,341	4,304	11	590	1,894	2,812
Mazot	3.1094	56.6	3,036	9,440	26.5	1,421	4,420	59.3	3,181	9,891	7,917
Others	2.9473	2	107	316	2.3	123	364	2	107	316	332
Total		100	5,364	16,779	100	5364	16,876	100	5,364	16,788	16,814

Source: Data through personal communication at The Egyptian General Petroleum Cooperation

Conclusions and Recommendations:

There is no doubt that some of the current development practices are described as unsustainable activities despite that all development efforts seek higher standards of living. In attempting to achieve that, however, such development activities had damaging affect on the environment. It is irrational to use part of our resources in the development process while the other part contributes negatively by polluting and depleting the rest!

In order to achieve sustainable development there are number of policies to be followed. These policies entail the adoption of the precautionary policies such as environmental impact assessment, natural reserve areas, environmental awareness, environmental researches and environmental accounting and corrective policies such as pollution control, reallocating industries, monitoring.

It is the researcher view that precautionary policies are of more importance as it helps to avoid negative impacts form materializing and environmental accounting one of the most important tool to measure and guide and control the sustainable development at all levels.

Nevertheless, environmental accounting is still facing number of problems such as lack of supporting information and skilled staff as well as the absence of a standard accounting principles.

The Egyptian petroleum sector prepares its accounts according to the traditional accounting system. i.e. no determination, classification of environmental expenditures. as a result, the allocation and unit pricing may not be fully accurate.

The case study indicated that the Egyptian petroleum sector already does a lot of efforts in the field of environmental protection. However, the current accounting system does not reflect such efforts for different stakeholders. So, the valuation of a number of environmental assets and impacts indicated the importance of their inclusion in the accounting system for different users inside and outside the petroleum sector as well as, for different purposes such as economic planning, prioritizing environmental expenditures, improving the sector image etcetera.

It is understood having a satellite environmental accounting system as an initial step and such system will have a separate item in the sector's balance sheet and the rest of end of period sheets for environmental assets, liabilities and expenditures.

As for the recommendations, the researcher makes the following ones:

1. Environmental Accounting should be responsible for measuring environmental performance and its reporting especially in published the financial statements.
2. Environmental bodies and scientists should develop a standard to guide different practices of environmental accounting.
3. Research and studies in the field of Environmental Accounting should be encouraged to develop at all levels.

4. Environmental Accounting and Statistics units should be established in different organizations with clear mandates.
5. Introducing Environmental Accounting should be encouraged by management and official authorities at all levels.
6. A separate accounts should be opened for environmental expenditures. This will enable measuring and reporting of environmental expenditures and environmental performance of each company as well as the whole sector.
7. Both physical and monetary approaches should be adopted in the Egyptian petroleum sector in order to enable introducing environmental accounting to the Egyptian petroleum sector.
8. It is better as an initial step that the suggested system for environmental accounting in the Egyptian petroleum sector to be parallel (as a satellite accounts) with the traditional accounting system.
9. In order to properly apply environmental accounting their should be a data base for environmental statistics.

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