Developing An Environmental Accounting Model For Egypt

*Khalid Attia**

ملخص

نموذج مقترح للمحاسبة البيئية فى مصر

إن نظام الأمم المتحدة للحسابات القومية، المطبق فى مصر وفى كثير من الدول النامية والمتقدمة، هو نظام للمعلومات يمدنا بالمؤشرات الكلية والقطاعية مثل: الناتج المحلى والقومى، الاستثمار، الادخار، إهلاك رأس المال. على الرغم من ذلك، فإن هذا النظام لا يتضمن أى معالجة لحساب إهلاك رأس المال الطبيعى، ولهذا فإن نظام الحسابات القومية الحالى بما يقدمه من مؤشرات تقليدية لا يمكن الاعتماد عليه فى قياس التنمية المطردة. ولهذا بدأت دول العالم النامى والمتقدم فى أخذ خطوات إيجابية نحو تعديل أنظمة حساباتها القومية، يذكر منها إصدار نظام الحسابات القومية المنقح والمعدل عن الأمم المتحدة عام ١٩٩٣، لتشمل الموارد البيئية ولتنتج المؤشرات المعدلة بيئياً (المؤشرات الخضراء)، وأكدت تجارب الدول النامية والمتقدمة فى محاولتها لتعديل أنظمة حساباتها القومية ولبناء نماذج المحاسبة البيئية، أن هذا النوع من العمل يجب أن يتم فى ضوء مستوى التنمية وظروف وموارد ومشاكل البيئة فى كل دولة. وتأسيساً على ذلك، فإن هذا البحث يقدم نموذجاً مقترحاً لتطبيق المحاسبة البيئية يتناسب والظروف المصرية، والذى قد يكون له عظيم الأثر فى دعم عملية اتخاذ القوارات وفى التخطيط وكذلك تحليل السياسات.

* Expert, Institute of National Planning, Nasr City, Cairo, Egypt.

1. Introduction

Egypt covers an area of about one million km^2 in the hyper arid regions of North Africa and West Asia. More than 95% of the land is desert. At present, more than 90% of the population live on less than 4% of the land area. They are concentrated on the banks of the River Nile and on the agricultural land in the Nile Valley and Delta Regions. Egypt's current population is estimated at about 60 million, with a growth rate of about 2.5%. The urban population is about 50% of the total population.

There are several challenges confronting the Egyptian economy. These are: meeting foreign exchange requirements for payment of debts; providing for the basic needs of the growing population; reducing deficit in the balance of payments; and reducing unemployment, especially that of university graduates. Natural resources in Egypt are very limited and inefficiently managed. The most critical resources are: water, land, and energy. The major environmental pollution problems are air and water pollution, soil erosion, solid waste and noise pollution.

There is a growing recognition in Egypt that economic activity and population growths have brought with them rapid environmental depletion and degradation of natural resources. This has led to an increasing concern about integrating these neglected environmental considerations into national development decision-making, planning and policy analysis in Egypt[1].

Increasing concern about environmental degradation, resource depletion and the sustainability of economic activity have made the development of natural resource and environmental accounting an area of significant activity. Approaches to environmental and natural resource accounting have been tested in some developed and developing countries. Types of natural resources and measures of the environment in these studies vary from country to country, reflecting the particular concerns of

each country. Even in two countries utilizing the same approach, details of methods are still slightly different from one to another. It is worth reviewing the reasons why and how these developing countries have utilized natural resource and environmental accounting systems and some of their common obstacles.

Preparation of national resource accounts and their regular publication can bring much needed accountability to public policy. It will tell how much is the real income of the nation, how much the nation borrows from nature, how much this generation borrows from the future as well how much some members of the society gain at the cost of others. What would be a broad outline of such an account? What kind of concepts do we need to value natural resources? How do we go about setting up such a system? If the natural resource accounts can be integrated with the standard national (economic) accounts, it will serve a number of useful purposes. First of all, valuation is a very economical way of presenting information contained in masses of physical data. Secondly, they would be understood and appreciated by the general public who will be asked to compare like for like. Thirdly, and most importantly, it will make it considerably easier to bring environmental considerations into decision-making.

The purpose of this study is to develop an environmental accounting model for a developing country, Egypt, which will subsequently need to be operationalized in order to calculate Egyptian sustainable income (long-term income). The structure of this paper is as follows. Section Two provides an overview of the Egyptian economy, examines the macro and sectoral performance of the Egyptian economy; examines the status of the environmental and natural resource base in Egypt and finally; stresses the necessary dimensions which need to be taken into consideration when trying to define and to measure the sustainability of the Egyptian economy. Sections Three and Four

investigate an appropriate approach that could be used in modifying the Egyptian System of National Accounts, through examining a series of natural resource and environmental accounting country case studies. The fifth section presents a developed environmental accounting model for Egypt. This model is designed to deal with accounting for the depletion of non-renewable resources first; accounting for the depletion and degradation of renewable natural resources second; incorporating the depletion and degradation costs into the Egyptian SNA in order to establish the Egyptian environmental macro and sectoral accounts third; and finally analyzing both the environmental macro and sectoral accounts to draw some of the policy implications from environmental macro and sectoral accounts. The sixth and final section presents conclusions and policy implications.

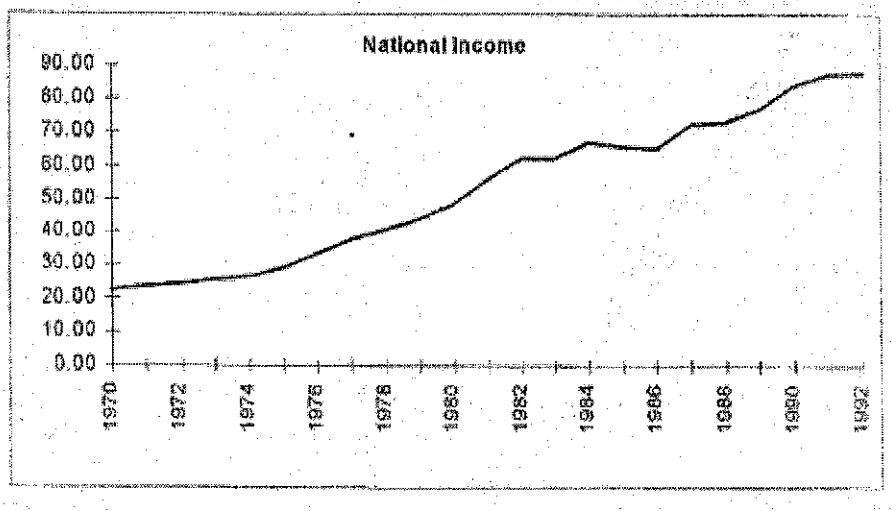
2. Egypt: Economy, Environment, And Sustainable Development

2.1 Macro And Sectoral Performance

The System of National Accounts (SNA) provides information to identify a country's assets and liabilities at particular points in time, as well as to keep track of transactions such as purchases of goods and services, payments of wage and profit to the earners, import payments and export revenues for goods and services. Through its ability to measure disparate goods and services using a common metric, the SNA has become the standard framework used for measuring macroeconomic and sectoral performance, analyzing trends of economic growth, and providing the economic counterpart of social welfare. At the heart of the SNA is the calculation of Gross Domestic Product (GDP), the market value of goods and services produced by all economic sectors in a given period.

The developments of the National Income, for the period 1970-1992, are presented in Figure 1. For the 12-year period, 1972-1982, the Egyptian economy grew rapidly. The average annual rate of growth of real GDP was 8.77% over this period. Although the first half of the 1970s witnessed no evident change in the GCF and GDS [(2)] as a percentage of GDP, the second half was a turning point. For the years 1975-1979 the GCF as a percentage of GDP averaged 28.36%. Private investment, both domestic and foreign, played the key part in this increase. GDS as a percentage of GDP more than doubled in 1975 (12.3% of GDP) from its previous year level (5.7% of GDP) and remained in excess of this new level through to 1986, reaching a peak of 18.5% of GDP in 1977. In 1987 GDS as a percentage of GDP fell back to its 1972 level (6.6% of GDP) and remained at a level of less than 10% of GDP through to 1990.

Figure 1: Egyptian national income, 1970-1992 (billions of £E 1990)



Egypt experienced rapid GDP growth in the 1970s. However, the rate of growth slowed significantly in the 1980s.

On the other hand, the structure of the gross domestic product (GDP) during the period 1955/56- 1991/92 shows that agriculture was the major sector in the 1950s and 1960s. Its share of GDP was 32.3% in 1955/56 followed by other services, 21.6%, and industry and mining (including petroleum), 17.6%. After 1973, major changes to the GDP structure occurred due to the liberalization and open-door policies. Petroleum, Suez Canal, tourism, and trade sectors have grown increasingly. The GDP share of petroleum increased from 2.7% in 1974 to about 10.6% in 1991/92, while the trade and finance share of GDP increased from 9.5% in 1960/61 to about 21.2% in 1991/92. The agricultural sector contribution to GDP decreased from 30.5% in 1974 to about 16.5% in 1991/92 due to the government policy of investment allocation and structural economic changes. The industrial sector share of GDP declined from 21.6% in 1965/66 to about 13.7% in 1981/82 and increased again slowly to reach about 17% in 1991/92. The performance of this sector is weak, and its indicators of growth in labour absorption, export earning, productivity change and economic rates of return are therefore low. Although government policy in the 1970s was for an open-door to attract foreign investment to Egypt, unfortunately most of the industrial investment was in the consumer goods industry such as food, beverages, textiles, and cigarettes and essential intermediate goods such as building materials, petroleum products, fertilizers, chemicals, paper. The capital goods industry such as machinery, tools and implements is small.

Examining the main changes which have taken place in the macro and sectoral performance of the Egyptian economy during the last three decades, the study has revealed that: (1) the economy has experienced a transition from a system characterized by public ownership of the means of production and rigid regulations on foreign trade before 1973, to a more liberalized system and the re-emergence of an active private sector after

1973: (2) there are two main factors which have led to the main economic developments which have occurred in the Egyptian economy in particular after 1973. These two factors are the opening policy and the oil revolution resulting in the increases in oil prices: (3) examining the role of the economic sectors in the growth of the Egyptian economy the study shows that: (a) the petroleum sector contribution to the Egyptian economy measured by some indicators related to the level of foreign exchange earnings, balance of payments, financing public expenditures, revealed the importance of this sector in the Egyptian economy: (b) the manufacturing sector contribution to the total value added has increased from about 13% in the 1970s to about 18% in the 1980s: (c) finally, the agriculture sector contribution has fallen dramatically from more than 30% in the 1960s to about 20% in the 1990s.

2.2 State Of Environmental and Natural Resource Base

Having examined the macro and sectoral growth and performance of the Egyptian economy and the main changes, which have occurred in it, the study now turns to examining the impact of the economic activities on the Egyptian environmental and natural resource base. The purpose is to show to what extent the past development programs have contributed to the depletion and degradation of the environmental and natural resources base in the name of achieving economic development and growth of the economy. Therefore, the main purpose of examining the state of the Egyptian environmental and natural resource base is to point out the environmental depletion and degradation that need to be accounted for, as soon as possible, in order to sustain the contribution of the environmental and natural capital in the economic growth for the welfare of the present and future generations.

The Egyptian natural resources-base could be classified into four main categories, namely (see El-Kassas, 1995):

1- Non-Renewable Resources:

Such as fossil fuels (oil, natural gas and coal), minerals and metals, and deep desert ground water.

2- Renewable Resources:

- Biotic or living organisms: terrestrial biomass (flora and fauna), aquatic biomass (such as fisheries).
- A biotic or non-living organism: water and land.

3- Semi-Renewable Resources:

Such as: soil quality, assimilative capacity of the environment.

4- Natural Heritage:

This consists of three types of sites:[3]

- Cultural heritage sites,
- Natural protected areas, and
- Coastal shores and marine areas.

In this study, we will concentrate on natural resource issues of high priority for Egypt and which are relevant to agricultural land, water and air, and energy resources.

2.2.1 Energy Resources

Energy is a critical natural resource in Egypt. A small quantity of coal exists in Sinai. Oil is known around the Gulf of Suez and the northern parts of the western deserts, and natural gas is found in the Nile Delta. Since 1972, Egypt has become an oil exporter. Fossil fuels (oil and gas) are still the primary sources of commercial energy in Egypt, and oil is one of the main sources of foreign exchange. However there are two energy

issues which need to be addressed. The first is that the lifetime of the proven reserves of fossil fuels is not large and that production cannot continue to increase very long into the future. Second, the emissions resulting from energy transformation and use have consequences on environmental quality.

Therefore, energy decision-makers in Egypt are challenged by: (a) step-wise transfers to alternative types of non-polluting renewable resources, for example solar, wind, and biomass energies, but economically expensive resources to meet future increased energy demand: (b) optimally utilising existing reserves to conserve the share for future generations by: (1) encouraging the discovery and exploration of new oil and gas fields and developing those fields to increase the proven reserves of oil and gas: (2) reducing local consumption rates in such away that the depletion rate is equal to the rate at which renewable substitutes are developed.

2.2.2 Agriculture Land Issues

The issues of agricultural land losses, either in quantity or quality, are the major causes of the decline of food self-sufficiency since the 1960s. The agricultural land problems can be summarised as follows:

- Land losses. Agricultural land suffers by losing areas with the best fertile soil due to the spread of buildings in urban and rural areas. During the last 30 years, accumulated land losses are estimated in 1990 at more than 840,800 feddan (World Bank, 1993).
- Land quality degradation. Soil erosion is often considered one of the major environmental problems in Egypt. Degradation of agricultural land in Egypt is mainly due to: (a) soil salinization and water logging because of an inefficient drainage system. Presently, more than 35% of agricultural land, 2.5 to 3 million feddans, is reportedly

affected by salinity, the major portion of which is found in the lower delta, 2 million feddans (EEAA, 1992); (b) loss of the fertility of agricultural land due to scraping; (c) chemical and biological pollution. Soil pollution may occur because of the disposal of industrial waste on agricultural land, atmospheric fall out, the use of sewage effluent or sludge, and overuse of fertilisers and pesticides that could be seen from the very high rates of fertilisers and pesticides application compared to other developed or developing countries[4]: (d) and finally loss of fertility because of desertification.

2.2.3 Air Pollution

Critical air pollutants in Egypt, mainly in urban areas, include Suspended Particulate Matter, Sulphur dioxide, Carbon Monoxide, Lead and Ozone. All of these pollutants in most, if not all, urban areas, exceed national and international levels. The three main causes of air pollution in Egypt are as follows. First, the large concentration of polluting industries in and around the major urban areas such as Cairo and Alexandria (EEAA, 1995). Second, the use of high sulphur fuel in industry and for thermal power generation also contributes to a high SO_2 level in the air. Third, the heavy use of subsidised leaded gasoline for transportation in urban areas leads to its overuse and a high level of lead dust in the air. This is compounded by traffic management problems[5], congestion and large numbers of poorly maintained vehicles. The negative side effect of air pollution is its damaging impacts on human health, soil and vegetation, economic materials and constructions, the income from tourism, and the physical properties of the atmosphere.

2.2.4 Water Pollution

In Egypt, water quality degradation of the River Nile, the Lakes, and agricultural drains is mainly related to the discharges of untreated effluents and drains from industrial effluents, agricultural drains, raw sewage from the expanding un-serviced areas, and other sources such as navigation and weed control. Therefore, the main causes of water pollution in Egypt are: (1) Industrial Effluents: (2) Agricultural Drainage. However, one can say that the industrial sector is the most responsible sector for the water pollution problem in Egypt. Bilharziasis disease (as a water-borne disease from water pollution) is a threatening sickness and death disease for most poor farmers. In that sense, addressing the water pollution problem would be particularly important to the poor (EEAA, 1992 and 1995).

2.3 Sustainable Development

The previous analysis of the Egyptian economy and natural resource base have made clear that it is important to give a practical dimension to the concept of sustainable development that is introduced by World Commission on Environment and Development (WCED) in 1987, also known as Bruntdland Report. WCED defined sustainable development as "the paths of human progress, which meet the needs and aspirations of the present generations without compromising the ability of future generations to meet their needs". This definition may indicate the general direction, but translating it into practical goals, programs, and policies which nations, like Egypt, could apply is not an easy task to accomplish. So, it invited some authors to make it more specific by trying to describe the necessary conditions for sustainability, or ways of achieving sustainability, or the indicators for measuring sustainability. Some of the definitions and measurement indicators for sustainability concepts found in the literature are presented below:[6].

Sustainable income. Daly in 1989, for example, proposed two adjustments for the SNA to replace the present income measure- GDP- by a measure of "sustainable" income. One adjustment is simply to extend the principle of depreciation to cover consumption of natural capital stocks depleted through production. The other is to subtract "defensive expenditures" to protect or restore the environment from the unwanted side effects of our aggregate production and consumption. That is, the correlated income concept, "Sustainable Social Net Domestic Product" (SSNDP), is defined as:

$$SSNDP = NDP - DE - DNC \qquad (2.3.1)$$

Where:

NDP = Net Domestic Product

DE = Defensive Expenditures

DNC = Depreciation of Natural Capital (Depletion and Degradation)

Environmentally sustainable development: Barbier and Markandya (1989), among others, interpret environmentally sustainable development as the maximisation of net benefits of economic development, subject to maintaining the services and quality of natural resources over time. That is, if the resource base is a composite of non-renewable and renewable (including semi-renewable and waste-assimilative capacity), sustainability requires:

I- utilising renewable resources at rates less than or equal to the natural or managed rates of regeneration;

II- Generating wastes at rates less than or equal to the rates at which they can be absorbed by the assimilative capacity of the environment; and

III- Optimising the efficiency with which exhaustible resources are used, which is determined, inter alia, by the rate at which

renewable resources can be substituted for exhaustible and by technological progress.

A workable measure for Barbier and Markandya's definition for sustainable development has been proposed to be estimated as follows:

Sustainable Income = Measured Income
- Household Defensive Expenditures
- Monetary Value of Residual Pollution
- Depreciation of Man-made Capital assets
- Depreciation of environmental capital (ecosystem function damage, renewable capital, exhaustible capital).

This definition, although conceptually similar to that given above, provides a basis for empirical estimation.

The United Nations, however, in 1993 endorsed the calculation of two measures for sustainable development: (1) Environmentally-adjusted net Domestic Product (EDP); (2) Environmentally Adjusted Net Income (ENI). These concepts are equivalent to the earlier concept of SSNDP or sustainable income by Barbier and Markandya. The EDP is arrived at by deducting imputed charges for the depletion of minerals and other natural resources, and cost of degradation of land, water, air, and other environmental amenities, resulting from production activities, from the GDP. The EDP measure does not include damage unrelated to production activities, such as natural disasters, naturally occurring erosion, and so on. These costs are reflected in the measure ENI. To arrive at the ENI, according to Lutz and Munasinghe (1993), the following five items are subtracted: (1) Environmental protection expenditures of governments and households, (2) Environmental effects on

health and other forms of human capital, (3) Environmental costs of household and government consumption activity, (4) Environmental damage from capital goods that are discarded, and (5) Negative environmental effects caused by production activities in other nations, and negative environmental effects transferred abroad. These empirical computations require knowledge of the process relating to the production activities with environmental effects not only in the country (region) but also in those with which trade takes place [7].

Net and Genuine savings, rather than EDP, is the national accounting aggregate with the clearest policy implications for sustainable development. Hamilton (1994) argues that 'green GNP' per se is not particularly useful for policy applications, even though it is important to know the true level of income in an economy. What does have much greater policy salience is the rate of genuine saving, i.e., net savings adjusted for environmental depletion and degradation. Pearce and Atkinson (1995), from University College London (UCL), have proposed an indicator of weak sustainability based on the neo-classical assumptions inherent in the Hartwick/Solow approach, in that man-made and natural capital are assumed to be perfect substitutes for each other, as shown in equation (2.3.2) below.

$$S_g = GDP - C - \delta_M - \delta_N \geq 0 \qquad (2.3.2)$$

Where:

S_g = genuine savings,

C = public and private consumption,

δ_M = depreciation of produced assets, and

δ_N = depletion and degradation of natural assets.

In Pearce-Atkinson Measure (PAM) if PAM ≥ 0 the economy is judged to be on the sustainable path. Equation

(4.3.2) states that PAM will be only positive if gross savings (GDP-C) exceed the sum of depreciation on man-made (δ_M) and natural (δ_N) capital. Pearce and Atkinson argue that this is a useful rule, in that if countries fail even this weak test of sustainability, they are unlikely to pass a stronger test.

In 1995 and 1997 the World Bank adopted the idea and proposed two measures for sustainability; Genuine Savings I that is similar to PAM; and Genuine Savings II (GSII) that is equal to in addition to investment in human capital E_H, as shown in equation (2.3.3) below. The World Bank argument is that, since the emphasis is on sustainable development, educational and health expenditures should be considered to be saving for the future as well. For current education and health expenditures E_H therefore, genuine saving becomes:

$$S_g = GDP - C - \delta_M - \delta_N + E_H \geq 0 \qquad (2.3.3)$$

For governments concerned with sustainability, virtually all of natural resource policy, the targets for environmental quality, public investment programmes (particularly for the development of human capital)[8], and large elements of monetary and fiscal policy, are all germane to the question of avoiding negative genuine savings. By expanding the asset base under consideration, green national accounting leads to a conception of economic development as a process of portfolio management. The efficient exploitation of resource assets, the shrinking of pollution liabilities to efficient levels, and changing the mix of produced and human capital in line with the highest rates of return on the marginal investment, all should become components of development policy.

Bishay in 1992, however, defined sustainable development for Egypt as: "achieving a dynamic balance between the pressing basic needs for economic development in face of a staggering population increase and gross underdevelopment, with the

unique limitations of the Egyptian environment – primarily the country's dependence on the River Nile for its very existence and scarcity of land available for development". In their report, Bishay addressed the general economic, social, and environmental problems in Egypt and proposed general strategies for managing these problems [9]. Unfortunately, they did not mention the need for the economic valuation for the depletion and degradation costs of natural capital, when calculating the national and sectoral income from SNA, as a necessary condition for achieving the sustainability of the Egyptian economy; and also, they did not define explicit indicator(s) for measuring sustainable development in Egypt.

As can be seen from the above analysis, although there are many partial interpretations of sustainability, whether social, economic, or ecological, the more comprehensive concept of ecologically sustainable economic development requires three broad, sometimes conflicting, policy goals to be satisfied, namely: economic efficiency; environmental integrity; and intergenerational equity. From our point of view, there are some urgent issues that need to be taken into consideration when trying to define and to measure the sustainability of the Egyptian economy, namely:

- Accounting for the depletion of non-renewable resources, mainly for oil and gas.
- Accounting for agricultural land losses in quality and quantity (i.e. land degradation), since water and land are the major constraints for sustainable agriculture.
- Estimating the cost of water pollution problems resulting from the industrial sector, municipal waste water and chemical fertilisers and pesticides.
- Estimating the cost of air pollution problems.

- Estimating ground water and fish depletion.
- Applying carrying capacity concepts, especially in the regions of high population density.
- Alleviating poverty, because there is a strong link between poverty, development, and environmental degradation.
- Development of tourism as an important sector for driving the economy.
- Avoiding illiteracy problems, especially among women.
- Stabilization of population growth.

3- International Experience in Environmental Accounting

For the purpose of the present study, we can divide the efforts of establishing the natural resource and environmental accounting into three groups, namely: those of some developed countries (members of OECD); of some developing countries.

Table (1): is the summary of the current natural resource and environmental accounting experiences and approaches, which have been seen so far. From the review of the contribution, we conclude that there is a real need for a great deal more empirical work, especially in developing countries, in the area of environmental and natural resource accounting. To construct a complete environmental accounting system requires data-intensive procedures, and is time-consuming. The country case studies reveal that a wide variety of approaches to natural resource and environmental accounting are currently being developed. This variety reflects different endowments, environmental concerns and, to some extent, systems of political economy in the countries studied.

Table (1)

Environmental accounting approaches and case studies and their main concerns

Developed Countries	Environmental Concerns	Main emphasis
Canada	Natural resources.	Physical accounting based on STRESS database.
France	Environmental & natural resources.	Physical and monetary accounting "patrimony accounts; physical geographical, agents accounts".
Netherlands	Environmental losses & damage.	Physical accounting.
Norway	Natural resources.	Physical accounting.
USA	Pollution abatements expenditures.	Environmental accounting
UK	Environmental & natural resources.	Physical and monetary accounting
Developing Countries	**Environmental Concerns**	**Main emphasis**
Indonesia	Forests, petroleum, soil.	
Costa Rica	Fisheries, forests, soil.	Depreciation of natural resources, economic performance or adjusted GDP.
Brazil	Minerals, forests, air and water.	Economic performance or adjusted GDP by sectors
Pakistan	Soil, air and water.	Environmental degradation and Genuine Savings as sustainability indicator
Mexico	Land, forests, petroleum, water, air.	Depletion of natural resources environmental degradation based on new SNA, i.e., SEEA
Papua New Guinea	Mine, fisheries, forests, energy.	New economic performance.

Notes: 1- STRESS [10] (Stress Response Environmental Statistical System).

2- SEEA (System of integrated Environmental and Economic Accounting).

It can also be concluded from the above case studies that, for resource base economies in general and those of developing countries in particular, the evaluation of economic performance and estimates of macroeconomic relationships may be seriously distorted by failure to account for natural resource depreciation. However, different countries have responded to perceived inadequacies in conventional accounting systems in different ways. In some cases this is because of differences in the scale of objectives (limited in the USA but ambitious in France). Also important are differences in the cost and effort involved in gathering data and differences in the interests of individuals responsible for the development of different techniques.

Probably the chief factor, however, is the view taken about the two main functions of conventional national accounts--i.e. whether to assist in performance measurement or to provide a more general data system for the management of a modern economy. In the former case conventional accounts mis-state income, and perhaps growth, because of their neglect of environmental deterioration and the depletion of natural resources. In the latter case the function of national accounts is to provide a coherent database to support economic policy, research, and modeling. This function can not be adequately performed without information that will better reflect environmental economic interactions. The various approaches differ in the degree to which they emphasise each of these two broad functions. Thus, for example, the responsible government agencies in Norway and US have so far shown little interest in producing better GDP estimates. Instead they have concentrated on developing better databases for policy analysis and economic modeling. In contrast, in developing countries such as Indonesia and Costa Rica (Repetto, 1989 and Solorzano, 1991) they have concentrated on the correction of conventional income indicators to reflect the real growth rate of economic performance.

The approaches also differ significantly in their complexity and coverage. The USA approach is narrowly focused on expenditure data, whereas the French approach covers a wide range of data reflecting environmental-economic interaction and resource depletion. On the other hand, the Indonesian and Costa Rican approaches fall between the two extremes. The differences in complexity and coverage reflect not only the particular degree of emphasis on the two major functions of national accounts but also different policy objectives. The Norwegian system is well suited to support the Norwegian desire to manage their resources of petroleum, timber, hydrocarbon, and fish. The US approach, with its emphasis on expenditure data, supports the analysis of the macroeconomic effects of environmental policy. The Repetto approach in Indonesia addresses sustainability issues in developing countries, which is mostly needed in developing countries.

Finally, however, although these approaches may have different structures in accordance with their different concerns and policy objectives, their data requirements are often quite similar. Thus the Norwegian and the Repetto frameworks appear to differ substantially on the surface. Yet similar data could be used for them. This means that efforts at implementation in developing countries could begin before a final decision is taken as to which approach will better suit country needs. And since the conditions for success in resource and environmental accounting are likely to be country-specific, there is little point in waiting for broader experience in developed countries before a developing country decides to embark on its own studies. Given the relative severity of resource and environmental problems in the developing countries and therefore the relative seriousness of the deficiencies in the ability of standard economic accounts to reflect these problems, a productive strategy for developing nations might be to initiate their own, low cost, pilot studies.

4. Alternative Approaches In Environmental Accounting

Including the environment in national income accounting of developing countries requires some questions to be answered, such as: Should they start with the aggregated or disaggregated approach? Should they prepare their accounts using the physical or monetary measures? Should they aim at full accounting for the depletion and degradation of environmental and natural resources, or start now with their available data-base? Finally, should they focus on integrating the environmental costs with SNA aggregates or should it be attached as a supplement to the systems in satellite accounts? These questions need to be explored and discussed in order to decide the most appropriate approach before launching any environmental accounting exercise in the developing world.

This section examines all the approaches that have been designed or used to improve the effectiveness of conventional national income accounting by including environmental impacts and natural resource depletion and degradation. These approaches could be categorised in four main groups of alternative approaches. These are: (1) the aggregated and disaggregated approach; (2) the physical and monetary approach; (3) the full and partial approach; and finally, the satellite and the integrated approach. These approaches, as seen from Section 2, have been practised in some countries.

Seeking to address the inadequacies of the SNA, two approaches to constructing integrated accounts have been proposed. Natural resource accounting corrects national accounts for the depletion and degradation of natural capital through expansion of the asset boundary. Environmental accounting, on the other hand, has a broader focus and includes more complex issues through expansion of the production boundary. Supporters

of environmental accounting suggest deducting a monetary value from GDP[11] to account for environmental degradation. The value of environmental degradation is defined as the cost of returning the environment to its original state at the beginning of the accounting period. However, the empirical means of accounting for the loss of non-market environmental services is usually conducted by applying the indirect valuation techniques that normally capture only the direct loss of resources services; thus the environmental accounting exercise is more difficult and time-consuming.

Proponents of natural resource and environmental accounting, for developing countries, are in agreement that countries should focus upon those resources and environmental problems that are most important for the economy, acknowledging that the sum-total of the adjustment is only partial. El Serafy suggests, "Let us adjust income gradually for degradation of petroleum, forestry, fisheries, water and air quality, soil erosions, one at a time and as our methodologies firm up and the physical basis of our calculations improves, leaving economic valuation of thorny areas such as biodiversity to the last" (El Serafy, 1993 and 1997). As seen in the previous section, investigations of this type have been carried out in Indonesia and Costa Rica, Papua New Guinea and Mexico, Pakistan, and Brazil either by international organizations or by independent researchers.

From the above analysis and discussion one may conclude for developing countries that, first, the aggregated approach is far more appropriate than the disaggregated one for various reasons: (1) it is not difficult to apply; (2) it does not require detailed data and much expense. Second, monetary estimates and integrated approaches are also more important than the physical and satellite approaches because: (1) money estimates are the tool for aggregation and focusing the policymakers' attention on

the seriousness of the environmental issues and problems, especially if we know the priorities of the policymakers in the developing world are different form those in the developed world; (2) monetary estimates for the environmental costs will be attached to economic aggregates, which are the main base of countries' planning and policy analysis. Finally, the partial approach is much more appropriate for developing countries than the full approach because: (1) their data bases are limited; (2) the valuation techniques are new and sometimes controversial; (3) and finally, the partial approach means to start as soon as possible with the most critical environmental issues and problems. The following analysis of Egypt's System of National Accounts in this study is very much in this spirit. It focuses on aggregate rather than disaggregate data, monetary rather than physical measurements, integrated accounts rather than satellite accounts, and only considers: (1) the depletion of oil and, gas, and agriculture land; (2) the degradation of soil, air, and water.

5. An Environmental Accounting Model

5.1 Valuing The Depletion Of Natural Capital

There are two main approaches, which address resource depletion directly in the national income accounts; they are the "Depreciation" (Landefeld and Hines, 1985; Repetto et al. 1989) and the "User-Cost" Approaches (El Serafy, 1981 and 1989). Both attempt to redress the asymmetrical treatment of natural and man-made capital in the current calculation of national income, and incorporate the environmental depletion into economic indicators. However, the two approaches address this issue in quite dissimilar ways. While both attempt to develop a new definition of national income compatible with Hicksian definition, the Depreciation Approach focuses on net natural resource flows, whereas the User-Cost approach concentrates upon natural capital stock.

Both the depreciation and user-cost approaches claim that national income indicators, as they are currently constructed, are deceptively overstated and likely to inappropriately encourage increased consumption of resources and environmental services. Current accounting procedures ensure that the greater the exploitation of the environment, the more profitable an activity will appear, thus creating incentives to expand ecologically costly production. Unfortunately, what appears to be remarkable growth and profits may, in fact, be irreversible environmental dis-investment.(12)

5.2 Valuing the Degradation of Natural Capital

Together with the direct valuation techniques analyzed before, in estimating costs indirect monetary values need to be attached for non-priced services provided by natural resources and the environment. 'Environmental valuation' is a very active, rapidly expanding field. It is also somewhat controversial. Many non-economists regard putting prices on environmental services as totally misconceived, if not wicked. While most economists accept the desirability of environmental valuation, there is disagreement over the prospects for actually doing it in a satisfactory way.

Environmental degradation/damage imposes costs to nations. Some of these costs produce impacts on GDP: GDP is lowered as a result of environmental damage. Other costs are not currently recorded as part of GDP, but would be if GDP accounts were modified to reflect comprehensive measures of aggregate well being rather than concentrating on economic activity. Focusing on costs that are currently recorded as part of GDP, evidence is now available to show that environmental degradation results in appreciable losses of GDP. The kinds of impacts that give rise to such costs include:

- Forgone crop output due to soil erosion and air and water pollution.
- Forgone forestry output due to air pollution damage, soil contamination and soil erosion.
- Impairment of human health and consequent loss of labour productivity.
- Diversion of labour and resources from high productivity uses to low productivity uses such as maintenance of buildings damaged by pollution.

National environmental damage cost estimates can play a useful role in assessing development priorities. Because environmental damage costs do not show up explicitly in measures of national product, planners have no obvious incentive to treat environmental damage as a priority in development plans. Increasingly, however, the environment is entering into development plans as the GDP costs of degradation are being shown to be significant and sometimes very substantial. Therefore, economic valuation of degradation costs is particularly appropriate at the levels of macroeconomic and sectoral management of the economy: it may be more important that the Ministry of Finance as well as Ministry of Planning appreciate the costs of environmental degradation than that the Ministry of the Environment does.

The monetary measure of a change in an individual's well being due to a change in environmental quality is called the total economic value (TEV) of the change. It is important to understand that it is not environmental quality itself that is being measured, but people's preferences for that quality. Valuation is therefore anthropocentric in that it relates to preferences held by people, and the economic value of something is established by an actual or hypothetical exchange transaction. The TEV of a resource can be disaggregated into use value (UV) and non-use

value (NUV), also called 'passive use value'. Use values can be direct use values (DUV), indirect use value (IUV) and option value (OV). Direct use values are derived when an individual makes actual use of a facility, for example visiting a recreation area to go fishing. Indirect use values arise from the natural functioning of ecosystems, such as storm protection provided by trees. Option value is an individual's WTP for the option of using an asset at some future date. NUV has proved to be both difficult to define and measure. It can be subdivided into existence value (XV), which measures WTP for a resource for some "moral", altruistic or other reason and is unrelated to current or future use; and bequest value (BV), which measures an individual's WTP to ensure that his or her heirs will be able to use a resource in the future. So,

$$TEV = UV + NUV = (DUV + IUV + OV) + (XV+BV) \qquad (5.2.1)$$

Table (2)

An economic taxonomy for environmental resource valuation

	Conventional market	Implicit market	Constructed market
Based on actual behavior	Change of productivity Loss of earnings Defensive expenditure	Travel cost Wage differences Property values	Artificial market
Based on potential behavior	Replacement cost Shadow project		Contingent valuation

The valuation techniques presented in **Table (2)** are grouped according to analytical method. Under specific conditions, such as when the environmental impact leads to a marginal change in the supply of a good or service that is bought on a competitive market, the WTP can be estimated directly in

terms of changes valued at prevailing market prices. If the market is not fully competitive, then the market valuation will be a partial measure, and shadow price corrections may need to be made. The foregoing comments apply to change of productivity. Often, the result of the impact cannot be directly related to a market activity. In some of these cases, the WTP could be estimated at conventional market value by using a closely related proxy. This approach applies to the following techniques: loss of earnings, defensive expenditure, replacement cost, and shadow project.

From the above Table, it could be summarized that total economic value refers to the whole class of values that have a basis in human preferences and so are amenable to analysis within an economics framework. Total economic value is the sum of current use and non-use values. A summary of the most commonly used methods for estimating current use value, because of the difficulty surrounding measuring non-use value, of environmental assets is given in Table 2 above. From this Table the following should be noted: first, if market prices exist for specific impacts, then the change in market price following an impact (or compared to an environment which is broadly identical apart from the impact) represents a valid basis for calculating the loss in use value, although as already emphasized, account should be taken of price distortions in imperfect markets; second, if market prices do not exist, indirect valuation methods must be applied.

5.3 The Developed Model

To develop an environmental accounting model for a developing country, Egypt, it has to be a reflection of the country's characteristics, which were explored in great detail in the previous sections. These characteristics, briefly, are: (1) a large, populous, developing country that needs economic

development; (2) a country where agriculture is dominant and in its middle stage of industrialization; (3) a country in which much economic activity is in the small and informal sector; (4) a country in which millions of poor depend on natural resources for their subsistence; (5) and finally a country with a large ecological diversity. The resources we emphasize and the priorities we give in preparing environmental accounting would have to reflect these characteristics.

We will extend the current Egyptian national accounts in many ways for our purpose. First of all, we will consider the environmental deterioration resulting from various emissions and effluents associated with the various economic activities of production and consumption. Second, we will build the sectoral detail accounts for the resources of interest. The environmental consequences of the various economic activities affect the different natural resources, their qualities as well as their amounts. Our objective is to calculate quantitatively the changes that are brought about in the various natural assets. The main natural assets of interest to us are the following: (1) exhaustible resources such as oil and gas; (2) renewable resources such as land, water, and air.

5.3.1 Accounting for the Depletion of Natural Resources

5.3.1.1 Oil and Gas

In order to modify the Egyptian National Accounts for the depletion of natural resources, two main approaches could be used to illustrate differences in opinion: the User-cost Approach, and the Depreciation Approach (both Net-Price I and Net-Price II). These approaches have been widely applied in Indonesia, Mexico, Papua New Guinea, Australia, USA and in the UK.

5.3.1.2 Agriculture Land Losses

The valuation techniques discussed at Section 4 above were developed mainly to value depletion of non-renewable resources (oil and gas). However, the net present value method could also be used to value the depletion of renewable natural capital. It is necessary to value them in order to include net depletion of their capital stocks in income accounts. For example, the United Nations guidelines suggest that the value (of fish extraction, land losses, and timber tracts) should be based on market prices where available. These capital assets prices should reflect the present value of future income flows. If there have been insufficient market transactions to provide a base for estimation, agriculture land losses, for example, could be valued by discounting the future net revenues of a hectare of land at current prices after deducting management and operation costs (United Nations, 1977). Therefore, Net Present Value (NPV)[13] will be used to estimate the value of agriculture land losses due to urban and industrial expansion.

5.3.2 Accounting for the Degradation of Natural Resources

As discussed in great detail in the previous sections, the most urgent environmental problems in Egypt are water and air pollution and soil erosion. These type of resources are non-marketed ones. Therefore the indirect valuation techniques will be utilized in order to estimate the use value (Capital Consumption Allowance) for these resources. For example, the value of commercial fertilizers that have been used to replace the nutrients loss from soil is used as a proxy for estimating the cost of soil erosion. However, the implicit assumption in using indirect valuation methods is that the markets for these proxies are perfectly competitive. In the case of fertilizers, for example, this is certainly not the case, as these prices were subsidized by the government. This fact may introduce a distortion in our

estimates. However, as long as this distortion is on the side of underestimating the real cost of degradation it will not have a negative effect on the overall results.

5.3.2.1 Air and Water Pollution

Air and water pollution inflicts its damaging effects on Human Capital (morbidity and mortality), Physical Capital, and Vegetation. For Human Capital, sickness and absenteeism (morbidity), the most commonly used approaches rely on information on loss of earnings and medical care costs. Local data on these costs can be collected, and can also be presented to decision-makers to focus their attention on the economic and social costs of pollution. On the other hand, one widely known approach to estimate the "value" of a human life is the human capital approach. This approach is based on foregone earnings and treats a life as a productive capital and estimates the production lost from premature death. This approach is full of methodological and moral problems; however it offers probably the most feasible and acceptable method of estimating the value of human life in developing countries. The alternative approach is based on information on the willingness to pay of individuals to avoid premature death. Contingent valuation techniques based on individuals' willingness to pay to avoid environmental damage may represent the best available valuation method in many cases. However, in common with other techniques, it is potentially subject to bias as a consequence of unrepresentative sample selection, poorly structured questionnaires incorporating leading questions, upward bias in hypothetical bids for environmental assets, etc. Consequently, estimates such as those derived from the human capital approach are more applicable and appropriate for developing countries than those derived from willingness to pay.

- **Loss of Earnings**

This method is most commonly used in evaluating the losses in net output that result from sickness and premature death. Environment-related health diseases are the most significant effects of air and water pollution, responsible for human capital productivity losses in Egypt. These losses comprising the aggregate value of estimated earnings foregone as a consequence of environment-induced illness (morbidity) in addition to the imputation value for the productivity lost as a consequence of the premature deaths resulting from environment-induced illness (mortality). The principles which are followed in case of mortality are the same as in the case of morbidity: the years of productive life lost are estimated and then valued using a proposed human capital accounting model.

- **Preventive or Defensive Expenditures**

Defensive expenditures are outlays that are required to counter or mitigate the damage imposed by environmental degradation. In the case of Egypt, in addition to the estimate of loss of earnings induced by environment-related illness, the productive resources foregone as a result of defensive expenditures such as medical and staff costs, were also estimated. On the other hand, the effects of air pollution on physical capital, particularly buildings damage, are measured by an indicator of WTP to avoid the damages- the costs of extra painting, cleaning and the like. Finally, the cost of crop damages resulting from air and water pollution have not been accounted for because it was not significant compared to human and physical capital effects; in addition the available data were incomplete and inaccurate.

5.3.2.2 Soil Erosion

We attempted to use change in land value as a means of approximating the losses induced by erosion, but failed because markets for land and property are insufficiently developed to allow credible use of this method. The position, however, is likely to improve over time. Therefore, the "second best" has been used, the costs of replacing the losses. This may be a relatively poor measure of willingness to pay, because it only estimates the costs of replacement, not whether anyone would be willing to incur these costs. When all else fails, however, replacement costs do give an approximate estimate of the willingness to pay. The gross On-site and Off-site costs of replacement of nutrient losses in Egypt were estimated because it proved impossible to derive productivity losses.

5.4. Environmental Accounting Model for Egypt

The general structure of the Egyptian environmental accounting model, developed for this study, consists of three main modules - the SNA module, depletion module, and the degradation module. The SNA module is the core of the environmental accounting model. The major linkages of the three modules are shown in Figure 5.1; however the detailed structure of the degradation module is presented separately in Figure 5.2. Figures (5.1) and (5.2), which present a block diagram model of the study, show the objectives, the methodology, the main steps, and the relationship between the main steps of the study.

The developed environmental accounting model for Egypt, shown in Figures (5.1) and (5.2), is designed to deal with the most urgent environmental problems in Egypt, namely: (1) the depletion of natural resources such as oil and gas, and agriculture land losses due to urban expansion; (2) the degradation of natural capital such as water and air pollution and soil erosion. However,

the model's framework is flexible in such a way that it can be enlarged to cover more resources as our knowledge improves. Second, the accuracy of the results could be improved when the methods of calculations improve. Third, it performs the two main functions of accounting science, which are: (1) measuring the environmental cost (depletion and degradation); (2) reporting and disclosure in the accounting final statements (modified national accounts) for SNA users. Fourth, the modified aggregated and disaggregated environmental accounting could show a totally different picture for the whole economy, which may indicate the distortion in the country's planning and policy analysis on both macro and sectoral levels. Fifth, when comparing the model's outputs with its inputs (feedback process), some important issues will arise such as the lacks and the gaps in environmental and economic data which need to be completed, and the actions which need to be taken either to reduce or to stop the environmental deterioration on macro and sectoral levels. Finally, this model is specifically built for Egypt; however it could be modified and applied in other developing countries, which may have quite similar or different environmental problems.

6. Policy Implications

The policy conclusions, which emerge from this study, for Egypt in particular and for developing countries, in general are:

(i) From examining Egypt's macro and sectoral economic growth and performance in the last three decades one may conclude that Egypt's debts are not only financial, but also demographic (a high population growth rate of 2.6%), social (insufficient investment in people), and environmental (exhaustion of natural resources and increasing pollution). Without drastic improvements, Egypt's development efforts

will become increasingly unsustainable. An urgent change to an integrated, sustainable approach is vital.

(ii) There are several areas of work for setting up a comprehensive system for Environmental Accounting in Egypt. It is important to start with environmental issues with policy implications of immediate relevance to Egypt. Therefore, in this initial stage, the following activities were proposed to be included in a detailed elaboration of a comprehensive methodological framework for environmental accounting, that can lead to integrated economic and environment accounting. Therefore, the depletion of non-renewable natural resources is accounted for first. The depletion and degradation of renewable natural resources is accounted for second.

(iii) For developing countries, the adjustments to standard national accounting aggregates that result from resource and environmental accounting can be sizable. This is obviously true for the most resource-dependent economies, but it is also likely to be of growing importance for those countries that are rapidly industrializing and urbanizing. For these countries, the growth in damage from pollution emissions, in terms of human health in particular, is of mounting concern [14]. However, as explored above, it is not a useful investment of scarce intellectual resources, in developing countries, to attempt the full integration of environmental impacts into the national accounting system. This view is supported by El Serafy (199).

(iv) From examining the country's experiences of environmental accounting, one can conclude that environmental accounting will not be a uniform process across countries. Many developed countries have sophisticated models that permit the integration of resource and environmental information into macroeconomic analysis. For these

countries the usefulness of adjusting national accounts aggregates may be limited, largely because policy simulations can be carried out directly. The physical natural resource and environmental accounts described above can support the implementation of these models. However, building complex policy models may be an expensive luxury in many developing countries. For these countries, rapid assessments of resource depletion and the value of environmental degradation, placed in the savings and wealth framework as well as SNA aggregates presented above, will guide policy-makers aiming for sustainable development.

(v) Also, from examining the variety of approaches in previous efforts of environmental accounting, one may argue that environmental accounting exercises in developing countries must proceed in stages. It has to be aggregated, monetary, integrated, and gradual. It calls also for an interdisciplinary approach. Normally available data is inadequate and patchy, and sometimes is not uniform in high quality. Therefore, information has to be collated from various sources to progress the work. Once again, the following analysis of Egypt's National Accounts is very much in this spirit. It focuses on aggregate rather than disaggregate data, monetary rather than physical measurements, integrated rather than satellite accounts and only considers: (1) the depletion of oil, gas and agriculture land; (2) the degradation of air, water and soil.

(vi) An approach for integrating and incorporating the depletion and degradation of environmental resources in the UNSNA for Egypt in particular and for developing countries in general is recommended, that is:

- Aggregated.

- Monetary.
- Integrated.
- Gradual.

These recommendations stress that we should proceed without delay to incorporate the environmental depletion and degradation, however imprecisely, fully realising that such an approach will remain partial, but it is bound to be expanded gradually as knowledge of the facts is improved, and as more environmental concerns are brought "into relation with the measuring rod of money".

(vii) Finally, the developed environmental accounting model for Egypt, in this study, is a partial representation for measuring sustainable development, because it only includes the environmental issues where there is available data. However, the designed model is flexible: to include more environmental issues; to the improvement of the data accuracy; and to the development of the applied valuation techniques over time. More importantly, the developed model could be used by other developing countries.

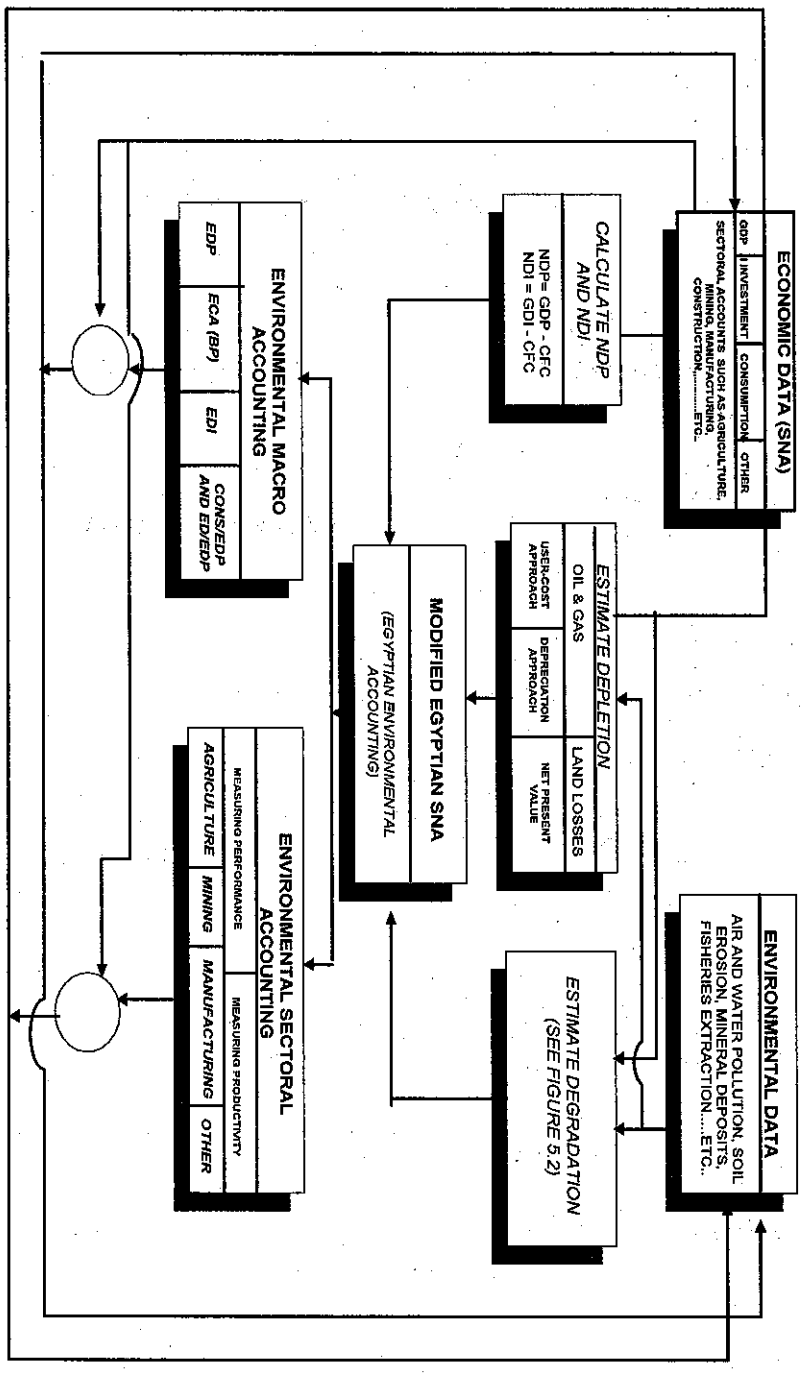
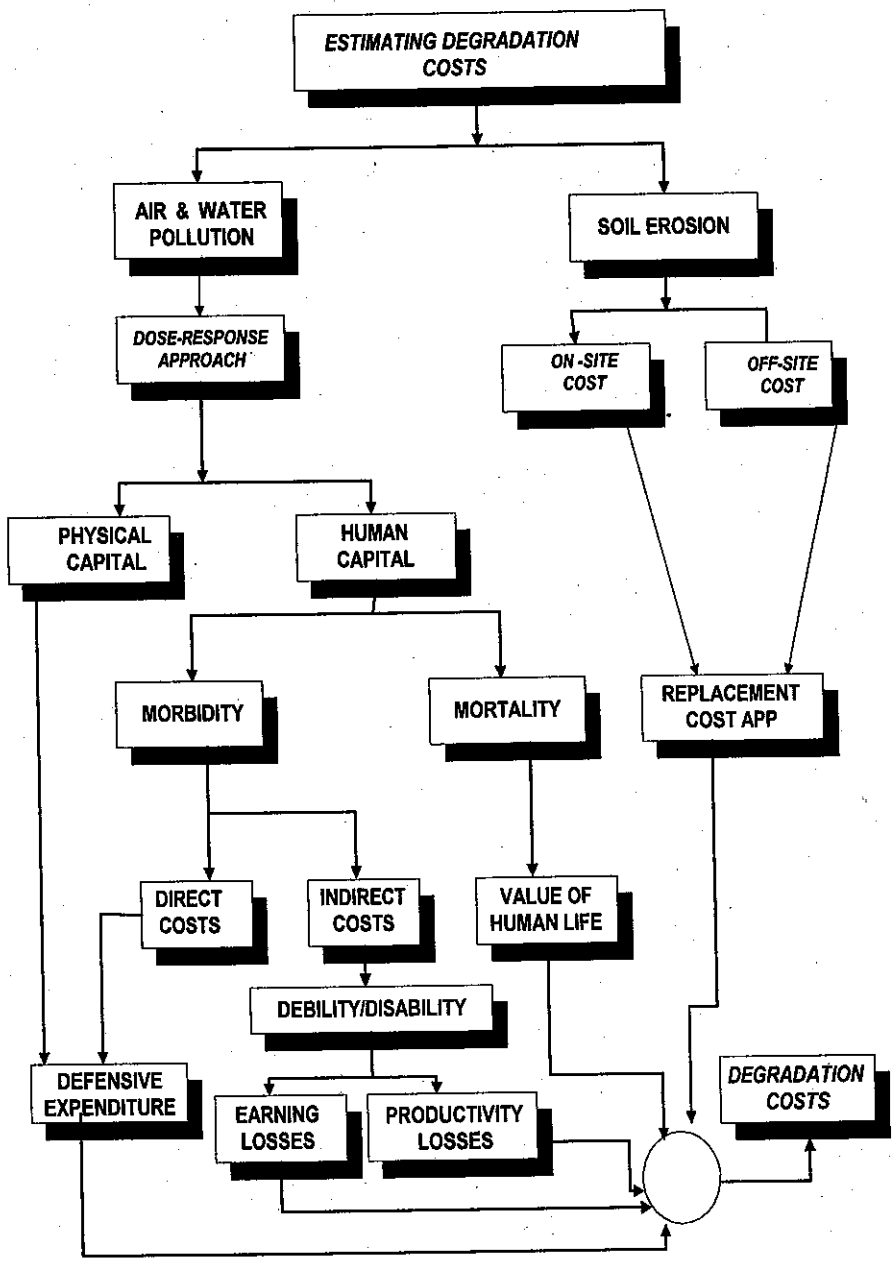


FIGURE 5.1: ENVIRONMENTAL ACCOUNTING MODEL FOR EGYPT

FIGURE 5.2: ENVIRONMENTAL DEGRADATION MODULE



Notes:

(1) In this context, in early 1991, the government of A.R.E. decided to prepare a National Environmental Action Plan (NEAP) to strengthen the management of environmental affairs in Egypt.

(2) GCF = Gross Capital Formation; GDS= Gross Domestic Savings.

(3) For more details see: Egyptian Environmental Action Plan (1992).

(4) Another important cause of land degradation in Egypt is the distortion of the land tenure system that makes it difficult for the majority of poor farmers to make long-term investment in sound environmental management.

(5) It has to be mentioned that, the big number of vehicles as it is responsible for air pollution, it is also responsible for noise pollution which is really a real danger in urban areas such as Cairo.

(6) For a review of the numerous definitions and interpretations of sustainability concepts see, for example: Yusf, J. A. et al., 1989; WB, 1995 and 1997; WRI et al., 1992; Daly, 1989; Pezzy, 1989 Lutz, 1993.

(7) Proops and Atkinson (1996) and Common and Sanyal (1998) have extended the Heartsick/ Solow indicator to cover the depreciation of non-renewable resources (oil and gas) that takes place in international trade, between exporters and importers. Their idea is to treat each trading economy as if it were a single sector in the global economy, and then using the input-output methods to calculate the measures of depreciation of man-made and natural capital in each economy on account of domestic and overseas final demand, D^{IN}, and a measure of the global depreciation attributable to final demand in each economy, DATT (for details see Proops and Atkinson, 1996; Common and Sanyal, 1998).

(8) UNDP, for example, in 1990 adopted the use of Human Development Index (HDI) as a measure for sustainable development. HDI is a component of three equal weighted indicators; they are knowledge (adult literacy), health (life expectancy at birth), and income (GDP per capita). According to UNDP 1992 HDI report, Egypt HDI was only 0.385 as compared to 0.976 for USA, 0.981 for Japan, and 0.982 for Canada. This ranks Egypt as 110^{th} as compared to USA (Six) and Canada (First) on a list of 160 countries investigated. For a review of Egypt's HDI rank for the 1990-1995 period. It has to be also noted that UNDP has not so far included an environmental component in HDI, although it recognises that the environment cannot be completely ignored. This is why the researchers and organisations are now

researching ways to incorporate an environmental dimension into HDI model (Proops, 1998).

(9) However, the management of natural resources in Egypt is constrained by the poor and the lack of information on environmental deterioration. In addition, policy-makers do not have reliable quantitative data on the status of natural resources, economic values of resources, and the environmental costs of environmental depletion and degradation. Interestingly, the same conclusion has also been reached by Clark et al., 1997 and Clark 1998 in the cases of Kenya and Ethiopia. Apparently, this is a common case in most, if not all, of the developing world (see Clark et al., 1997; Clark, 1998).

(10)STRESS are physical accounts designed to be used as data-bases for model-building and analysis, and not to be used for valuation purposes. But SEEA is a combination of physical and monetary accounts and therefore they allow for incorporating natural resources depletion and degradation into SNA framework in order to produce the environmentally adjusted indicators such as EDP.

(11)The foregoing argument for including the resources and the environment in the national accounts faces some difficulty. Should the adjustment in the change affect both GDP and NDP, or merely change NDP? Current answers are political rather than economic. Some economists argue that because the media and politicians focus on one number, GDP, any framework for incorporating the environment must affect the gross figure to reflect environmental damage. Others, citing that welfare and sustainable income are better measured by net income, argue for an adjustment in NDP.

(12)For more details about the proposed models see Attia and Clark, 1999.

(13)For more details see Attia and Clark, 1998.

(14)Therefore, pollution costs should be counted in addition to the depletion costs. As evidence, Faber and Proops (1994) write that
especially economists, see pollution as the lesser of these two evils. This is because one may view pollution as an "externality" where its non-market nature leads to its over-production. If, somehow, one were to internalise this externality then pollution would cease to be a problem .

References

Attia, K. A and Clark, N. (1998) "Environmental Accounting: Capital Consumption Allowance for Egyptian Agriculture Land Losses", Presented at DSA Annual Conference, Bradford, 9-11th September.

Attia, K. A and Clark, N. (1999) "Environmental Accounting: Valuing the Depletion of the Egyptian Non-Renewable Natural Resources", Presented at Development Studies Association, Scotland Study Group, One-Day Conference, University of Edinburgh, Management School, UK.

Attia, K. A. (1999) " Environmental Accounting in A Developing Country: a Case Study of Egypt", Strathclyde University, Ph.D. Thesis, U.K.

Attia, K. A. (1994) " The Egyptian System of National Accounting and Some of the Arising Environmental Problems", Institute of National Planning, Cairo, Egypt.

Attia, K. A. (1996) "The Egyptian System of National Accounting and Its Role in Supporting Economic-Environmental Decision-Making", In Gaber, A. (ed.) "Environmental Economics in Egypt", Mansoura University, Cairo, Egypt.

Barbier, E. E., and Markandya, A. (1989) "The Conditions of Achieving Sustainable Development", IIED/UCL London Environmental Economics Centre.

Bartelmus, P., Lutz, E., and Schweinfest, S. (1993) "Integrated Environmental and Economic Accounting: A Case Study for Papua New Guinea", In Lutz, E. (ed.) "Toward Improved Accounting for the Environment", UNSTAT-World Bank Symposium. World Bank, Washington D.C.

Bishay, A. (1992) "Strategies for Sustainable Development in Egypt", Cairo, Egypt, (Unpublished Report).

Brandon, C. (1996) "Valuing Environmental Costs in Pakistan: The Economy-Wide Impact of Environmental Degradation", Asia Technical Department, The World Bank: Washington, D.C.

Clark, N. (1998) "The Ethiopian Agriculture Sector", Report on the UNCTAD SPTI/FDI Review Team Visit, November 9th - 19th, Graduate School of Environmental Studies, University of Strathclyde, Glasgow, U.K.

Clark, N., Mugabe, J., and Seymour, F. (1997) "Environmental Adjustment in Kenya: Emerging Opportunities and Challenges", African Center for Technology Studies (ACTS), Nairobi, Kenya.

Common, M., and Sanyal, K. (1998) "Measuring the Depreciation for Australia's Non Renewable Resources: A Cautionary Tale", Ecological Economics, 26, 23-30.

Daly, H. (1989) "Toward a Measure of Sustainable Social Net National Product " In Ahmed et al., (1989) "Environmental Accounting for Sustainable Development", World Bank, Washington, D.C.

Egyptian Environmental Agency Affairs (EEAA) (1992) "National Action Plan", Cairo, Egypt.

Egyptian Environmental Agency Affairs (EEAA) (1992) "National Report on: Environment and Development in Egypt", Cairo, Egypt.

Egyptian Environmental Agency Affairs (EEAA) (1995) "Framework of National Action Plan for Dealing with Climate Change", U.S. Country Studies Program, July, Cairo, Egypt.

El Serafy, S. (1989) "The Proper Calculation of Income from Depletable Resources", In Ahmed Y. J., El Serafy, S. and Lutz, E. (eds.) "Environmental Accounting for Sustainable Development", World Bank, Washington, D.C.

El Serafy, S. (1993) "Country Macroeconomic Work and Natural Resources", World Bank, Environment Department, Environment Working Paper No. 58.

El Serafy, S. (1995) "Measuring Development: The Role of Environmental Accounting", International Social Science Journal, 143, March, 60-73.

El Serafy, S. (1997) "Green Accounting and Economic Policy", Ecological Economics, 21 (217-229).

El-Kassaa, A. S. (1995) "Studies of Submodels for Use in Future Decision-Making Information Support System for Analyzing

Complex Economic- Environmental Dynamic Problems", Ph. D. Thesis, Mathematics Department, Faculty of Science, Ain Shams University.

Hamilton, K. (1994) "Green Adjustments to GDP", Resources Policy, Vol. **20**, No. 3, 155-168.

Hicks, J. (1946) "Value and Capital", Oxford, Clarendon Press.

Landefeld, S., and Hines, J. (1985) "National Accounting for Non-Renewable Natural Resources in the Mining Industries", The Review of Income and Wealth, Series **31**, March, 1-20.

Lutz, E. (1993) "Toward Improved Accounting for the Environment: An Overview", In Lutz, E. (ed.) "Toward Improved Accounting for the Environment", World Bank, Washington, D.C.

Munasinghe, M., and Lutz, E. (1993) "Environmental Economics and Valuation in Development Decision-making", In Lutz, E. (ed.) "Toward Improved Accounting For The Environment", World Bank, Washington, D.C.

Pearce, D. W., and Atkinson, G. (1995) "Measuring Sustainable Development", In Bromley, D.W. (1995) "The handbook of Environmental Economics", Oxford Blackwell.

Pearce, D. W., and Markandya, A. (1989) "Environmental Policy Benefits: Monetary Valuations", OECD, Paris.

Pezzy, J. (1989) "Economic Analysis of Sustainable Growth and Sustainable Development", Environmental Department Working Paper No. 15, Environmental Department, the World Bank.

Proops, J., and Atkinson, G. (1996) "A Practical Sustainability Criterion When there is International Trade", In Facuhex, S., O'Connor, M., Van der Straaten, J. (1996) "Sustainable Development: Analysis and Public Policy", Kluwer, Amesterdam.

Repetto, R., Magrath W., Wells M., Beer C. and Rossini F. (1989) "Wasting Assets: Natural Resources in the National Accounts", World Resources Institute, Washington, D.C.

Solorzano, R., Camino, R., Woodward, R., Tosi, J., Watson, V., Vusquez, A., Villalobos, C., Jimnez, J., Repetto, R. and Cruz, W. (1991) "Accounts Overdue: Natural Resource Depreciation

in Costa Rica", World Resources Institute, Washington, D.C.

Solow, R. M. (1986) " On the Intergenerational Allocation of Natural Resources", The Scandinavian Journal of Economics, Vol. 88 (1), 141-149.

United Nations (1977) "Provisional International Guidelines of National Accounts", Department of Economics and Social Affairs, Series M, No. 6, 48-49.

United Nations (1993) "Integrated Environmental and Economic Accounting", Interim Version, Handbook of National Accounting, Series F, No. 61, Department of Economic and Social Development, Statistical Division, New York.

Van Tongeren, J., Schweinfest, S., Lutz, E., Gomez Luna M. and Guillen, F. (1993) "Integrated Environmental and Economic Accounting: A Case Study for Mexico Environment", In Lutz, E. (ed.) "Toward Improved Accounting for the Environment", UNSTAT-World Bank Symposium. World Bank, Washington D.C.

World Bank (1993) "Arab Republic of Egypt: An Agriculture Strategy For the 1990s", A World Bank Country Study, Washington, D.C.

World Bank (1995) "Monitoring Environmental Progress", Environmentally Sustainable Development Series, World Bank, Washington, D.C.

World Bank (1997) "Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development", Environmentally Sustainable Development Studies and Monographs, Series No. 17, World Bank, Washington, D.C.

World Commission on Environment and Development (WCED) (1987) "Our Common Future", Oxford Press.