ENVIRONMENTAL ACCOUNTING – CONCEPT NOTE

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RATIONALE FOR ENVIRONMENTAL ACCOUNTING

The measures like Gross domestic Product (GDP) and Net Domestic Product (NDP) have been key indicators in the economic policy making since last 50 years. These measures are part of the national income accounts developed in each country, whose objective is to provide a database for macroeconomic analysis. Besides this, these indicators were for a long time used as a measure of the economic progress of a country and also as a measure of standard of living. These traditional measures of economic activity such as GDP and NDP are now recognised as inadequate as they cannot accurately measure the contribution of environment and the impact of economic activities on environment. As we all know, the environment provides a source of raw materials and energy, serves as assimilator of wastes of production and consumption, provides the context in which all human actions take place and sustains basic life-support systems. However, these traditional measures of economic activity failed to recognise the fact that economy cannot operate in a black box. As a result the national accounts allow depreciation allowance for man-made assets, while the contribution of environmental assets to economy are not valued and hence no depreciation allowance is made for these assets. Thus the depletion and degradation of environment is treated as increases in income, while this depletion and degradation can in fact have negative consequences to the economy in the future. In this paper, a brief review of the national accounts, their flaws and how better indicators of human well-being can be constructed are reviewed followed by the survey of case studies in India.

THE STANDARD NATIONAL ACCOUNTS

The systems of national accounts (SNA) view the relationship between the environment and the economy from economic perspective only (System of National Accounts, United Nations, 1968). The national income accounts are grouped under three categories: current accounts, accumulation accounts and balance sheets. Current accounts deal with production, income and use of income, accumulation accounts cover changes in assets and liabilities and changes in net worth; Balance sheets present stock of assets and liabilities and net worth. The most familiar of the three accounts are the current accounts (the supply and use accounts). The supply and use

accounts compute income in three ways: 1) the sum of value added (revenue minus intermediate consumption) across all industries (i.e., the production account); 2) the sum of final consumption and savings (disposable income) (i.e., the use of income account), and 3) the sum of employee compensation and operating surplus (i.e., the distribution of income account). Production in SNA mainly covers only those goods and services that are bought and sold in markets (there are few exceptions).

The supply and use accounts reflect three basic national accounts identities:

1. ***The supply-use identity***

   Production + imports = intermediate consumption + exports + final consumption + gross capital formation; (1)

2. ***The value - added identity***

   Net Value added = output – intermediate consumption – consumption of fixed capital; (2)

3. ***The domestic product identity***

Gross domestic product = final consumption + gross capital formation + (export - imports) (3)

In addition to the supply and use accounts, there are also asset accounts. The 1993 SNA includes natural assets in the asset accounts only if ownership rights exist and natural assets bestow economic benefits to their owners. Some examples of produced natural assets include the value of livestock for breeding, orchards, private plantations, timber tracts etc. The products of economic assets are generally valued in the market, either directly or indirectly. These assets are referred to in the SNA as economic assets. The asset balances for produced assets and non-produced natural assets include the opening and closing stocks of produced assets and the elements explaining the change between the two i.e., net capital formation, holding gains or losses of assets, other changes in volume of produced assets and the closing stocks (i.e., opening stocks plus the sum of the preceding adjustments). Due to inclusion of asset accounts also in the national accounts we have one more set of identity, which explains the difference between opening and closing stock of assets by flows during the accounting period.

For produced and non-produced assets, the balances are identified as:

Closing stocks = opening stock + gross capital formation – consumption of fixed capital + other changes in volume of assets + holding gains/losses on assets (4)

The gross capital formation consists of a) gross fixed capital formation and b) changes in inventories in produced assets like building roads, machinery, stocks of commodities etc. The gross fixed capital formation may also include additions to the produced assets such as improvement of land, cost of transferring land and other non-produced assets between owners. The value of capital formation is added to the value of non-produced assets, but separately 'depreciated' as other changes in volume. Thus, the elements of the column related to non-produced economic assets, do not figure in the calculation of NDP, as all the changes in non-produced natural assets between opening and closing stocks are explained in the SNA as holding gains or losses and other changes in volume of assets. Hence, the elements under other changes in volume are the most relevant items to be reclassified for analysis in the natural resources accounting.

FLAWS IN THE CONVENTIONAL SYSTEM OF ACCOUNTING

The main flaws in the conventional national accounts discussed earlier can be listed below:

1. The traditional measures focussed mainly on goods and services that are bought and sold in markets and ignored the non-marketed services provided by natural assets. For example, forests provide many environmental services like flood control, protection from soil erosion, carbon sequestration and amenity values in addition to marketed products like timber and fuelwood. The national accounts only consider the economic contribution of forests and ignore the environmental services. Similarly, the waste disposal services of the environment are not recorded in the national accounts.
2. There is inconsistent treatment of man-made and natural assets. As mentioned earlier, while computing sustainable income measures like net national product or net domestic product, the man made machinery is depreciated so as to allow for replacement of losses in the capital stock. However, losses in the natural resources are not similarly depreciated. For example, when forests are transferred for non-forest purposes, the national accounts record only the expenditure incurred in clear-felling the forests, and do not account for the loss to society as a result of this transfer. Moreover, the reduction in the forest area is shown in other volume changes, which do not have any affect on GDP.
3. These measures like GDP and NDP do not adequately represent the degradation of environment. Some times the expenditures incurred in restoring the environmental

quality are accounted as increases in national income and product. For example, cleaning up of rivers, treating water for drinking, preventive expenditures to protect from ill effects of pollution all are shown as increases in GDP.

Thus, this traditional system of accounting implies that the environmental assets like air, water etc. may be degraded due to economic activity, resulting in a reduction in social welfare, however corresponding adjustment need not be made in the accounts. This gives a false impression of increase in income while natural wealth is reducing. Further, ignoring the contribution of non-market value of environmental goods and natural resource depletion will result in misrepresenting the current well-being and distorts the economy's production and substitution possibilities. Thus the current measures of national income are inadequate as indicators of social welfare, and moreover provide misleading information about whether an economy is using its resources sutainably. Thus the policy-makers are not rightly informed on the important link between economic growth and the environment. Hence environmental accounting can be useful in removing the current biases.

HOW CAN WE MODIFY THESE MEASURES TO MEASURE THE INCOME ACCURATELY[1]?

To measure the national income more accurately, two types of adjustments to the existing national income and product accounts are required. The first adjustment requires defining and valuing non-marketed environmental goods and services, and the second adjustment requires measuring and valuing stock changes in natural resources. For example, to account for natural resources like forests, one should extend traditional NDP by including the non-marketed benefits associated with forests. In addition, the traditional NDP should also be adjusted for the value of change in the forest resources. Although there has been wide consensus that greening the national accounts is important, there has been no consensus on how to do it. Different researchers have advocated different approaches. Some are concerned with preserving the stock of environmental assets; and others with the effect of environmental change on welfare. The various approaches can be grouped under four headings. These are: 1) Pollution expenditure

[1] Sections 4.1 to 4.4 are based on Uno and Bartelmus (1998)

accounting; 2) Physical accounting; 3) Development of green indicators and 4) Extension of the SNA type systems.

Pollution Expenditure Accounting

This has been the earliest reaction to overcome the weaknesses in the conventional economic accounts. This involved developing data series on pollution abatement and other environmental expenditures. Such data series has been maintained by USA since 1972 and are also available for other OECD countries. However, there are some limitations of using this approach: 1) These data refer to expenditure already incurred, either due to policy or standard business and household practice. Hence they should not be considered as additions to conventional economic accounts as they are a re-specification of the information already accounted for; 2) The abatement expenditure data can tend to overestimate the true opportunity costs, as they contain outlays on materials, which are already included in the value-added expression of the sector producing these materials. Thus there may be the risk of double counting; 3) The practice of comparing pollution abatement expenditures with GDP is misleading since the GDP covers primary costs and is free from double counting. This can be addressed by using input-output techniques. The use of pollution expenditure data has limited scope for policy. They can only give an indication of how various environmental policies may affect the productivity.

Physical Accounting

The second approach to improve the conventional economic accounts is to supplement these accounts with physical information about the natural environment and its status. i.e. one can provide information on physical indicators for forests like the area under dense forests, open forests, volume of stock of timber, area disturbed by fire etc; or give the quality of air in terms of CO_2 emissions, suspended particulate matter, nitrogen oxide emissions etc; or water using physical indicators like dissolved oxygen, BOD, COD, pH etc. Such type of information can also be arranged in conventional input-output type of matrices. For example Netherlands has used such a complete input-output matrix system in their National Accounting Matrix including Environmental Accounts (NAMEA). The system fully integrates economic and physical environmental information.

Development of such physical accounts is important as the accounts can provide the inputs for the construction of various environmental indicators and thus be used for scorekeeping purposes[2]. However it is very difficult to use these physical accounts for policy purposes. Some of the reasons include: 1) the choice of appropriate physical units of measure is not obvious; 2) there is incomparability of units 3) difficulty in getting condensed description as the units are not similar; 4) involve development of huge data sets due to different quality indicators for forests, air, land and water without reaching general conclusions on their (economic and non-economic) significance; 5) the potential severity of the environmental problem not reflected and hence the decision-makers will not be able to set relative environmental priorities while taking various investment decisions. This can be illustrated using an example. For examples a forest can be measured in terms of its area, volume of timber, number of species of flora and fauna etc. Even the units of measuring forests are different. For instance, area is measured in hectares, volume in cubic metres and the species in number. Thus there can be no common unit, which can be used to indicate all the three. Another choice that has to be made is which physical measure to choose. This once again depends on the policy objective in mind, i.e. should the forests be used for timber management or provision or firewood or preserving biodiversity. This results in developing huge data sets without reaching any conclusion for the policy. For instance, if a policy maker is faced with the dilemma of preserving hundred hectares of forest, which is a rich source of biodiversity versus developing multipurpose project, which provide numerous quantifiable benefits, the latter is favoured against the former as they cannot get the value of the benefits of preserving the forests.

Green Indicators

A third approach has been to construct a green GDP or some other economic index to replace the conventional GDP or NDP. Two approaches have been adopted for this. In the first approach, efforts were made to construct entirely new indicators of well-being. This has been achieved by altering the conventional aggregates like subtracting out pollution expenditures from the GDP, adding the factors like negative effects of urbanisation etc. Some of the examples of this approach are the Measure of Economic welfare (MEW) indicator by Nordhaus and Tobin, the net national welfare (NNW) indicator developed for Japan (Economic Council, Japan, 1973) and

[2] 'Score keeping function' means the function of maintaining a record of performance of the economy.

the Index of Sustainable Economic Welfare (ISEW, Daly and Cobb, 1989). The second approach did not involve replacement of conventional gross income aggregates but involved modifying the conventional measures of net product. Such approach has been provided by Repetto and his colleagues at the World Resources Institute (WRI; Repetto *et al.*, 1989). Essentially, their idea is to depreciate natural assets such as forests, mineral stocks, fish stocks and soils in order that reproducible capital and natural capital receive equal treatment in the computation of net income. The main criticism of the approach is that while various indexes may indicate that society is worse off than might be suggested by the conventional GDP, they give the policy maker a little indication of what to do about it.

Extensions of the SNA-type Systems

The fourth group builds upon the existing SNA and covers all the sectors that interact with the environment rather than focussing on just one element of the conventional accounts such as depreciation or pollution expenditure accounting. Examples of such an approach are the United Nations Satellite System of Integrated Environmental and Economic Accounting (SEEA) and Environmental and Natural Resource Accounting Framework (ENRAP) (also referred to as Peskin framework). Both the approaches require sector-specific information on the use of environmental assets, and are concerned with the management and score keeping functions of accounting. But the principal difference between these two lie in the extent of their adherence to SNA concepts. SEEA appears much more concerned with adherence to the principle of SNA than to economic theory. The ENRAP framework, on the other hand, stresses more on the consistency with economic theory than with the SNA (Peskin, 1998, page 387)[3].

The SEEA attempts to overcome the limitations of the SNA by reclassifying the elements in other volume changes so as to include them in the calculation of NDP. In the absence of international consensus on how to incorporate environmental assets and the costs and benefits of their use into national accounts, the United Nations Statistical Division approved the "satellite" System of Integrated Environmental and Economic Accounting framework rather than modifying the core SNA itself (United Nations 1993). The satellite system becomes a link

[3] For example , if willingness to pay to avoid environmental degradation is the correct way to measure the value of pollution damage, while calculating the cost of pollution controls the incorrect way, the ENRAP framework chooses the former over latter though the latter is easier to measure.

between the SNA and the accounts describing the natural environment. This approach was also ratified by the United Nations Conference on Environment and Development (UNCED) in its Agenda 21. The main success of SEEA is because of its close integration with the SNA and also due to its ability to address various flaws of conventional national accounts by means of alternative versions or modules. The building block approach allows SEEA users to choose among different approaches according to their priorities and statistical capabilities. The main objectives of SEEA are (Bartelmus *et al*., 1994):

1. ***Segregation and elaboration of all environment-related flows and stocks of traditional accounts***

   The objective of this module is to present separately environmental protection expenditures[4]. These expenditures have been considered as part of the costs necessary to compensate for the negative impacts of economic growth, in other words as defensive expenditures.[5]

2. ***Linkage of physical accounts with monetary environmental accounts and balance sheets***

   This module consists of a description of the interrelationships between the natural environmental and economy in physical terms (like changes in total stock or reserves of natural resources and changes therein, even if those resources are not affected by the economic system). These accounts provide the physical counterpart of the monetary stock and flow accounts of the SEEA.

3. ***Assessment of environmental costs and benefits***

   The SEEA expands and complements the SNA with regards to assigning costs to a) the use of natural resources in production and final demand; and b) the changes in environmental quality, resulting from pollution and other impacts of production,

[4] Environmental protection expenditures are actual expenses incurred by industries, households, the government and non-governmental organizations to avoid environmental degradation or eliminate the effects after degradation has taken place. They are included in the SNA, but are usually not identified separately in the conventional production and final use accounts.

[5] The defensive expenditures are the expenditures incurred to repair the environment or the abatement expenditures incurred to prevent further damage to the environment like installation of electrostatic precipitators to remove SPM in a boiler or a furnace or a de sulphurization process to remove sulphur oxides.

consumption and natural events on the one hand, and environmental protection expenditures on the other.

4. ***Accounting for the maintenance of tangible wealth***

   The SEEA broadens the concept of capital to cover not only the man-made but also the natural capital. Natural capital includes scarce renewable resources such as marine or tropical forests, non-renewable resources like land, soil and subsoil assets (mineral deposits), and cyclical resources of air and water. Capital formation is correspondingly changed into a broader concept of capital accumulation.

5. ***Elaboration and measurement of indicators of Environmentally adjusted product and income***

   Including the costs of depletion of natural resources and changes in environmental quality allows the calculation of modified macroeconomic aggregates in SEEA. Indicators thus compiled include, in particular, an environmentally adjusted net domestic product (EDP).

Modules 3, 4 and 5 require valuation of environmental resources. In order to facilitate this SEEA proposes three different versions based on different techniques of valuation. One version of SEEA applies a market valuation approach. The second version uses a maintenance cost approach and the third version combines the market valuation with the contingent valuation approach. Of all the market valuation is the closest to the conventional SNA. In the market valuation approach, the stocks of non-produced economic and environmental assets can be valued using either the net-price/discounted present value/user-cost methods. The net price of the asset is defined as the actual market price of the raw materials minus its marginal exploitation costs including the rate of return on the invested produced capital. In case of exhaustible resources SEEA proposes using the user-cost method to value the depletion. The idea of this method is to convert a time-bound stream of (net) revenues from the sales of an exhaustible natural resource into a permanent income stream by investing a part of the revenues, that is, the 'user-cost allowance' over the lifetime of the resource. Only the remaining amount of revenues should be considered as 'true income'. The discounted present value of natural resources is obtained by using the discounted value of the goods extracted/services provided by those assets in the future reduced by the exploitation costs (net return). However, the limitation of market value approach is that it covers only those natural assets that have an economic value. As an

alternative to market valuation, maintenance cost valuation is introduced. Maintenance costs are defined as the costs of using natural environment that would have been incurred if the environment has been used in such a way that its future use had not been affected. The maintenance costs concept implies that uses of the environment that have no impacts on nature have a zero (monetary) value i.e. if water is available in plenty, extracting water does not have any value.

The other most important improvement in SEEA over the SNA is the extension of the asset boundary. In SEEA the term ‘natural resource’ is used in a much broader sense than SNA’s definition of ‘economic non-produced natural assets’. The SEEA identifies separately non-produced economic assets and non-produced environmental assets (instead of non-produced natural asset) in addition to the produced economic assets. 'Produced assets' are those assets that result in future benefits to their owners. In the category of 'produced assets', the natural assets consist of all those whose growth is controlled by man through the process of cultivation, including vineyards, orchards, timber tracts and other plantations, inventories of agricultural crops standing on the land after harvesting etc. 'Non-produced economic assets' are those natural assets that are currently exploitable or likely to be so, for economic purposes, even if no explicit ownership or control is currently exerted over these resources and have market price if they can be exploited. For example, fish in oceans or timber in forests, which can be exploited for commercial purposes, come under this category. 'Non produced environmental assets' are those assets for which neither ownership rights are enforced nor direct monetary benefits are derived from their use. For example, forests provide other environmental services like global climate balance, which are not commercially exploitable. Such type of assets, which provide only environmental services but cannot be commercially exploited come under this type. These assets include air, land and terrestrial ecosystems (excluding forests), forests and forestland in wilderness, rare and endangered species of fauna and flora, water and aquatic ecosystems.

Apart from the extension of the asset boundary in the SEEA, the information on ‘other changes in volume’ for non-produced economic and environmental assets is disaggregated into four categories (Bartelmus and van Tongeren, 1994: p 7). These categories are:

- Depletion: reductions in the quantity of assets, due to economic uses (e.g., timber harvesting)

- Degradation: positive or negative changes in the quality of assets, due to economic decisions (e.g., soil erosion due to forest loss leading to loss of land productivity)
- Other accumulation: additions or reductions in the quantity of assets due to economic decisions (e.g., additions due to afforestation or reduction due to transfer of forests to non-forest uses like agriculture etc.)
- Other volume changes: quantitative or qualitative changes in assets not caused by economic decisions (e.g., destruction of forests by natural fires etc.)

Like SEEA, the starting point for ENRAP is the conventional national economic accounts. The ENRAP accounting structure is based on the premise that economic accounts should attempt to cover all the economic inputs and outputs that, together, comprise an economic system. For inputs and outputs to be "economic" they need not have market prices. The natural environment is one such example. ENRAP includes the excluded goods and services from the national accounts under three categories: input services (e.g., waste disposal services); output or environmental quality services (e.g., recreation and aesthetic services); negative outputs (e.g. pollution). The basic ENRAP strategy is to append these non-marketed services to the marketed services already accounted for in the conventional accounts. The monetary value of these services is obtained using estimated shadow prices. This treatment is similar to SEEA. The modified accounts are completed with two other entries. The first, non-marketed household production covers the nonmarketed household production like firewood collection. The final entry is natural resource depreciation, included along with conventionally measured capital depreciation. Both entries are included to provide a measure of modified net national product, modified to include the depreciation of natural assets as well as marketed assets.

HOW ARE GREEN ACCOUNTS USEFUL FOR THE POLICY?

Greening the national accounts are useful both for economic and environmental policy especially the developing countries. Developing countries are generally natural resource based economies and are characterised by high population growth and pressure on natural resources. Most of the developing countries depend mainly on agriculture, fishing, forestry, mineral extraction and other primary activities, rooted in the natural resources. Thus in these countries, omission of the degradation and depletion of the country's natural capital will lead to over estimation of the

national income figures. This also gives a false illusion that economy is growing when in fact natural wealth (in fact the future wealth) is declining. By having some green indicator in place like environment adjusted domestic product (EDP) or genuine savings, the policies can be designed to enhance economic growth without extensive natural resource depletion, thereby achieving more sustainable income. It is also possible that after proper accounting of natural resources, the GDP may need to be adjusted downwards as natural resource extraction no longer can be considered under value-added expression but as depreciation. The gap between GDP and the environmental adjusted GDP (EDP) quantifies the extent of depletion and degradation and therefore serves as a signal of the importance of environmental effects. Not only this the revised indicators of national wealth can also be used to compare 1) the standard of living over time; 2) standard of living across countries; 3) as an indicator of sustainable consumption: and 4) as a benefit-cost decision rule (that is to know whether or not a project having impact on environment should be undertaken or not). There are other uses of these accounts for policy like the measurement of physical resource scarcity, valuation of depletion, measuring the incidence and burden of existing regulations and taxes, estimating emission taxes and providing environmental components of existing macro-policy models etc. (Hamilton and Ward, 1998).

WHAT IS THE PROGRESS IN INDIA SO FAR ON GREEN ACCOUNTING?

Though it is important to account for natural resources in the national accounts, only a few researchers demonstrated how to account for natural resources in the national accounts. A comprehensive study at the state and national level has been done by Haripriya (1998, 2000) and Haripriya (2001). Haripriya (1998, 2000) made an attempt to incorporate the forest resources in the state accounts of Maharashtra using the SEEA framework. In another study Haripriya (2001) incorporated the forest resources into the national accounts for all the states. The study constructs accounts containing information on the opening stocks, changes due to economic activity (due to logging/illegal logging/afforestation), other accumulations (mean annual increment, regeneration and transfer to nonforest purposes), other volume changes (due to forest fires, stand mortality, animal grazing etc.) and the closing stocks. The value of depletion is obtained by deducting the value of opening stocks from the value of the closing stocks. The studies adjusted the NDP in two ways. First, adjustments were made in the forest sector to include non-market production of timber, fuelwood and non-timber forest products left out of NDP. This converts NDP to Adjusted

Net Domestic Product (ANDP), Second the study adjusts ANDP for the depletion of forest assets to derive environment adjusted domestic product (EDP). The forest accounts were limited to incorporating monetary benefits from timber, fuelwood, fodder and non-timber forest products. The study done for Maharashtra illustrates that the ratio of Environment adjusted state domestic product to Adjusted Net state domestic product is around 99.3 percent. In yet another study Atkinson and Gundimeda (2004) accounted for the carbon benefits of forests along with other benefits mentioned in the earlier studies. In relation to *GNP*, the findings with regards to the net change in forest wealth in India indicate that this magnitude is significant but possibly no greater than 1%.

Some other researchers also tried to account for natural resources but not specifically in the context of SEEA framework. Chopra and Kadekodi (1997) for instance illustrated how to account for forests in Yamuna Basin for four states in north India. They have considered extraction, regeneration, degradation and preservation of forest resources. They considered four parameters: total dense forest area, annual forest degradation rate, extraction rate and regeneration rate. From these physical values monetary value of the parameters are deduced. The shadow price of the stock of forest resource has been estimated using the ecological value of the biomass, which includes timber, ntfp, ecological function values etc. To estimate the value of the degraded area, the study uses contingent valuation method to analyse the WTP by the local communities to protect this forest area. The Preservation value of the forests in the Yamuna Basin is estimated using the net contribution of the tourists per year in Bharatpur National Park. The net contribution of the tourists per year is obtained using the Travel cost method The study found that the adjusted SDP of Himachal Pradesh, on account of excessive extraction over and above regeneration can go down by as much as 21.64%. The estimates of SDP adjustments for other states are –0.73 % for Rajasthan, -2.53% for Uttar Pradesh, and 0.04% for Haryana.

In another study, Murty et al. (1999) illustrated how to account for water pollution. Water pollution is measured by a number of indicators like Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH, suspended solids, dissolved solids, variety of chemicals, metals etc. Two approaches have been used in the literature to value and account the impacts of water pollution. The first is to assess the health and other impacts of water pollution on human

and animal life. The second is take account of the cost of water treatment before discharging the effluents into the rivers etc., following the principle of "polluter pay". Brandon and Homman (1995) used the first approach to provide an all-India level estimate of urban and rural health effects due to water pollution (measured basically in terms of mortality and morbidity rates). Taking the estimate of reduction in disability adjusted life years (DALY) of the Indian population, they estimated the cost of water pollution in India to be anywhere between US$ 3076 to US $ 8344 billion. However, Murty et al. (1999) provide an alternative estimate based on the principle of 'polluter pay' in establishing Effluent Treatment Plans. According to him, the total value added by ETP activities are estimated to be Rs. 64.10 Lakh as against conventional GDP of Rs 5,98,964 crore in the Indian economy in 1991-2. However, since the estimate is based only on about 25 percent of the industries, the actual value-added lost in conventional GDP are of the order of Rs 16 crores.

Parikh and Parikh (1997) made an attempt to account for air pollution in India, using input-output sectoral information at the all India level, power and transport sector and household level emissions (including livestock sector). Two approaches can be used to value and account the air quality changes within an income accounting framework. They are: Maintenance cost or Avoidance cost approach. Parikh and Parikh used the second method of assessing the damage due to air pollution.

WHAT ARE THE PRACTICAL LIMITATIONS OF DEVELOPING ENVIRONMENTAL ACCOUNTS IN INDIA?

Developing environmental accounts is by no means very simple. This is because of the huge data requirements. Especially in developing countries like India there are several data limitations that may come in the way of accurate accounting of the environment. Another problem is that environmental accounting needs a more localised approach. In the sense that Delhi is polluted does not mean that neighbouring place is also polluted. Within a city itself, the air quality varies depending on the locality. Similar is the case for water. Water is a mobile source. Moreover, the extent of pollution at any particular location depends on whether the location is situated upstream or downstream, the temperature, rainfall, wind direction etc. This means that the monitoring points of water quality parameters are many and also need to be measured often. This involves

developing accounts at many locations and then finally aggregating it. Another major problem we encounter is the problem of valuation. There are several valuation methods and no method so far is perfect and some of the methods are controversial (like placing a value on a tiger). Hence the research on this issue does suffer from several limitations. However, this should not discourage us from developing the accounts.

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