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Integration Of Environmental Accounts With National Income: A Review Of Literature.

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Abstract: Environmental accounts bring together economic and environmental information in a common framework for measuring the contribution towards the economy as well as the impact of the economy on the environment. It organize environmental data from different domains by showing the interaction between economic, household and environmental factors, which as a result becomes more informative than national accounts alone. The paper is an attempt to report survey results for framing a better decision by establishing a link between economy and the environmental accounts. This paper is based on certain literature from a limited database.

Keywords: environmental valuation, accounting, national accounts, literature survey.

INTRODUCTION

Assets are considered as items of value to society and they have been defined as stores of value which provides inputs to production process. In regard to this there have been consideration of value inherent in the components of the environment and the inputs the environment provides to the society in general. More recently, there has been consideration of the value inherent in the components of the environment and the inputs the environment provides to society in general and the economy in particular. The term "environmental asset" is used to denote the source of these inputs which may be measured in both physical and monetary terms. Environmental accounts provide an integrated framework for data, indicators and analysis. Integrating environment related data with the national accounts framework makes the resulting indicators more consistent among themselves and permits aligning also with the social aspects of sustainable development. The interaction between the economy and the environment study leads to a different perspective of analysis of environmental and economic issues. The account allows the physical flows of materials and energy within the economy and environment, along with the changes in environmental assets, as well as the economic activity and its relation to the environment

The use of natural inputs by an economy is linked to change in stock of environmental assets .Though the environmental assets, naturally occur, but they are transformed to different degrees by economic activities. The accounting of the environmental assets in physical terms(often for the environment) and in monetary terms showing the stock of environmental assets during two period of times as well as the depletion or adjusted economic aggregate of the same is of great importance.

The purpose of the study is to have a comprehensive overview over how better decisions which aims at balancing human and environmental needs can be enabled through accounting by having a consistent and integrated environmental and economic information.

METHODOLOGY

In order to address the above question, the paper aims to consolidate and conduct an analysis of published research abstracts and reviews on integrated environmental data with national accounts framework. To identify published evidence related to above areas, a list of appropriate keywords were identified, such as environmental accounts, national income, which pertains to integrated environmental accounts and national income. The search was conducted on the online literature search engine of the Web of Science and ResearchGate databases.

Environmental Accounting and National Income

In the current period, global awareness concerned with the stability of financial growth and environmental friendly activities appear continuously, which has called for sustainable business concern at different macro and micro aspects. Bose (2004) argued that neo classical economics has been incapable of responding to the challenges posed by the environmental degradation caused by economic activities. It has outlived its usefulness in explaining the functioning of the economy in the content of degradation of environment which is caused due to economic activities.

National Economic policy is underpinned by macroeconomic theory (Keynes 1936) and a range of data/statistics to support and arrange using the System of National Accounts(UN:1953) which covers economic

activities such as production, consumption and accumulation .The basic theoretical underpinning of the SNA has not changed since 1953 but the detail has continued to evolve with technology , economic and social changes around (EC at al,2009), a key indicator from the SNA is Gross Domestic Product(GDP).But (Nordhaus and Tobin ,1972,Rockstorm et al 2009) has detailed that SNA doesn't adequately account for the environment and moreover that economic activity is the key driver of environmental degradation. In conventional national accounts and in present days in many cases, cost of extraction was determined on the basis of capital and labour employed. But as a separate asset , natural resource was not valued, for which Net Domestic Product (NDP) is arrived at after manufactured capital allowance on manufactured capital from GDP. Symbolically is can be expressed as :

NDP=C+1+(X-M)

Where C= Final consumption after deducting intermediary consumption.

I= Investment after depreciation or net capital formation(NCF)

X= Exports, M= Imports

Therefore NCF= NDP-C-(X-M)-1.

But the SNA system is measured under a conventional accounting system where growth is overstated, because it doesn't take into consideration the depreciation allowance on natural resources. Because Pearce-Atkinson Measure (PAM) defines sustainable development in terms of some indicator of sustained human well being and according to it savings rate is generally considered to be a good indicator for understanding the health of the economy (Kadekodt, 2001)

PAM=S/Y –(σm/Y)-(σn/y)

Where S is savings , Y is income ,σm is depreciation of manmade capital and σn is depreciation of natural capital(Kn).Pearce and Atkinson proposed a measure of weak sustainability , where it has been expressed that if all the savings and reinvested in natural and manmade capital , it is agreed that the aggregate capital stock will not be falling and a constant consumption stream can be maintained. General savings mesure is referred to a weak sustainability measure since no special condition are placed on the level of Kn. If PAM is positive or zero, the economy is considered to be sustained.

Environmental accounting suggests for inclusion of environmental capital in national accounts. Then the sustainable development require that the overall capital assets(both manufactured and environmental capital assets) should not be decreased and the correct measure of sustainable national income or sustainable net national product is the amount that can be consumed without diminishing the capital stock(Todaro,2001). It can be expressed as

Environmentally Adjusted NDP(EDP)=GDP-D_m-D_n, where Dm is the depreciation of manufactured capital assets and Dn is the depreciation of environmental capital assets i.e. the depletion and degradation of environmental capital assets.

Repetto.et.al (1989) estimated the green accounting estimated EDP for Indonesia for a period of fourteen years,1971-84 by deducting the value of depreciation for three categories of natural capital,namelyoil,forests and soil.The analysis recorded that the EDP was normally about 20 percent lower than the GDP.And a study of accurately measuring of EDP in Sweden during the period 1993-1997 , a more wider set of natural resources was include like soil erosion, recreation values, metal ores and water quality, where the EDP was about1-2 percent lower than NDP .The overall adjustment was relatively minor as compared to Repetto et. al(199) because the analysis didn't consider all potential environmental damages, such as climate change,loss of biodiversity,agriculture,forestry and fisheries Another study estimated the value of changes in forest resources in India in 2003, where the result indicated that while the overall stock of timber decreased , EDP was actually slightly higher than NDP, which illustrates that the potential discretionary effect of looking only at adjustments in monetary terms without looking in more detailed adjustments at the actual physical environment.Under the system of national accounts , for SEEA, environmentally adjusted net domestic products are obtained by deducting all environmental costs from the net capital formation i.e. EDP= NCF(or I) – All environmental costs (Dasgupta,1997). EDP can further be classified into EDP_1.i.e. depletion in produced economic assets , non produced economic assets/ environmental assets and EDP_2 as degradation of environmental assets.

Net Capital Accumulation =EDP_1- Degradation of all types of assets.

Under EDP_2= I- Depletion and degradation costs of all types of assets.

For accurately measuring the national income accounts, it is necessary to define and value non marketed environmental goods and services along with measuring and valuing the changes in stock of natural resources. The need for valuation of environmental assets and their use in national accounts is important by supplementing the conventional accounts with physical information ,A complete input –output matrix system has been developed by Netherland in their National Accounting Matrix including Environmental Accounts (NAMEA) as this can provide inputs for the construction of various environmental indicators , such as Green GDP or some other economic index to replace conventional GDP or NDP. UNs Satellite System of Integrated Environmental and Economic Accounting (SEEA) and Environmental and Natural Resource Accounting Framework (ENRAP) has been introduced to realize the need for valuation of environmental assets and their use in national accounts.

Valuation of Environmental Assets

Environmental valuation techniques are useful evidence to support habitat conservation policies by quantifying the economic values associated with the protection of resources(Frew,2013)In market economics , market determine prices and quantities of products and services, but for products and services that are not sold in the market, no direct market price information is available which makes it difficult to optimize the supply and demand of such services. This has given rise to the concept of externalities (Jochem, 2006) which has consequences for another activity but is not reflected in market prices. As externalities are not traded in market, the value of the externality needs to be estimated making use of a variety of methods that have been developed and applied over the years. It is thus more important t consider the opportunities which are available for the use of environmental value transfer or more commonly known as benefit transfer which can more importantly be considered as transferring values that have been estimated for one environmental attribute or group of attributes to assess the benefit(Robinson,2001).(Devousages et al ,2001) expressed benefit transfer as Minimize Mean Square Error=var (+(B ias , subject to AF=AFO and AT=ATO, where AF is the available fund, AT is the available time.

The value of environmental assets originates from its present and future benefits. The value of environmental assets consists of use value and non usevalue.The existence value (environmental amenities having intrinsic value) of environmental assets is very important from the perspective of sustainable development for ascertaining the total economic value of the natural asset. However the usual methods are(Dasgupta,1997) Market Value Approach(for cultivated and non cultivated land).Present Value Approach ,Net Price Approach ,Maintenance Cost Approach and Compensation Cost Approach.Life Cycle Assessment has been developed as a methodology for assessing of environment impact(Catterjee,2002)It cover the assessment of the environmental impact on the procurement of raw materials to be used for the products, processing of raw materials , using the product and its disposal.

The System of Environmental-Economic Accounting (SEEA) is a framework that integrates economic and environmental data to provide a more comprehensive and multipurpose view of the interrelationships between the economy and the environment and the stocks and changes in stocks of environmental assets, as they bring benefits to humanity. The SEEA widens the concept of capital to cover not only man made but also the natural capital, because economic growth alone doesn't numerically represent true economic development (especially in developing nation which depend heavily on natural resources).

Way for a Modified Accounting Structure

There have been efforts over the years to modify the conventional income and product accounts in connection with gross national productivity to obtain a better measure of production or of a better social well being through suggesting ways for more adequate accounting for the environment.Nordhaus and Tobin(1973)devised an alternative measure as Measure of Economic Welfare (MEW) where there has been a re arrangement of items of national accounts, such as reclassification of GNP expenditure as consumption,investment and intermediate;correction for some of the dismantilities of urbanization. The OECD Economic Survey of Japan has addressed a more direct approach through Net National Welfare (NNW) measure to account for environment as part of national well being by supplementing the services of government capital and other non market activities. Environmental cost has been treated separately from GNP to obtain a better welfare measure.In contrast to Nordhaus – Tobin's MEW , the environmental adjustment of Japanese NNW is fairly substantial as compared to urban disamenities as urban disamenities are confined to time costs of commuting.Haripriya(1998),Bartelmus (1998) has detailed regarding the analysis of prices of forests species and their extraction costs .This has been carried out by valuing the resources at the beginning of the period ,considering the opening stock,average market value per unit of the resource and the per unit marginal cost of extraction, development and exploration. Olson(1977) has applied the theory of collective action to the problem of national advance to synthesize the topics of growth and development , efficiency and flexibility and to correlate them with the size and power of the special interest groups .The suggestion introduces that GNP be reduced by an amount equal to the social damage from pollution, which in principle would equal the amount of consumption expenditures incurred to defend against the dismantilities in addition to an additional amount people would be willing to pay to eliminate any remaining dismantilities.

In valuing the goods and services provided by the natural environment two basic problems are to be addressed i.e. determining which aspects of the natural environment should be measured and in what units. Physical accounting procedures use data or information expressed in physical units in an extension of standard input output analysis.It account for both the current status and trends of depletion of a physical resource using available environmental information. While monetary environmental valuation involves assigning monetary values to environmental goods and services by taking into account for both environmental and market functionswhich are expressed in terms of money.

Determination of the amount of environmental damage is a difficult and complex task as it is mainly based on estimation to a large extent. Accounting or shadow pricing may be used to determine the cost of environmental damage. The cost of environmental damage would be C_{ED}=nΣnΣi = 1(ai) + nΣi = 1(WI) + nΣi = 1(ni)
Where a= cost of air pollution, w= cost of water pollution, n= cost of medical treatment for disease arising out of noise pollution (Chowdhury, 1995).
Life Cycle Assessment has been developed to assess the environmental impact (Chatterjee, 2002).It covers the assessment of the environmental impact on the procurement of raw materials to be used for the products, processing of raw material, using the products and its disposal. In India, LCA is used for awarding the Eco mark label to products. Aproduct is awarded if it satisfies the specific criteria and requirements of Indian standard as specified by the Ministry of Environment and Forests (Chatterjee, 2002)

Relating SEEA and analysis to Decision Making
The system of SEEA address the deficiency of the SNA through accounting for the environment and linking it to environmental information through common concepts by considering the key theoretical constructs of hydrology, geology, forestry, ecology , etc.(Smith,2014; Vardon et al.,2017). The SEEA helps to improve data quality along with reducing uncertainty in decision making by providing a framework for systematically linking economic and environmental data and consistently presenting information in accounts from which indicators can be derived(Vardon,2013) .Environmental accounts can inform decisions at all stages of the policy cycle .Bass et al.(2017) draw a range of material and show that the use of accounts spans the monitoring of sector based policies like water, energy and forests. Countries like Netherland, United Kingdom and Sweden have developed relationships betweenthe users and producers of accounts to enable more effective use of the accounts in policy processes. The environmental performance can be reported by the environmental performance indicators.Sustainable development requires proper environmental reporting.Sutainable environmental reporting can be ensured through the 'triple bottom line' system, which considers profit,planet and people by incorporating the economic, environmental and social/ethical performance(UNCTAD,2000).
There are various reasons for integrating environmental and economic accounting. Environmentally adjusted net capital accumulation and the growth rate based on these data present a real position of the country. Environmental accounting discloses the unsound methods of production vis-à-vis unsound production and consumption patterns.Government may take measures in this regard by imposing different tax and penalties.The other reason for integrating work on environmental and national income accounting makes different resulting indicators more consistent among themselves and permits aligning with social aspects of sustainable development and employment aspects of green growth. The comprehensive accounting approaches allocate the environmental impacts of depletion and degradation to the separate economic activities which causes these environmental impacts to expenditure components, reflecting immediate effects to change in natural assets.

CONCLUSION
The systematic integration of economic and environmental information is important for better decision making. While the focus of Shared Environmental Information System(European Commission ,2008) is on physical environmental information, the SEEA provides the structure of integration of environmental information with economic data. The integrated data for decision making has been presented for Guatemala (Castaneda,2006)Netherlands(Dee Boo et. al,1993). Environmental accounts integrate existing data and provide coherence which enables a wide range of source information to be compared and contrast to provide better estimates for creating a rationally sound aggregate indicators across a broad spectrum of environmental and economic issues.

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