Chapter 7

MAJOR CONCLUSIONS AND POLICY IMPLICATIONS

The purpose of this chapter is to present the summary, main findings, major policy implications and few further extensions of this study.

7.1 Summary and Main Conclusions

1. This study finds that, in SNA, consumption of fixed capital (assets) i.e., depreciation is estimated only for man-made capital while ignoring the environmental capital. Environmental economists argue that the depreciation factor in SNA is grossly underestimated, since the depletion of environmental resources (such as land, air and water) and natural resources (such as forests and minerals) is not taken into account though they are used for all economic activities. The computations of Net Value Additions do not consider this depreciation in conventional SNA. However, these resources and their depreciation need to be considered as fixed capital (at par with man-made capital) in the production process, since any economic activity cannot be undertaken without having a bearing on such resources. Most importantly, a mere increase in national income cannot be considered as a true indicator of economic development particularly if it is attained at the cost of a degraded environment and depleted natural resource base. Thus, for sustainable growth, macroeconomic policies need figures of sustainable income. Nevertheless, the present national income figures in India do not adequately represent sustainable income. This fact has provided the basic
motivation for this study, which in essence, attempts to integrate environmental concerns with the SNA for the state of Karnataka in India.

2. In the context of integration of environmental costs with SNA, this study has raised a number of analytical, empirical and policy issues. These issues include (a) are the depletion of natural resources and degradation of environmental resources well defined and addressed in the existing framework of SNA?, (b) is there a framework of environmental accounting that explicitly takes into account all environmental repercussions of economic activities in the SNA?, (c) do the estimates of income aggregates in the existing framework of SNA represent true income for a country / region? If not, do the current estimates underestimate or overestimate the true income?, (d) can the environmental repercussions be taken into account in SNA by individual sectors in an economy? If not, should all sectors be considered as interdependent of an economy for estimation of environmentally adjusted national / regional income?, and (e) what are the policy implications of integrating environmental aspects in the framework of income accounting and by generating green income aggregates? Next, a detailed review of literature is undertaken with the purpose of identifying whether or not these issues have been analysed, specifically in the context of India in general, and Karnataka in particular. For analytical convenience, the review is divided into two classes of studies. First, studies which analyse and estimate environmental degradation and depletion, and valuation of environmental / natural resources in general. Second, studies which deal with the estimation of environmental costs and their integration with national / regional income accounting. An important implication of this extensive review of literature is that the issues of environmental concerns, which are
raised in this study, are only partially answered, if not totally neglected. These neglected aspects have provided researchable issues and justification for the present study. These researchable issues constitute the major objectives of this study.

3. The study is undertaken for the year 1994-95 for the state of Karnataka in India. Interestingly, a comparison of macro indicators between India and Karnataka state shows that Karnataka state is fairly representative of India. This has provided the initial basis to find relevance and application of the results of this regional study for national level.

4. The methodological aspects of this study have raised three issues: (a) estimation of sector-wise environmental costs; (b) integration of environmental costs into state income estimates obtained through conventional system of income accounting; and (c) capturing the interdependence of sectors in the context of integrating environmental costs with income accounting. Since all these issues have been raised within the framework of official estimation of state income in Karnataka, a summary of the existing methodology of estimation of state income is provided. In estimation of sector specific environmental costs, three select techniques have been deployed in the present study, viz. (a) depreciation approach, (b) user cost approach and (c) defensive expenditure approach, which are consistent with institutional realities of environmental protection and regulation in the state of Karnataka. However, it should be emphasised that, these alternative techniques have been selected after a detailed review of relevant but inapplicable techniques of valuation of environmental resources and costs (under demand and non-demand curve approaches) in this study.
5. The Kamataka economy consists of three sectors such as (a) Primary sector, (b) Secondary sector and (c) Tertiary sector. The share of these sectors in the state income is 36.1 per cent, 23 per cent and 40.9 per cent respectively. These three sectors include sub-sectors. In each sub-sector, one or more activities are chosen for the estimation of environmental costs. Throughout, this choice of activities is guided by two considerations. First, availability of data for estimation of environmental costs by sectors. Second, relative impact of the sectors on environmental degradation and their share in the state income. The main results of sector-wise environmental costs are as follows:

5.1 Environmental costs in primary sector are estimated for (a) Agriculture, (b) Forestry and Logging and (c) Mining and Quarrying. In Agriculture, environmental costs are proximated by the cost of soil degradation; in Forestry and Logging by depreciation of forest resource base; and in Mining and Quarrying by user cost of the mineral resources. The estimated environmental costs as a percentage of reported state income is 1.52 per cent in Agriculture; 58.77 per cent in Forestry and Logging; 62.1 per cent in Mining and Quanying; and 2.91 per cent in the entire Primary Sector.

5.2 Environmental costs in Secondary sector are estimated for (a) Manufacturing-registered, (b) Manufacturing-unregistered and (c) Construction. In manufacturing-registered, environmental costs are proximated by the cost of complying with pollution standards and administrative costs of monitoring by the Karnataka State Pollution Control Board; in Manufacturing-unregistered by the environmental costs in Tanneries; and in Construction by the cost of treatment of construction
wastes. The estimated environmental costs as a percentage of reported state income is 8.6 per cent in Manufacturing-registered; 0.27 per cent in Manufacturing-unregistered; 8.52 per cent in Construction; and 6.59 per cent in the entire Secondary sector.

5.3 The estimation of environmental costs in tertiary sector is done for (a) Transport by other means, (b) 'Trade, Hotels and Restaurants', (c) 'Real Estate, Ownership of Dwellings and Business services' and (d) Other Services. In Transport by other means, environmental costs are proximated by the cost of complying with emission standards; in 'Trade, Hotels and Restaurants' by the cost of treatment of untreated wastes, in 'Real Estate, Ownership of Dwellings and Business Services' by the cost of treatment of untreated wastes; and in Other Services by the cost of treatment of hospital wastes. The estimated environmental costs as a percentage of reported state income is 14.91 per cent in Transport by other means; 11.72 per cent in Trade, Hotels and Restaurants; 14.57 in Real Estate, Ownership of Dwellings and Business Services; 0.26 per cent in other services; and 7.6 per cent in the entire Tertiary sector.

5.4 The estimated environmental costs for all sectors as a percent of reported state income is estimated at 5.7 per cent for the state. The relative share of different sectors in the total environmental costs for the state is as follows: 18.45 per cent in the Primary sector, 26.72 in the Secondary sector, and 54.82 per cent in the Tertiary sector. Thus, the larger contributor of the environmental costs in the state is the tertiary sector, followed by secondary sector and primary sector.
6 The estimated environmental costs by sectors are integrated with the SNA for Karnataka state. When the sectors in the state income are not interdependent, the following green incomes are estimated.

6.1 In the case of primary sector, the estimated green income or NVA as a per cent of reported income is 98.48 per cent in Agriculture; 41.23 per cent in Forestry and Logging; 37.9 per cent in Mining and Quarrying; and 97.09 per cent for the entire Primary sector.

6.2 In the case of secondary sector, estimated green income as a percentage of reported state income is 91.4 per cent in Manufacturing-registered; 99.73 per cent in Manufacturing-unregistered; 91.48 per cent in Construction; and 93.41 per cent for the entire Secondary sector.

6.3 In the case of tertiary sector, estimated green income as a percentage of reported state income is 85.09 per cent in Transport by other means; 88.28 per cent in Trade, Hotels and Restaurants; 85.43 in Real Estate, Ownership of Dwellings and Business Services; 99.74 per cent in Other Services; and 94.3 per cent for the entire Tertiary sector.

6.4 The green income from all sectors as a percent of reported state income is estimated at 94.3 per cent for the state. The relative share of different sectors in the total environmental costs for the state is as follows: 37.12 per cent in the Primary sector, 22.81 in the Secondary sector, and 40.73 per cent in the Tertiary sector. Thus the larger contributor of the green income in the state is the Tertiary sector, followed by Primary sector and Secondary sector.
Next, this study finds that it is important to integrate estimated environmental costs with interdependence between sectors so that the policy decisions with regard to environmental regulation and protection can be taken appropriately. For this purpose a linear, static, open input-output model is used as a framework for empirical analysis. Since the basic input-Output table for Karnataka for the reference period and purpose of this study does not exist, an alternative approach is developed in this study for generation of 11 x 11 sector input-output table for Karnataka state from the all-India input-output transaction table with the assumption that technological coefficients at the national level and regional level are identical. For estimation purposes two types of matrices are derived. First, derivation of transaction and coefficient matrices of 11 x 11 sectors for Karnataka economy without incorporating environmental costs. Second, derivation of transaction table and coefficient matrix for Karnataka with incorporation of environmental costs. In this case, the dimension of the matrices is (12 x 12) with environment being the 12th sector. The estimated results are as follows:

7.1 The magnitude of quantitative difference between observed output and equilibrium output levels for 11 sectors are negligible. This implies that the reported state income may be considered as being estimated under interdependence between sectors. Or, the reported state income may be considered as equilibrium state income.

7.2 The elements in Leontief inverse matrix with environment are larger than the Leontief inverse matrix without environment. This result is consistent
with theoretical explanation and prediction that, with environmental costs, the value of the gross output levels is higher than the value of gross output levels without environment. Since all these input-output relations are derived and estimated using the value of gross output levels, the estimated results are in conformity with the underlying environmental economic theory.

7.3 The NVA figures obtained through input-output analysis do not match with the NVA figures reported by the DES, although the GVO between the estimates coincides. The difference may be explained in terms of the underlying methodology in obtaining the value of inputs and other costs. For instance, the estimated value of inputs and other costs for Karnataka state are obtained by assuming identical ratio of inputs and other costs to GVO at all India level. This methodological assumption is consistent with identical technical coefficients between all India level and Karnataka state in the entire input-output analysis of this study. In the case of DES, however, the inputs and other costs are estimated at the state level. Therefore, the NVA figures in absolute numbers are not comparable with that of reported NVA by the DES.

7.4 At the state level, the environmentally adjusted NVA is estimated at Rs. 819,935 lakh at constant prices. As compared to the estimated NVA without environment at Rs. 832,068 lakh at constant prices, the environmentally adjusted NVA is smaller in magnitude. Thus, with environmental costs, the estimated state income is lower than in the absence of environmental costs.
7.5 The estimated NVA with environment is 98.5 per cent of the NVA without environment at the state level. However, at the sectoral level, divergence between estimated NVA with and without environment are evident. For instance, for sectors like (a) Agriculture, (b) Fishing, (c) Electricity, Gas and Water Supply, (d) Banking and Insurance and (e) Other Services, the estimated NVA with environment is larger than estimated NVA without environment. On the other hand, for the remaining sectors, the estimated NVA with environment is smaller than the estimated NVA without environment. Further, of all the 11 sectors, the environmental costs are minimal (i.e. in terms of ratio between estimated NVA with and without environment being close to unity) for sectors like (a) Agriculture, (b) Fishing and (d) Banking and Insurance. In short, these above results have two major implications. First, with the introduction of environment into input-output model, estimated green incomes are larger than the NVA without environment for those sectors where environmental costs are minimal or zero. Second, the NVA with environment are smaller than NVA without environment for those sectors where environmental costs are substantial and positive.

7.6 In spite of assumed zero environmental costs for sectors like ‘Banking and Insurance’ and ‘Electricity, Gas and Water Supply’, the estimated NVA with and without environment show divergence in magnitude. For instance, estimated NVA with environment as a percentage of estimated NVA without environment is 111.7 for Banking and Insurance. This result is due to the interdependence among all the sectors including environment. Thus, in the absence of input-output model in the estimation of NVA, this important result would have been missed.
8 In essence, the estimated green income in this study is obtained with and without interdependence among the sectors in the state income. A comparison of these estimated green incomes reveal few insights. For instance, the estimated sectoral incomes are larger with inter-dependence of sectors as compared to estimated sectoral incomes without sectoral interdependence except for Transport, Storage and Communication sub-sector. It implies that, if environmental costs are endogenized in a system of input-output framework, the green income from this sub-sector is relatively smaller as compared to estimated green income without sectoral interdependence. This is because, the environmental costs are high in this sector and since all the sectors depend on the transport sector, its green income is relatively less where this sector is treated independently. Thus, if environmental repercussions are integrated into SNA by taking into account the sectoral inter-dependence in the framework of input-output analysis, the green incomes are larger than the green income without interdependence among the sectors in the regional economy.

9 To the best of our knowledge, there exists no study in India or elsewhere in the world, which is comparable in approach and results of this study. Thus, the empirical results of this study remain un-compared with other studies in the literature.
7.2 Major Policy Implications

1. The methodology inscribed in this work is capable of estimating green income for a regional economy. The green income is qualitatively as well as quantitatively different from the income obtained through conventional SNA to the extent that the former accounts for environmental costs. Under the current practice, growth rates are arrived at without accounting for environmental concerns. Effectively measuring the green income would have implications for the sustainable growth. Such an approach is more relevant in the long run since 'environment' as an input for production system must exist in infinitum.

2. In view of the importance of accounting for environmental repercussions in arriving at income aggregates, the Karnataka state must make efforts towards construction of input-output tables. The advantage of constructing input-output tables lies in its ability to effectively capture sectoral interdependence of environmental repercussions. And consequently, more exact sector-wise green income aggregates can be estimated.

3. If the Karnataka state can construct input-output tables and estimate green income aggregates, it would have implications for re-allocation of resources. Under the current practice, the notion of optimal allocation is compatible with economic efficiency alone. Consideration of environmental factors would redefine the notion of efficiency in a production set-up in such a way so as to make it sustainable by giving due importance to environmental concerns.
4. Estimation of green income while accounting for environmental factors could alter the price mechanism in the state. Prices in sectors like forestry and mining, which to a great extent are undermined, would definitely undergo change, once environmental repercussions are accounted for. Consequently, the changes in prices in these sectors would have general equilibrium implications in related sectors’ prices, production and consumption activities.

5. The results of this study imply that, the law enforcing agencies like State Pollution Control Board and Central Pollution Control Board of India should ensure the compliance of pollution standards in all spheres of economic activities. This would not only curb pollution levels but also helps reduce environmental degradation and eventually would lead to higher sustainable growth. From this viewpoint, regulation is indirectly contributory to economic growth in the state.

6. The empirical framework for estimation of environmental costs by sectors within the official state income estimation, and its integration with SNA at the state level in this study, offer useful guidelines. First, the DES of the Government of Karnataka may consider the empirical framework for estimation of official green income in the state. Second, other states within India may follow the empirical framework for estimation of their official green income. Third, subject to the comparability of economic structure, the empirical framework may be replicated in other developing nations as well.
7. The empirical results of this study are obtained under different and restrictive assumptions due to non-availability of relevant data. These limitations qualify the results and policy implications of this study. For instance, they set the lower limit to all estimations (e.g. environmental costs) of this study. At the same time, this underlines the urgent need for improving the available databases from the viewpoint of estimating comprehensive green income for the state. In fact, the data limitations of this study may be considered as the identified data gap to be filled in future.

Subject to the availability of new databases for estimation of green state income in the state, this study may be extended in many directions. First, new activities under each sub-sector (e.g. in agriculture under Primary sector, in Manufacturing-unregistered under secondary sector and in Medical and Health sectors under Tertiary sector) may be brought into the estimation and, thereby, enlarging scope of the estimation of green income in each sector. Second, if input-output table for the state is constructed, equilibrium levels of output may be determined under more plausible conditions for the state planning purposes (e.g. for determining forward and backward linkages and employment effects of changes in final demand for sustainable income). These extensions show the potential for further work in the subject of this thesis.