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SYSTEM OF ECONOMIC AND ENVIRONMENT ACCOUNT: COUNTRY EXPERIENCE, A CASE STUDY FOR MAURITIUS

1. INTRODUCTION

Mauritius is located in the Indian Ocean at the south eastern coast of Africa. Its area is around 2040 Km² but has an Exclusive Economic Zone (EEZ) of nearly 2 million km². The climate is sub tropical. The population is around 1.2 million with a politics situation of being Independent since 1968. The GDP per capita of US \$ 7000 has its main economic pillars the Services sector including hotels & tourism and Manufacturing, especially Textiles, and Information and Communication technology (ICT). The main exports are sugar and textiles while the main imports include food and energy sources. The location is shown below:

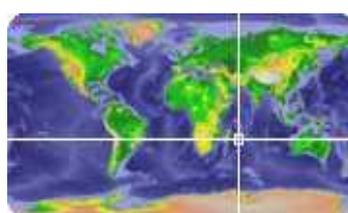


Figure 1; Location of Mauritius

The need for the System of Economic and Environment account, denoted simply as Environment-Economic Account (EEA) in Mauritius was given a high priority since the last decade. The country witnessed significant economic growth and the environment needed close monitoring. With a view to adopt a sustainable growth the EEA provides an essential tool to keep track of interactions between the economy and the environment. This was made possible as the EEA is a set of statistical accounts showing the environment-economy relationship. In this way, we investigated and analysed sustainability in the patterns of production and consumption as well as the economic consequences of maintaining given environmental standards.

After several consultations with stakeholders in the field of agriculture, water, energy, forestry and the environment among others, areas with high priority were identified. It was thereafter, and taking into consideration the available data that the following three accounts were chosen to be developed:

Energy Use and Atmospheric emissions, Water, and Economy-wide Material Flows Accounts (MFA). The accounts showed, for instance how agriculture was the most water intensive sector having recourse to irrigation for better productions; energy use was important in several sectors but there were impacts in terms of carbon dioxide emissions; MFA showed that much sugar cane and rocks were extracted from the national environment.

2. METHODOLOGIES

The basic framework adopted for the development of the accounts was the e System of Environmental-Economic Accounts (SEEA 2003) worked out by the United Nations Statistics division (UNSD). The basic concept stipulates that flows from the national environment to the national economy consist of resources and ecosystem inputs. The national economy emits residuals (wastes) to the national environment and to the environment of other countries (rest of the world – ROW in System of National Accounts - SNA). In addition the environment receives residuals from other countries’ economies and environment. Flows between the two environments are residuals transported by wind and water. Residuals going from one economy to the other environment relates to economic activity taking place abroad, for example international travel. In addition, products flow between the national economy and the economy of other countries as imports and exports. Figure 2 below shows how the flow of inputs and outputs occur in the economy and the environment.

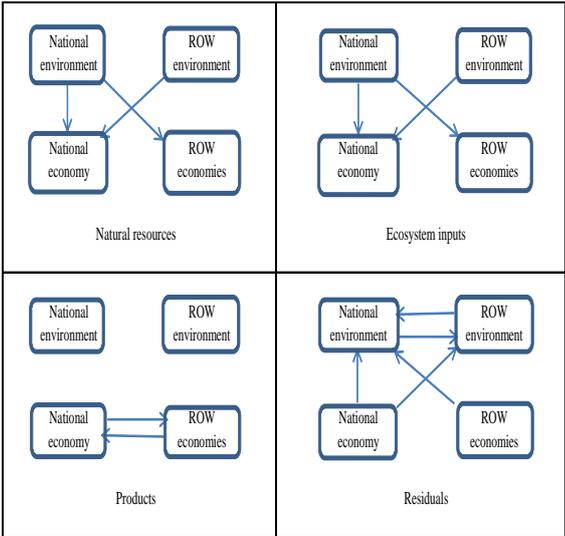


Figure 2: Framework for EEA

2.1 Water Accounts

Water accounts show the water use, water intensity of the economy and the flow of water from the environment/atmosphere to the economy and vice versa. The main concepts are from the SEEA Water 2007 (SEEA –W 2007). The data sources for the water accounts include the water supply industry, the agricultural operators, the water management bodies and industries. Some of the estimation methods include the following, adopted from a study carried out by SADC¹ in 2009 (SADC 2009):

$$\text{Water Intensity of the sector } WI = \frac{(E+G) - (F+H)}{\text{Value Added}}$$

¹ SOUTHERN AFRICAN DEVELOPMENT COMMUNITY, EUROPEAN DEVELOPMENT FUND, REGIONAL INDICATIVE PROGRAMME ECONOMIC ACCOUNTING OF WATER USE PROJECT, 2010

Where

- WI: Water Intensity in sector
- E: Water abstraction by the sector
- G: Water received from other economic units
- F: Water supplied to other economic units
- H: Returns of water to the environment

2.2 Energy and Atmospheric Emissions Accounts

Energy use accounts (SEEA 2003) extends from the national energy balance where the flow of energy, including production, imports, exports and use for transformation into electricity and direct combustions of fuels are considered. The data for estimations in the various economic sectors comes from the census of economic activities and the energy balance. The atmospheric emissions can be summarized by the following:

$$E = AD \times EF$$

Where

- E: Emissions of carbon dioxide or other gases
- AD: activity data such as fuel use in sector
- EF: emissions factor for the particular fuel or the gas considered

It should be noted that this set of account is more detailed in terms of sectoral coverage than the national greenhouse gas inventory.

2.3 The economy-wide Material Flow Accounts (MFA)

How much materials are extracted from the national environment? How much is needed by the economy? How much resources are being depleted? These are questions that can be answered from the MFA. Data sources include agricultural statistics, trade and environment statistics. MFA identify two main types of flows: direct flows are those which are used directly by economic activities within the territory, while indirect flows relate to materials which are moved but not used by the same set of economic activities

3. RESULTS

The EEA shows the Environment-Economic relationship by relating environmental pressures in physical terms to economic drivers expressed in monetary terms. It facilitates a more in-depth analysis of environmental concerns, since the different modules are broken down by sectors of the economy. The main findings are given below (Statistics Mauritius 2011).

3.1 Water Accounts

An analysis of water use by sector reveals that, as might be expected, agriculture is a relatively intensive user. In 2007 out of a total of about 880 million cubic metre of water abstracted, half (50%) was used by the agricultural sector. The hydro power stations used 29% for the production of electricity while households consumed 9% and manufacturing used 2%. The remaining 10% was mainly the water unaccounted for, by the 'collection, purification and distribution of water' sector (Figure 3).

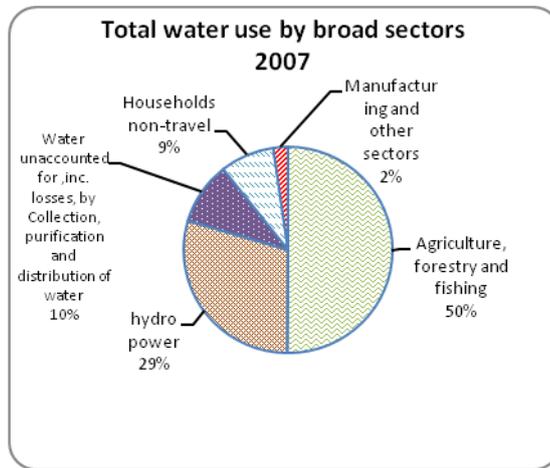
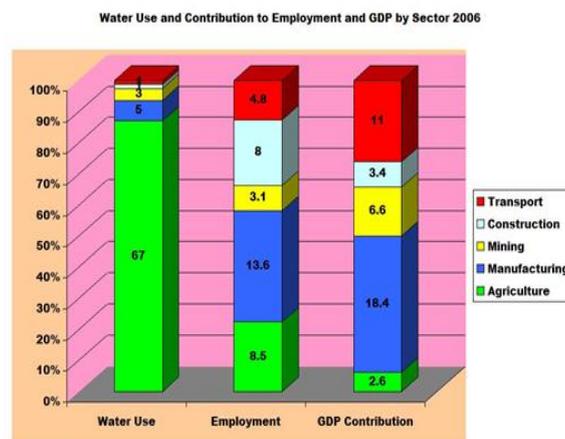


Figure 3: Water use by sector 2007

Water use intensity indicates the amount of water in million cubic metres used by a particular sector of the economy per million rupees (local monetary unit) of Gross Value Added (GVA) generated in that sector. Sectors which are the most water intensive are ‘Production of electricity’ mainly as hydro power and ‘Agriculture’. However, from 2002 to 2007, the water intensity of the ‘Agriculture’ sector dropped by 25% from 0.08 to 0.06 million cubic metres per million rupees of GVA. The same pattern was noted in ‘Production of electricity’ with a decline of 14% from 0.14 to 0.12.

Water productivity measures the GVA generated in a particular sector per unit volume of water used. In 2007, this indicator was highest in ‘Construction’ and ‘Wholesale and Retail’ sectors with over Rs 20 million of GVA generated per Mm^3 of water used. ‘Agriculture’ and ‘Production of electricity’ sectors had the lowest rate with 17 million and 9 million rupees per Mm^3 of water used respectively. Figure 4 below shows the interaction of employment and economy with water.



Source: Manase 2008

Figure 4: Water Use, Employment and economy

3.2 Energy Use and Atmospheric Emissions Accounts

This set of account depicts the impact of energy use on the environment. Energy use has the direct consequence of causing atmospheric emissions and global warming. The carbon dioxide emissions per capita are commonly used to compare countries to assess the level of impacts of economic activities. Mauritius has a relatively lower annual per capita CO_2 emissions, of about 3 tonnes, as compared to many other countries which emit above 5 tonnes, as shown in figure 5 below

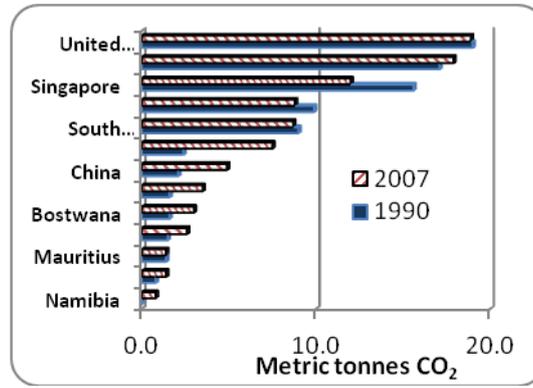


Figure 5: Carbon dioxide emission per capita for selected countries

Energy use accounts shows that between 2002 and 2009, the activity groups where the energy use has decreased, as opposed to their increase in GVA, are: ‘Agriculture’, ‘Food and Drink Manufacturing’, ‘Construction’, ‘Wholesale and Retail’ and ‘Hotels and Catering’. The energy intensity of the economy shows that for every Rs 100,000 of GDP that was produced, 0.87 toe energy was used in 2009 as compared to 1.04 tonnes in 2002. This indicates an improvement in the energy efficiency.

Figure 6 shows the evolution of primary energy use and GVA. It can be noted that as from 2006, despite maintaining economic growth, the primary energy use was going down. This indicates decoupling of energy use from GVA and achieving more wealth with less energy.

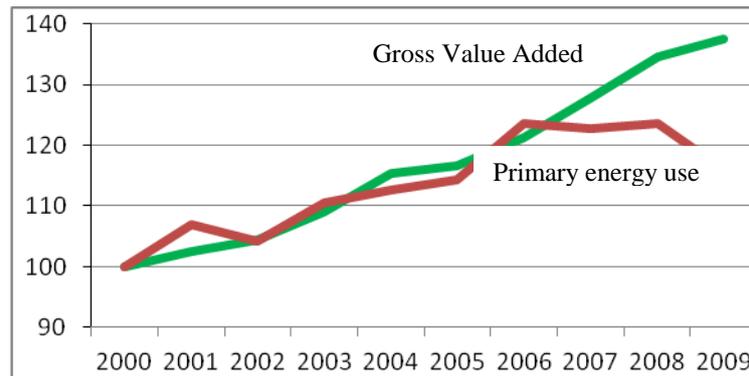


Figure 6: Primary Energy use and Gross value Added, 2000 - 2009

Households consume energy mostly by making use of electricity for lighting and powering household appliances, gasoline and diesel for private transport and LPG and solar energy for cooking and water heating respectively (Figure 7).

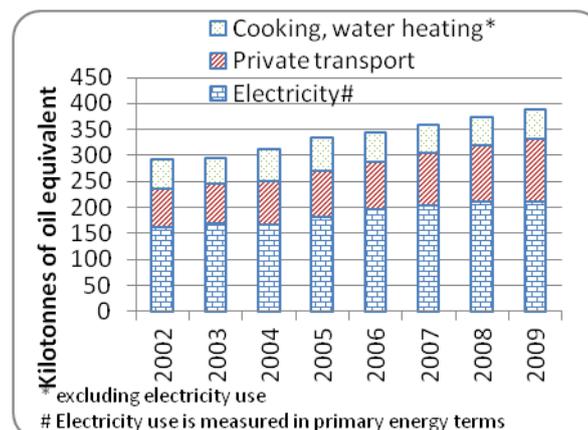


Figure 7: Household Energy use, 2002 2009

The important part of this set of accounts is the **carbon dioxide emissions accounts**. An analysis shows the changes in CO₂ emissions from energy sources of some selected sectors compared to changes in the GVA. Between 2002 and 2009, the sectors where the CO₂ emissions have decreased, as opposed to their increase in GVA, are 'Agriculture', 'Construction' and 'Hotels and Catering'. Also, there were increases in CO₂ emissions coupled with increasing GVA, in the 'Food and drinks manufacturing', 'Wholesale and retail trade', 'Chemicals Manufacturing', 'Transport' and 'Finance and real estate' sectors.

One of the ways of decreasing CO₂ emissions is to improve the energy efficiency of economic activities, in particular, for the activity groups which emit high amounts of CO₂ in their production processes. The most emission intensive sectors in 2009, in terms of tonnes of CO₂ per hundred thousand rupees of GVA, were the 'Water Supply industry' with 12 tonnes, 'Textiles' with 4.7 tonnes, 'Chemicals' with 4 tonnes, 'Transport' with 3.4 tonnes, and 'Food and Drinks' with 2.8 tonnes.

Linking CO₂ emissions and water use can lead to the working out of the carbon footprints and water footprints. This provides how much CO₂ is emitted for each stage of water use and conversely it can tell how much water is used for each sectoral productions in economic activities.

3.3 Economy-wide Material Flow Accounts

Direct Material Input (DMI) consists of domestic extraction plus imports of quantity of materials in the country. DMI in 2009 was estimated at 14.6 million tonnes, up by 7% as compared to 2005 (13.6 tonnes). Of this amount, 75% of the materials were extracted from the national environment.

Domestic extraction (DE) of biomass and materials from the national environment totalled some 10.9 million tonnes in 2009, which is estimated to be about 10% higher than in 2005 (9.9 tonnes). More than half (55%) of this amount comprised aggregates (rocks) and another 43% were sugarcane. The remaining 2% were mostly salt products and biomass such as food crops, wood and fish.

Domestic Material Consumption (DMC) is the indicator which is most used by the international community, as it can be most readily compared with GDP. It is defined as DMI less exports. In 2009, DMC worked out to 13.5 million tonnes, up by 9% from 12.4 million tonnes in 2005. This was mainly driven by the 10% increase in DMI while exports of materials went down by 8% during that period.

Physical Balance of Trade

The **Physical Balance of Trade** (PTB), that is imports less exports of materials, increased slightly from 2.5 to 2.6 million tonnes (+4%) during the period 2005 to 2009.

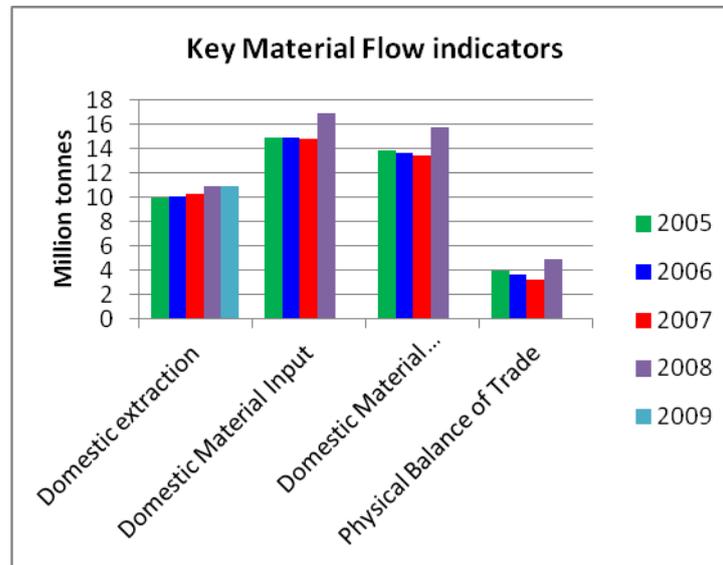


Figure 8: Indicators of material Flow Accounts, 2005 - 2009

4. THE WAY FORWARD

The UN SEEA gives further opportunities to explore the EEA. There are additional resources available for instance at the European Environmental Agency, the FAO, the Eurostat, World Bank and OECD where works are being carried on the EEA. One of the areas where important accounts could be developed is the ecosystem accounts where Mauritius is envisaging to embark. This set of accounts comprise ecosystems including inland systems, seas/oceans and the atmosphere. Inland ecosystems include: land systems, forests (natural or managed), other terrestrial systems (wetlands, shrubland, grassland...), agro-ecosystems, urban systems, inland water systems (rivers, lakes), below-surface systems functionally related to land, soil and aquifers.

5. Conclusions

There are lots of possibilities where one can analyse the impact of economic and social changes on the environment. There are many countries where EEA are a working tool, especially in the European countries. Some African countries have also developed EEA with technical assistance from donors. With challenging issues worldwide, like climate change, energy and food security, the EEA will be a crucial tool to measure sustainable development. Ongoing research might enhance the capabilities of developing countries to undertake the accountings. The UNSD is currently under the revision process of the previous SEEA. All these need to be taped for having effective national statistics.

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