Measuring sustainability: an elaboration and application of the system of environmental-economic accounting for Indonesia

Pirmana, V.

Chapter 6

Conclusions and general discussion

This thesis is an illustration of how the System of National Accounts (SNA), combined with data from the System of Environmental-Economic Accounting (SEEA), can be used to analyze simultaneously the economic and environmental pillars of sustainable development (and therefore, the Sustainable Development Goals (SDGs)). Focusing on developing countries, it first analyses the problems in creating accounts in these countries. It then explores detailed case studies for Indonesia calculating environmental damage costs (one of the indicators in SEEA) in part using Environmentally Extended Input-Output Analysis (EEIOA) as the primary analytical tool. The main aim is to measure the environmental costs incurred due to economic development activities, particularly the environmental costs due to environmental degradation from air pollution and the destruction of cultivated forest resources. This study's measurement of environmental costs is also intended to complement and expand the scope of environmental costs calculated by Indonesia's Central Bureau of Statistics (BPS), which is currently limited to measuring environmental costs in terms of resource depletion. The results of this thesis will be beneficial as a guide for policymakers to identify possible measures and policy options in response to future environmental-economic challenges.

This thesis starts in Chapter 2 with an assessment of the potential of the SEEA to contribute to monitoring SDG-related indicators and analyze the current level of the SEEA implementation in developing countries and barriers to its adoption. Next, Chapter 3 assesses the priorities for improving and expanding environmental accounts in Indonesia. We used environmental costs related to emissions and resource extraction in Indonesia to assess priorities. Chapter 4 analyzes the environmental costs of emissions and the environmental costs associated with forest resources from a consumption perspective. In addition, it analyzes Indonesia's priority sectors when economic and environmental performance are measured simultaneously. We use EEIOA to calculate environmental costs of consumption and further analyze backward and forward linkages to identify the priority sectors. Finally, in Chapter 5, we use EEIOA to evaluate the economic and environmental impacts of the production of electric vehicles (EVs) in Indonesia. The analysis assumes that all Indonesian nickel ore will be absorbed for further processing in domestic economic activities consisting of battery and EV production, assuming all produced EVs are for export purposes only.

This concluding chapter will first answer the research questions defined in Chapter 1, followed by a discussion and recommendations for future research and final remarks.

6.1 Answer to research questions

6.1.1 Question 1. Focusing on developing countries in general: what is the potential of the SEEA in supporting the monitoring of SDGs indicators, what is the current state of SEEA implementation, and what are the barriers for a comprehensive SEEA implementation?

To address this question, Chapter 2 provided a brief preview of the current and potential uses of the SEEA to support the success of SDG indicator monitoring. It also reviews the current level implementation of the SEEA and identifies the main factors hindering the implementation of the SEEA through literature reviews and small assessment surveys.
The results confirmed that the SEEA is a very useful accounting system to cover SDGs. As a standard international statistical framework, the SEEA has a great potential to support the monitoring of SDG indicators and address priority issues in each country. Indicators and analytical methods based on SEEA support the national SDG process exist. In addition, SDG indicators that were potentially supported by the existence of the SEEA were classified into Tiers 1 and 2. Of the overall indicators, 50 indicators have a high potential to be covered by the SEEA. Several indicators were conceptually clear, had an internationally established methodology, and could be informed by data collected via the SEEA. However, the success of the SEEA in supporting the SDGs will largely depend on the ability of countries to develop their SEEA-based accounts in an internationally comparable manner.

The topics covered by environmental-economic accounting programs vary between developing and developed countries. In most developing countries, the existing activities and plans should focus on natural resources management and specific issues such as energy security. Meanwhile, for most developed countries (mainly European Union countries), the salient issues are expenditure flows, economic instruments, resource efficiency, and environmental degradation related to economic production and consumption activities.

Barriers to the SEEA implementation, particularly in developing countries, are related to several issues. An inquiry among practitioners and a literature survey indicate that data availability, data quality, and lack of human resources are the three main obstacles at the compilation stage and further development of the environmental-economic accounts. There are indications that financial and technical assistance from international institutions plays an essential role in supporting the successful development and implementation of the SEEA, especially for developing countries. For instance, the WAVES program has demonstrated that it is possible to produce internationally standardized environmental accounts in middle-income countries. International organizations' support concerning technical assistance, financial support, methodological guidelines, and training materials seem to significantly improve the compilation and development of the SEEA accounts, especially in developing countries. Countries without regular government funding experience greater obstacles in developing their SEEA accounts.

6.1.2 Question 2. How can we enrich the Indonesian SNA with environmental costs accounts and what are the sectors and types of environmental interventions for which such accounts have to be developed with the highest priority? (Chapter 3)

Indonesia has good economic accounts but limited accounts for environmental extensions such as emissions and resource extraction by sector. In order to find out what environmental accounts should be an improvement priority in Indonesia, we made a rough estimate of emissions and resource extractions by sectors from a variety of sources and calculated the environmental costs associated with them. This allowed for a priority setting of environmental pressures and sectors for which the need for having good quality data is most prominent. The total environmental costs in this study are divided into three categories: (i) environmental degradation due to emissions, (ii) ecosystem damage (value loss of ecosystem), and (iii) depletion of natural resources.

Based on the calculation results, the total environmental costs in Indonesia were around Rp. 915.11 trillion or 13% of GDP in 2010. The total environmental costs in Indonesia are mainly due to the depletion of energy and mineral resources, which account for around 55% of the total environmental costs. It has to be noted, though, that these costs are not damage costs but represent the value of resource stocks that have been sold. These environmental costs are a logical consequence for any country with mining activities in its economy. The remaining 38% came from environmental costs due to environmental degradation from air pollution, and almost 7% due to environmental costs caused by the destruction of the ecosystem.

It can be concluded that the BPS is on the right track by prioritizing the compilation and publication of environmental-economic accounts related to resources, which includes energy, minerals, and forest resources accounts. However, BPS publications on forest resource accounts are still limited to timber resources. BPS should consider the complete compilation and publication of these forest accounts, including loss of ecosystem services value.

In addition, BPS has not yet included environmental accounts related to environmental degradation due to emissions. Suppose BPS would invest in expanding the scope of Indonesia's economic-environmental accounts. In that case, it is highly recommended to include at minimum data on air pollution emissions from the top ten sectors and top ten polluters that are the main contributors to Indonesia's environmental costs of emissions. The top ten sectors cover 73% of the environmental degradation due to air pollution. These ten sectors comprise electricity; manufacture of basic iron and steel and ferro-alloys and first products thereof & re-processing of secondary steel into new steel; mining of coal, lignite, and extraction of peat; the sea and coastal water transport; cultivation of paddy rice; manufacture of rubber and plastic products; livestock and their result; manufacture of cement, lime, and plaster; fertilizer and construction. At the same time, the ten most prominent air pollutants cause 93.70% of the cost of environmental damage due to air pollution and hence also are a priority. They include SOX, NOx, CO2, CH4, NH3, TSP, PB, PM10, PM2.5, and Nitrogen.

6.1.3 Question 3 - Using the SNA enriched with environmental cost accounts, what final demand components drive most external costs and hence would be priorities for consumption-based policies? How much are the environmental costs for each final demand component in Indonesia, what are the economic sectors which perform best when both economic and environmental performance are considered simultaneously?

The environmental impact of an economic system can be viewed from two complementary perspectives: production and consumption. Chapter 4 provides an overview of these impacts by measuring the environmental costs of emissions and forest resources from a consumption perspective and identifying Indonesia's priority sectors when economic and environmental performance is considered. Environmental Extended Input-Output (EEIO) Analysis is employed for this purpose. The EEIO approach can relate, in a comprehensive manner, to how consumption through the value chain drives production and, in relation, to how consumption drives emissions, resource use, and the associated external environmental costs. The EEIO approach further allows us to calculate backward and forward linkages to identify priority sectors when economic and environmental performance are taken into account.

Based on the calculations, the environmental cost of emissions generated by final demand is roughly 7% of GDP. The environmental costs of emissions value in this chapter have been adjusted to include the environmental costs of emissions embodied in imported products, resulting in a higher value than the environmental costs of emissions in Chapter 3, which are sourced only from domestic production activities (total environmental costs are 13% of GDP, of which 5% comes from the environmental costs of emissions, see chapter 3)

The findings of the calculations demonstrate that the environmental costs of emissions due to final demand are primarily derived from domestically produced final consumption, with household consumption accounting for the majority of total environmental costs of emissions. Meanwhile, the environmental cost of forest resources accounts for just 7.5% of overall final consumption environmental costs, with gross fixed capital formation and household consumption being the primary final demand components that contribute to forest resource environmental costs.

Finally, findings from a backward and forward linkage analysis pointed out that key sectors for Indonesia from a sustainability and economic point of view that must be prioritized in the Indonesian economy are: the manufacture of textile; publishing, printing, and reproduction of recorded media; chemicals n.e.c.; manufacture of other non-metallic mineral products n.e.c.; construction; and other land transport. Stimulation of economic activity in these sectors will have a more than proportional positive impact on Indonesia's economic development, with a relatively limited increase in external costs.

6.1.4 Question 4 - How can we use the SNA enriched with environmental cost accounts to assess the economic and environmental implications of investment in new economic activities, illustrated by the potential use of Indonesian natural resources to produce electric vehicle batteries and electric vehicles? (Chapter 5)

The Indonesian government has ambitions to become a production hub for electric vehicles (EV) in Asia. The ambitions are motivated by the fact that Indonesia has the largest nickel reserves in the world, 70% of which is in the form of nickel limonite, an essential raw material in the global EV supply chain, especially in the supply of raw materials for EV battery production. To support this ambition and encourage the production of value-added products, including mineral processing such as nickel ore, the government has issued a policy through Presidential Regulation Number 55 of 2019 concerning the Acceleration of the Electric Vehicle Battery Program for road transportation. This Presidential Decree then was followed up with the Minister of Energy and Mineral Resources Regulation No. 11/2019 concerning a ban on exporting nickel ore with a content below 1.7% Ni, which, combined with a ban on exports of high-grade nickel in 2014, brought all exports of nickel ore to a halt by Indonesia. Hence, it is interesting to analyze the Indonesian context's economic and environmental impact of such an enhanced EV production. Chapter 5 simulates the economic and environmental impacts of EV production in Indonesia. For this purpose, we use the EEIO model discussed in chapter 4 and section 6.1.3 and simulate what economy-wide changes would occur in value-added, jobs, and external costs if Indonesia developed an electric vehicle battery (EVB) and an EV production sector. In simulating this impact, several assumptions are applied: 100% of the previously exported nickel ore is absorbed by domestic economic activities, and the production of electric vehicles is assumed to be only for export and does not substitute for the use of conventional vehicles in the country. This implies that the analysis is only limited to the production phase. We assume no substitution of vehicles in the use phase in Indonesia and assume no reduction in the production of conventional vehicles and the use of fuel in Indonesia.

In order to analyze the economic and environmental impacts of the production of electric vehicles, two new sectors were added to the EEIO model, i.e., the battery sector for EVs and the electric vehicle sector. Estimates of two new sectors were made by estimating their input and output coefficients, including value-added creation, labor inputs, and emissions/external cost. The input coefficients for the electric vehicle sector were derived from the input-output tables for 86 industries in Indonesia that already exist for conventional vehicles. Adjustments were made using input structure information for electric vehicle production from various relevant studies. Similar steps were also taken to build coefficient input data for the electric vehicle battery sector. Since the Indonesian IOT does not contain employment tables, we created employment tables based on the National Labor Force Survey (SAKERNAS) data from the BPS for all sectors following the sector classification in this study. The employment intensity for the new sectors is assumed to be the same as the employment intensity for conventional vehicles and the conventional battery sector. Meanwhile, to estimate the external cost coefficient of emissions, we use detailed emission data based on economic sectors from the EXIOBASE dataset and damage cost value by type of air Pollutant from several relevant studies. The two new sectors' direct external costs per unit of output are assumed to be the same as the coefficient value for conventional vehicles and the conventional battery industry.

The simulation results indicate that the production of electric vehicles positively increases output, value-added growth, and job creation. Compared to the Indonesian economy, additional output, value-added, and labor due to final demand for the electric vehicle sector were 1.87%, 1.5%, and 0.5%, respectively. However, it should be noted that the simulation using the input-output model is for 2010, while the output and value-added generated by the Indonesian economy is currently around 2.25 times higher than in 2010. Having said this, stimulating EV production in Indonesia will still significantly contribute to economic growth, considering that GDP gains are realized by expanding only one sector. This finding forms the defensible justification for the Indonesian government's ambition to use its large nickel reserves to stimulate fast-growing upstream user industries, such as battery and EV production. The simulation also found that EVB and EV production creates additional external emissions costs. The amounts are, however, insignificant. The extra value-added created due to the formation of new sectors in the economy, the EV and EVB sectors, was Rp. 100.57 trillion, and the extra external cost of emissions was only Rp. 2.23 trillion. Alternatively, to put it another way, the extra external cost from emissions to the extra GDP attributable to the existence of these two industries is only about 2.2%. Note further that the simulation assumes that all produced EVs will be exported. Using EVs domestically can reduce the production of traditional vehicles and, therefore, lower job gains and value-added. EVs do not have direct emissions, which, if they replace traditional vehicles domestically, have the potential to lead to reduced external costs, depending on the carbon intensity of the electricity used.

6.1.5 Answer on overall RQ - How can we set up environmental-economic accounts in developing countries such as Indonesia, and how can such accounts support both development as environmental policies?

In order to deal with the challenges of sustainable development, the availability of appropriate and high-quality data is crucial to inform policy decisions. Sustainable development challenges need to be answered with consistent data that uses the same standards, definitions, classifications, units, assumptions, and history of standardized data to achieve development goals.

This thesis shows that the SEEA's role in supporting and managing sustainable development programs is critical.

As shown in chapter 2, many economic and environmental indicators relevant for measuring progress to the SDGs at the national or global level can be measured via integrated environmental-economic accounting systems. Therefore, The EEA data as part of a comprehensive accounting database consisting of the SNA and its satellite systems EEA (SEEA) is relevant for analyses in the context of scientific policy advice. We can see in each chapter that the SEEA plays an essential role in supporting sustainable development and the green economy agenda, which is very relevant for countries with abundant natural resources like Indonesia.

The SEEA can be applied for different types of analysis. In general, SEEA data can be used to calculate adjusted and better indicators of macroeconomic aggregates such as Green GDP, the productivity of energy and raw materials, emissions of greenhouse gases, environmental costs from resources depletion, and economic and environmental impact analysis.

The SEEA covers both environmental and economic SDGs well. In chapters 3-5, we demonstrated how the SEEA is a powerful tool for setting priorities and analyzing environmental priorities and the impacts of economic development on SDGs. As we saw in chapter 2, implementation is complex, but it can be overcome with financial resources and technical assistance. That suggests that the SEEA is vital.

Efforts to advance the SEEA can be initiated by conducting a scoping exercise to assess institutional readiness and capacity to expand the SEEA through priority accounts. This includes evaluating the relevance and importance of policies, access to data, and the availability of institutional and financial frameworks, as well as the technical resources needed to implement priority accounts. Using such an assessment, the government can develop a national outline that can be used to determine initial priorities for implementing the different types of accounts, collecting/allocating funds, and establishing the necessary institutional arrangements for their implementation.

6.2 Discussion and policy recommendations

Designing and managing development programs becomes impossible if we cannot measure the achievements or progress of development itself. The stages of development management, such as planning, budgeting, implementation, control, and evaluation, become inappropriate and ineffective when their progress cannot be measured correctly. Against this backdrop, data plays an important role. Accurate, up-to-date, complete, and open data so that it can be widely accessed are prerequisites for quality development management and community involvement in participatory management.

Sustainable development includes the interaction between economic and environmental dimensions. The United Nations developed a System of Environmental-Economic Accounting (SEEA), which builds on the System of National Accounts (SNA) to respond to the weakness of conventional national accounts that ignore problems related to natural resource scarcity, degradation, and environmental degradation damage. Measuring macroeconomic aggregates without considering environmental costs can potentially provide misleading information about sustainable development. In this case, the SEEA offers more comprehensive statistical information because it considers an aspect that was previously often overlooked, the environment. Even now, after the SDGs have been agreed upon as a global development agenda, there is a strong impetus to explore the possibility of a broader account that extends beyond GDP, where the SEEA role becomes very strategic. Chapter 2 provides a clear picture of the potential of the SEEA in supporting the monitoring of SDG indicators; there are even indications that all the SEEA accounts are useful as a tool for monitoring most of the SDGs indicators.

The SEEA is an important vehicle for coherent monitoring of progress towards SDGs and sustainable development. The development of The SEEA implies standardization and coherence of the concept, definition, clarification, and accounting of development data agreed upon by statistical offices in countries that have agreed on the SDGs as the main development agenda. This aligns with the principle of one sustainable development data set and one data standard. The construction of the SEEA will enable us to generate useful policy implications relating to natural resource utilization for development and the environment. In general, policy-related issues of the SEEA concern how it helps policy formulation as well as the kind of change it brings once it is implemented.

The experience of Indonesia in developing the SEEA may give important lessons on how developing countries can proceed with further developing this accounting system. Since 1997, the Central Statistics Agency (BPS) has developed an Integrated System for Indonesia's Environmental and Economic Accounts, including external cost accounts, known as SISNERLING. However, a main limitation of SISNERLING is the coverage since it currently only includes natural resource depletion, while environmental costs caused by environmental degradation and damage have not been included (Tasriah, 2021). Several challenges include data availability and quality, low resource support, limited knowledge, and methodological challenges.

Moreover, the data is spread across various institutions, with unclear coordination mechanisms. SISNERLING also has not been appointed as a resource supporting information in formulating public policies and evidence-based development planning. Hence, more effort is needed for data collection activities related to data confirmation, methodologies, and units (UKP-PPP, 2014). This thesis also identifies similar problems in compilation and expanding the SEEA (see chapter 2).

Important issues that need further consideration are what should be covered in the indicators, as sustainability is a broad concept. Data and methodological limitations could become the critical constraint in developing and applying sustainable development measurement. Better data and statistics would help policymakers track the progress and make sure that decision-making is evidence-based and can strengthen accountability (Burov et al., 2016). Due to these issues, we now turn to the recommended direction for the future.

Build linkages between sustainability measurement and policy implication. One important feature to be developed in terms of sustainability measurement is not limited to the issues and its measurement per se, but more importantly, how to develop the necessary linkage between measurement result and policy implication. The sustainability measurement results best include an analysis component in their routine report and built-in feedback to the relevant stakeholders (Alisjahbana & Yusuf, 2004). In terms of the SEEA/EEA, BPS can strengthen the current system of environmental-economic accounts (SISNERLING) by establishing priority accounts based on policy needs to address national policy priorities, including green economy and monitoring SDGs. In addition to the mineral and the forest accounts that BPS has carried out, the account that should be prioritized is the air emissions accounts, which in this study is the second contributor to the total environmental costs in Indonesia.

Enhance integration/coordination across institutions and at the level of government. Data with high integrity is born from integrated data management, not from data scattered across various ministries, institutions, technical units, or individuals. Data with high integrity results from good coordination between data producers and data users or between data producers and data users. Data integrity is born from the coordination process, both between and within ministries and government agencies, where data and information centers each play an important and substantial role in supporting the overall activities of ministries and agencies. With such coordination, the right combination between the substance of the data (what is the content and what is the data for) and the methodological side of the data (how the data is generated) is possible and, in turn, leads to reliable and accountable sustainable development data. The coordination mechanism must be regulated in the provisions and regulations related to data so that the coordination procedure is clearly described. This would embed the sustainable development measurement such as the SEEA within the regulatory framework of enhancing the National Statistical System for information on environment-economy linkages.

Enhance training and capacity building in environmental-economic accounting. Institutional and personnel capacity building within BPS, academicians, and departments such as the Ministry of National Development Planning (Bappenas), Ministry of Environment and Forestry (KLHK), and Ministry of Finance are essential components for improving the quality of the environmental-economic accounting output. Capacity building provides a better understanding of the concepts and engages experts in professional development through collaborative activities, staff exchanges, and training on data compilation, analysis, and evaluation (UN, 2015).

Enhance partnerships and coordination with International and donor agencies. Partnerships and coordination accelerate implementation. Indonesia can use various international initiatives to help build capacity regarding the implementation and development of their current environmental-economic account through technical assistance, financial support, training materials, and methodological guidelines. For example, to support the sustainable development agenda, the aforementioned global partnership, WAVES (Wealth Accounting and Valuation of Ecosystem Services). Specifically, WAVES aims to develop environmental accounts using internationally agreed standards and develop a standardized approach to environmental services accounts. In Indonesia, WAVES involves the ministry of national development planning (Bappenas) as the principal partner, together with BPS and relevant ministries/agencies, and started in 2014 through piloting accounts for selected commodities. The WAVES global partnership is the operationalization of the SEEA so that standardization and coherence of concepts, definitions, classifications, and data accounting rules are the keys to implementing the partnership.

Develop a data quality assurance mechanism. Specific mechanisms along the chain of statistical activities need to guarantee data quality, from data collection to presentation. In the case of Indonesia, this mechanism has not been implemented in some ministries/agencies. Together with the relevant policy departments, BPS can allocate their staff specifically to support this data quality assurance system, such as a dedicated SEEA unit.

This thesis is one effort to continue the previous Indonesia SEEA estimation conducted by BPS (SISNERLING) by extending it to a broader scope. The EEA measurement in this thesis is carried out by considering the environmental costs caused by the depletion of natural resources and expanding its scope to include the calculation of environmental costs caused by environmental degradation and damage in the Indonesian context. In chapter 3, it can be seen that BPS is on the right track by prioritizing the preparation and estimation of the EEA, which includes a mineral and forest resource balance regularly, both physical and monetary accounts. However, there are indications that the environmental costs of environmental degradation are also significant. In this thesis, environmental degradation only includes information on air emissions as an additional environmental stream in Indonesia's EE-IOT framework. Although it only includes air emissions in the calculation, the environmental costs of these air emissions are the second contributor to the total environmental costs in Indonesia. The environmental costs exercise in this thesis can be used as initial consideration for BPS to expand its SISNERLING coverage. The coverage includes environmental flows from air emissions and even other environmental flows such as water pollution, energy use, water use, and waste generation.

In addition, this thesis uses the EEIO model as the primary approach in measuring environmental costs in Indonesia. EEIOT provides a unified framework for analyzing the interconnections between economic sectors and environmental flows. Chapters 4 and 5 show how the EEIO approach can be used as a powerful and valuable analytical tool concerning the measurement of environmental costs based on detailed sector classifications, which will be of great use to policymakers in formulating evidence-based sustainable development policies. Considering the potential of this EEIO approach in measuring EEA, we suggest the BPS compile data on such flows of emissions and resource extractions using the SEEA framework. They can be integrated directly into standard input-output tables to build a comprehensive Indonesian EEIOT.

6.3 Final Remarks

Indonesia's current national development should focus on achieving sustainable development goals. In measuring long-term economic development related to environmental aspects, the presentation of GDP figures should be expanded to take into account the depletion of natural resource availability and environmental damage in order to be able to provide a more comprehensive picture of sustainable economic development. Efforts towards improving data quality, unifying data, and opening data access for the wider community, can be started by doing what we might do together in stages and measurably. The first step of these efforts is to identify data management issues in the context of Indonesia's institutions and public policies and consider the progress that has been made and the limitations faced. This includes paying attention to the possibilities available to rejuvenate what Indonesia already has established, improve what Indonesia is currently doing, and leave behind what tends to hinder, limit or slow down Indonesia's efforts in establishing a sound System of Environmental and Economic Accounts. However, due to its limitations, this thesis is not intended to answer all problems in measuring sustainable development indicators such as Indonesia's environmental-economic accounting (EEA). It is just one exercise in, hopefully, other major endeavors in the future and can be seen as a message which shows that improvements of this kind in the national accounting system are feasible and should be warmly supported. From a methodological perspective, this thesis provides a perspective on the potential and usefulness of the EEIOA to be used as a valuable tool in measuring sustainable development indicators. Such an approach can significantly support future research to refine and expand the scope of the EEA. Furthermore, the calculation of the SEEA helps countries conduct analyses and design and implement policies that would bring about environmentally sound and sustainable economic growth and development. Therefore, further studies to improve the SEEA estimation and address the gaps and limitations of previous SEEA studies are needed.