

Accounts for the Environment and Sustainability

Mark de Haan, Carl Obst & Peter van de Ven

Abstract: This paper reviews the work done in response to environment related topics in the System of National Accounts (SNA) research agenda. Recently, a designated area group provided draft recommendations on e.g. the recording of natural resource depletion, the identification of natural resource ownership, the distinction between produced and non-produced biological resources, the recording of environmental taxes, provisions and renewable energy resources. The main findings on these issues are briefly discussed. In addition, the paper highlights several linkages between the updates on ecosystem accounting (SEEA EEA) and the SNA. Finally, this paper explains SEEA's position in a broader framework for measuring wellbeing and sustainability.

Paper Prepared for the IARIW SNA Update
August 26, 2020
Part I: Well-being and Sustainability

Accounts for the Environment and Sustainability

Mark de Haan, Carl Obst & Peter van de Ven

IARIW Digital Session on the SNA Update and Related International Standards

Part I – Well-being and Sustainability

Wednesday, August 26, 2020

This paper reviews the work done in response to environment related topics in the System of National Accounts (SNA) research agenda. Recently, a designated area group provided draft recommendations on e.g. the recording of natural resource depletion, the identification of natural resource ownership, the distinction between produced and non-produced biological resources, the recording of environmental taxes, provisions and renewable energy resources. The main findings on these issues are briefly discussed. In addition, the paper highlights several linkages between the updates on ecosystem accounting (SEEA EEA) and the SNA. Finally, this paper explains SEEA's position in a broader framework for measuring wellbeing and sustainability.

1. Introduction

Environmental accounting is a well-developed and a highly dynamic area of official statistics, having its own international statistical standard, the System of Environmental-Economic Accounting Central Framework (SEEA CF).¹ An update of the SEEA Experimental Ecosystem Accounting (SEEA EEA) is underway.

This paper reviews the work that was recently carried out in respect of the upcoming update of the System of National Accounts (SNA), with special attention given to research issues in the environmental domain.² A so-called area group was brought together and asked to provide guidance on a range of SEEA-SNA cross border accounting issues.³

Obviously, the SNA should keep track of developments in environmental accounting which are of relevance for the traditional economic accounts. Yet, one should be aware that the guidelines in the SEEA CF and the SNA sometimes differ. For example, an important difference between the two systems is the recommended recording of natural resource depletion. Looking more carefully at those differences, one may come to the conclusion that the reasons behind those differences are not self-evident. So, one of the objectives of this area group was to look at opportunities to overcome these conceptual differences and to strengthen those parts of the accounts for which current practice has

¹ <https://seea.un.org/content/seea-central-framework>

² https://unstats.un.org/unsd/nationalaccount/Update_Issues.asp

³ The environmental-economic accounting area group members are: Mark de Haan (Statistics Netherlands, Lead), Alessandra Alfieri (UNSD), Pablo Castaneda (World Bank), Adam Dutton (UK ONS), Bram Edens (UNSD), Raúl Figueroa Díaz (INEGI, Mexico), Dennis Fixler (US BEA), Francisco Guillen (INEGI, Mexico), Glenn-Marie Lange (World Bank), Carl Obst (consultant), Viveka Palm (Statistics Sweden), Sjoerd Schenau (Statistics Netherlands), Anton Steurer (Eurostat), Joe St Lawrence (Statistics Canada), Jim Tebrake (IMF), Gemma Thomas (UK ONS), and Peter van de Ven (OECD).

shown stronger guidance is desirable and feasible. The area group has also looked at phenomena which gained increasing attention in recent years, such as renewable energy resources⁴.

This paper is structured as follows. The next section discusses the new guidance proposed by the environmental-economic accounting area group. In this respect, it should be noted that, when drafting this paper, it was not possible to provide a full recollection of recommendations, as some of the guidance notes are still work in progress. Section 3 explains how the SEEA EEA is linked to the SNA, while Section 4 provides some proposals on how the SEEA could be positioned in an overarching framework for measuring wellbeing and sustainability. The final section winds up the paper with some conclusions and recommendations.

2. A summary of the newly proposed guidance

2.1 Natural resource depletion

A prominent issue addressed by the area group is the recording of natural resource depletion. The SEEA CF (paragraph 5.76) defines depletion, in *physical* terms, as “*the decrease in the quantity of the stock of a natural resource over an accounting period that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration*”. The 2008 SNA explains that “*reductions in the value of known reserves of mineral and energy resources resulting from their depletion as a result of extracting the assets for purposes of production are not recorded in the capital account but in the other changes in the volume of assets account*”.

With respect to the recording of natural resource depletion, there are two noticeable differences between the SEEA-CF and the 2008 SNA:

1. In the 2008 SNA, resource depletion only applies to mineral and energy resources and not to (renewable) biological resources. The SEEA CF's scope of depletion is broader, including also biological resources;
2. In the SEEA CF, natural resource depletion is considered as a cost of production, and accordingly recorded in the generation of income accounts and the capital account. Together with consumption of fixed capital (depreciation), natural resource depletion adds in this way to the distinction between gross and net income, or gross and net saving. As mentioned, the 2008 SNA recommends a recording of depletion in the other changes in the volume of assets account. In the 2008 SNA, the difference between gross and net income is restricted to consumption of fixed capital.

→ It is recommended that the next version of the SNA follows the recording of natural resource depletion as recommended in the SEEA CF.

2.2 Net instead of gross income and saving

The recording of depletion is tied to the longstanding discussion on advocating net, instead of gross, income and saving. Gross income is in a way a contradiction in terms, as neither consumption of fixed capital nor natural resource depletion are income. Both are costs of production. In the context of measuring wellbeing and sustainability, this notion is considered of paramount importance, particularly for developing countries, to appropriately reflect in how far income growth is realised with maintaining the capital base, produced or non-produced. A rapid running down of natural resources may be a way to elevate GDP in the short term but it clearly hampers a country's income growth

⁴ The guidance note of the environmental-economic accounting area group can be found at the following (password protected) website: <https://community.oecd.org/community/iswgna-wellbeing-sustainability/content?filterID=contentstatus%5Bpublished%5D~category%5B2-environmental-economic-accounting%5D>

potential on the longer term. Boosting GDP by way of asset stripping is not necessarily a sustainable development path. The volume change of NDP (net of capital depreciation and depletion) is in this respect a more prudent measure of economic growth.

The argument used against net income (and in favour of GDP) is the complexity of measuring capital stocks and capital depreciation. Even though the OECD provides thorough guidance on capital measurement, this guidance also explains a number of assumptions (e.g. on service lives, price and efficiency profiles, discount rates) are usually needed to arrive at capital estimates.⁵ However, one should be aware of the fact that most countries face the same challenges in making these assumptions, and stronger guidance on making these assumptions could be a major step forward in improving and harmonising capital measurement worldwide. Indeed, capital accounting is data demanding, as a perpetual inventory method (PIM) requires investment time series in current and constant prices. However, the calculations themselves are not overly complex and could be done in an excel sheet (which is not necessarily recommended).

The rejection of net income due to its measurement complexities is also a weak and ironic response of statisticians in times when economic-environmental sustainability is at the forefront of policy debates.

→ It is recommended that the next version of the SNA advises against the use of gross income and saving.

→ Practical international guidance is needed to allow countries with less advanced statistical systems to catch up in the area of capital measurement and to calculate more representative net national income estimates.

2.3 Ownership of natural resources

Governments may grant mining corporations concessions to extract natural resources. Depending on the nature of the arrangement, the extractor of natural resources and the government will have substantial assets in the form of expected future incomes from the extraction of the resources. The 2008 SNA already recognised this situation and explains (paragraph 13.50) that *“because there is no wholly satisfactory way in which to show the value of the asset split between the legal owner (government) and the extractor, the whole of the resource is shown on the balance sheet of the legal owner and the payments by the extractor to the owner shown as rent”*.

From a conceptual point of view, one could argue that this SNA recommendation contains an implicit misalignment, as the allocation of the natural resource assets does not match the recording of income from these assets. Typically, not all of the income related to the natural resources is appropriated by the legal owner (assumed to be government). Part of the income, and often a substantial share of this income, is retained by the extractor of the natural resource.

How the actual distribution of natural resource income and costs (depletion) could be recorded in the sequence of accounts is illustrated in Table 5.10 of the SEEA CF. A logical consequence of this way of accounting is that the natural resource together with its income needs to be split up in terms of its economic ownership.

→ Based on a careful assessment of who carries the risks and obtains the rewards, an ownership split is recommended in cases where both are shared between the legal owners (often government) and the private extractors.

2.4 Biological resources: produced or non-produced?

Recent accounting practice has shown that the distinction between cultivated and non-cultivated biological resources can be quite thin and unspecific. This distinction is important as it has a direct

⁵ <https://www.oecd.org/sdd/productivity-stats/43734711.pdf>

impact on how output and assets are being defined and recorded. For biological resources, the 2008 SNA and also the SEEA CF, make a distinction between cultivated and non-cultivated resources. If the growth and regeneration process of the biological resource is controlled by, managed by and under the responsibility of an economic agent, the growth is considered production, and the relevant resource is considered a produced asset, i.e. a cultivated resource. If this criterion does not apply, and the growth relates to a purely natural process without any human involvement, in line with the definition of the SNA production boundary in paragraph 6.24, the growth of the biological resource is not production in an economic sense, and the asset is considered a non-produced asset, i.e. a non-cultivated resource.

Compared to the 2008 SNA, the SEEA CF is more precise and prescriptive in providing guidance for the distinction between cultivated and non-cultivated resources for the various types of cultivated and non-cultivated biological resources. A quite distant and relatively inactive type of management will not qualify the relevant resources as being managed. According to SEEA CF, the establishment of quota regimes for say fish in open seas does not constitute significant management activities for the fish stock to become a produced asset.

→ For distinguishing cultivated from non-cultivated resources, it is proposed to take the continuum from intensely managed to totally undisturbed as a starting point for the recording of biological resources. The distinction would then cease to exist, as ecologically speaking all biological resources are impacted by human activity (directly or indirectly) and become 'produced'. Output would then be measured as the percentage of natural growth that is expected to be exploited in the foreseeable future. This would come down to an accrual accounting of production, which in the case of non-cultivated resources currently is recorded at the time of removing the biological resources from nature.

→ If the above is not considered feasible, it is recommended to strictly define the significance of management practices. Biological resources would then only be considered as cultivated if intensively managed. Only those assets qualify as being produced, e.g. for timber resources only plantations would be considered as produced assets, while for aquatic resources only fish farming would qualify as such. All other biological resources, for which management levels are not that intensive, would be recorded as non-produced assets.

In respect of the above, one should be aware of the fact that, in line with the first recommendation, in ecosystem accounting the distinction between cultivated and non-cultivated also ceases to exist. In ecosystem accounting, the output of all biological resources is defined as the contribution of the ecosystem to the growth in the biological resource that is expected to be exploited/harvested in the foreseeable future. In other words, in the SEEA EEA, ecosystems are considered the suppliers of ecosystem services. Note that in ecosystem accounting, biological resources may supply services beyond the production boundary of the SNA, e.g. trees providing air filtration services.

The area group also questioned the 2008 SNA guidance for leases on biological resources (and land). Income receivable on a resource lease is currently recorded as property income. Alternatively, one could record the income from a lease as a service provided to the lessee, i.e. as output. It should be noted that such an alternative recording of natural resource leases will change the recording of transactions in relation to these resources quite dramatically. So this requires further investigation.

2.5 Strengthening the guidance on resource valuation

While the need for further guidance to improve and harmonise the measurement of resource rents and Net Present Value (NPV) calculations was investigated, the conclusion is that much of the needed guidance can already be found in the SEEA CF. The use of alternative non-market valuation techniques is being discussed as part of the revision of the SEEA Experimental Ecosystem Accounting (SEEA EEA). It has been concluded that, when it comes to the alignment with the SNA, the revised SEEA EEA should not incorporate valuation concepts that include consumer surplus, nor consider including monetary values reflecting alternative institutional and policy contexts. The SEEA EEA revision will contain

discussion on how alternative non-market valuations could be used to complement monetary measures from the SEEA and the SNA.

2.6 Recording of losses

It is explored how losses in the course of natural resource extraction and processing such as theft, storage and distributional losses, need to be accounted for in the SNA vis-à-vis the SEEA CF. One of the key questions raised is whether or not flows must be recorded gross or net of losses. It is important to acknowledge the differences in scope when comparing the *physical* (SEEA CF) and *monetary* supply and use tables (SNA). The first aims at the recording of the material flows running through the economic system, while the latter aims at a recording of economic transactions. Both flow types may differ in terms of scope. For example, emissions (leakages) to soil are not economic transactions in the SNA sense. Also, materials may be shipped and/or processed as a service provided to its owners which means that (cross border) movement and processing of materials do not necessarily coincide with economic transactions while these events may have a significant environmental impact. In strict economic terms, the most relevant question seems to be in whose balance sheet a loss (in inventories) must be recorded. In environmental accounting terms, the (potential) environmental impact of losses is the key concern either in terms of harmful emissions or resource use efficiency.

2.6 Environmental taxes and subsidies

In the attempt to steer economies in an environmental friendly direction, governments may introduce a variety of policy measures such as environmental taxes and subsidies or introduce other pricing mechanisms. Cross country data comparisons are sometimes hampered by both these differences in policies and by a lack of accounting guidance and divergences in accounting solutions. This issue is still work in progress. A number of problem areas have been identified. Recommendations on a way forward are pending.

2.7 Provisions

The 2008 SNA provides guidance on the recording of decommissioning costs but not on the treatment of provisions. In business accounting, the difference between terminal costs and compensation costs is basically non-existent. The undesirable consequences of mining may reach third parties which may hold the mining companies responsible for damages caused. There are many examples where mining and shipping of minerals have led to severe environmental impacts. In response, mining companies may start building up provisions in their balance sheets once such impacts are being expected to materialise in the near future.

Provisions remain unrecorded in the current versions of the SEEA and SNA. As a consequence, the net worth of mining companies or mine owners may be overstated when future claims are being expected. Therefore the area group provides additional guidance on how the SEEA/SNA could account for provisions in response to future obligations to compensate third parties for the caused environmental damages.

This guidance could be summarized as follows:

→ Even though a recording in the financial account may provide a better reflection of the net worth of the expected future beneficiaries, a recording in the capital account of a provision is to be preferred for two reasons:

- The financial account option requires the recording of a capital transfer at the moment a provision is being acknowledged (ex-ante). In case of a capital account recording, the capital transfer takes place at the moment of settlement (ex-post). Obviously, an ex-post capital

transfer reflects the actual compensation, while an ex-ante transfer will represent an estimate of the expectations regarding future claims.

- The capital recording coincides with the recording of a so-called provision charge which provides a more credential reflection of the mining company's net income and saving compared to the financial accounting option, when this provision charge is acknowledged as a cost of production.

→ The recording of resource rents, adjusted for charges to provisions, is not recommended, as this would lead to a double counting of the downward adjustment of a provision on the net worth of the mining company or mine owner.

2.8 Renewable energy resources

In many countries, the share of renewable energy in total energy supply is rapidly increasing. Technology improvements in recent years have clearly put several renewable energy (solar, wind) resources on the edge of competing with fossil powered energy. The discussion on recording of renewable energy resources is still ongoing and entails the following points:

- While for certain types of renewable energy sources, ownership rights can clearly be defined (water reservoirs), other sources of renewable energy, such as wind power, are a bit more 'intangible' in nature. One may argue that governments assign ownership by way of granting rights to collect wind power. In a way, this is similar to how land obtains its use function and value. When a government changes a land destination plan, for example a plot of agricultural land being reassigned to residential land, its price will often substantially increase. In other words residential land is usually a highly government regulated asset. Irrespective of whether or not land ownership includes the right to collect wind power, land is clearly defined in terms of its size and a cadastre will show its ownership. In the case of wind such a situation does not exist. How to define wind assets in quantitative terms is not straightforward and requires further consideration.
- In an unregulated competitive world, renewable energy generation could lead to a resource rent for two reasons:
 1. Renewable energy generation becomes competitive compared to fossil fuel based energy sources. This situation may exist only temporarily, i.e. in the transition period of shifting from fossil to renewable energy generation.
 2. Some locations, or certain renewable energy sources, are more profitable than others.

Since energy markets are often regulated by way of imposed taxes and subsidies on both fossil and renewable energy, this complicates the measurement of the resource rents of renewable energy resources. Alternatively it is proposed to use a government appropriation method. Such a method assumes any fee paid to government to obtain access to renewable energy production represents its resource rent. From other guidance provided by the area group on environmental-economic accounting, it became clear that for fossil energy resources governments are not always appropriating the full resource rent. Also the issue of valuation of renewable energy resources requires further thinking.

3. Linking the revision of the SEEA EEA and the SNA

In 2013, the United Nations Statistical Commission endorsed the System of Environmental-Economic Accounting - Experimental Ecosystem Accounting (SEEA EEA) manual as the initial version of statistical framework on the integration of data on ecosystems and the economy. A process to revise the SEEA EEA began in 2017 with the aim of harmonising and standardising relevant definitions and concepts in

the SEEA's approach to ecosystem accounting. The revision process is well advanced and a revised manual will be presented to the UN Statistical Commission in March 2021. A first round of global consultation on draft chapters has been completed concerning the valuation of ecosystem services and ecosystem assets and the integration of these values into the system of national accounts. A second round of consultation will be undertaken in October and November this year. There has been active engagement with the national accounts community including via the Advisory Expert Group (AEG) on National Accounts, in its meeting held in October 2019, where a paper on ecosystem accounting was presented.⁶

By way of context, ecosystem accounting organizes data in a series of accounts. Three of the core ecosystem accounts organise biophysical and other data in quantitative terms, namely the ecosystem extent account, ecosystem condition account, and ecosystem services supply and use account in physical terms. There are also two core ecosystem accounts that present data in monetary terms, the ecosystem services supply and use account in monetary terms and the ecosystem monetary asset account. The revised SEEA EEA will also describe the integration of these ecosystem accounts in monetary terms with the sequence of institutional sector accounts, including the balance sheets, and the supply and use accounts of the SNA.

In national accounting terms, the primary conceptual distinction from the SNA is the extension of the production boundary to include ecosystem services. Ecosystem services are supplied by ecosystems (such as forests, wetlands and agricultural areas) as inputs to economic and other human activity. They include, for example, ecosystem contributions to food and fibre provision, climate regulation, air and water filtration, flood mitigation and recreation. Some ecosystem services are inputs to goods and services already included in the measurement of GDP, while others will reflect additional production and consumption thus, in aggregate, expanding the measure of GDP.

The expansion of the production boundary will also imply an expansion in the potential monetary value of assets, in particular land and natural resources, beyond the monetary value that would be recorded in the SNA. Thus, for example, the value of forests would be larger than the monetary value of the timber resources they hold and would include, among other things, the contribution of the forest to global climate regulation through the sequestration of carbon.

While the monetary value of some ecosystem services can be derived from associated market transactions – e.g. with respect to food and fibre provision, there are many non-market ecosystem services for which alternative valuation techniques need to be applied to obtain exchange values consistent with national accounting principles. In the discussion of these alternative valuation techniques it has been generally agreed that they can, in some circumstances, be used to estimate exchange values, for example through the application of cost-based valuation techniques. As noted before, it has been concluded that the revised SEEA EEA will not apply valuation concepts that include consumer surplus, nor consider including monetary values reflecting alternative institutional and policy contexts. An explanation will be provided about the conceptual connections between exchange values and these alternative values to support engagement between statisticians, environmental economists and policy makers in this area.

The analysis and discussion of alternative valuation concepts that has taken place in the context of ecosystem accounting is likely to be of interest in the wider discussion of sustainability and wellbeing, since much of this discussion requires consideration of the treatment of non-market factors in accounting contexts. This includes for example, discussion of the treatment of externalities in an accounting context. Framing these non-market considerations in a national accounting context has proved challenging but steady progress is being made.

Separately, with respect to supporting discussion on the environmental aspects of wellbeing, the revised SEEA EEA, in conjunction with the SEEA Central Framework, will be able to provide a relatively

⁶ https://unstats.un.org/unsd/nationalaccount/aeg/2019/M13_2_4_3_SNA_SEEA_EEA.pdf

comprehensive set of aggregates and indicators in physical and monetary terms that are based on the application of national accounting principles. This will include for example measures of degradation adjusted GDP and national wealth.

4. SEEA as part of the broader well-being sustainability information system

When it comes to extended accounts on environmental issues, the UN Committee of Expert on Environmental-Economic Accounting (UNCEEA) has agreed on a number of priority accounts for the development of databases with global coverage. These priority accounts first and foremost relate to one of the most critical policy issues, i.e. climate change: accounts for energy, accounts for air emissions, and accounts on environmental taxes and subsidies. In addition to these accounts, global databases are being developed which are considered important for describing and analysing the circular economy: the material flow accounts. Accounts on land cover and land use are also considered as a priority for which agreed global databases are being put in place in the coming years. Less well developed, but increasingly important for measuring progress in developing countries, are accounts on water. Here, it is suggested to use the above accounts as the starting point for the extended accounts in the context of measuring wellbeing and sustainability in a broader framework of national accounts.

As noted before, new standards are being developed for the measurement and analysis of developments in ecosystem services and ecosystem assets. How and when this extension of the production and asset boundary can be reflected in the broader framework for measuring wellbeing and sustainability depends on the future developments of the international standards, including their implementation in practice.

5. Conclusions and recommendations

The next SNA update provides the opportunity to bring important elements of environmental accounting in the SEEA CF within the realm of mainstream economic accounting. There is no reason why depletion of natural resources should not be recorded, as a cost of production, in the SNA. Natural resource depletion and consumption of capital are both costs of production and not income and should be recorded as such. This is why from a wellbeing and sustainability perspective, much more emphasis in the SNA should be put on *net*, instead of *gross*, income and saving. At the same time, since net income and saving are already defined in the 2008 SNA, we should not wait five years for an SNA change for this issue to progress. The first steps could be taken instantly. These would be (1) developing the practical guidance on capital measurement and (2) putting the incentives in place for statistical offices to move from gross to net income measures.

The current guidance in the SNA of assigning natural resource ownership by convention to the legal owner (often government) cannot be maintained and the SEEA CF approach of split economic ownership of natural resources should also be pursued in the SNA.

Further, the next SNA should, as a minimum, embrace the precision provided by the SEEA CF in natural resource measurement, for example with respect to the distinction of produced and non-produced biological resources but also with respect to the valuation techniques offered in the SEEA CF for the various natural resources.

Finally, the SEEA CF and the SEEA EEA provide the accounts and indicators by which the environmental dimension of broader measurement frameworks for wellbeing and sustainability can be empowered.