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# Indonesian Net Domestic Product (NDP) Adjusted for Depletion of Environmental Asset

**Prepared by BPS - Statistics Indonesia**[1]

*Summary*

Economic theory and accounting already utilize a tightly defined sustainability criterion when evaluating the depreciation or consumption of generated capital. This is to make a clear distinction between income and capital to prevent consuming capital base of income generation. By expanding the asset boundary of national accounts to include non-produced natural assets like land/soil, minerals, forests, fish, water, and environmental sinks for pollutants (air, water, land), a broader concept of economic performance sustainability can be defined as the maintenance of produced and natural capital used to produce goods and services. Costing produced and natural capital consumption in the national accounts yields a Depletion-adjusted Net Domestic Product (NDP1). The trend of NDP1 can be considered an indicator of sustained economic growth. This is analogous to gauging economic growth based on the trends of GDP or NDP.

SEEA (System of Environmental-Economic Accounting) is the first international statistical framework that looks at both the economy and the environment. SEEA physical and monetary environmental accounts give us a picture of the uses of natural inputs such as forest, mineral and energy resources in the economy. Further development of monetary environmental accounts is helpful to analyze the depletion impact on national accounts as the result of extracting natural resources. Using the SEEA framework, BPS (Statistics Indonesia) has compiled environmental-economic accounts in which NDP1 is generated. As of 2022, environmental depletion included in BPS' work comprises the total value of extraction of mineral and energy resources and the value of logging less planted timber. This paper will present the rationale for environmental accounting, depletion-adjusted NDP, and its sustainability along with its limitations.

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# I. Introduction

1. There have been two important indicators of national income over the past 50 years: Gross Domestic Product (GDP) and Net Domestic Product (NDP); with GDP being the most generally utilized. These variables are commonly used in macroeconomic analysis and worldwide comparisons. In addition, they have historically acted as an indicator of a country's economic development and standard of living. Unfortunately, these conventional measures of economic activity are inadequate and deceptive because they fail to account for the role of the environment and its influence on economic activity.

2. First, the NDP aggregate is a representation of the value of goods and services, which is calculated by deducting an allowance known as the consumption of fixed capital. This allowance accounts for the use up of man-made capital, such as machinery and equipment. However, it is important to note that the national accounts do not include an allowance for using environmental assets, which means that they do not provide a sustainable measure of national production.

3. On the other hand, while GDP correctly represents the production of marketed goods and services, it falls short of providing a more comprehensive measure of social welfare. Regarding environmental problems, GDP does not account for environmental degradation and resource depletion. This is a critical problem, particularly in developing countries like Indonesia, which rely heavily on natural resources. If a country clears its forests, depletes its soil fertility, and pollutes its water sources, it will undoubtedly become poorer. However, national income accounts only reflect the market worth of timber, agricultural produce, and industrial output as positive contributions to GDP. This may cause policymakers to view the country's growth in an overly rosy light - at least until the effects of environmental damage become evident, which may take decades in the case of environmental damage.

4. Can we conclude that a country with a higher per capita income is inevitably more prosperous than a comparable nation with a lower per capita national income? Many experts have pointed out that the national income indicators discussed above may provide a misleading picture of economic and human development. Therefore, taking natural capital and environmental quality seriously influences how we estimate national wealth and well-being and the integrated economic and environmental information can come to answer these questions.

5. Because the goal is to account for qualitative and quantitative changes in natural capital, the starting point could be NDP, where the depreciation of real capital has been subtracted from GDP in a similar manner. From this, a (partially) environmentally adjusted net domestic product (EDP) would be the proper measure, taking into consideration natural resource depletion and degradation. However, the compilation of environmentally adjusted NDP in this paper only includes the calculation of depletion of environmental assets.

# II. System of Environmental-Economic Accounting (SEEA)

6. SEEA is part of the statistical system and guidelines developed by the world's statistical agencies (UNSC), UN, IMF, World Bank, OECD, and European Commission. It is linked to the System of National Accounts (SNA), which provides a global standard for national accounts. It provides a framework that integrates physical environmental data with monetary data from the SNA to provide a more comprehensive and multipurpose view of the interrelationships between the economy and the environment. It contains internationally agreed concepts, definitions, classifications, accounting rules, and tables for producing internationally comparable statistics and accounts, which are interoperable with the SNA.

7. Two complementary approaches of the SEEA include the SEEA Central Framework (SEEA-CF) and the SEEA Ecosystem Accounts (SEEA-EA). SEEA-CF is a compartmental and partial approach to measuring the environment and natural resources. In the SEEA-CF, there are four types of accounts, namely flow accounts, asset accounts, sequence of economic accounts, and functional accounts. Flow accounts include the measurement of energy, materials, water, and emissions to the environment. Asset accounts include the measurement of mineral and energy, timber, fish / aquatic resources, soil, water, land, and other biological

resources. The depletion-adjusted economic aggregates are highlighted in a sequence of economic accounts, while the functional accounts contain information on transactions and other economic activities carried out for environmental purposes.

8. On the other hand, SEEA-EA is a systematic framework to measure the contributions of ecosystems to economic activity that is aligned with the National Accounts (UN, 2014a). It includes ecosystem services flows and ecosystem assets. Ecosystem accounting involves expanding SNA production boundaries. This allows the inclusion of a wider range of ecosystem services, such as regulatory services and cultural services, as well as the natural growth of biological assets (such as timber) to measure economic activity. In turn, this can more comprehensively record changes in ecosystem capital (Bordt, 2015). Both SEEA-CF and SEEA- EA can provide information in the physical and monetary unit if supporting data is sufficient.

# III. SEEA Implementation in Indonesia

9. Based on the Republic of Indonesia law on Statistics Number 16 of 1997, BPS is the national statistical organization responsible for providing basic statistics, sectoral statistics, and special statistics in Indonesia. In addition, in accordance with Government Regulation No. 46/2017 concerning environmental economic instruments, BPS shall coordinate with the Ministry of National Development Planning (BAPPENAS), the Ministry of Finance (MoF) and relevant ministries that provide data to compile SEEA accounts. Furthermore, in the latest development plan, BAPPENAS has included environmental sustainability, disaster risk management, and climate change mitigation and adaptation as one of the targets in the 7 medium-term development plans (RPJMN) 2020 2024. Related to this, BPS contributes by providing SEEA accounts.

10. BPS has begun to produce a yearly publication called SISNERLING (Integrated System of Environmental-Economics Accounts of Indonesia) since 1990. Through the SISNERLING, BPS aims to implement SEEA accounts, such as asset accounts, flow accounts, and environmental activity accounts.

11. As one of the components of SEEA, asset accounts in physical or monetary units, measure the stock of natural resources and the changes in stock. The compilation of asset accounts in BPS comprises land accounts, timber asset accounts, and mineral and energy asset accounts. The most interesting feature in asset accounts is its ability to estimate of natural resources depletion in physical and monetary units. For non-renewable resources, quantity of depletion is equal to the amount of resources extracted, but for resources that can be renewed, the quantity of depletion take the population, resources, values, growth rate, and improvement of the sustainability rates. The valuation methodology used in the monetary asset accounts adopts Net Present Value (NPV) method which is recommended for valuing the environmental assets.

12. BPS also publishes an annual report specifically dedicated to energy flow accounts, which provides a detailed overview of energy supply and consumption by both economic and environmental units, as well as the corresponding air emissions resulting from energy-related activities. Furthermore, BPS conducts an in-depth study analysis each year to expand its implementation of environmental economic accounting in other areas. The selection of these areas is based on prioritized governmental programs or critical issues that arise during that year. For instance, in 2016 and 2017, BPS conducted an in-depth study on EPEA-EGSS, while in 2018, BPS studied SEEA-AFF. BPS then conducted an in-depth study on sustainable tourism in 2019 and 2020, and ocean accounts in 2021 and 2022. This year, in 2023, BPS will conduct an in-depth study on biodiversity accounts and climate change.

# IV. Data source

13. Due to limitations in available data, not all natural resources can be evaluated in monetary terms. As a result, the valuation of monetary asset accounts in BPS is based on a prioritization of natural resources that have a significant impact on the Indonesian economy.

Specifically, BPS's monetary asset accounts focus on eleven key natural resources, including land, timber, oil, natural gas, coal, gold, silver, copper, tin, nickel, and, bauxite.

14. To compile physical asset accounts for timber in Java, BPS generally rely on forestry data from Perum Perhutani, specifically for teak timber and other types of timber in the region. For physical asset accounts related to timber outside of Java, data from the MoEF's publication on FRA is used. Additionally, to complete the Monetary Asset Account for Timber Resources in Indonesia, we utilize data from BPS-Statistics Indonesia and the MoF.

15. To compile asset accounts for mineral and energy, BPS rely on data from several line ministries in Indonesia, including BPS itself, Ministry of Energy and Mineral Resources (MEMR), and Ministry of Finance. Data from BPS primarily comes from national accounts, such as output and gross value added for each mining industry by type of mineral and energy. BPS also use information from the Input-Output Table (IOT) and the Supply and Use Tables (SUT) which provides detailed information about cost structure of each type of mineral and energy mining industry.

16. The MEMR has the authority in collecting sectoral data related to mineral and energy resources in Indonesia. We use data on reserves, resources, and production of mineral and energy obtained from the MEMR. We also rely on their data to estimate the extraction of mineral resources in both ore and metal content forms. The classification of reserves and resources for each type of mineral and energy resource was adjusted to the UNFC-2009 classification as recommended by the SEEA.

17. Similar to the valuation of timber asset accounts, BPS determine the monetary value of mineral and energy assets by setting a discount rate for each type. BPS use government bond rates obtained from the MoF as discount rate.

18. Lastly, to compile integrated economic-environmental accounts, several sources of data are utilized in the following manner:

a. The Directorate of Expenditure Accounts BPS provides GDP data by expenditure at current prices, which includes macro-level information such as final consumption, capital formation, exports, imports, and depreciation of economic assets.

b. The Indonesian 2016 input-output table is another data source used to determine the structure of product supply and intermediate consumption.

c. The monetary asset accounts for eleven key natural resources dicussed above

# V. Methodology

## A. Introduction

19. Natural resources that have been compiled in monetary asset accounts in BPS consists of timber, as well as mineral and energy comprised of oil, natural gas, coal, gold, silver, copper, tin, nickel, and bauxite.

## B. Timber Asset Account

20. The timber resource asset account is constrained by data limitations hence covers only teak timber of Java, other timber of Java, and other timber outside of Java. The rationale for selecting these commodities is that they make the largest contribution to the value added to the GDP of the Forestry Subcategory. The presentation of asset account for timber resources is therefore presented by teak timber of Java, other timber of Java, and other timber outside of Java.

21. The additions and reductions in stock cannot be presented as detailed as the SEEA asset account standards. In the physical asset accounts (Table 1), additions to stock are detailed according to natural growth and reclassification (reforestation and planting); while reductions in stock are detailed according to removals as well as losses and reclassification

(natural losses and catastrophic losses). The structure of the monetary asset account for timber resources (Table 2) is almost similar to that of the physical asset account for timber resources. However, the former includes a new element called "revaluation," which serves as a correction factor to account for price fluctuations over a given period. The physical asset account is measured in cubic meters ($m^3$), while the monetary asset account is measured in rupiah.

Table 1
**Structure of physical asset account for timber in Indonesia (m3)**

| Detail | Timber type | | | Total of Timber Resources |
|---|---|---|---|---|
| | Teak Timber of Java | Other Timber of Java | Other Timber Outside Java | |
| (1) | (2) | (3) | (4) | (5) |
| **Opening stock** | | | | |
| Additions to stock | | | | |
| Natural growth | | | | |
| Reclassifications | | | | |
| **Total additions to stock** | | | | |
| Reduction in stock | | | | |
| Removals | | | | |
| Losses and reclassifications | | | | |
| **Total reductions in stock** | | | | |
| **Closing stock** | | | | |

Table 2
**Structure of monetary asset account for timber in Indonesia (Indonesian rupiah)**

| Detail | Timber type | | | Total of Timber Resources |
|---|---|---|---|---|
| | Teak Timber of Java | Other Timber of Java | Other Timber Outside Java | |
| (1) | (2) | (3) | (4) | (5) |
| **Opening stock** | | | | |
| Additions to stock | | | | |
| Natural growth | | | | |
| Reclassifications | | | | |
| **Total additions to stock** | | | | |
| Reduction in stock | | | | |
| Removals | | | | |
| Losses and reclassifications | | | | |
| **Total reductions in stock** | | | | |
| **Revaluations** | | | | |
| **Closing stock** | | | | |

22. To calculate the monetary asset account for timber resources, the physical asset account is multiplied by the unit rent (resource rent per unit of resource), which is determined using the Net Present Value (NPV) method. The NPV method involves estimating the value of resources by using their current price as a proxy for their future sales value, and then subtracting the costs of exploitation. Resource rent of timber commodities is obtained using the value of Gross Operating Surplus (GOS), namely by multiplying output by the ratio of GOS to output. GOS ratio is obtained from the 2016 IOT.

23. The formula used is $PV = \sum_{t=1}^{T} \frac{FV_t}{(1+r)^t} = \sum_{t=1}^{T} \frac{N_t Q_t}{(1+r)^t}$. Where PV = The present value of a natural resource, FVt = Future value of a natural resource, Nt = The value of natural

resource deducted by exploitation cost at year t, Qt = Exploitation volume at year t, T= year, t = age of natural resources, r = discount rate.

## C. Mineral and Energy Asset Account

24. Asset accounts for mineral and energy resources present information on the stock and changes of these resources over time, and are presented both in physical unit and monetary unit. Due to data limitation, the additions and reductions in stock cannot be presented as detailed as the SEEA asset account standards. Physical and monetary asset accounts for mineral and energy are shown in the Table 3 and Table 4 respectively.

25. Mineral and energy resources include proven reserves of oil, natural gas, coal, metallic minerals, and nonmetallic minerals, among others. The United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) is the framework used to determine the extent of known deposits. The mineral and energy asset accounts do not include potential mineral deposits because in these deposits, it is not expected that these deposits will be economically viable in the future. Moreover, there is a scarcity of data to assess mining feasibility or the level of confidence in geological knowledge.

26. Like timber resources, mineral and energy resources are categorized as environmental assets that offer provisioning services by being extracted from nature and benefiting humankind. As a result, their market value is determined by estimating their resource rent via the net present value (NPV) approach.

Table 3
**Structure of physical asset account for mineral and energy resources in Indonesia**

| **Descriptions** | **Type of mineral and energy resources** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Crude oil (barrels) | Natural gas (BSCF) | Coal (ton) | Gold (ton) | Silver (ton) | Copper (ton) | Tin (ton) | Nickel (ton) | Bauxite (ton) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Opening stock | | | | | | | | | |
| Extraction | | | | | | | | | |
| Other changes in stock | | | | | | | | | |
| Closing stock | | | | | | | | | |

Table 4
**Structure of monetary asset account for mineral and energy resources in Indonesia (Indonesian rupiah)**

| **Descriptions** | **Type of mineral and energy resources** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Crude oil | Natural gas | Coal | Gold | Silver | Copper | Tin | Nickel | Bauxite |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Opening stock | | | | | | | | | |
| Extraction | | | | | | | | | |
| Other changes in stock | | | | | | | | | |
| Revaluations | | | | | | | | | |
| Closing stock | | | | | | | | | |

## D. Compilation of integrated accounts

27. Further development of monetary asset accounts is used measure environmental depletion, which subsequently can be integrated to the system of national accounts. Due to the limited data available, the calculation of environmentally adjusted national accounts is only carried out up to the generation of NDP1, namely the NDP adjusted for natural resource depletion.

28. In the integrated economic-environmental account (Table 5), the concept of capital formation is expanded into the concept of capital accumulation which also considers capital produced by environment. In this account, mineral, energy, and timber reserves are regarded as natural-made capital. As such, it is essential to calculate the costs that reflect the utilization or reduction of this natural-made capital in economic activities in the form of depletion value. The depletion value for mineral resources is equivalent to the extraction value, whereas for timber resources, the depletion value equals the logging and damage value substracted by the value of planting or addition. The adjusted NDP (NDP1), which takes into account the use of natural assets and the environment, is obtained by subtracting the value of depletion from the conventional NDP in the SNA.

Table 5
**Structure of integrated environmental and economic accounts for timber, mineral, and energy commodities**

| Components | | Year | | | | | |
|---|---|---|---|---|---|---|---|
| | | Economic Activities | | | | | Non-produced Environmental Assets |
| | | Industries | Final Consumption | Capital | | Rest of The World | |
| | | | | Produced Assets | Non-Produced Assets | | |
| (1) | | (2) | (4) | (5) | (6) | (3) | (7) |
| 1 | **Opening stock** | | | | | | |
| | Capital | | | | | | |
| | a. Timber | | | | | | |
| | b. Oil | | | | | | |
| | c. Natural gas | | | | | | |
| | d. Coal | | | | | | |
| | e. Gold | | | | | | |
| | f. Silver | | | | | | |
| | g. Copper | | | | | | |
| | h. Tin | | | | | | |
| | i. Nickel | | | | | | |
| | j. Bauxite | | | | | | |
| 2 | **Supply** | | | | | | |
| 3 | **Use** | | | | | | |
| 4 | **Depreciation** | | | | | | |
| 5 | **NDP (conventional)** | | | | | | |
| 6 | **Depletion** | | | | | | |
| | a. Timber | | | | | | |
| | b. Oil | | | | | | |
| | c. Natural gas | | | | | | |
| | d. Coal | | | | | | |
| | e. Gold | | | | | | |
| | f. Silver | | | | | | |
| | g. Copper | | | | | | |
| | h. Tin | | | | | | |
| | i. Nickel | | | | | | |
| | j. Bauxite | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | **Other changes** | | | | | | |
| | a. Timber | | | | | | |
| | b. Oil | | | | | | |
| | c. Natural gas | | | | | | |
| | d. Coal | | | | | | |
| | e. Gold | | | | | | |
| | f. Silver | | | | | | |
| | g. Copper | | | | | | |
| | h. Tin | | | | | | |
| | i. Nickel | | | | | | |
| | j. Bauxite | | | | | | |
| 8 | **NDP1 1** | | | | | | |
| 9 | **Revaluations** | | | | | | |
| | Capital | | | | | | |
| | a. Timber | | | | | | |
| | b. Oil | | | | | | |
| | c. Natural gas | | | | | | |
| | d. Coal | | | | | | |
| | e. Gold | | | | | | |
| | f. Silver | | | | | | |
| | g. Copper | | | | | | |
| | h. Tin | | | | | | |
| | i. Nickel | | | | | | |
| | j. Bauxite | | | | | | |
| 10 | **Closing Stock** | | | | | | |
| | Capital | | | | | | |
| | a. Timber | | | | | | |
| | b. Oil | | | | | | |
| | c. Natural gas | | | | | | |
| | d. Coal | | | | | | |
| | e. Gold | | | | | | |
| | f. Silver | | | | | | |
| | g. Copper | | | | | | |
| | h. Tin | | | | | | |
| | i. Nickel | | | | | | |
| | j. Bauxite | | | | | | |

# VI. Results (Indonesian depletion-adjusted NDP)

29. Table 6 shows the value of natural resource depletion that impacts the level of NDP and net capital accumulation. Net capital accumulation is a constituent of NDP, valued at Rp2,370,880 billion in 2021, representing 17.15 percent of total NDP. When accounting for the impact of natural resource depletion, the value of net capital accumulation reduces to only Rp2,043,845 billion or 15.14 percent of total NDP 1. The decline in net capital accumulation value is attributed to the deppreciation of fixed capital assets and depletion of the value of natural assets utilized in economic activities namely timber, minerals, and energy resources.

Table 6
**Comparation of conventional NDP and depletion-adjusted NDP (NDP1)**

| Year | Component | NDP | | NDP1 | |
|---|---|---|---|---|---|
| | | Value (Billion Rp) | Distribution (%) | Value (Billion Rp) | Distribution (%) |
| 2017 | 1. Final consumption | 9 023 120 | 80.86 | 9 023 120 | 82.47 |
| | 2. Net capital accumulation | 1 999 990 | 17.92 | 1 781 980 | 16.29 |
| | 3. Net export | 135 778 | 1.22 | 135 778 | 1.24 |
| | 4. Total | 11 158 888 | 100.00 | 10 940 878 | 100.00 |
| 2018 | 1. Final consumption | 9 793 746 | 81.35 | 9 793 746 | 83.05 |
| | 2. Net capital accumulation | 2 403 579 | 19.97 | 2 157 881 | 18.30 |
| | 3. Net export | -158 599 | -1.32 | -158 599 | -1.34 |
| | 4. Total | 12 038 726 | 100.00 | 11 793 028 | 100.00 |
| 2019 | 1. Final consumption | 10 566 547 | 83.43 | 10 566 547 | 85.62 |
| | 2. Net capital accumulation | 2 168 420 | 17.12 | 1 844 947 | 14.95 |
| | 3. Net export | -70 411 | -0.56 | -70 411 | -0.57 |
| | 4. Total | 12 664 556 | 100.00 | 12 341 083 | 100.00 |
| 2020* | 1. Final consumption | 10 575 347 | 84.64 | 10 575 347 | 86.48 |
| | 2. Net capital accumulation | 1 676 913 | 13.42 | 1 410 754 | 11.54 |
| | 3. Net export | 241 952 | 1.94 | 241 952 | 1.98 |
| | 4. Total | 12 494 212 | 100.00 | 12 228 053 | 100.00 |
| 2021** | 1. Final consumption | 10 995 483 | 79.54 | 10 995 483 | 81.46 |
| | 2. Net capital accumulation | 2 370 880 | 17.15 | 2 043 845 | 15.14 |
| | 3. Net export | 458 017 | 3.31 | 458 017 | 3.39 |
| | 4. Total | 13 824 380 | 100.00 | 13 497 345 | 100.00 |

* Preliminary figures

** Very preliminary figures

30. Table 7 provides a more detailed breakdown of the depreciation of gross fixed capital formation and depletion of natural resources. It is evident from the table that in 2021, the ratio of NDP to GDP (point 4) was approximately 81.46 percent, which means that the consumption of fixed capital as a percentage of Indonesia's GDP was around 18.54 percent. On the other hand, the ratio of NDP1 to GDP (point 5) in 2021 was about 79.53 percent. Moreover, the natural resource depletion percentage in Indonesia in 2021 was 1.93 percent (or 20.47 minus 18.54).

Table 7
**Comparation of GDP, NDP, and NDP1**

| | 2017 | 2018 | 2019 | 2020* | 2021** |
|---|---|---|---|---|---|
| 1. GDP (Billion Rp) | 13 589 826 | 14 838 756 | 15.832.657 | 15.438.018 | 16.970.789 |
| 2. NDP (Billion Rp) | 11 158 888 | 12 038 726 | 12.664.556 | 12.494.212 | 13.824.380 |
| 3. NDP1 (Billion Rp) | 10 940 878 | 11 793 028 | 12.341.083 | 12.228.053 | 13.497.345 |
| 4. NDP/GDP x 100 (percentage) | 82.11 | 81.13 | 79,99 | 80,93 | 81,46 |
| 5. NDP1/GDP x 100 (percentage) | 80.51 | 79.47 | 77,95 | 79,21 | 79,53 |
| 6. NDP1/NDP x 100 (percentage) | 98.05 | 97.96 | 97,45 | 97,87 | 97,63 |

* Preliminary figures

** Very preliminary figures

31. By compiling integrated economic-environmental accounts, the sustainability aspects of natural resources can be analyzed. Table 8 presents a summary of the value of national assets, categorized based on the value of fixed capital assets (produced assets) and the value of natural assets (non-produced assets), obtained from the natural resources accounts

calculation. Between 2017 and 2021, the contribution of natural assets to the total national assets varied from 14 to 21 percent. However, the monetary value of natural assets is still relatively small since the valuation does not encompass all natural resources.

Table 8
**National asset value**

| Year | Asset value at closing year (Billion Rp) | | Total (Billion Rp) | Asset value at closing year (percent) | |
|---|---|---|---|---|---|
| | Produced assets | Non-produced assets | | Produced assets | Non-produced assets |
| 2017 | 34 987 129 | 9 431 868 | 44 418 997 | 79 | 21 |
| 2018 | 39 778 340 | 9 557 955 | 49 336 295 | 81 | 19 |
| 2019 | 44 899 711 | 9 204 516 | 54 104 228 | 83 | 17 |
| 2020* | 49 796 761 | 8 257 793 | 58 054 554 | 86 | 14 |
| 2021** | 55 024 615 | 13 204 887 | 68 229 502 | 81 | 19 |

* Preliminary figures

** Very preliminary figures

32. The sustainable development agenda emphasizes sustainability as a measure, which asserts that the value of total assets per capita or national wealth per capita should not experience negative growth within a given period. The aspect of sustainability assumes that there exists perfect substitution between different types of assets; when the value of one asset decreases, it will be compensated by an increase in the value of other assets. For instance, depletion of oil and gas resources can be compensated by investment in fixed capital such as oil and gas exploration. The value of national wealth per capita and its growth are presented in Table 9.

33. Table 9 presents data indicating that from 2017 to 2021, the value of national wealth exhibited positive growth, as demonstrated by the increase in total national wealth per capita. In 2019 and 2020, the per capita value of natural wealth experienced a contraction in growth. However, the growth rate of fixed capital assets per capita increased at a faster pace, offsetting the decline in natural wealth per capita. Moreover, in 2021, there was a significant increase in national wealth per capita.

Table 9
**National asset value per capita**

| Year | The value of asset per capita (Billion Rp) | | Growth (%) | | | |
|---|---|---|---|---|---|---|
| | Produced assets | Non-produced assets | Produced assets | Non-produced assets | Produced assets | Non-produced assets |
| 2017 | 133 594 | 36 014 | 169 609 | 12.89 | 22.24 | 14.75 |
| 2018 | 150 098 | 36 066 | 186 164 | 12.35 | 0.14 | 9.76 |
| 2019 | 168 219 | 34 485 | 202 704 | 12.07 | -4.38 | 8.88 |
| 2020* | 184 729 | 30 634 | 215 363 | 9.81 | -11.17 | 6.24 |
| 2021** | 201 790 | 48 426 | 250 216 | 9.24 | 58.08 | 16.18 |

* Preliminary figures

** Very preliminary figures

34. Table 10 shows the value of depreciation of national assets that indicates the usage of both produced and environmental assets in economic activities. The growth in produced assets, in the form of gross fixed capital formation, fluctuated between -7.08 to 19.42 percent. On the other hand, the use of environmental assets had the lowest growth rate of -17.72 percent in 2020, and the highest growth rate of 31.66 percent in 2019.

Table 10
**Depreciation Value of National Assets in Indonesia**

| Year | Depreciation value (Billion Rp) | | Growth (%) | |
|---|---|---|---|---|
| | Consumption of fixed capital | Depletion of natural resources | Produced assets | Non-produced assets |
| 2017 | 2 430 937 | 218 010 | 19.42 | 12.62 |
| 2018 | 2 800 030 | 245 697 | 15.18 | 12.70 |
| 2019 | 3 168 101 | 323 473 | 13.15 | 31.66 |
| 2020* | 2 943 805 | 266 159 | -7.08 | -17.72 |
| 2021** | 3 146 409 | 327 035 | 6.88 | 22.87 |

* Preliminary figures

** Very preliminary figures

# VII. Conclusion and Limitation Conclusion

35. Integrated environmental-economic accounting helps to combine economic and environmental accounts and generate adjusted macroeconomic indicators (such as NDP) that accounts for the depletion of natural resources. BPS has compiled integrated enviromental-economic accounts of Indonesia since 1990. In this paper, NDP1 suggests that natural resource depletion in Indonesia is relatively low. However, it is important to interpret this result carefully because not all environmental assets, let alone the valuation of environmental degradation such as pollution and climate change, are accounted for in NDP1.

36. Additionally, damage aspects that were not valued due to the unavailability of appropriate valuation techniques, such as the biodiversity aspects of acidification, can also be included. In future calculations of environmentally adjusted macro aggregates, it is important to also include the transboundary aspects of environmental problems, such as the exports and imports of pollution, which have not been taken into account in this paper.

37. The discount rate used in this paper's NPV calculation is based on government bond rates from the Ministry of Finance, which are more market-oriented and not specifically geared towards environmental sustainability. Therefore, there is a need to explore other suitable discount rates for intergenerational discounting purposes from an environmental sustainability perspective such as non-constant or declining discount rates, weighted average, or shadow capital price approach.

# References

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