

PART I

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**Global, Regional, and Country  
Trends in Wealth, 1995–2018**



# 1

## The Wealth of Nations

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### Main Messages

- Wealth accounts are a necessary complement to gross domestic product (GDP) and other traditional economic measures because they reflect the state of assets that produce GDP.
- Wealth accounts provide an indicator, change in wealth per capita, that offers insight into whether growth will be sustainable in the long term and whether investments in human, produced, and natural capital are sufficient to keep pace with population growth and a country's development aspirations.
- *The Changing Wealth of Nations (CWON) 2021* provides the most comprehensive set of global annual wealth accounts for 146 countries, from 1995 to 2018.
- This edition of the CWON significantly extends and improves the coverage of natural capital and monitors its trends in order to inform the debate on the environmental dimension of sustainability. New work demonstrates how wealth accounts can be used for policy and applies scenario analysis for asset valuation to inform decision-making under uncertainty.

### Why Measure Wealth?

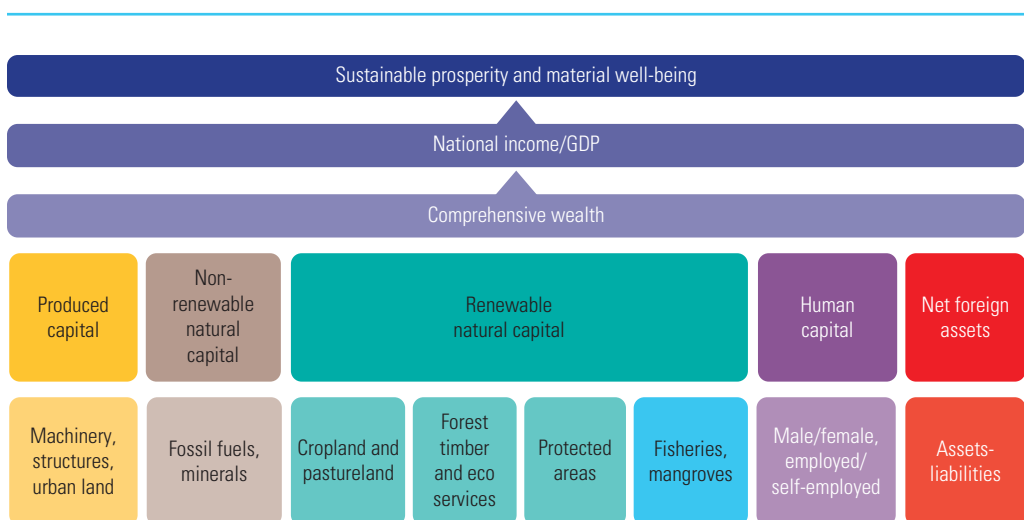
The starting point, as in the previous editions of the CWON, is that a nation's income is generated by its wealth, measured comprehensively to include all assets: produced, human, and natural capital (renewable and nonrenewable). Sustained economic growth over the long term requires building and managing this broad portfolio of assets. Although a macroeconomic indicator like GDP is an important indicator of economic activity, it is a flow measure that captures income or production over a period

but does not reflect changes in the underlying asset base. Hence, used alone, GDP may provide misleading signals about the state of the economy, the efficiency of asset utilization, and the sustainability of development. GDP does not reflect depreciation, depletion, and degradation of assets.<sup>1</sup> It does not indicate whether accumulation of wealth keeps pace with population growth or whether the mix of different assets will support a country’s development goals. GDP indicates whether an economy is growing, but wealth indicates the prospects for long-term economic growth (figure 1.1). Economic performance is best evaluated by monitoring both GDP and wealth.

One can see the usefulness of this approach by comparison with firms or households. If a firm wants to raise money from potential investors, it must report both its annual income statement and its balance sheet.<sup>2</sup> The income statement alone is not sufficient, because a firm can increase its income simply by selling off its assets. But this is a short-term strategy that cannot be maintained and undermines the long-term financial viability of the firm. Similarly, when applying for a mortgage or other loans, households must reveal their income and the sum of assets minus liabilities to provide a complete picture of financial health. Although the same principles should apply to national economies, countries regularly report only their national income, or GDP. Few regularly compile national balance sheets. Both GDP and national wealth accounts are needed for an accurate picture of the financial health of nations and their prospects for long-term development.

The World Bank established a program for measuring national wealth to monitor long-term economic well-being and guide the development process through the lens of a country’s portfolio of assets (box 1.1). The first edition of the CWON, *Where Is the Wealth of Nations? Measuring*

**FIGURE 1.1** Structure of Comprehensive Wealth Accounts



Source: World Bank.

### BOX 1.1 Sustainability and the Wealth of Nations

The World Bank first introduced the concept of wealth underpinning national income, and long-term prosperity as dependent on wealth, in the 1990s. *The Changing Wealth of Nations* (CWON) developed the argument for a new metric of sustainability for economic development—the *change in wealth per capita*—and demonstrated its usefulness in many applications. *Nondeclining wealth per capita* is an indicator based on the original definition of sustainability from the *Our Common Future* report, also known as the Brundtland Report (World Commission on Environment and Development 1987). (Prior to the CWON, the World Bank developed a proxy indicator, *adjusted net savings*. The relationship between change in wealth per capita and adjusted net savings is discussed in chapter 2.)

The change in wealth per capita combines all assets into a single indicator by applying a common unit of measurement: monetary value. This implies a high degree of substitutability among different forms of capital (weak sustainability) and does not convey the very real limits to substitutability, impending thresholds for natural capital, or potential irreversibilities and catastrophic events. Given the poor state of the world's ecosystems, which can threaten the fundamentals of economies, these are serious concerns. The CWON makes use of underlying biophysical data, such as forest extent, to construct natural capital accounts that can be used to inform sustainability analysis.

In addition, economic sustainability is not the same as human well-being. Wealth, like gross domestic product (GDP), is intended to represent material well-being, not broader human well-being. Although per capita wealth may be similar for different countries, the well-being of their citizens may be quite different because of such factors as institutions, governance, and social capital that influence but cannot be directly incorporated into economic values. Such concerns gave rise to the widely embraced “beyond GDP” movement that has led to new approaches in measuring well-being, broadly defined.

Many of the new measurement approaches have greatly improved the ability to create a more comprehensive measure of national wealth, especially for natural capital. Wealth and GDP are essential companions. When properly understood and combined, they provide the financial tools for managing human economies, although they are not sufficient on their own for addressing sustainability and human well-being—that requires additional indicators of critical natural capital and social capital.

*Capital for the 21st Century* (World Bank 2006), was a proof of concept that demonstrated that wealth accounts could be constructed for a large number of countries. The second edition, *The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium* (World Bank 2011), provided the first time series of wealth accounts for 140 countries over 10 years. This allowed readers to examine the dynamic relationship between development and wealth. The most recent edition, *The Changing Wealth of Nations 2018: Building a Sustainable Future* (Lange, Wodon, and Carey 2018), included, for the first time, an explicit measure of countries' human capital. These editions of the CWON developed the argument for a new metric of sustainability for economic development, *change in wealth per capita*, and demonstrated its usefulness in numerous applications.

Wealth and GDP are essential companions. When properly understood and combined, they provide the financial tools for managing human economies. But they are not sufficient on their own to fully address sustainability and human well-being. Additional indicators of critical natural capital and social capital are needed. This chapter returns to interpreting wealth in the broader context of sustainability after detailing the composition of comprehensive wealth accounts.

The full story told by GDP or wealth, however, lives in the underlying disaggregation of the accounts. People may be tempted to view an increase in the value of natural capital as a sign of improvement in the state of forests, land, and so forth or a fall in value as a sign of environmental decline. But values can change because of changes in quantity and/or price; scarcity or improved efficiency can drive up land value. Therefore, the underlying land accounts can better reflect the reality in countries. Understanding the meaning of a change in wealth requires looking at the underlying physical data used to compile the wealth accounts. This edition of the CWON makes those data much more accessible than they were in the past.

### What Is Included in Comprehensive Wealth Accounts?

Wealth accounts are grounded in the concepts and framework of the System of National Accounts (SNA) 2008 (EC et al. 2009) and its extension for natural capital, the System of Environmental-Economic Accounting (SEEA) Central Framework (UN et al. 2014a) and SEEA Ecosystem Accounting (UN 2021; UN et al. 2014b). Although there has been experimentation with human capital, it is not yet part of the SNA national balance sheet. CWON 2021 estimates wealth data for 146 countries from 1995 to 2018 in market exchange rates. (The data set can be accessed at <http://www.worldbank.org/cwon/>.) The wealth estimates are provided according to five asset classes (figure 1.1),<sup>3</sup> which are further explained in chapter 2:

1. *Produced capital and urban land*: machinery, buildings, equipment, intangible wealth such as intellectual property and mineral exploration, and residential and nonresidential urban land<sup>4</sup> (For the sake of brevity, the term *produced capital* is used to include produced capital and urban land.)
2. *Nonrenewable natural capital*: fossil fuels (oil, gas, and hard and soft coal) and minerals (10 categories)
3. *Renewable natural capital*: agricultural land (cropland and pastureland), forests (timber and ecosystem services), protected areas, mangroves, and marine fisheries
4. *Human capital*: the value of skills, experience, and effort by the working population over their lifetime disaggregated by gender and employment status (employed and self-employed)
5. *Net foreign assets*: the sum of a country's external assets and liabilities:<sup>5</sup> for example, foreign direct investment and reserve assets (For further explanation, see Lane and Milesi-Ferretti [2007, 2017].)

The key strength of including natural and human capital in national balance sheets is that it makes these assets visible to decision-makers, from civil society and private individuals to the private sector and policy makers, especially those dealing with the economy and finances. Providing transparent information about the value of natural capital puts it on the same economic footing as produced capital and supports the reality that, like any other asset, ecosystems need to be rewarded for their services, invested in, and managed well.

The strengths of adhering to the rigor of SNA-compatible balance sheets go hand in hand with the limitations of this approach. One limit is that some economic assets are more difficult to measure in market terms than others. CWON 2021 makes important strides toward rigorous valuation of blue natural capital, including fisheries and mangroves. It improves the coverage and rigor of valuation of several terrestrial ecosystems and agricultural land, as well as human capital. This makes the current edition of the CWON the most comprehensive source of wealth accounts available. The approaches have been explored and piloted so that additional asset classes can be included in future editions of the CWON: for example, climate regulatory services for the biosphere and renewable energy.

## From Monitoring Economic Performance to Managing the Economy

All well-designed accounts, including the comprehensive wealth accounts, serve two purposes: (1) *score keeping* to indicate progress toward sustainability and (2) *management* to help understand how to improve the score if it heads in the wrong direction or maintain the score if it is on the right path. The initial motivation for the World Bank's wealth accounting program focused on the first goal, providing a forward-looking indicator of sustainability, the *change in wealth per capita*, and earlier editions of the CWON primarily addressed the measurement challenges to developing this indicator. In all the editions of the CWON, top-down estimates have increasingly been replaced by accounts built from the bottom up, using country-specific information. CWON 2021 continues to strengthen the measurement of wealth through expanded coverage and improved quality of all assets, notably, natural capital and human capital. It also increases country coverage.

The World Bank's extensive work to develop global wealth accounts has been necessary because, although the SNA includes guidelines for national balance sheets along with the income and production accounts that produce GDP, few countries regularly compile wealth accounts, even for produced capital and nonrenewable resources, let alone human and natural capital. Without reliable and consistent data, it is difficult to advance economists' analytical work. Growing recognition of the limitations of GDP has led to new emphasis on accounting for assets and on advances in expanding measurement to natural capital. The United Nations Statistical Commission's adoption of the SEEA in 2012 as an extension of the SNA was an important milestone (UN et al. 2014a, 2014b).

But implementation of the SEEA has been slow, and there is no statistical standard for the measurement of human capital (yet).

Change in wealth per capita has intuitive appeal among policy makers, but unless the measure is actionable, they may put it aside. Wealth accounts can be, and should be, put to broader use—if development is a process of building and managing a comprehensive portfolio of assets, then wealth accounts should be able to provide advice for policy questions: how much to save and invest, what mix of assets to invest in, and whether assets are managed efficiently or policy reforms are needed to do better. And how are various policies likely to affect assets and their long-term ability to provide benefits?

Wealth must be integrated into the diagnostics and toolkits used for macroeconomic and sectoral analysis and decision-making. This is a long-term agenda. The SNA (EC et al. 2009), on which the CWON is based, was originally designed for short-term policy concerns around national income and employment, with much less attention to assets, and much of macroeconomics has developed around the information provided by the SNA. Recent work by Dasgupta (2021), Hoekstra (2019), and the Organisation for Economic Co-operation and Development (OECD) (Stiglitz, Fitoussi, and Durand 2018), as well as work led by Diane Coyle of the Wealth Economy Project,<sup>6</sup> provides a clear explanation of why national accounts and macroeconomics have not fully integrated the asset side of national economies, especially natural capital.

With substantial progress in measurement, CWON 2021 now turns to using wealth accounts to meet policy needs. CWON 2021 begins that journey by applying the lens of wealth to analysis of important economic challenges. Key among those challenges is the management of assets under risk and uncertainty. Unlike GDP and national income accounts, which are backward looking, wealth accounts are essentially an attempt to peer into the future. By SNA and SEEA standards, the concept of asset value is the discounted flow of expected, future economic benefits to the owner. As fraught with uncertainty as the effort is, some prognostication about the future cannot be avoided. Households must make decisions about investments in education, health, marriage, jobs, child-rearing, and purchases of homes and cars. The private sector faces this challenge every day in its investment decisions, as do governments.

Climate change and, more recently, the COVID-19 pandemic loom as huge potential challenges to the productive value of all assets. These include physical risks to assets and transition risks from changes in policy, technology, working arrangements, and consumer preferences.<sup>7</sup> Sea level rise and increasingly intense storms may make vast areas of coastal settlements uninhabitable; extensive droughts and fires destroy assets, and changing weather patterns may greatly reduce the productivity of agricultural land in some places while increasing it in others; and fossil fuel deposits and the capital stocks (produced and human) that use them may lose their potential to generate income much earlier than expected. But the effects in a particular country and time are uncertain because the transition to a low-carbon economy could take many different paths that are yet to be chosen by different people.



In a recent report from the Bank for International Settlements (Bolton et al. 2020), some of the potential impacts of climate change are described as “green swans”: events that (1) are rare and unexpected, hence outside regular expectations; (2) have the potential for extreme or wide-ranging impacts; and (3) can be explained only after the fact, not on the basis of past experience and probability distributions. The recent coronavirus pandemic illustrates that green swans are not limited to climate change effects.

What is the meaning of wealth accounts—the future value of assets—in such an uncertain world? To start to understand how such risks might affect wealth, CWON 2021 introduces a new component to the selected assets: estimates of value under scenarios of the potential impacts of climate change and, for human capital, the impact of the COVID-19 pandemic. CWON 2021 begins with baseline asset values, called *core accounts*, that are estimated under a fairly conservative approach that does not assume great change from the present.<sup>8</sup> This is not because the analysis assumes that the future will be like the past but because there is such great uncertainty and high variability among the global models of climate change and other events—thus, it is not useful to choose only one possible outcome. The core accounts provide a baseline that is not tied to any one projection of future impacts. This approach is consistent with the SNA, where a single figure for GDP is reported and a single figure for a country’s net worth is reported, which can then be used for a wide range of scenario analyses.

When uncertainty is deep, meaning that the probability distribution of future critical external events and tipping points cannot be determined or agreed upon, it is helpful to navigate the plausible futures with a range of exploratory scenarios, or foresights, rather than a single rigid forecast of expected value. Against the CWON baseline based on highly simplified assumptions grounded in SNA and SEEA guidelines, asset values are simulated under a range of scenarios about the future, for comparison with the core accounts. This approach is not intended to argue that any one estimate is correct but rather to demonstrate how vulnerable various assets and national wealth may be under alternative and plausible versions of the future. The approach provides foresight, rather than forecast, into the future to inform prudent asset management decisions under uncertainty.

## Role of Policies and Institutions in Creating Value for Natural Capital

Country policies, institutions, property rights, governance, and even what has been called social capital can influence how efficiently productive capital is used, the returns generated, and hence the value of an asset. These factors can vary over time within a country or across countries, even for an asset that is physically identical.

Prevailing market institutions and policies may distort the price that buyers and sellers face in markets, failing to inform users about the true value of an asset. Policy and market failures create a wedge between the true value and the price that is visible to economic agents. The resulting

price incentive can result in overharvesting or degrading an asset. While all assets can be subject to these market failures, it is a particularly serious problem for natural capital, especially when ecosystem services are not priced at all and externalities—positive or negative impacts not felt by the parties to a transaction—exist, such as the damages from carbon emissions or the benefits of renewable energy that reduces carbon emissions. Many ecosystems and the services that underpin and embed all other assets go systematically undervalued, and, as a result, ecosystems are mismanaged.

Furthermore, many natural systems, such as the atmosphere or open oceans, do not have “owners” and property rights assigned. Therefore, their governance is subject to the “tragedy of the commons” (Hardin 1968; Ostrom 1990). Many negative impacts on markets are visible only long after the critical ecosystems degrade, making them subject to the “tragedy of the horizon” as well (Carney 2015). These three market failures explain in economic terms why countries need adequate policy intervention to evoke value from nature and manage natural capital sustainably.

The good news is that, over the past several decades, this problem has been recognized and tools for more accurately pricing or otherwise rewarding ecosystem services have been developed. Some of the chapters in this volume apply information from the wealth accounts for policy analysis to help countries unleash value creation from renewable natural capital, such as fisheries and renewable energy, and manage the risks of excessive dependence on nonrenewable natural capital.

## Roadmap for the Report

This report is divided into four parts. The first part reviews overall trends in wealth accounts over the past 24 years, focusing on how those trends may have changed since CWON 2018, and introduces wealth in purchasing power parities (PPPs). The second part describes the new work on renewable natural capital and human capital, focusing on trends in human capital and potential impacts of the COVID-19 pandemic as well as on air pollution. The third part discusses several applications of wealth accounting to policy. The fourth part discusses new developments to increase the coverage of wealth accounts for important assets that are currently missing.

### Part I. Global, Regional, and Country Trends in Wealth, 1995–2018

The main goal of the report’s first part is to broaden the measures used to assess economic progress by providing forward-looking indicators based on wealth, which is defined to encompass most productive assets. Chapter 2 begins with a detailed explanation of wealth accounting. Chapter 3 provides the big picture, showing broad trends in wealth at the global level over the past two decades and progress toward convergence among income groups. The chapter explores how the volume and composition of wealth have changed over time for different income groups and takes a closer look at wealth in low- and middle-income countries by geographic region.

The chapter explores in depth the reasons some countries have failed to significantly increase their per capita wealth over the past 24 years.

Chapter 4 looks more closely at the unequal distribution of wealth across countries, using PPPs instead of market exchange rates. Market exchange rates have limitations for understanding how material well-being varies across countries, because one US dollar can purchase different amounts of goods and services across countries. To adjust for this and provide a better understanding of comparative material well-being across countries, the International Comparison Program estimates PPPs for broad categories of goods and services, which the chapter applies to the wealth accounts. In 2018, the OECD's market exchange rate-based total wealth per capita was 58 times greater than the low-income average—a vast difference. Although it is still large, the gap narrows to 21 times when valued in PPPs.

## **Part II. Measuring Comprehensive Wealth: New Work on Natural Capital and Human Capital**

The second part provides a more detailed discussion of trends in specific assets, including assessment of risk under different climate change scenarios. The information presented here leads to a deeper understanding of comprehensive wealth and provides a resource that can be used for many kinds of analysis. Part II begins with two chapters on renewable natural capital and then addresses human capital.

Chapter 5 reviews land accounts for agriculture, forests, and protected areas. The chapter reports on new work on agricultural land and forests. Through spatially explicit modeling, estimates of cropland value are provided based on three regional and country factors that affect yields: technological improvements, climate change, and land degradation. New work on forest ecosystem services, based on the SEEA Experimental Ecosystem Accounts, builds wealth accounts from spatially disaggregated data for three ecosystem services: water services, recreation services, and nonwood forest products. It is now possible to analyze how the provision of each of these services has changed over time, with changes in the extent and condition of forest land.

Chapter 6 fills one of the CWON's major data gaps: blue natural capital. Blue natural capital in CWON 2021 includes accounts for mangroves and marine fisheries; future work will include additional components such as offshore renewable energy. Mangroves are valued for their coastal protection service.<sup>9</sup> The fisheries accounts build on work introduced in CWON 2018, examining the influence of subsidies on fisheries' asset value and the potential impacts of climate change on asset value under alternative scenarios.

CWON 2018 introduced human capital accounts for the first time, measured as the expected value of future lifetime earnings (Lange, Wodon, and Carey 2018).<sup>10</sup> It showed that the accumulation of human capital has been a key factor in economic growth, sustainable development, and poverty reduction. Chapter 7 examines trends in human capital accounts by country and gender and includes a discussion of human capital in the

informal sector. Preliminary estimates of the effects of the COVID-19 pandemic on human capital are based on the likely impact of the massive economic downturn on wage growth rates, which would permanently lower the trajectory of wage growth and future income. CWON 2021 covers only the period to 2018; the long-term impacts of COVID-19 have not yet been felt or fully understood. These accounts stand as a pre-COVID-19 benchmark for the next edition of the CWON.

Chapter 8 estimates the impact of air pollution exposure on human capital through premature deaths, using data from the Institute for Health Metrics and Evaluation. As a leading health risk, air pollution represents a loss of human capital and national wealth. This annual cost is captured implicitly in the annual survival rates used to calculate human capital. The chapter makes that portion of mortality explicit to measure the loss of human capital resulting from exposure to air pollution from 1995 to 2018. Premature deaths declined over the period but still remain high in some countries.

### Part III. Applying Wealth Accounts for Policy Analysis

An important benefit of comprehensive wealth accounts is for guiding public policy. By shedding light on different components of wealth, as well as their evolution over time, policy makers can evaluate the sustainability of economic growth and understand how to manage assets and build wealth for the future.

Nonrenewable natural capital is discussed in chapter 9. The chapter presents trends in nonrenewables such as oil, gas, and mineral wealth. For the first time in the CWON, new decomposition analysis allows decomposing changes in wealth by their contributing factors. For example, where nonrenewable wealth has decreased, the analysis reveals the extent to which this was driven by physical depletion, lower prices, higher costs, or other factors. The chapter also explores the danger of dependence on nonrenewable natural capital for development. In earlier times, such dependence was a successful strategy for increasing wealth and national income in some countries, and nonrenewable wealth grew fairly consistently from 1995 to 2014. However, global prices for fossil fuels have declined precipitously since 2014 and have not fully recovered. The broad economic downturn resulting from the COVID-19 pandemic and the potential for declining demand for fossil fuels in the future puts at risk the development of many countries that are heavily dependent on nonrenewables.

Chapter 10 explores the potential implications of climate and trade policy scenarios and the global low-carbon transition for national subsoil energy wealth. Many countries are rich in and dependent on fossil fuel wealth. However, international efforts to meet the goals of the Paris Agreement may significantly reduce the economic benefits that these countries expect from their fossil fuel assets. A transition away from fossil fuel consumption—whether policy or technology induced—may have serious implications for certain countries. The value of their subsoil energy wealth may decline precipitously in the coming decades. The risk to individual countries and fuels varies depending on when and how the low-carbon transition unveils. The chapter provides simulations of how

different scenarios of cooperative and unilateral climate policies and broader carbon adjustments might affect national subsoil energy wealth.

Chapter 11 applies the CWON accounts to macroeconomic and fiscal management questions. The chapter illustrates how conventional measures of fiscal sustainability overlook important wealth considerations, such as the depletion and degradation of natural capital. If it is not offset by accumulation of other assets, economic growth driven by resource depletion is fundamentally unsustainable. The chapter provides a guide for policy makers to make better use of wealth accounts.

Chapter 12 explores the linkages between nonrenewable natural capital and human capital. Nonrenewable natural capital can create distortions in the economy, such as the Dutch disease. This in turn can impact the accumulation and distribution of human capital in the economy. A better understanding of these linkages can help policy makers to mitigate the distortionary effects and ensure greater wealth sustainability.

Chapter 13 explores the usefulness of comprehensive wealth accounts for finance and the financial sector. Growing interest in environmental, social, and governance aspects of financing, as well as innovative financial instruments such as green bonds, has increased attention on country performance in a wider range of measures beyond GDP. The chapter explores the value of comprehensive wealth accounts and, in particular, measures around the sustainable management of renewable natural capital that investors and the financial sector can use.

#### **Part IV. New Developments in Measuring Wealth**

The fourth part reports on two new developments, which were poorly measured in the past or not measured at all, and the prospects for including them in future work on wealth accounts: renewable energy and social capital.

Chapter 14 proposes the first experimental effort to develop renewable energy asset values for the CWON. It develops an SNA-consistent methodology that includes hydroelectricity, solar, and wind electricity assets in the national balance sheets. The chapter demonstrates the proof of this concept by estimating values for the renewable energy assets of 15 countries. The results show that leaving renewable energy assets off national balance sheets misses a great deal of wealth. The chapter also identifies methodological issues to address before considering inclusion of renewable energy assets in the core CWON natural capital accounts. The trends in the values of renewable energy assets are compared with the trends in the values of fossil fuel wealth for selected countries. Lastly, the chapter presents simulations of the future values of renewable energy assets under alternative climate and energy policies.

Chapter 15 discusses the concept of social capital and its impact on nations' wealth and prosperity. It provides an overview of conceptual approaches to social capital and its definitions. It also discusses measurement challenges and applications in policy making. The chapter provides recommendations for the role of social capital in the national accounting framework and future editions of the CWON.

## Summing Up and Future Research

The goal of CWON 2021 is to advance the important tasks of measuring wealth to assess sustainability, applying wealth accounts to policy, and addressing some of the most urgent global issues. With 24 years of wealth accounts covering 146 countries and 22 classes of natural capital assets, human capital, and produced capital, CWON 2021 provides a great source of information that the World Bank hopes will be widely used in the coming years. To promote this broad analytical endeavor, an online platform has been developed that will make the wealth accounts and much of the underlying data publicly available.

This report contains model simulations of the future value of selected assets, complementing the accounting approach of the CWON core accounts. The goal is not to predict future asset values but to inform decision-making under uncertainty. Uncertainty is represented by the set of exploratory scenarios built from several plausible combinations of potential external impacts and policy choices. This approach can be interpreted as the simplest way to represent deep uncertainty, where the probability of events affecting future wealth is unknowable or cannot be agreed on by stakeholders. Constructing a wide range of future scenarios provides an opportunity to identify policy and investment choices that make wealth portfolios resilient or vulnerable under a range of plausible but unpredictable external shocks (green swan events) as well as endogenous choices that may be made by future decision-makers.

The report demonstrates how comprehensive wealth accounts provide a valuable tool for economic analysis and diagnostic exercises. By tracing the distribution and evolution of different categories of wealth in a country, economists can better understand the sustainability of growth and the structural changes in the economy. Chapter 11 provides examples and guidance to World Bank country economists on how they might use the wealth accounts for Systematic Country Diagnostic reports and Country Economic Memorandum exercises and provides a blueprint for how others might use the wealth accounts as well. Furthermore, the chapter examines measures from the wealth accounts that can supplement traditional macroeconomic indicators for understanding the sustainability of economic development and public finances.

The wealth accounting approach allows for a better appreciation of the components of wealth, that is, a better reflection of natural capital's contributions to wealth, which GDP is too narrow to demonstrate. Individual components of the wealth accounting approach are already widely used. For example, information about mineral accounts from the previous editions of the CWON has been used in more than 100 published articles analyzing a wide range of topics, particularly on natural capital and economic growth.<sup>11</sup>

Much work remains to be done, however. On the measurement side, the chapters in part IV show where it is feasible to expand coverage to meet the goal of *comprehensive* wealth accounts: renewable energy and social capital as well as biodiversity and carbon accounts. These advances are somewhat different in nature. Adding renewable energy and water to

the core CWON accounts can be done, depending on data availability. This report provides a proof of concept that renewable energy can be part of the national balance sheets and develops experimental renewable energy accounts for a sample of countries. Although there are a lot of data for carbon, there is not yet agreement about how to account for carbon in the SEEA; the complexities of this issue are discussed in annex 1A, at the end of this chapter. Biodiversity and social capital are what Dasgupta (2021) refers to as enabling characteristics of assets, a quality that gives value to other assets. Social capital will not be part of the core monetary accounts, but it will provide an essential, complementary indicator to the change in wealth per capita to assess development. Further analytical work may illuminate how social capital adds value.

As social capital is brought into the broad sustainability framework to complement monetary measures of sustainability, there is also a need to address biodiversity and *critical* natural capital: renewable natural capital where losses and degradation have brought ecosystems to potentially irreversible thresholds that may precipitate catastrophic events. As noted in earlier editions of the CWON, changes in wealth per capita provide only a measure of “weak” sustainability that implicitly assumes a high degree of substitutability among different kinds of assets. The emergence of multiple global crises, such as biodiversity loss, climate change, or ocean pollution, is a strong wake-up call about the limits to replacing several critical ecosystem services with human-made substitutes. Within countries, the mix of wealth can make a difference for development prospects and exposure to various risks, and the interaction between and among various components of wealth may be crucial.<sup>12</sup>

There have been great improvements in measuring ecosystem conditions and services, based on rapid advances in remote sensing and the ability to interpret such data through integrated assessment models. But identifying and quantifying potential tipping points in the context of national wealth accounts still remains highly uncertain. To date, the CWON accounts have reported measures of wealth at the national and annual levels. However, improvements in data, including via remote sensing methods, have opened possibilities for greater spatial and temporal measurement of wealth. Future editions of the CWON may explore increased spatial and temporal granularity to meet the needs of different stakeholders and improve the targeting of policy interventions for sustainable wealth management.

There are limitations in the estimates of produced capital and human capital that may be addressed in future editions. It would be useful to disaggregate produced capital by public and private sector, and the International Monetary Fund has done some estimates that could be incorporated into future editions of the CWON (IMF 2019). Produced capital is measured as the sum of investment minus normal depreciation. The lack of adjustment of produced capital stocks for losses caused by catastrophic events was noted earlier, and efforts to incorporate them would make the accounts more useful. A recent study by the UK Office for National Statistics finds that the normal depreciation rates that have been in use for many years do not reflect current depreciation and suggests

revision (ONS 2019). Others have called for a review of what should be considered normal depreciation rates, in light of the impact of climate change, the “new normal.”

Obsolescence of capital is another issue that is not addressed in global databases on produced capital. The shift to home-based work in response to the COVID-19 pandemic is an extreme example of rapid obsolescence. This shift resulted in the obsolescence of many business assets (offices and equipment, buildings, and transportation capital), partly offset by an increase in household office durables and private sector expansion of communications and information technology–related capital goods to support home-based work. These changes will be difficult to quantify in the near future.

Human capital accounts are limited to what is defined as economically productive activity in the SNA. It captures the contributions of health and education but excludes much of the unpaid work done in households. Household work to produce goods, such as growing food for own use, is included in the SNA, but the provision of services such as childcare, food preparation, and other services is not. The implications of the transfer of human capital through permanent or temporary migration is another area of great concern and not directly measured by the core accounts.

Several broader policy issues remain for the next edition of the CWON. Although the current edition of the CWON considers the impacts of climate change on asset value, it does not include carbon sequestration as an asset. Discussion of this in CWON 2011 identified challenges associated with including carbon sequestration in the core accounts, and this will be addressed in the next edition of the CWON.

Including the asset values of natural capital acting as carbon sinks or subtracting from national wealth the cost of carbon emissions presents challenges for the SNA and SEEA approach at present. This is due to the absence of widely applied carbon prices, as well as the lack of national and international frameworks for valuing carbon storage. Similarly, much of the value of biodiversity and critical natural capital is not amenable to a wealth accounting approach at this time, because of the absence of clear market valuation for such vital natural phenomena. In this absence, despite the importance of these issues, they cannot readily be put on the balance sheet, for example as an income-generating asset. It is hoped that policy progress on biodiversity, climate change, and valuing nature, at the national and international levels, will help advance these topics, and that in the future it will be feasible to measure their contributions to national wealth.

A global push for greater inclusivity to remedy the extreme inequality in the distribution of income and wealth is a major issue. Data are available for better understanding the distribution of human capital between genders, but not for other assets. While the CWON is able to quantify the distribution of wealth among countries, the data are not available for extending that to the distribution and inequality within nations.

An intriguing issue for the CWON is the aftermath of the COVID-19 pandemic, which has left countries with unprecedented levels of debt



liabilities. This has led to a call for greater transparency and a greater focus on national debt and its long-term economic impacts. This may be an avenue for broadening interest in comprehensive wealth, balancing government debt against all government assets, including natural capital, as well as the nation's assets and liabilities.

To conclude, this edition of the CWON describes some of the main findings emerging from the new wealth accounts. The analysis and the abundance of data—which will become available online—should generate new questions about development, the dynamics of how countries accumulate wealth, and how to promote efficient and equitable use of wealth. Sustainability into the 21st century will depend not only on the assets base but also on the strength of institutions and governance and the integrity of natural capital. This new CWON sets the stage for addressing these issues in an integrated manner. The hope is that it will help generate new research and insights for policy.

## Annex 1A: Treatment of Carbon Accounting in the SEEA Ecosystem Accounts

### Global Climate Regulation Service in the System of Environmental-Economic Accounting Ecosystem Accounts

The System of Environmental-Economic Accounting (SEEA) Ecosystem Accounting Accounts (UN 2021, chap. 6.4.3) recommends considering global climate regulation services (in the case of carbon) as a single service consisting of two components: a carbon retention component and a carbon sequestration component. This distinction reflects the role of ecosystems in terms of storing carbon over a long time, thereby avoiding its release, as well as removing carbon from the atmosphere. The SEEA Ecosystem Accounts provide the general approach; more specific guidelines on biophysical modeling and valuation of climate regulation services are expected to be released later in 2021 or in 2022.

#### One Service, Two Components

Measuring the carbon retention component consists of (1) estimating carbon stocks of relevant carbon pools at the beginning of the accounting period, (2) valuing these stocks using a suitable carbon price, and (3) deriving an annual service flow by multiplying this value by a suitable rate of return (to create a perpetual annuity). The scope of measurement of a carbon retention service is in principle limited to terrestrial ecosystem assets (excluding geocarbon stored in subsoil assets such as oil and gas) and restricted to what the Intergovernmental Panel on Climate Change calls *long-lived biomass* (excluding carbon stored in aboveground biomass in cropland). The carbon sequestration component is measured using the net ecosystem carbon balance, taking into account all changes in carbon stocks (for example, changes resulting from respiration, timber harvest, or forest fires) and can be valued by multiplying these changes by a suitable carbon price.

The use of two components recognizes that countries face very different circumstances in terms of the dynamics of changes in carbon stocks, with some experiencing slow changes and others undergoing large changes resulting from changes in land use or as a result of fires. These differences are reflected in the range of policy instruments that exist. Some focus on reducing and/or avoiding emissions: for example, reducing emissions from deforestation and forest degradation in developing countries and avoiding emissions through conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries (REDD+). Others focus on stimulating carbon uptake (for example, mechanisms developed under article 6 of the Paris Agreement).

In contexts where carbon stocks are declining, for example, because of timber harvesting or land-use changes, the retention component ensures that the accounts reflect carbon losses in terms of a decrease in retention services provided. In turn, this may be reflected in a measure of ecosystem degradation in the monetary ecosystem asset account. Ecosystems with high carbon stocks (for example, tropical rain forests) provide relatively high retention values (although often they have low sequestration, as they are in equilibrium), signaling that they are worth preserving.

### Pricing Carbon

The approach allows the use of different prices for the two components of the service. In the case of carbon retention, it is recommended to apply a social cost of carbon (SCC), as this aligns with the framing of avoided damages. When choosing a SCC, it is important that it is derived from models that are consistent with the exchange value concept that is the basis of the System of National Accounts,<sup>13</sup> that is, limited to assessment of the effects on measures of output. For the carbon sequestration component, the recommendation is to use suitable carbon market prices where they are available.

### Examples

NSO India (2021) estimated the carbon retention provided by India's forests for two consecutive periods (2015–16 and 2017–18). It first estimated the total carbon stock consisting of aboveground biomass, belowground biomass, dead wood, and litter, as well as soil organic carbon, using data from the Forest Survey of India. This physical stock estimate was valued using a country-specific social cost of carbon. Finally, the avoided damage value was turned into an annuity by using a 3 percent rate of return. It was found that the annual retention service provided to the world was equivalent to 2–3 percent of India's gross domestic product, and more than twice as large as the gross value added of its forestry sector. The state-wise estimates of the value of carbon retention are presented in table 1A.1.

Turpie et al. (2021) value and map carbon retention in KwaZulu-Natal province, in South Africa, using an SCC approach. The study contains a sensitivity analysis of the portion of damages that would impact the province, as well as the value in case of global damages. ONS (2019) values carbon sequestration using the United Kingdom's prescribed carbon price.

**TABLE 1A.1** State-wise Value of Forest Carbon Retention Services in India, 2017–18

State/union territory	Carbon retention service (Rs/ha/year)
Andhra Pradesh	8,291
Assam	21,197
Bihar	3,610
Chhattisgarh	21,863
Delhi	5,130
Goa	42,125
Gujarat	3,363
Haryana	1,457
Himachal Pradesh	27,898
Jharkhand	13,744
Karnataka	12,315
Kerala	33,735
Madhya Pradesh	11,755
Maharashtra	8,811
Manipur	49,266
Meghalaya	49,658
Mizoram	45,706
Nagaland	50,311
Odisha	17,087
Punjab	1,631
Rajasthan	1,949
Sikkim	49,594
Tamil Nadu	10,258
Telangana	8,338
Tripura	44,640
Uttar Pradesh	2,955
Uttarakhand	42,683
West Bengal	10,243
Andaman and Nicobar Islands <sup>a</sup>	84,060
Chandigarh <sup>a</sup>	10,404
Dadra and Nagar Haveli <sup>a</sup>	22,563
Daman and Diu <sup>a</sup>	8,428
Lakshadweep <sup>a</sup>	48,416
Puducherry <sup>a</sup>	5,062
Other territories (average)	44,036

Sources: MoSPI 2020; NSO India 2021.

Note: ha = hectare; Rs = Indian rupees.

a. Union territory.

## Notes

1. The calculation of net domestic product or net national income deducts depreciation of fixed capital, but GDP does not.
2. The terms *wealth* and *balance sheet* are used interchangeably. And note that publicly traded extractive firms are increasingly required by international stock exchanges to include the estimated value of their natural resources and reserves, the natural capital component of their balance sheet.
3. Previous editions of the CWON classified assets into four classes, but here natural capital is divided into renewables and nonrenewables because they differ greatly in terms of management for development.
4. Urban land is a nonproduced asset in the SNA, but here it is separated from other nonproduced assets (natural capital) to focus on the other forms of natural capital.
5. Domestic financial assets do not add to national wealth because “assets plus liabilities” sum to zero. It would be quite useful to have such information, but the data are not readily available for many countries.
6. The Wealth Economy Project is located at the Bennett Institute for Public Policy, University of Cambridge, UK, <https://www.bennettinstitute.cam.ac.uk/research/research-projects/wealth-economy-social-and-natural-capital>.
7. In the rest of the text, climate change risks are meant to cover physical risks and policy transition risks unless otherwise noted.
8. This is the approach generally recommended by statisticians for the SNA and SEEA when the factors determining future values are not known.
9. Mangrove timber and nontimber products, which are typically much smaller in value than coastal protection services, are already included under the forest accounts.
10. Other, nonmonetary approaches to human capital are discussed in chapter 7.
11. G. Davis, Colorado School of Mines, personal communication, January 15, 2021.
12. Johnson et al. (2021) provide estimates of country vulnerability to ecosystem collapse.
13. Exchange values are the values at which goods, services, labor, or assets are exchanged or could be exchanged for cash (SNA 2008, para. 3.118).

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