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How Wealth Is Measured: Basic Approach and New Developments

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Main Messages

- Wealth accounts are built on the concepts and methods laid out in the System of National Accounts (SNA) and the System of Environmental-Economic Accounting (SEEA).
- Wealth accounts measure the financial value of the stock of assets available for production and consumption; they do not measure broad human welfare.
- Wealth accounts provide an indicator of sustainability, the change in wealth per capita, which is necessary but not sufficient on its own to assess sustainability. Complementary indicators for social capital and critical natural capital are needed to cover all the components of sustainability: economic, social, and environmental.

How Wealth Is Measured

Like gross domestic product (GDP), wealth accounts are intended to estimate the financial worth of assets, which is critical for economic management, but not broad human well-being. Also like GDP, which is often criticized for not representing well-being, wealth accounts may be expected to provide more than intended. This chapter takes a closer look at how wealth is measured, the factors that contribute to a change in wealth per capita over time, and some of the issues that are critical for a correct interpretation of the wealth accounts. The purpose is to make clear what wealth includes and what it does not, how it can be used, and inappropriate uses of wealth.

Wealth accounts are grounded in the framework of the SNA 2008 (EC et al. 2009). The SNA measure of wealth is much narrower than what is presented here because the SNA asset boundary includes only produced assets, natural resource assets, and net foreign assets. The SEEA Central Framework (UN et al. 2014a) and SEEA Ecosystem Accounting (UN 2021; UN et al. 2014b) expand the SNA to develop the methodology for natural capital accounts. Although there has been experimentation with human capital, it is not yet part of the SNA national balance sheet. This edition of *The Changing Wealth of Nations* (CWON) estimates wealth data for 146 countries from 1995 to 2018.[1] The wealth estimates are provided according to five asset classes (see figure 1.1, in chapter 1):[2] produced capital and urban land, nonrenewable natural capital, renewable natural capital, human capital, and net foreign assets.

For some assets, such as produced capital and net foreign assets, the asset values used in this report are directly available from other sources. The values of other assets are estimated using data collected from a wide range of global sources, as described in appendix A. Given the need to harmonize data across countries, the wealth accounts for any country are unlikely to be as accurate as the accounts that the country might construct itself using its own, more accurate and comprehensive data sources. Here, the value addition lies in the provision of comparable measures of wealth for many countries, with countries included when data for the core set of assets are available or can be reasonably estimated. That said, chapter 10 explores the potential impacts of policies to support a low-carbon energy transition on national wealth. This effort sits at the intersection of accounting and analysis; it is useful, not only for the specific results it generates, but also as a demonstration of how to undertake a more detailed assessment of wealth and how it may change.

The construction of the wealth accounts is guided by the concepts and methods of the SNA. Although values for produced capital and net foreign assets are generally derived from widely used methods based on observed transactions for these assets, the value of many natural capital assets and human capital must be estimated. The approach to asset valuation is based on the concept that the value of an asset should equal the discounted stream of expected (net) earnings (for example, resource rents or wages) that it earns over its lifetime. This in turn depends on the ability to measure the earnings stream. For those features of the economy that do not generate explicit rents or income—such as with forest ecosystem services such as watershed protection—this must be derived, or it may fall outside the current SNA boundaries, so that it is not possible to place a monetary value on it. Such is the case with carbon dioxide emissions, natural carbon sinks, or the important roles played by biodiversity, critical natural capital, or clean air.

For natural capital, the practical recommendations of the SEEA are used as a guide (UN 2021; UN et al. 2014a, 2014b). The SEEA is an extension of the SNA, using consistent concepts and structure and providing the basis for the estimates of the value of natural capital. Several

key simplifying assumptions are made for valuing natural capital in the CWON's core accounts. Although these assumptions are often replaced in estimates undertaken by countries themselves, where access to country-specific data may be available, they are necessary for a consistent data set for many countries over many years, when such information is lacking.

- *Future value of resource rent or ecosystem service*: the CWON core accounts typically assume that the rent remains constant in the future and do not include projections of future rents.
- *Lifetime of the asset*: if assets are being depleted (nonrenewables) or overharvested (renewables), the lifetime is given by the time to depletion, assuming constant levels of extraction. For renewable resources, a maximum lifetime of 100 years is used, drawing on guidance from the United Kingdom's natural capital accounting work (ONS 2020).
- *Discount rate*: a 4 percent discount rate is used for all assets. This rate was used in all the previous editions of the CWON and is further explained in World Bank (2006). Discounting is consistent with a financial approach to asset valuation, but it has been controversial and subject to a great deal of discussion. (See, for example, Stern 2006.)

No international statistical standard yet exists for human capital, but there has been a great deal of experimental work on this topic based on the Jorgenson-Fraumeni approach, including work by national statistical offices and the Organisation for Economic Co-operation and Development (OECD). To maintain consistency with the SNA, human capital estimates are restricted to earnings that are recorded in the SNA or that can be reasonably derived from data in a country's SNA. While the SNA includes unpaid household production of some goods, it excludes the production by households of services for final consumption within the household, such as family care, meal preparation, or home repairs. Women provide a disproportionate share of this unpaid work. Because these services are excluded from the SNA, the value of human capital to produce these services is also excluded from the human capital estimates provided in this report.

Comprehensive wealth is measured at market exchange rates in constant 2018 US dollars. Valuing wealth accounts using purchasing power parities (PPPs) provides a better understanding of the comparative material well-being derived from assets across countries, just as GDP can be measured using market exchange rates and PPPs. This important application is explored further in chapter 4.

How Wealth Changes over Time

Multiple factors contribute to changes, positive and negative, in wealth per capita, the indicator of sustainability (table 2.1). Although some of these factors may be obvious, others are less so because they may influence value in an indirect way. For example, reducing the level of

TABLE 2.1 Factors That Change Wealth over Time

	Wealth per capita, beginning of period	
Factor	**Minus**	**Plus**
Produced capital	Normal depreciation Not included: catastrophic losses from natural disasters or civil conflicts, obsolescence	Investment in produced capital: buildings, structures, machinery, intellectual property
Nonrenewable natural capital	Extraction Other reductions in proven reserves and production volume Decrease in unit rent due to • Lower market price • Higher production costs Extended extraction path Not included: the impact of changes in future prices and policies, because these are unknown	Increase in proven reserves and production; increase in unit rent due to • Higher price • Lower production costs Accelerated extraction path Not included: the impact of changes in future prices and policies, because these are unknown
Renewable natural capital	Extraction greater than natural regeneration Degradation Decrease in unit rent due to • Lower market price • Higher production costs Not included: the impact of changes in future prices and policies, because these are unknown	Increase in harvestable extent, improved condition, increase in unit rent due to • Higher price and/or unit value • Lower production costs and/or improved efficiency Not included: the impact of changes in future prices and policies, because these are unknown
Human capital	Decline and/or aging of the labor force, declining wage rates, decline in education Changing wage growth trajectory due to economic shocks such as COVID-19 Not included: loss of human capital from missed schooling and health damages from COVID-19 Loss of human capital via migration	Growth of the labor force through growth of the domestic population, increased labor force participation, or migration (gain to one country, loss to another) Increasing wage rates; increasing education
Net foreign assets	Foreign liabilities	Foreign assets
Population change	Mortality Out-migration	Births Immigration
	Wealth per capita, end of period	

Source: World Bank.

extraction of minerals extends the lifetime of a resource and pushes the delivery of rents further into the future, which reduces the value of the asset because future rents are discounted. In addition, there are often interaction effects among the factors. For example, the asset value of mangroves has increased over time although the extent of mangrove coverage has markedly declined. This has occurred because in many countries the unit value increased sufficiently to offset the decline in physical extent over the same period. The unit value is measured as damages prevented to produced capital, and produced capital has grown substantially, which caused the unit value of a hectare of mangroves to increase. Decomposition analysis is applied for the first time in CWON 2021 for better understanding the drivers of change; the analysis is discussed in chapter 9.

What Is Missing from the Wealth Accounts?

Losses due to catastrophic events, mainly natural disasters and civil conflicts, in produced capital and renewable natural capital such as cropland and forests are not included in the CWON core accounts. Such losses have become frequent and especially severe for low- and middle-income countries and are projected to increase under climate change. However, there is no global database of these losses that is consistent with SNA produced capital.[3] A few countries, such as Japan and the United States, include such losses in their national balance sheets when damages reach a specified threshold. But most countries do not even compile balance sheets and, if they do, do not include catastrophic events.[4]

Not all assets are yet included in the CWON 2021 database. Assets are included in the core database only when the necessary data (1) become available for a large number of countries (at least 100), (2) are updated regularly to provide a time series, and (3) are publicly available. Each edition of the CWON discusses selected assets that cannot yet be included in the core wealth accounts and provides a roadmap for their future inclusion. CWON 2018 proposed a way forward for marine fisheries, forest ecosystem services, and the impact of air pollution on human capital. All three of these are included in CWON 2021. Biodiversity remains a major omission, but there is controversy over whether it is a productive asset itself or what Dasgupta (2021) refers to as an enabling asset, something that supports the efficient functioning of other assets.

Similarly, not all countries are included in CWON 2021. For some countries, the missing data gap is too great to be filled reasonably. Many of the Small Island Developing States are absent for this reason, which is a particular challenge in introducing blue natural capital for marine assets.

Changes in CWON 2021 Core Accounts and Impact on Wealth Estimates

The World Bank has established the CWON as a regular publication that will be updated repeatedly. Major changes in the coverage or methodology for the core accounts are always applied backward to 1995 for a consistent time series, so the most recent edition is not strictly comparable to those published earlier. Although CWON 2021 takes the same overall approach to wealth accounts as previous editions, it differs from CWON 2018 in several important ways: (1) additional accounts for renewable natural capital, (2) improved methodology for natural capital (renewable and nonrenewable) and human capital, and (3) expanded country coverage. These changes and the impact on the wealth accounts are summarized in table 2.2 and table 2.3. The implications of these changes are discussed in chapter 3 and the relevant subject chapters.

Country coverage has increased from 141 countries to 146, but the distribution across regions and income groups remains fairly similar, although 17 countries changed their income classification. The reclassification of two large countries, Argentina and the Russian Federation, from

TABLE 2.2 Improvements in Data and Methodology for the Core Wealth Accounts

New accounts, updated data and methodology	Impact on new wealth accounts
Blue natural capital. New accounts for marine fisheries and mangroves (coastal protection service)	Increased value of renewable natural capital (and total wealth)
Agricultural land. New region- and country-specific crop yield growth rates: estimated at the grid-cell level, accounting for impacts of soil degradation and climate change	Global agricultural land value lower than previous estimates due to lower global average crop yield growth rate (0.5%) but varies by region
Forest timber. Broadened definition of forest area where timber is harvested	Increased value of forest timber wealth
Forest ecosystem services. Three forest ecosystem services for each country and year from values estimated at the grid-cell level	Increased per hectare value of forest ecosystem services
Minerals. New accounts using mine-level data on production costs for each mineral (S&P Global Market Intelligence); improved accuracy of rent and asset value estimates	Per new data source, much higher production costs and lower rents than earlier estimated, hence, lower mineral wealth
Human capital. Region- and income group–specific wage growth rates replacing previous estimate of 2.46% used for all countries. New rates are higher in low- and middle-income countries in East Asia and Pacific, lower in high-income countries and low-income countries in Africa New data for the Middle East and North Africa's Gulf Cooperation Council countries based on access to survey data for Saudi Arabia	Higher (lower) human capital in countries with higher (lower) wage rate growth than 2.46%

Source: World Bank.

TABLE 2.3 Country and Income Group Coverage: CWON 2018 versus CWON 2021

	Number of countries	
Income group	**CWON 2018**	**CWON 2021**
Low-income	24	24
Lower-middle-income	37	36
Upper-middle-income	36	42
High-income: non-OECD	15	12
High-income: OECD	29	32
Global	**141**	**146**

Source: World Bank.
Note: OECD = Organisation for Economic Co-operation and Development.

high-income non-OECD in 2014 to upper-middle-income in 2018, reduces the already small number of countries in the high-income non-OECD group.

New countries added in CWON 2021:

- Benin
- The Czech Republic
- The Islamic Republic of Iran
- Lesotho
- Trinidad and Tobago

Countries that moved up in income groups from 2014 to 2018:

- *Low- to lower-middle:* Cambodia, the Comoros, and Zimbabwe
- *Lower-middle to upper-middle*: Armenia, Georgia, Guatemala, Guyana, and Sri Lanka
- *Upper-middle to high-income non-OECD*: Panama
- *Joined the OECD*: Latvia and Lithuania

Countries that moved down in income groups from 2014 to 2018:

- *Lower-middle to low-:* Tajikistan and the Republic of Yemen
- *Upper-middle to lower-middle*: Mongolia and Tunisia
- *High-income non-OECD to upper-middle*: Argentina and Russia

Wealth, Adjusted Net Savings, and Sustainability

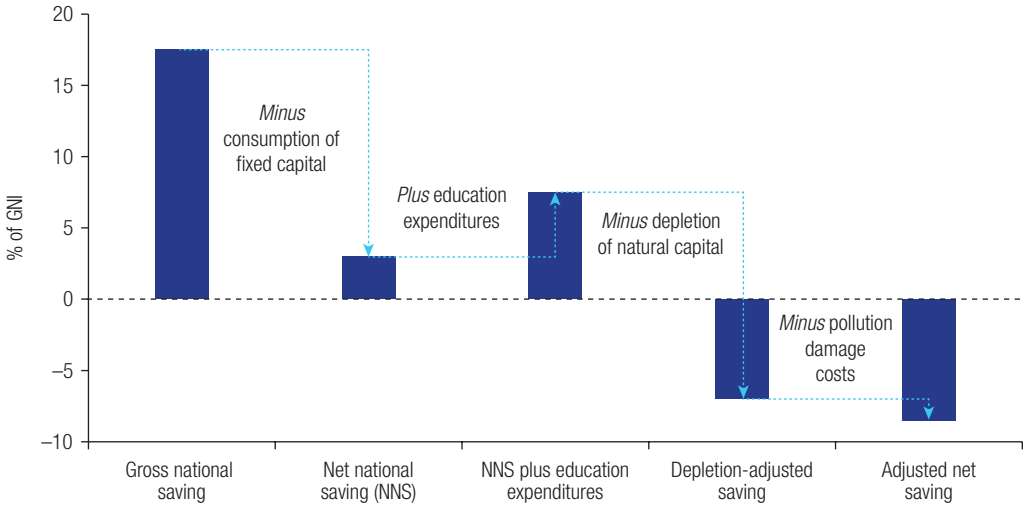
Income measures such as GDP can be understood as the annual production generated by a country's use of its asset base. Said differently, income can be understood as the annual return that a country derives from its wealth. Therefore, the key to increasing economic well-being in the future lies in building national wealth. This, in turn, requires savings to finance this investment, as well as good institutions and governance to make productive use of assets. From a wealth accounting perspective, development can be viewed as a challenge of portfolio management, with countries deciding how much to save or consume each year, what assets to invest in, and how to make the most efficient use of their assets.

In the 1990s, the World Bank introduced the concepts of wealth underpinning national income, and long-term prosperity as dependent on wealth, but it had no widely reported data to monitor wealth at that time. To fill this gap, Hamilton and Clemens (1999) developed an indicator, adjusted net savings (ANS), also known as genuine savings, as a proxy for the change in wealth (but not per capita wealth). In accounting conventions, saving equals investment, but by the same conventions, change in wealth is more than investment, as shown in table 2.1. In the early days of the work on wealth, the ability to compile comprehensive wealth accounts was limited, so a proxy indicator that could be compiled quickly was a great advance. ANS also had the advantage of being easy to understand. However, ANS provides only part of the picture of wealth and how it is changing.

ANS is measured as gross national saving minus depreciation of produced capital, depletion of subsoil assets and timber resources, and air pollution damages to human health, plus a credit for expenditures on education (see figure 2.1). The rule for interpreting ANS is simple: if ANS as a percentage of gross national income is negative, it indicates that the country is consuming more than it is saving, which will undermine long-term sustainability; if ANS is positive, then it is adding to wealth and future economic well-being.

For countries with growing populations or aspirations to higher standards of living, it is not sufficient to maintain wealth; per capita wealth

FIGURE 2.1 Procedure for Estimating Adjusted Net Saving



Source: World Bank.
Note: GNI = gross national income.

must be growing, or at least not declining. Comprehensive wealth accounts show the value of various assets at a point in time and can be used to monitor whether per capita wealth is maintained or increased over time. This is a simple criterion for sustainable, long-term growth. ANS provides a complementary indicator to help in understanding the dynamics that drive the changes in wealth from one period to the next, by capturing some of the important policy-induced dynamics.

Measured annually, ANS provides policy makers immediate feedback about the direction of the economy and possible actions they may need to take to ensure long-term growth. By breaking down its components, it is easy to discuss policy interventions that could improve a nation's ANS, such as increasing the level of gross saving; improving the quality and maintenance of built capital to achieve a longer lifetime and improved resilience to reduce the depreciation of fixed capital; increasing investment in education and innovation to increase human capital; optimizing the use of natural capital (sustainable use of renewables and efficient extraction of nonrenewables); or improving air quality to reduce pollution damage costs.

Although ANS is a very useful concept, it can differ significantly from changes in wealth, as explained in box 2.1. Many factors affecting wealth are not included in ANS because of SNA conventions for saving and investment. This means that it is possible to observe negative (or positive) ANS and an increase (decrease) in wealth, even if this is typically not the case for most countries. Much of the difference between ANS and changes in wealth results from factors that are omitted from the ANS (such as agricultural land and changes in human capital) or treated as exogenous in the SNA and SEEA (such as new discoveries of minerals or increased

BOX 2.1 Savings and Changes in Wealth

In economic theory, investment net of depreciation and depletion equals the change in wealth. However, because of practical data limitations in measuring adjusted net savings (ANS), as well as the System of National Accounts (SNA) accounting definitions for savings and investment, this is not the case for the Changing Wealth of Nations wealth accounts. There may sometimes be a significant gap between ANS and the change in wealth.

Several factors that affect national wealth are currently omitted from ANS because of a lack of data (a weakness that could be corrected in the future). These factors include (1) changes in the extent and value of agricultural land, as well as (2) changes in the present value of earnings for the labor force (the measure of human capital) that need not reflect investments through the public budget in education (the measure used for ANS).

In addition, some factors that affect national wealth are not included in savings and investment according to SNA conventions but are part of changes in wealth. These factors include the following:

- New discoveries of subsoil assets, which are only added to the balance sheet, not ANS
- Some capital gains or losses due to commodity price changes, which are included in wealth accounts when the gross domestic product deflator is used to value an asset in constant prices
- Changes in technology, world prices, and/or management that affect the productivity of an asset, or the volume of resources that are now economically feasible to exploit:
  - Improvements in extraction technology for energy and minerals that can make extraction of previously uneconomic resources feasible, increasing the volume of resources and adding to wealth (However, changes in technology may reduce the demand for other resources: for example, shale gas reducing the demand for and value of coal resources, or cheaper renewable energy sources that may reduce the demand for fossil fuel energy.)
  - Changes in world prices that increase the volume of resources, adding to wealth resources that previously were not profitable to exploit (a separate effect from capital gains/losses)
  - Agricultural land that increases in value if a farmer switches to higher-value crops or changes technology that results in higher yields or simply improves efficiency of management
- Policy changes affecting asset value: for example, trade policy, transport infrastructure, or environmental regulation impacting a country's costs (Education, labor markets, and changes in the business environment may affect the opportunities for human capital and other assets. The effect would show up in higher returns and higher asset values in wealth accounts, but not in ANS.)
- Other exogenous impacts on assets such as civil unrest, natural disasters, or similar events

prudence in the government's fiscal and investment management). Thus, ANS may be observed to be negative although wealth may be increasing. More generally, squandering existing wealth, especially in the case of exhaustible resources that can finance future investment, can never be prudent. Negative ANS often suggests that opportunities to increase future economic well-being may be wasted for short-term gains, because it reflects a level of overall saving that is below the level of natural wealth being depleted.

Measuring Sustainability in the CWON

Given these considerations, the CWON preferred measure of sustainability is the change in total wealth per capita. This gives a fuller picture of how overall wealth is evolving, and it accounts for all asset classes and the change in population. Unsustainable management of the wealth portfolio—such as overfishing or consuming rather than investing resource rents—would lead to declining total wealth per capita if it were not offset by sufficient increases in the value of other assets in the portfolio.

GDP cannot illustrate the sustainability of prosperity, beyond changes in the annual flow. Therefore, if GDP is being increased by the depletion or degradation of assets, this would not be seen until much later, when such assets can no longer generate the same income flow. For example, a country might increase GDP in the short run via the destruction of forests for cheap agricultural land, or by overfishing its coastal waters. However, if left unchecked, such depletion of the underlying natural capital would eventually become a drag on GDP. Wealth accounting, and monitoring of the value of different assets, can help shed light on this much sooner than GDP can.

Total wealth per capita can help reveal whether the value of underlying assets is falling. However, like GDP, single metrics rarely tell the whole story. The detailed wealth accounts provide policy makers and analysts the tools to drill down to specific categories to examine how the underlying asset value is evolving over time and its relative importance in the national portfolio.

Weak versus Strong Sustainability

Box 1.1, in chapter 1, noted that change in wealth per capita is a measure of what is called *weak sustainability*, which assumes *complete substitutability* among asset classes. That is, cropland can be converted into residential homes with no major loss of economic well-being. This assumption is likely to be reasonable at fairly high levels of aggregation (of asset classes and spatial extent) and large volumes of assets, but less so when drilling down to specific locations. For example, biodiversity offsets are based on the assumption that losses in one place can be compensated by improvements in other places. At the other end of the spectrum, strong sustainability assumes that *no substitution* is possible without severe economic losses. This concept is useful when considering complementary assets in

specific locations, such as fish stocks and fishing boats—loss of fish stocks cannot be compensated by adding more boats.

The CWON wealth accounts have largely been used at a highly aggregated level. Greater spatial disaggregation and disaggregation by asset classes would help determine where weak sustainability is more problematic and a strong sustainability approach is needed. To support such assessments, the CWON website will make available much of the underlying biophysical data used to construct the natural capital accounts, including direct links to data sources such as the Food and Agriculture Organization and data sets where appropriate.

Spatially disaggregated measures of critical natural capital are not yet available for action. The European Union recently updated the estimates of nine planetary boundaries (EEA 2020), which were originally developed by Rockström et al. (2009). At the global level, they indicate where safe boundaries have been passed for critical ecosystem services. Although global figures are useful for communicating the urgency of action, actions to address these issues must be taken at the national and subnational levels. Without information about ecosystem thresholds at the national and subnational levels, it is difficult to prioritize actions.

Fiscal Sustainability and Natural Capital

Comprehensive wealth accounts can also shed light on the sustainability of fiscal policies and management. The conventional measures used in public finance do not account for depletion or degradation of natural capital, although the source of government revenues may be unsustainable if it comes from a nonrenewable asset, such as fossil fuel extraction, or if it comes from an asset that is being mismanaged, such as a fisheries sector that is suffering from overfishing.

By introducing information about the assets underlying government revenue sources, wealth accounts can help guide more sustainable policy making, including in fiscal management. The International Monetary Fund (IMF 2018) carried out such an estimate for a large number of countries in 2018. The IMF has consistently made the argument that the fiscal balance of resource-rich countries, in particular, should include depletion of natural capital (a public resource in all but a handful of countries). This issue is explored further in chapter 11.

Conclusion

This chapter explained wealth accounting in detail and the factors that make up the sustainability indicator *change in wealth per capita*. The purpose was to provide a clear sense of what the indicator includes, what it does not include, and how to interpret it. Wealth accounts are built on the concepts and methods laid out in the SNA and SEEA and, as such, measure the financial value of the stock of assets available for production and consumption, but they are not intended to measure broad human welfare. Similarly, the indicator of sustainability is necessary but not sufficient on

its own to assess sustainability; complementary indicators for social capital, biodiversity, and critical natural capital are needed. Social capital measures are explored in chapter 15, and the underlying biophysical data will be made available for other analytical work that informs sustainability.

Notes

1. The data set can be accessed at http://www.worldbank.org/cwon/.
2. Previous editions of the CWON classified assets into four classes. Here, natural capital is split into renewables and nonrenewables because they differ greatly in terms of management for development.
3. Global databases of estimated losses of produced capital from natural disasters are compiled by organizations such as Swiss Re and EM-Dat and the International Disaster Database (https://www.emdat.be), but the estimates are not consistent with SNA produced capital.
4. The perpetual inventory method that is used to estimate produced capital from annual investment adjusts only for "normal depreciation," not catastrophic events.

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