



Wealth Accounting in Botswana Adjusted Macroeconomic Indicators

Technical Report

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Abbreviations

ANNI	Adjusted Net National Income
ANNS	Adjusted Net National Savings
BoB	Bank of Botswana
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GNDI	Gross National Disposable Income
GNI	Gross National Income
GNS	Gross National Savings
GoB	Government of Botswana
MFDP	Ministry of Finance and Development Planning
NBS	National Balance Sheet
NDP	Net Domestic Product
NNI	Net National Income
NNS	Net National Savings
P	Pula
SEEA	System of Environmental-Economic Accounting
StB	Statistics Botswana
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
SNA	System of National Accounts

1. Introduction

This report is part of an ongoing project under the Wealth Accounting and Valuation of Ecosystem Services (WAVES) global partnership, being carried out by the Government of Botswana (GoB) and the World Bank. The WAVES project has a number of components, including the preparation of water accounts, energy accounts, mineral accounts, and relevant macroeconomic indicators. These elements were selected as the first components of the WAVES project following a scoping report prepared in February 2012.¹

This report is linked to related assignments on mineral accounting and public finance, and focuses on the preparation of adjusted macroeconomic indicators. In particular, it applies the System of Environmental-Economic Accounting (SEEA) to derive measures of the national balance sheet (NBS) and adjusted net national income (ANNI) and adjusted net national savings (ANNS), for the first time in Botswana. These measures incorporate various adjustments that focus on economic and environmental sustainability, and take a broader perspective of wealth than conventional macroeconomic measures. In principle, the measures incorporate a range of environmental impacts of economic activity, as well as natural resource depletion, and a broader definition of investment than is normally incorporated into the standard national accounts measures in the System of National Accounts (SNA)².

As this is the first time that such measures have been derived in Botswana, this report represents a “work-in-progress” rather than a final account. It provides the basis for future work in this area, which will require resolution of some methodological issues as well as filling data gaps.

The report is structured as follows: Section two describes the background to the assignment with the relevant components of the SEEA. Measures of the National Balance Sheet, Adjusted Net National Income and Adjusted Net National Savings are presented in sections three, four and five. Section six concludes and identifies areas of challenges from both policy and statistical perspectives. Appendix one extends the National Balance Sheet to include preliminary estimates of human capital.

¹ WAVES, 2012.

² SNA, 2008

2. Background: System of Environmental-Economic Accounting

2.1 The SEEA and SNA

The need to account for the environment and the economy in an integrated way arises because of the crucial functions of the environment in economic performance and in the generation of human welfare. These functions include the provision of natural resources as inputs to production and consumption activities; the negative impact of waste production on the environment; and the accumulation (or depletion) of environmental and human assets. These functions all have an impact on overall welfare.

Conventional national accounts have only partly accounted for these functions, focusing on market transactions and indicators that reflect important factors in welfare generation, but not measuring welfare itself. However, new scarcities of natural resources now threaten the sustained productivity of the economy, and economic production and consumption activities may impair environmental quality by overloading natural sinks with wastes and pollutants. By not accounting for the private and social costs of the use of natural resources and the degradation of the environment, conventional accounts may send incorrect signals of progress to decision makers, who may then set society on a non-sustainable development path.

In 1993, the United Nations Statistics Division (UNSD) elaborated a System of integrated Environmental and Economic Accounting (SEEA) as part of the System of National Accounts (SNA) handbook. For the first time, a United Nations publication set out a framework to systematically account for the stocks and flows of environmental resources in a way that was consistent with the SNA. The SEEA is thus a product of the new SNA, drawing attention to the need for assessing the environmental sustainability of economic performance.

The SEEA should thus be seen as an attempt at integrating environmental change into conventional measurements, without modifying the conventional accounts; they are meant to supplement the central accounts of the SNA with integrated accounts that expand the asset boundary of national accounts without changing their production boundary.

2.2 Conventional SNA measures

The SNA underpins conventional measures of national accounts produced by every country, which are commonly used to measure output, income and growth. At the centrepiece of this framework is Gross Domestic product (GDP), the aggregate measure of all economic value produced in an economy. It is based on monetary values and market transactions, although some imputations are made for non-market transactions where these are considered to be important.³

Although GDP is the most widely used measure of economic activity, certain adjustments may be undertaken to make it more relevant. First, the value of fixed capital used up in producing GDP may be deducted, resulting in Net Domestic Product (NDP).

The national accounts therefore specifically deduct an estimate of its value to arrive at the figure of NDP, which is generally accepted as giving a better indication of the economically sustainable level of production.

Second, GDP/NDP relates to production in an economy, but this does not equate to the income of residents of a particular country. Some income included in GDP is paid to non-residents, while some

³ For instance, the value of owner-occupied dwellings, subsistence agriculture, and some informal sector activities.

residents earn income from abroad. If GDP is adjusted for income paid to/received from the rest of the world, the resulting measure of Gross National Product (GNP) (and the related NNP) may be a more representative measure of a country's income.

National accounts also include measures of investment and savings. These are important for various reasons. From a macroeconomic balance perspective, the difference between investment and savings is equal to the current account balance:

$$S - I = X - M = \Delta IIP$$

In other words, if savings are greater than investment, the country will run a surplus on the current account of the balance of payments, and will acquire financial claims on the rest of the world through capital outflows. Conversely, if savings are less than investment, the country will run a current account deficit, and will require capital inflows to level the balance of payments, leading to increased claims by non-residents on the domestic economy. The International Investment Position (IIP) will go up or down, respectively, as a result.

Gross Domestic Savings can most easily be measured indirectly, through the above national accounts identity, i.e. $S = X - M - I$. It can also be adjusted for net income and transfers from abroad, to derive Gross National Savings.

In principle, national accounts should include a balance sheet alongside the flow accounts (in a similar manner to the two main components of a company's financial statements, the income statement and the balance sheet). However, most countries do not publish a national balance sheet, although various components of stock measurement are sometimes available. These include the IIP – a measure of a nation's financial assets (residents' financial claims on non-residents) and liabilities (non-residents' financial claims on residents). National accounts should also include a measure of the stock of produced capital, i.e. fixed assets. As Stiglitz (2005) commented: "No one would look just at a firm's revenues to assess how well it was doing. Far more relevant is the balance sheet, which shows assets and liability. That is also true for a country."

2.3 SEEA Adjustments

The SEEA entails a wide range of adjustment to the flow and stock components of the national accounts. The flow accounts are adjusted for environmental impacts, and for natural resource consumption/depletion. The logic is that, just as GDP must be adjusted for capital consumption (depreciation) in order to determine an economically sustainable measure of income, it must also be adjusted to take account of environmental deterioration, which represents the consumption of natural capital just as depreciation represents the consumption of produced capital. Similarly, conventional measures of national income may include "income" that is actually attributable to the depletion of an asset; hence such measures must be adjusted for the depletion of natural resources through the consumption of renewable or non-renewable assets. **An important purpose of environmental adjustments to the national accounts is to account for the consumption of natural capital in much the same way as the consumption of manufactured capital.**

Natural resources are often sold in markets, and so to some extent are reflected in the conventional national accounts. However, the prices of resources may not always reflect the cost of renewing renewable resources, nor the true (full) costs of depletion of non-renewable resources. Natural assets and their services of resource supply, waste absorption, and other amenities of the environment often have no price at all, being treated as "free" goods, so that their use is not fully reflected in the national accounts. The result is that, in presenting the value of the actual monetary

transactions in the economy, the national accounts systematically understate or omit the environmental costs incurred by those transactions, in terms of environmental depletion and degradation. GDP and related indicators thus contain a substantial element of consumption of natural capital, which is unaccounted for as a significant cost of production.

2.3.1 Adjusted Net National Savings

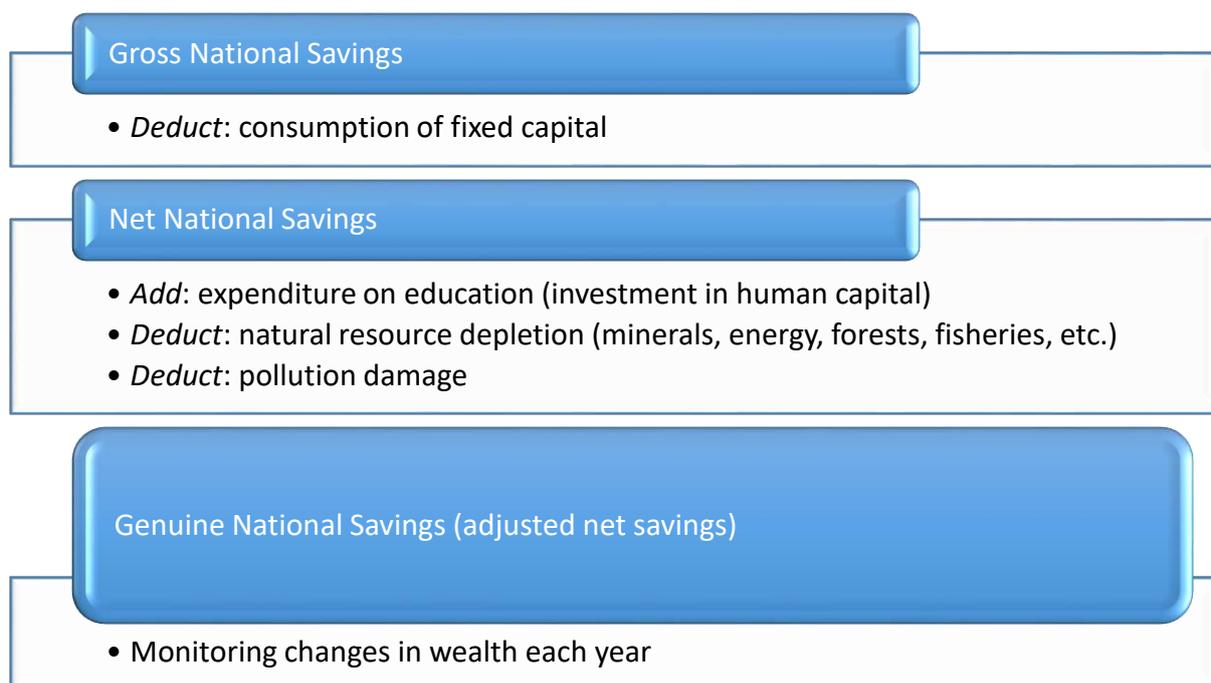
The focus of the adjusted flow accounts in this exercise is on Adjusted Net National Savings (ANNS), which measures the “true” rate of saving in an economy after taking into account investments in human capital, depletion of natural resources, and damages caused by pollution. ANNS, sometimes known as genuine net savings, is an indicator that aims to assess an economy’s sustainability based on the concepts of extended national accounts.

ANNS is related to measures of a country’s wealth. Positive savings allow wealth to grow over time, promising more opportunities for the next generation than the current generation benefits from. In this sense, adjusted net saving seeks to offer policymakers who have committed their countries to a “sustainable” development pathway an indicator to track their progress in this endeavour.

ANNS is important because it overcomes the problem of “invisible” depletion of mineral assets, especially in a natural resource dependent country, as this is not reflected in the standard national accounts. Conventional measures reflect mineral depletion as income, not as consumption of capital (which would hence over-estimate savings). Furthermore, standard national accounts measure savings only to the extent that they flow into financial assets or produced capital. ANNS comes closer to reflecting a country’s true savings efforts.

To calculate the ANNS, the standard Gross National Savings (GNS) is adjusted for four main measures: (i) consumption of fixed capital is deducted to obtain net national saving; (ii) current public expenditure on education is added to account for investment in human capital; (iii) estimates of the depletion of a variety of natural resources are deducted to reflect the decline in asset values associated with extraction and depletion; and (iv) deductions are made for damages from carbon dioxide and particulate emissions.

Table 1: Adjusted national savings



The WAVES project involves conducting the accounting exercises that are necessary to provide the data used in ANNS calculations, amongst other objectives. Nevertheless, some of the required sets of data are difficult to calculate (e.g. pollution damage), or have demanding data input requirements, and thus will not all be available in all countries.

2.3.2 Adjusted Net National Income

A second important adjustment is made to the conventional measure of national output. The adjustment is quite straightforward in that it deducts consumption of assets from Gross National Income (GNI), as follows:

Gross National Income

Less Consumption of fixed capital

Less Depletion of natural capital

Equals **Adjusted net national income (ANNI)**

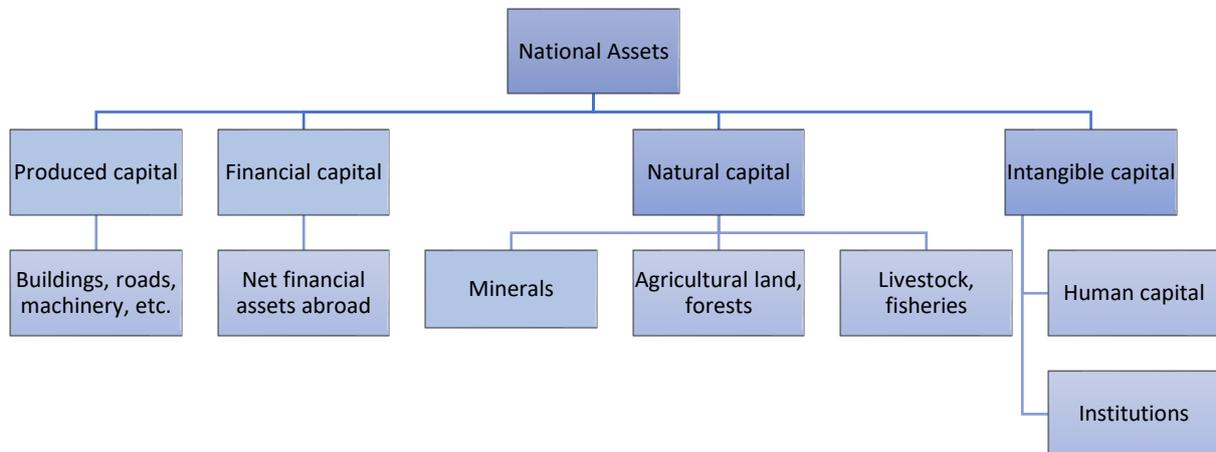
Natural capital depletion can include minerals, forests, fisheries, energy resources, etc., although the specific components to be included in a particular country depend on the economic significance of those resources, as well as data availability. The adjustments made to GNI to obtain ANNI have some similarities to those made to Gross National Savings to obtain ANNS. ANNI is a measure of the available income that can be consumed or invested to increase the nation's future consumption

2.3.3 National Balance Sheet

A second major development in the SEEA is the compilation of an extended national balance sheet, to enable the tracking of national wealth over time. Whereas the national balance sheet in the conventional SNA includes produced capital and financial assets – in parallel with a company balance sheet – the SEEA recognises that a broader range of assets contribute to welfare and therefore

comprise a country's wealth. Even in a narrow focus on production, a range of assets contribute to economic output and income. These include natural capital, human capital, and institutional capital. Natural capital, in turn, has several components, including mineral (sub-soil) assets, land (forests, pastureland, reserves), fisheries, and animals (domesticated, wildlife).

Figure 1: National Balance Sheet Components



Many of the components of national assets are difficult to measure, and data are not readily available. While many countries have measures of produced capital and financial capital, measures of natural capital and intangible capital are typically not produced by national statistical offices.

3. BOTSWANA NATIONAL BALANCE SHEET

3.1 Introduction

The current assignment involves developing three components of the SEEA for Botswana:

1. Compiling a national balance sheet (NBS), which provides a measure of national wealth and thereby enables the tracking of changes in national wealth over time. This can indicate whether the nature of production and consumption in an economy over time is sustainable. Hence it can help to inform policy decisions.⁴
2. Adjusted National Income (ANI), which provides an alternative measure of the income attributable to a country's residents, taking account of positive and negative contributions that are not reflected in GDP.
3. Adjusted National Savings (ANS), which indicates whether a sufficient proportion of national income/production is being saved to maintain wealth.

This section contains estimates of the consolidated national balance sheet covering the period from 1994 to 2014. The balance sheet contains estimates of the value of several components of Botswana's aggregate net worth, specifically mineral assets, produced assets and net financial assets (the International investment position, IIP).

Data on the valuation of mineral assets are available from the related mineral accounting exercise (also part of the WAVES Botswana project).⁵ At present, data are not available on other components of natural capital, such as agricultural land, forests, national parks, livestock, wildlife, etc. However, the overall NBS produced here can be adjusted – once the data is available – to incorporate any other natural capital accounts.

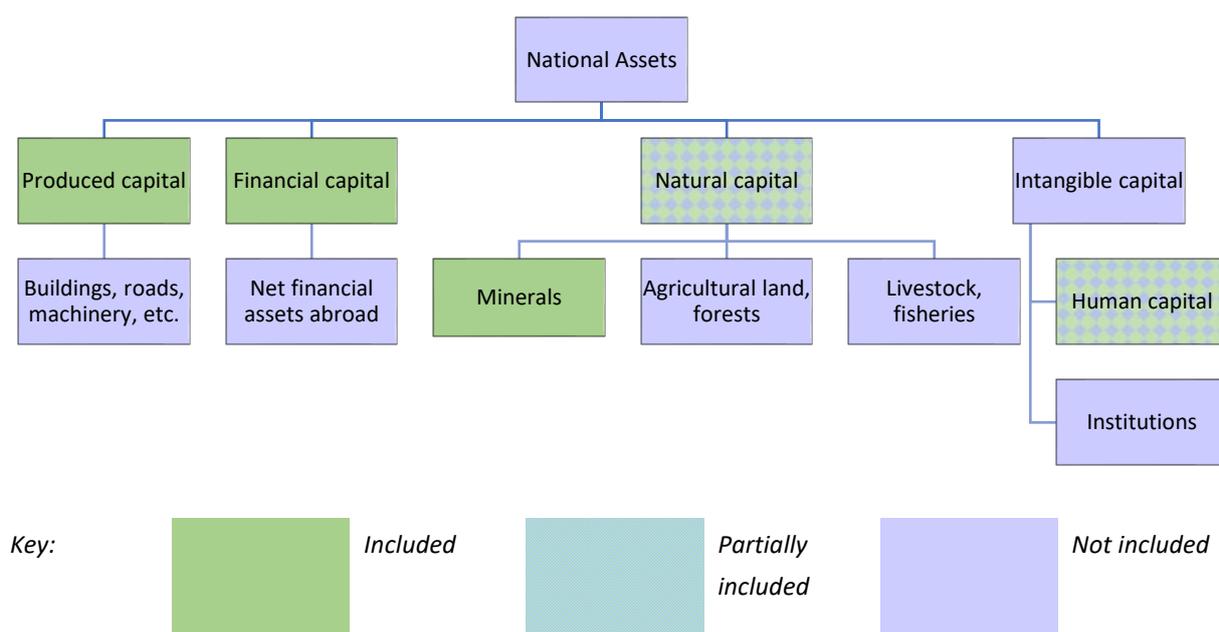
Intangible capital is not added to this NBS at this stage due to data limitations. However, a very preliminary attempt is made at the end of the paper to produce estimates of human capital, which will be added and analysed for their impact on net-worth.

The following diagram illustrates the selection of NBS components in the current exercise for Botswana.

⁴ *Fiscal policy dimensions are discussed further in the separate report on Mineral Revenues and Public Finances (Jefferis, 2016b).*

⁵ *Jefferis (2016a), Economic Accounting of Mineral Resources in Botswana.*

Figure 2: National balance sheet components for Botswana



Source: Econsult Botswana

The basic outline of the NBS calculations is shown below. It involves summing up selected assets and subtracting foreign financial liabilities, thus giving an assessment of the country’s wealth position (net worth).

Table 2: National balance sheet calculation

	Produced assets
Plus:	Mineral assets
Plus:	Financial Assets
Equals:	Total Assets
Less:	Financial Liabilities
Equals:	Net Worth (Net Assets)

Each of the components is described in more detail below.

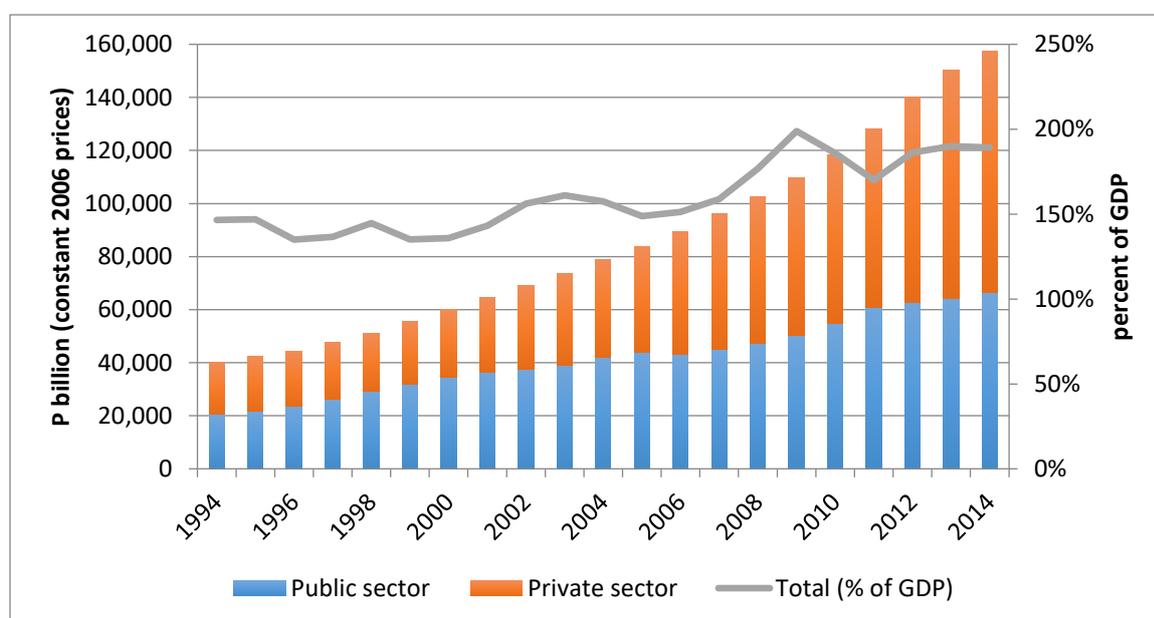
The estimates used are based on data sourced from the National Accounts (1994-2014 GDP) as published by Statistics Botswana; the International Investment Position (IIP), published by the Bank of Botswana; data on produced capital stock, from Statistics Botswana; and non-produced capital as calculated in the Botswana Mineral Accounts project.

3.2 Produced Assets (Produced capital stock)

Produced assets are non-financial assets that have come into existence as outputs from processes that fall within the production boundary of the SNA. They consist of fixed assets produced by both the public and private sectors, and result from expenditure on Gross Fixed Capital Formation (GFCF) in the national accounts, net of depreciation. Public sector produced assets in Botswana consist of general government assets as well as electricity and water infrastructure (owned by public utilities), while private sector assets – including both firms and households – make up the remainder. Data series on produced assets were produced by Statistics Botswana, and were first published in March 2015, for the period up to the end of 2014 (Statistics Botswana, 2015).

Total produced assets were estimated at P268.7 billion at the end of 2014, an increase of 294% in real terms since 1994. The average annual real growth rate of 7.2% reflects the vigorous public investment into infrastructure during that period, as well as investment in private sector activities such as mining. As a result, produced capital stock has grown faster than GDP, and the ratio of produced capital stock to GDP has increased from 146% in 1994 to 190% in 2014.

Figure 3: Produced assets (real BWP, public & private, and percent of GDP)



Source: Statistics Botswana, Econsult Botswana

It is worth noting that the growth of total capital stock has been driven more by the private sector (which has grown at an average annual rate of 8.6% in real terms from 1994-2014) than the public sector (at 5.8%). Given the dominant position of the public sector in the Botswana economy, the share of the public sector in total capital stock is very large, but has declined, given the differential in growth rates, from 50% in 1994 – and a peak of 57% in 2000 - to 42% in 2014. Since 2006, the private sector has accounted for more than half of produced capital stock. This was partly due to the rapid growth of capital stock in mining (with an annual growth of 11.2% in real terms).

3.3 Non-Produced Assets (Minerals)

The value of non-produced assets (minerals) was calculated in the WAVES mineral accounts report (Econsult, 2015). Botswana’s non-produced accounts are made up of un-mined mineral wealth, which is dominated by diamonds. Also included in this NBS calculation are base metals

(copper/nickel/cobalt), which are also economically important in terms of production, and other minerals – coal, gold and soda ash/salt - although they have a relatively small production value.

The value of these mineral assets represents the value of unexploited mineral deposits in the ground, valued in terms of the Net Present Value (NPV) attributable to anticipated mineral rents when future mining takes place.⁶

It is important to recognise that the value of mineral assets depends both on the physical quantity of minerals in the ground, and the value of those minerals. It is also important to recognise that the value of the un-mined asset is not the same as the value of the mineral when it is eventually mined and sold. In particular, if the price obtained when the mineral is sold is only the same as the cost of production, then the value of the un-mined asset is zero. Indeed, if the price at which it is sold is less than the cost of production, the value of the un-mined mineral may even be negative. The value of the un-mined mineral is determined by the mineral rent (its value after subtracting the cost of production), and this may be positive, zero, or negative (in which case a zero value is normally imputed).

The value of mineral assets therefore depends on the evolution of market prices as well as production costs. In order to minimise the impact of price and earnings volatility, mineral rents are calculated as 5-year moving averages.

Diamonds account for the vast majority of Botswana’s un-mined mineral wealth, with a share varying between 86% and 96% between 1994 and 2014. Copper-nickel has been the second most important, with smaller contributions from soda ash and gold. In recent years, however, low prices have reduced the value of copper-nickel deposits, and in 2014 soda ash was the second most important mineral asset.

Table 3: Contributions to the value of mineral assets

	Shares of total, 1994-2014			P (million)
	Average	Max	Min	2014
Diamonds	91.2%	97.1%	86.3%	142,300
Copper-nickel	6.7%	12.0%	0.0%	1,631
Coal	0.0%	0.0%	0.0%	0
Gold	0.2%	1.0%	0.0%	550
Soda ash	1.9%	2.9%	1.1%	3,580
Total				148,062

Source: Mineral Accounts Report (Jefferis, 2016a)

A result that may seem surprising is that Botswana’s un-mined coal deposits have never had any economic value. While Botswana is thought to have one of the largest unexploited coal deposits in the world - estimated at over 200 billion tonnes - there is no accurate published data on the magnitude of these coal deposits. Despite their likely large size, the current assessment of their economic value in the ground is minimal, due to the current low levels of coal production, the negative per unit rent earned on that production, and the lack of any certainty regarding potential future uses and values of Botswana’s coal. This illustrates the point that the value of an un-mined

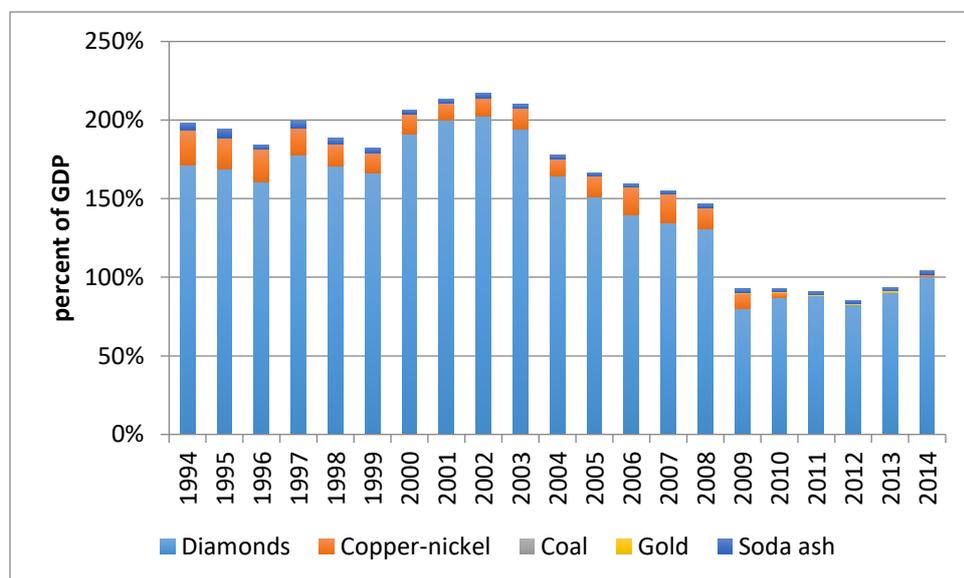
⁶ *The details of the calculation are available in the Mineral Accounts report (Jefferis, 2016a). Essentially, it is assumed that production continues at current rates until the mineral deposit is exploited, and that mineral rents are unchanged at the average value (per unit of production) over the past five years.*

resource is derived from its scarcity, and the likely difference between the costs of production and its market value. In Botswana’s case, coal has no scarcity value, and as such its market value in Botswana is close to the costs of production. While there are various proposals for ramping up coal production, the economic viability of such proposals is yet to be established, and hence no value can be placed on coal deposits based on potential future plans.

In total, the value of non-produced assets was estimated at P148,062 million in 2014, an increase of 37% in real terms from 1994. Despite high levels of production, and hence depletion of mineral reserves, the increase is mainly attributed to rising prices of diamonds and the fact that additions to known reserves have exceeded extraction. The rising value of diamond deposits has been offset by the declining value of copper-nickel deposits.

However, the increase in the value of mineral deposits has been slower than the growth of GDP, and hence the value of mineral deposits relative to GDP has been declining.

Figure 4: Value of mineral assets, relative to GDP



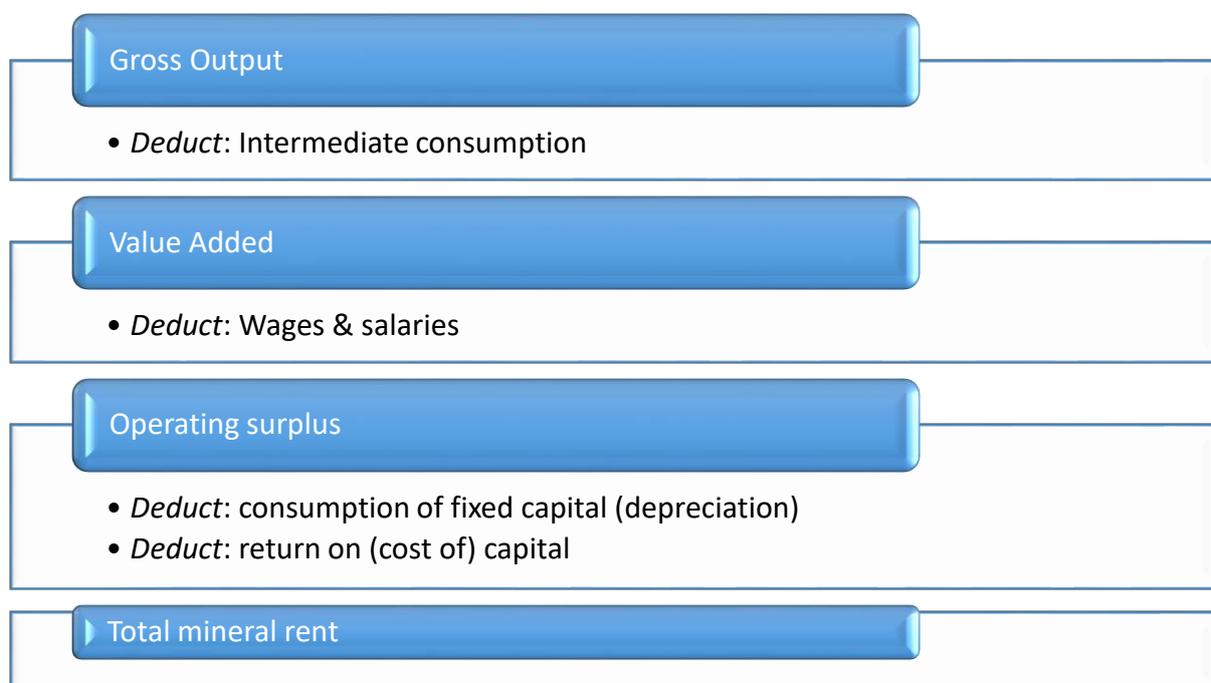
Source: Econsult Botswana

Box 1: Mineral rent calculations

The economic value of a mineral resource is measured by the resource “rent.” This is the economic return earned from the sale of a mineral over and above the costs of extracting the mineral. Resource rent occurs because of the scarcity of a resource.

The value of natural capital is the present (discounted) value of the stream of income (rent) it is expected to generate in the future, i.e. the Net Present Value (NPV) of future rents. There are two steps in calculating the NPV of mineral assets:

- calculating the rent per unit of output generated by current production;
- calculating the economic value of a mineral deposit as the discounted value of future rent (usually based on assumptions relative to current rates of rent).



3.4 Financial Assets (International Investment Position)

When compiling a national balance sheet, the value of financial assets is represented by the country’s financial assets and liabilities vis-à-vis the rest of the world. Domestic financial assets and liabilities are not included, as any financial asset held by a resident is offset by an equal and opposite financial liability.⁷

The difference between Botswana's financial assets and liabilities with the rest of the world (RoW) represents the net international investment position (IIP). Botswana has managed to maintain a

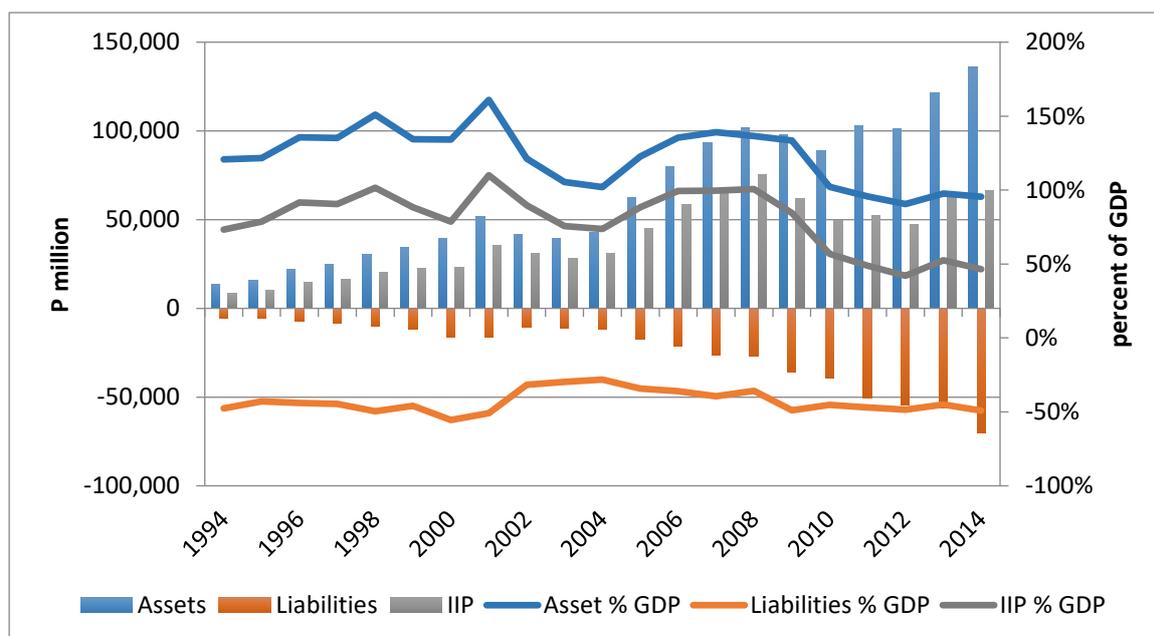
⁷ For instance, a government bond held by a resident represents a financial asset for the bondholder and an equal financial liability for the government.

positive balance between 1994 and 2014, indicating that the level of foreign assets is greater than the level of foreign liabilities. The main contributor to foreign assets has been holdings of official foreign exchange reserves, although over the past decade the contribution of private portfolio investment abroad has increased as the size of the pension industry has grown. The main financial liability to the RoW is foreign direct investment (FDI) in Botswana.

At the end of 2014, Botswana had a net IIP amounting to P66,122 million, or 13.7% of total net assets. While this is an increase from P10,304 million at the end of 1995, it represents a decline in the contribution to net assets (from 19%).

The level of financial assets with the rest of the world held by Botswana residents stood at P136,046 million at end of 2014. These assets were mainly in the form of reserve assets and direct investment abroad, accounting for over 80% of the total. The level of liabilities was P69,924 million in 2014, up from P5,629 million in 1994. Nearly all of these liabilities were in the form of shares and other securities, or loans, and resulted from FDI in Botswana or government borrowing outside of the country.

Figure 5: International investment position



Source: Statistics Botswana, Econsult Botswana

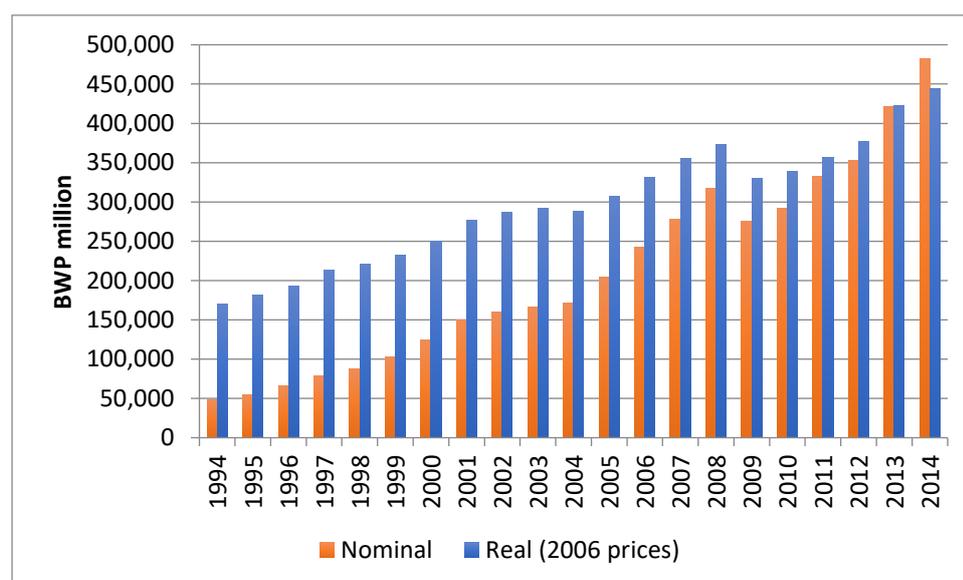
3.5 Total Assets

The total assets comprising the national balance sheet include produced assets, (net) financial assets, and non-produced assets (minerals). Total net assets were estimated to be P482,913 million in 2014.

Table 4: Asset class descriptions

Asset class	Comments/Data
Produced capital	Prepared specifically for the WAVES project
	Now published by Statistics Botswana
	Distinguishes between public (govt.) assets and private sector assets (firms and households)
Mineral assets (non-produced capital)	Prepared under the mineral accounting component of the WAVES project
	Value of (unexploited) deposits major minerals (diamonds, copper-nickel, coal, soda ash, gold)
(Net) Financial assets	Assets held abroad by Botswana residents (govt., firms, individuals)
	Mainly BoB foreign exchange reserves, external pension fund assets, and outward FDI
	Net of liabilities to non-residents (mainly inward FDI and govt. borrowing abroad)

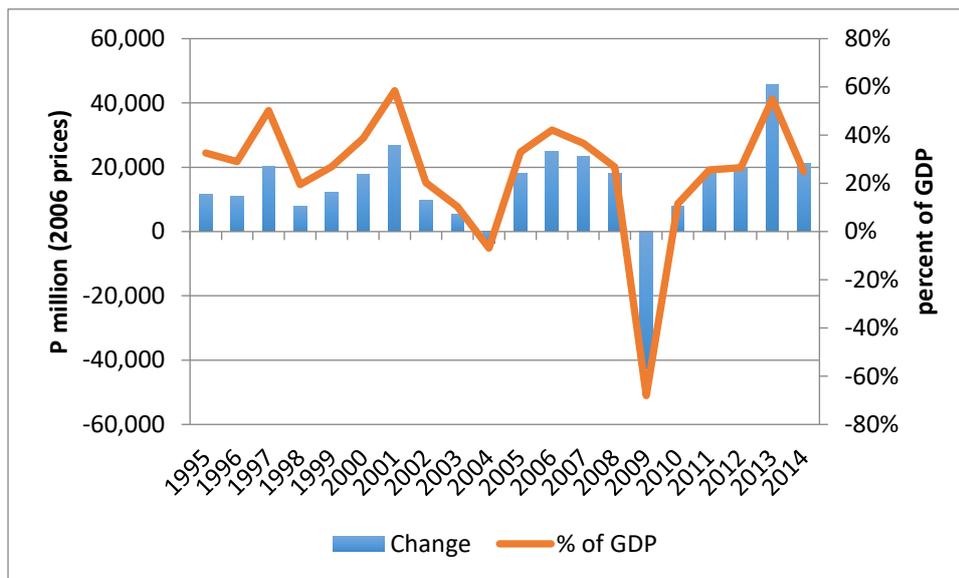
Figure 6: Total assets, real and nominal



Source: Statistics Botswana, Econsult Botswana

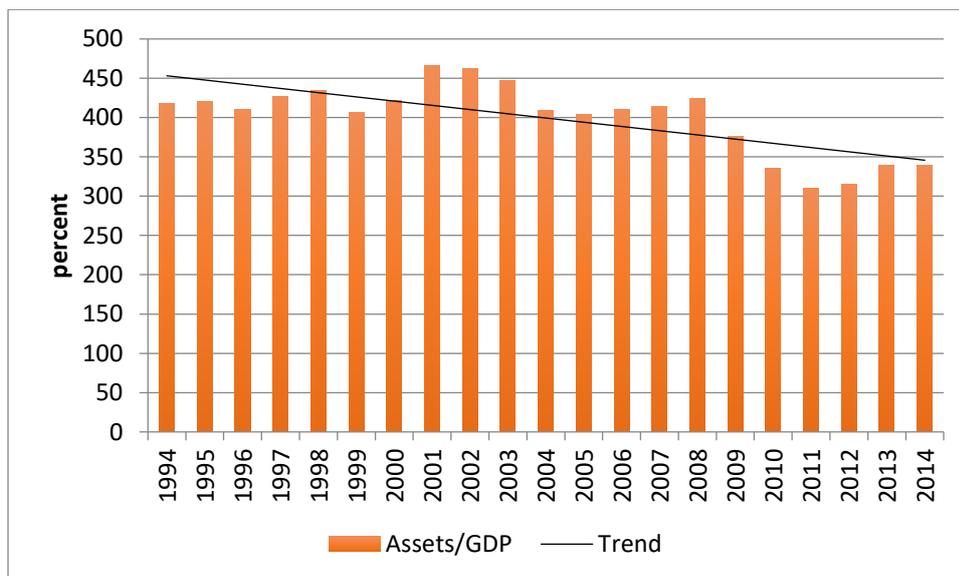
Total assets have grown reasonably steadily over the period presented, albeit with a decline in 2009 as the global financial crisis negatively affected the value of both financial assets and mineral assets.

Figure 7: Annual change in real net assets



Source: Statistics Botswana, Econsult Botswana

Figure 8: Net assets as percentage of GDP



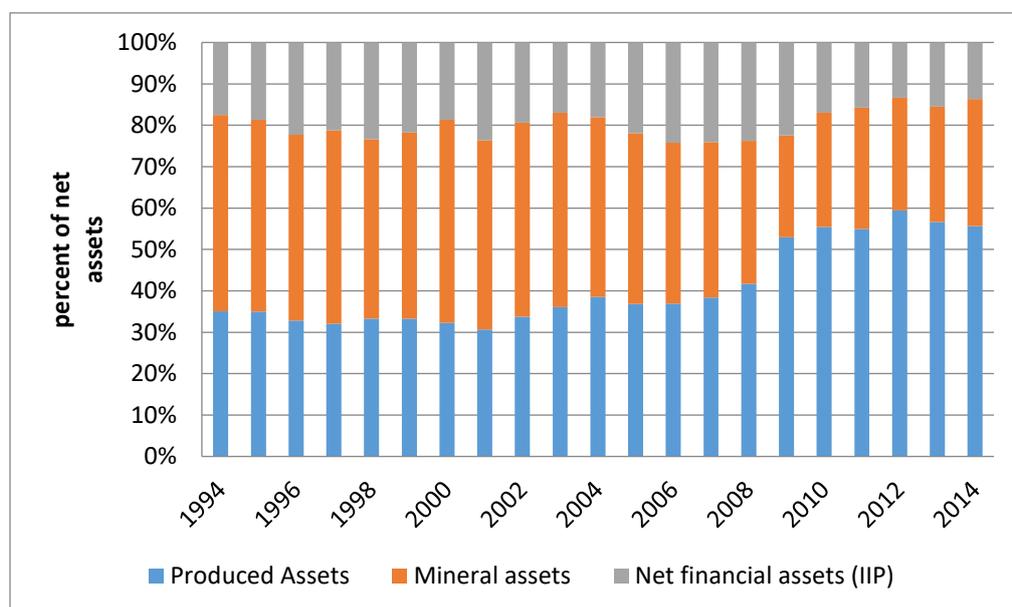
Source: Statistics Botswana, Econsult Botswana

Although total net assets have grown in real terms, they have grown more slowly than GDP. Hence the ratio of net assets to GDP has fallen. Total net assets were equivalent to just over 400% of GDP in 1994 but had declined to 340% of GDP by 2014, after peaking at 467% of GDP in 2001. The long-term trend is clearly downwards.

The composition of net assets has changed over time. Historically, net assets were dominated by mineral wealth; in 1994, for instance, mineral assets made up 47% of total assets. Gradually the share of mineral assets has declined, as is to be expected given that minerals are a finite, non-renewable resource that are depleted over time. In keeping with government objectives, mineral

revenues have been reinvested in other assets, including physical assets, financial assets, and human capital. This is one of the reasons that the share of produced assets has increased over time.

Figure 9: Shares of total assets



Source: Statistics Botswana, Econsult Botswana

Table 5: Shares of asset classes in total net assets, 1994 and 2014

Asset type	Value, 1994 (P million)	% net assets	Value, 2014 (P million)	% net assets
Produced capital	16,749	35%	268,730	56%
Public	8,308	17%	111,676	23%
Private (business)	5,476	11%	139,102	29%
Residential buildings	2,965	6%	17,952	4%
Mineral deposits	22,672	47%	148,062	31%
Financial assets	13,816	29%	136,046	28%
Total assets	53,238	111%	552,837	114%
Financial liabilities	5,449	11%	-69,924	-14%
Net financial assets (IIP)	8,367	18%	66,122	14%
Net assets (net worth)	47,788	100%	482,914	100%

Source: Statistics Botswana, Econsult Botswana

Since 2009, produced assets have accounted for more than half of total assets. Financial assets have been accumulated as a result of surpluses on the current account of the balance of payments, which are indirectly linked to the accumulation of budget surpluses by the government. The government has not deliberately targeted the accumulation of financial assets on its own account; however, some assets have been accumulated as residual budget balances. Nevertheless, as Figure 5 shows, national financial assets have not been accumulated to a significant extent. Figure 9 shows that the share of net financial assets in total assets has fallen, which is, to some extent, not what would be expected for a mature mineral economy. Financial assets were particularly drawn down in 2009-10 following the global financial crisis, and have not been fully rebuilt since then.

4. Adjusted Net National Income

The second macroeconomic indicator related to sustainability applies to national income; specifically, how much real income is generated in the economy each year? The task involves deriving an adjusted measure of national income, which reflects the fact that in the production of national output, assets are consumed or depleted. This measure – Adjusted Net National Income or ANNI – represents the available income that can be consumed or invested to increase the nation’s future consumption.

The first adjustment is to move from Gross Domestic Product (GDP) to Gross National Income (GNI), while the second adjustment is to move from GNI to ANNI. ANNI is derived from GDP as follows:

Table 6: Botswana ANNI calculation

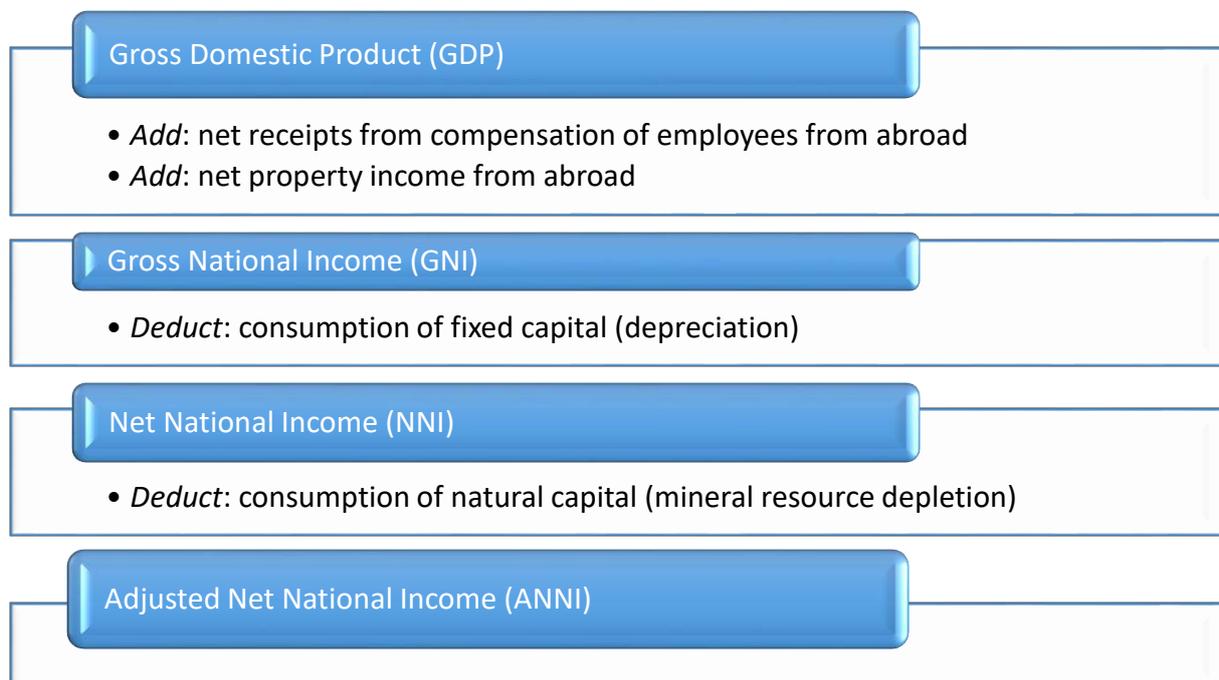
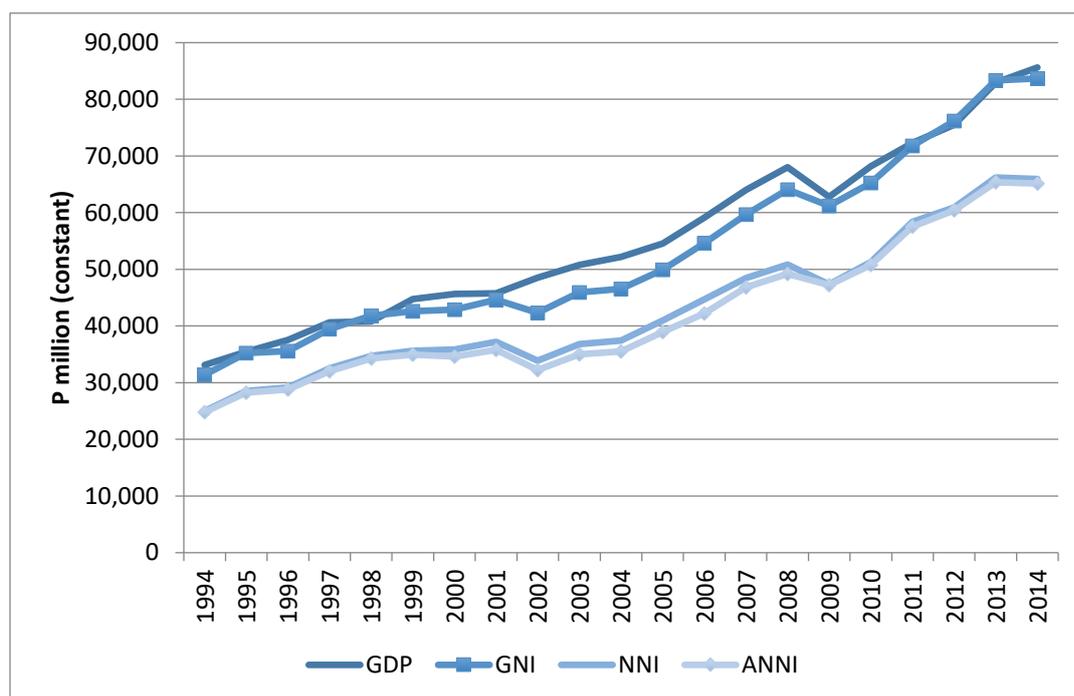


Figure 10: Measures of national income



Source: Statistics Botswana, Econsult Botswana

On average, GNI is around 5% less than GDP. This reflects the fact that both net compensation of employees and net investment/property income from abroad are negative in most years, although the negative flows have been decreasing in recent years. The deduction of depreciation, to obtain NNI, is rather larger, with around 20% of GNI being accounted for by depreciation. The adjustment for mineral depletion is relatively small, with NNI only being reduced by 2.5% on average to reach ANNI. Overall, ANNI represents around 75% of GDP. However, both have grown at an average rate of around 4.5% a year in real terms, from 1994 to 2004, meaning that there has been no overall divergence between the two figures.

The mineral depletion adjustment is relatively small due to the nature of the mineral depletion calculation, which essentially splits the value of mineral exploitation into an income component and a depletion component (see Box 2). While mineral deposits are large and have a long lifespan, most of the mineral rent is derived from the income component; the depletion component only becomes significant as the remaining lifespan falls.⁸

⁸ There is an analogy with renewable resources; if these are exploited sustainably, so that the stock of renewable resources is not depleted, the entire rent derived represents income. A mineral with a long lifespan has some similarities with a renewable resource.

Box 2: Mineral depletion calculation

The extraction and sale of minerals necessarily involves the depletion of a non-renewable asset. This may or may not be offset by other developments, such as new discoveries or price changes. However, it is necessary to calculate the depletion component of mineral consumption, as part of the mineral accounts, in order to provide input data for the calculation of Adjusted Net National Savings (ANNS) and Adjusted Net National Income (ANNI).

Under the SEEA, resource rents in a given year are divided between a depletion component and a return (income) component, according to the following formula:

$$Depletion = \frac{RR}{(1 + r)^n}$$

where RR = annual resource rent, r = chosen discount rate, and n = lifetime of mineral deposit (to exhaustion). The remaining portion of the resource rent is the income component. Hence the depletion component gets larger as the remaining lifetime of the deposit gets shorter.

Because the lifespan of most of Botswana's mines (notably diamond mines) is relatively long, the depletion component is in turn relatively small.

The sum of the annual depletion component over the lifespan of the resource is equal to the current valuation of the resource stock.

5. Adjusted Net National Savings

As noted in Section 2, Adjusted Net National Savings (ANNS) attempts to provide a more appropriate measure of the level of savings in an economy than conventional national accounts measures. This is especially the case in a natural resource dependent economy, where mineral depletion and investment in human capital (if mineral revenues are well used) are both likely to be important.

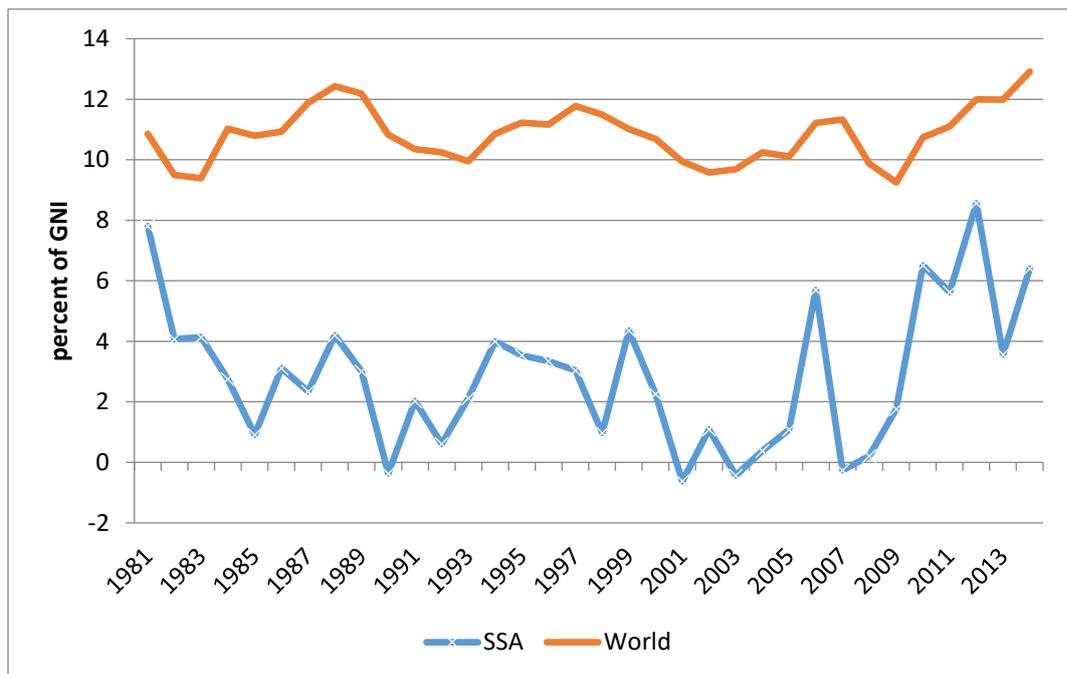
Although not yet standard practice, the calculation of ANNS is increasingly being applied in different countries as part of statistical toolkits to assess sustainability. The WAVES program has encouraged the calculation of ANNS at the global, regional and national levels, and the World Bank now includes ANNS as one of the variables in the World Development Indicators database and in the annual Little Green Data Book publication (World Bank, 2015). At the global level, ANNS has generally fluctuated in the range of 10%-13% of Gross National Income (GNI). Sub-Saharan Africa (SSA) has generally had low levels of ANNS, typically below 5% of GNI, and negative in some years, due to a high level of mineral depletion and a lack of investment. Although many African economies experienced high levels of GDP growth during the 2000s, this was not necessarily sustainable growth – as the negative ANNS shows.

Table 7: Adjusted net national savings, as percentage of gross national income, 2015

Region	ANNS (% GNI)
World	11.1%
East Asia and Pacific	28.4%
Europe and Central Asia	7.5%
Latin America and the Caribbean	5.7%
Middle East and North Africa	8.1%
South Asia	19.0%
Sub-Saharan Africa	6.7%
Botswana	29.2%

Source: World Bank, 2015

Figure 11: Adjusted net saving for Sub-Saharan Africa (SSA) and the world, 1981-2014

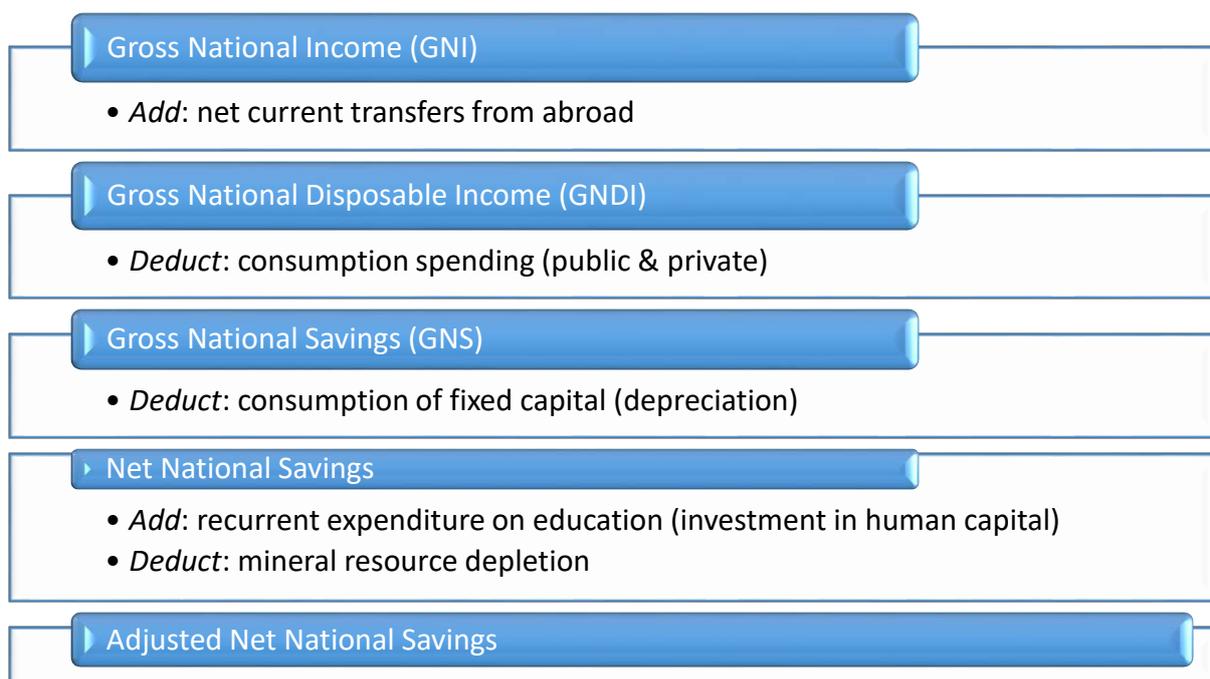


Source: World Development Indicators

Botswana’s domestic calculation of ANNS varies slightly from the ideal method outlined above, as there is inadequate data on pollution. Therefore, the subtraction of the value of pollution damage is not made, and the calculation focuses on the three main adjustments to Gross National Savings of fixed capital depletion, investment in human capital, and natural resource depletion.

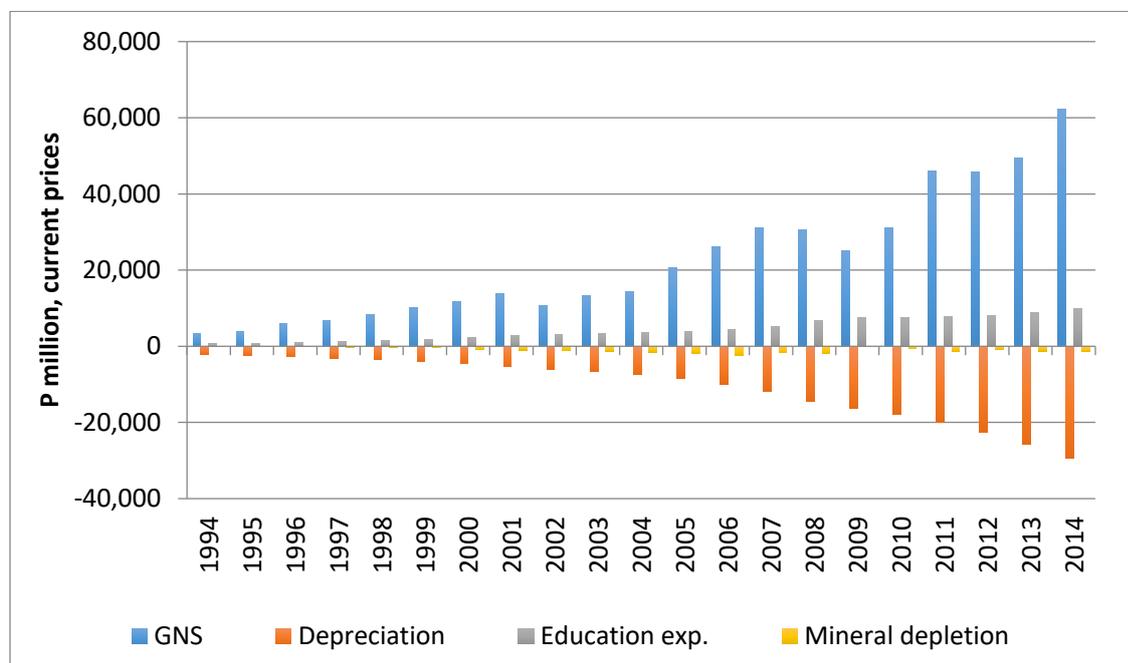
The ANNS calculation is therefore as below:

Table 8: Botswana adjusted net national savings calculation



The results of this calculation are as shown in Figure 12 below.

Figure 12: Botswana’s annual net national savings components

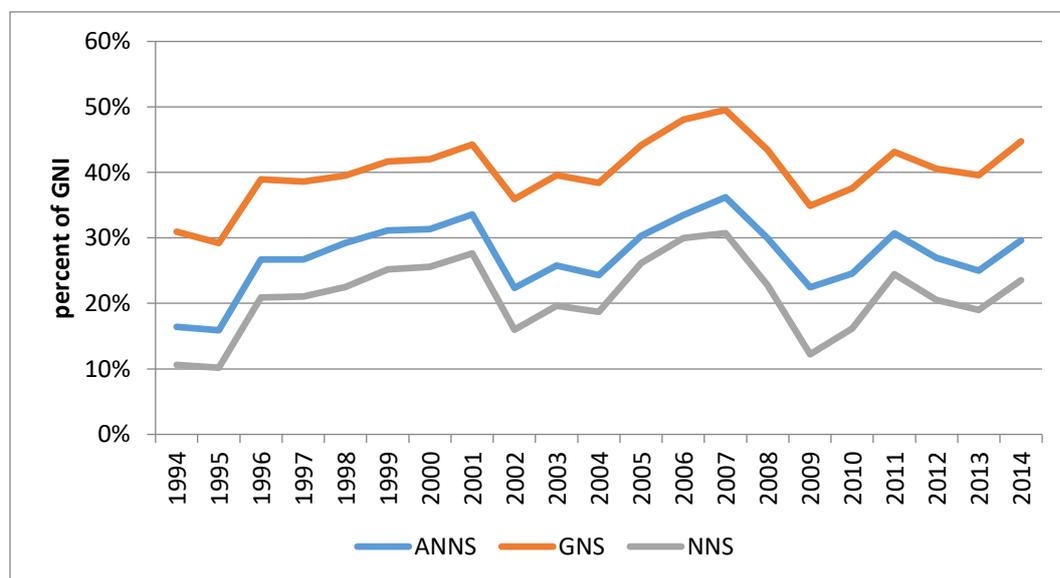


Source: Statistics Botswana, Econsult Botswana

The major components of ANNS are Gross National Savings (GNS) and Consumption of Fixed Capital, followed by Education Expenditure. Mineral Depletion results in a relatively small adjustment. Nevertheless, the adjustments made to GNS in this calculation have significantly reduced it, making

ANNS much lower than GNS (as illustrated in Figure 13). Investment in human capital has made an important contribution to boosting ANNS.

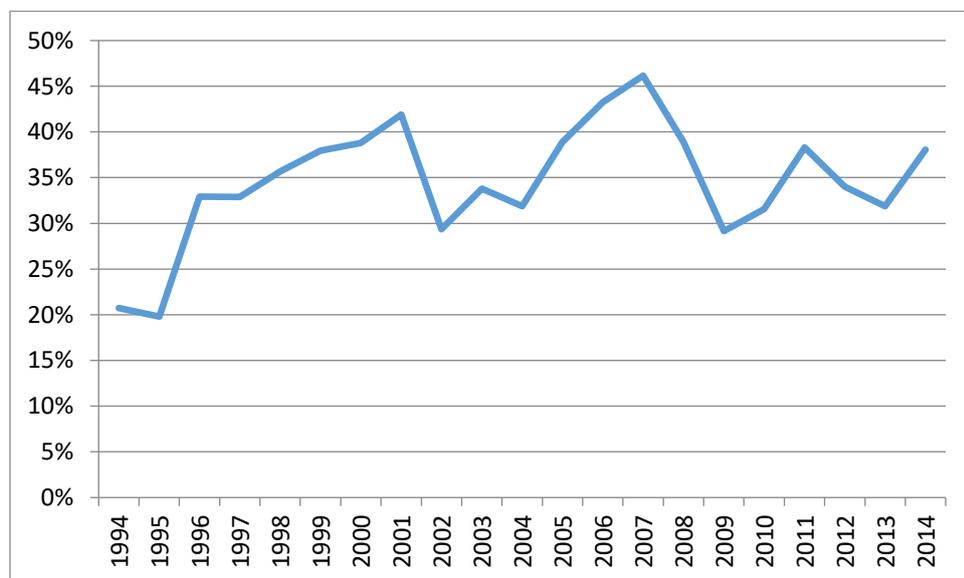
Figure 13: Gross national savings, net national savings, and adjusted net national savings (percentage of gross national income)



Source: Statistics Botswana, Econsult Botswana

We can also compare the level of ANNS with ANNI – i.e., of the national income that is available for consumption or savings/investment, what proportion has actually been saved? As Figure 14 shows, in general this proportion has been quite high – generally around 35%.

Figure 14: Adjusted net national savings as percentage of adjusted net national income



Overall, Botswana’s level of ANNS is high by international standards, comfortably exceeding the global and SSA levels reported above. Although ANNS has fluctuated considerably from year to year, it has generally been above 20% of GNI over the two decades from 1994 to 2014, and in general closer to 30%. This is mainly driven by the high level of GNS. Despite Botswana having a mineral-based economy, assets have been accumulated rather than depleted.

6. Conclusion

The above analysis shows that Botswana has had some success in macroeconomic management for sustainability. The level of savings has generally been high, even when adjusted to account for the consumption of produced and natural capital. The composition of assets on the national balance sheet has changed, with the earlier dominance of mineral assets gradually reduced and was replaced by produced capital, although the reduced share of mineral assets has not been matched by the accumulation of financial assets.

Despite the high level of savings, total national assets have not increased as fast as GDP, and hence the ratio of assets to GDP has fallen since 2002. This may seem puzzling, as a high rate of savings should have contributed to preserving national assets. However, the value of assets is affected by other factors, not just savings rates; the value of mineral assets, in particular, is affected by valuations of reserves and anticipated production levels, and reduced output levels of diamonds has reduced the net present value (NPV) of diamond deposits by pushing anticipated production further into the future. The declining value of mineral assets, for reasons other than depletion, has to some extent offset the high savings rates.

One of the important policy implications is the need to improve productivity or face declining economic growth rates as assets decline (in relative terms).

This exercise represents the first attempt to compile a national balance sheet for Botswana, along with adjusted macroeconomic indicators. Further work will help to refine the calculations and make the measures more comprehensive. Such work could include the following:

- (i) Extending the series back pre-1994, to track the accumulation of assets since independence in 1966, or at least to the start of mineral production in the early 1970s. Data on mineral accounts goes back to 1979; on produced assets back to 1956; and on education spending to 1983/4. However, data on net financial assets is not available pre-1994 and work would be required to construct a series going back before this time in order to extend the national balance sheet calculations backwards. Similarly, the current national accounts series starts in 1994 and some of the earlier data may not provide suitable savings measures.
- (ii) Valuation of pollution damage has not been included, but ideally should be in order to compile suitable measures of national income and savings.
- (iii) Human capital is an important component of national wealth, but a comprehensive time series of human capital (or even a recent valuation) is not available. The Appendix includes a preliminary attempt to value human capital, although this is only partial, and future work on improved human capital valuation would be useful.
- (iv) Other assets: in due course, it may be possible to include broader valuations of natural capital, including forests, conservation areas, wildlife and livestock. None of this is straightforward, although it should be possible to calculate an approximate valuation of the national cattle herd, for most if not all years.

Appendix: Incorporating Human Capital into the National Balance Sheet

Human capital is considered one of the key investments that a country can undertake. At a macroeconomic level, the accumulation of human capital is an important driver of output growth. At a microeconomic level, educational attainment can be tied to productivity, earnings and consumption. In principle, it should be clearly accounted for in any national balance sheet calculations. Also, given that adjustments for education spending are made to the flow-based measures (adjusted net national income and savings), for consistency the resulting human capital should be included in the resulting national balance sheet. As countries get richer, human capital tends to make up a larger proportion of total capital, and hence its inclusion is important to give a more accurate indicator of sustainability.

Since the discovery of diamonds, the government of Botswana has prioritized the development of human capital. The “Sustainable Budgeting” principle that has largely been followed over the past four decades has been based on investing mineral revenues – derived from the depletion of an asset – into other assets, including physical assets, human capital, and financial assets. In order to track whether total national assets are being preserved as mineral assets are depleted - a key national policy objective - some measurement of human capital should be incorporated into the national balance sheet. However, this is easier in principle than in practice, as no readily available measure of human capital exists for Botswana.

Human capital results from investment in education and training, both at formal educational institutions and “on the job.” Expenditure on investment in human capital comes from the government (public education and training institutions), households and firms. The majority of Botswana go through the public education system, and indeed Botswana spends a relatively high proportion of GDP on public education and training, compared to its middle-income peers.

There are various methods that can be used to calculate human capital stock, including:

- A cost-based approach (measuring inputs)
- An income-based approach (measuring outputs).
- A residual-based approach.

In principle, the cost-based approach considers costs incurred in producing human capital by Individuals, households, employers and governments. It is relatively easy to apply, and needs data on public and private expenditure on formal education. It could theoretically be extended to include spending on in-work and adult training. Human capital stock is calculated using the Perpetual Inventory method (similar to produced capital):

$$\text{Opening stock} + \text{new investment} - \text{depreciation} = \text{closing stock}$$

However, the cost-based approach does not include productivity impacts.

The income-based approach considers the stream of future earnings that human capital investment generates over the lifetime of an individual. It assumes that income reflects the value of human capital services (i.e. that market prices are appropriate). It requires assumptions about appropriate discount rate and future income growth, as well as data on incomes, occupations, qualifications etc. (Labour Force Survey). The calculation is more complex than for the cost-based approach, and parallels the methodology used for the valuation of mineral assets. It includes the value of on-the-job learning and productivity gains, and tends to give higher values for human capital than input-based measures.

The residual-based approach measures human capital indirectly, and has been used in the past by the World Bank. First, total wealth is derived from the discounted value of future consumption flows. From this, tangible wealth (produced capital, natural resources) is subtracted, and the residual is the value of human capital. This approach is affected by measurement errors, resulting in potential biases, and is not very useful in explaining changes. It is also strongly influenced by the discount rate.

In this report, we use the cost-based approach, mainly because data is readily available on government spending on education.⁹ The cost of production method values the human capital stock as being the depreciated value of the monetary amount spent on investment in human capital. This is a similar approach to that used for fixed capital, whereby the opening annual stock is increased by new investment and reduced by consumption of fixed capital (depreciation). Based on budget data on public spending on education and training, and estimates of withdrawals of human capital by people who never enter the labour force, deaths and retirements, a crude estimate of the human capital stock can be obtained¹⁰. However, it is also important to note the limitations of this method: its focus on the supply side excludes the value of human capital that is derived from the demand for it. There is also the difficulty of determining which part of educational expenditure is investment spending and which part is consumption; however, for present purposes, all government expenditure has been classified as investment.

This calculation of human capital accounts for the following:

- annual government education budget (recurrent), starting in the 1983/4 financial year;¹¹
- a labour force participation rate of 0.7¹²
- an annual death rate of labour force participants of 0.6%¹³
- retirement based on a working life of 35 years (effectively zero, as the time series is shorter than this).

Calculating human capital (all in financial terms):

$$HC = OS + (LPR * Edu) - (DR + R) * OS$$

where:

OS: Opening stock, zero at 1983/1984¹⁴

LPR: Labour force participation rate (labour force/working age population)

Edu: Government recurrent education expenditure

DR: Death rate

R: Retirement

The GDP deflator was used to normalize and calculate the level of human capital in real terms.

⁹ A large percentage of education in Botswana is government funded.

¹⁰ Of course, this does not include private expenditure on education and training.

¹¹ Development spending is excluded as this is already included in public sector produced capital.

¹² As estimated in the 2011 Population and Housing Census

¹³ Calculating the depreciation rate is an important element of this method. Like physical capital, human capital depreciates over time due to sickness or death, etc.

¹⁴ The first available data point for government education spending

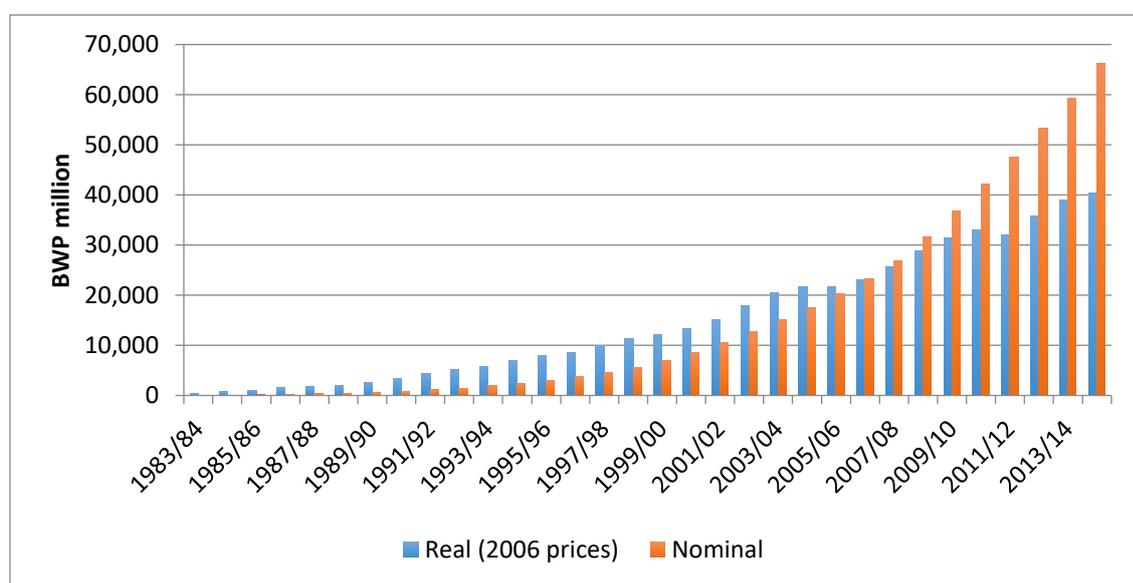
Interpreting the Results

Human capital is calculated as a stock on an annual basis. Its interpretation is similar to other produced and non-produced assets, and can be counted towards total assets when calculating net worth.

The stock of human capital measured on this basis has been rising steadily, which is to be expected given the high levels of spending on public education and training. Between 1994 and 2014, the stock of human capital rose from 21% to 45% of GDP, although it peaked at 49% of GDP in 2009 and has since declined. Human capital added between 5% and 15% to total assets over the period 1994 to 2014 – an important addition to the total, but not transformative.

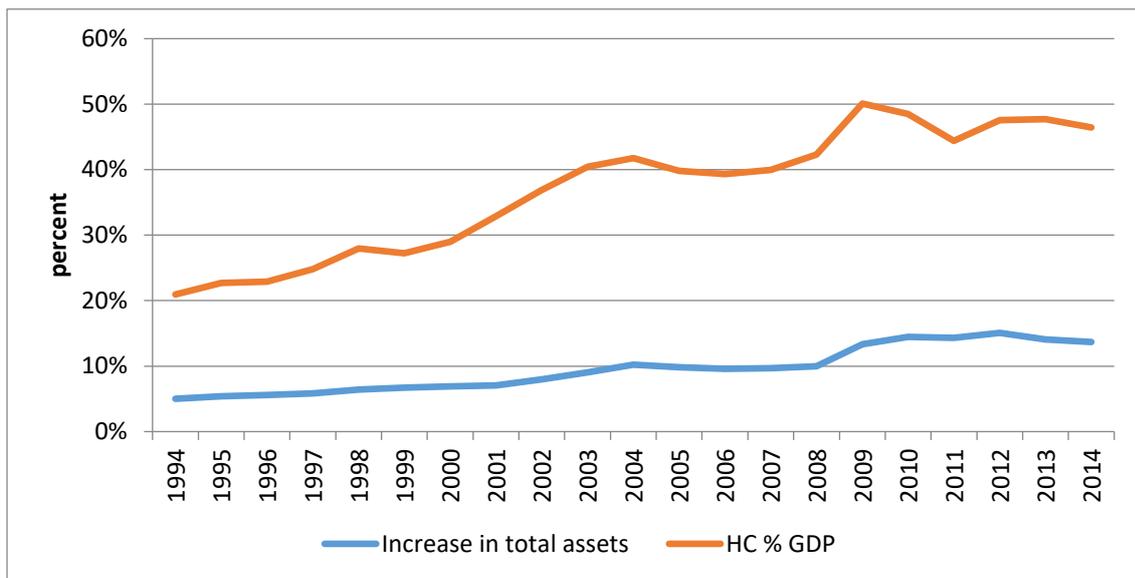
In 2014, human capital accounted for 12% of total assets (on the expanded definition), a similar contribution as net financial assets.

Figure 15: Human capital stock



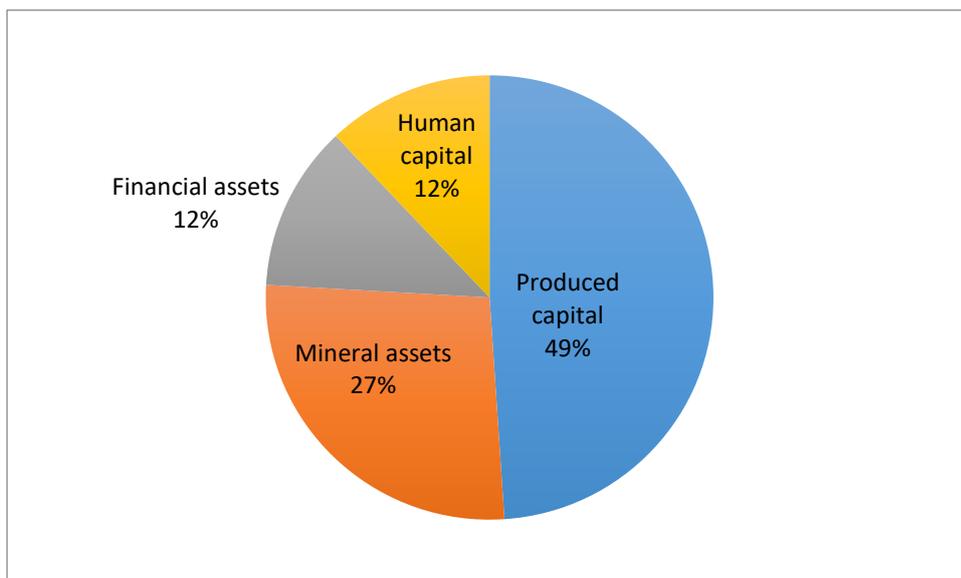
Source: Statistics Botswana, Econsult Botswana

Figure 16: Human capital relative to total assets and GDP



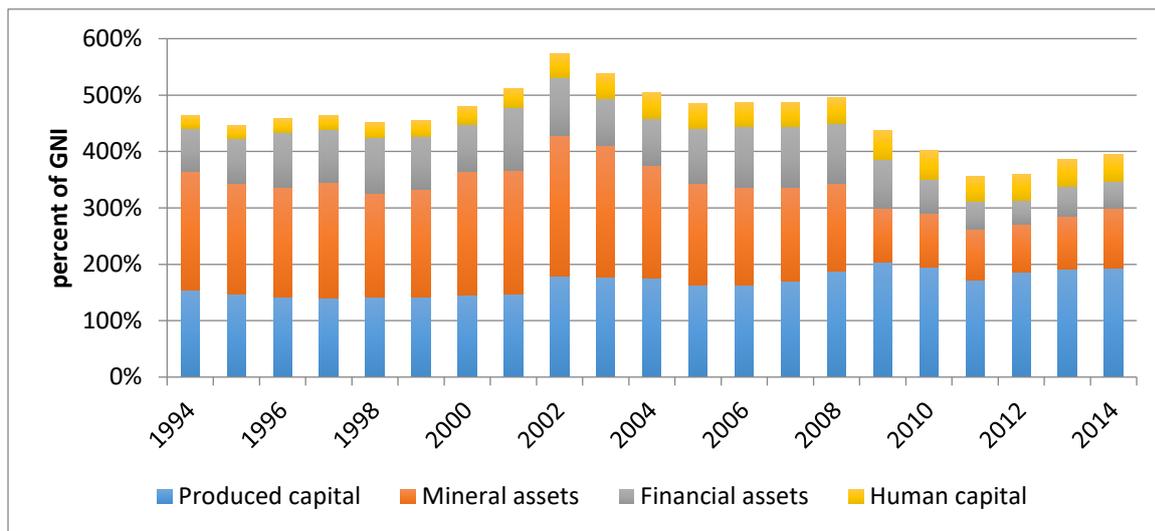
Source: Statistics Botswana, Econsult Botswana

Figure 17: Composition of total assets, 2014



Source: Statistics Botswana, Econsult Botswana

Figure 18: Total assets including human capital



Source: Statistics Botswana, Econsult Botswana

Adding human capital does not change the basic picture presented earlier in the report, which is that total national assets have declined relative to GNI. Investment in human capital has only offset the run-down of other assets to a very limited extent.

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