Aspects of Sustainability: The Australian Experience

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Introduction

This paper discusses the concepts of sustainable development and the main conceptual frameworks that are relevant to measuring sustainability in Australia. It also outlines a number of statistical initiatives across the social, economic and environment fields that are providing insights into aspects of sustainability.

As the national statistical agency, the Australian Bureau of Statistics (ABS) plays a leading role in the national collection and reporting of information about the various dimensions of life in Australia. While a number of other agencies also have important roles in providing information on issues such as sustainability, the main focus of this paper is on ABS work that can inform the sustainability debate and decision-making processes.

Concepts of sustainable development

In 1992 the Council of Australian Governments released *The National Strategy for Ecologically Sustainable Development* (NSESD). The concept of ecologically sustainable development is described in this document as 'development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'. This broad concept has helped to guide the development of measures of sustainable development in Australia.

The strategy commits all levels of government to a package of core objectives and guiding principles that have social, economic and environmental dimensions. For example, the three core objectives are:

- to enhance individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems.

A number of alternative views of sustainable development are outlined in the latest draft (2002) of the United Nations *System of Integrated Environmental and Economic Accounting* (SEEA) which has been used by ABS to guide the development of Australia's environmental accounts. The SEEA considers that the most widely accepted concept is 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. But it notes that there is widespread

divergence of thought about what 'needs' should be covered and how they should be measured.

ABS has identified six alternative views of how the concept described in SEEA could be operationalised:

- Preservation of national wealth.
- Rising per capita income and rising levels of wellbeing: ensuring that the welfare and quality of life of the population continues to rise.
- Strong sustainability: never using renewable resources in excess of their natural regeneration
- Weak sustainability: replacing any natural resources used with alternative resources of an equal value.
- Resource efficiency: using natural resources prudently and efficiently.
- Target dependent sustainability: not consuming certain resources beyond a critical level and not using sink functions beyond their assimilative capabilities.

The NSESD concept, with its wide focus elaborated through objectives, could be seen as embracing all of these views and more. For example:

- it has a stronger emphasis on the need to protect biological diversity and maintain essential ecological processes and life-support systems; and
- it covers intra-generational equity issues that can be obscured when sustainable development is looked at from a 'whole of population' perspective.

A number of reports aimed at assessing sustainable development or addressing particular sustainability issues have been produced by Australian government agencies. For example:

- *Are We Sustaining Australia: A Report against Headline Sustainability Indicators for Australia*, a periodic report by Environment Australia, which measures performance against the core objectives of NSESD using a range of indicators, first released in 2001.
- *State of the Environment Report*, a five yearly report coordinated by Environment Australia, first issued in 1996 with the second issue in 2001.
- Implementation of Ecologically Sustainable Development by Commonwealth Departments and Agencies, a report by the Productivity Commission in 1999.
- *The Intergenerational Report*, a five yearly report by the Treasurer and first issued in 2002.

ABS has also produced various reports that include measures and analysis relating to aspects of sustainability. For example:

- *Measuring Australia's Progress*, published in 2002 and discussed later in this paper.
- Environmental accounts on a range of topics (Water, Energy and Greenhouse Gases, Minerals, Environment Protection Expenditure), also discussed later in this paper.
- Compendium or thematic publications (e.g. Environment by Numbers, Australia's Environment Issues and Trends, Australian Social Trends, Education Indicators, etc).

Key frameworks and their relevance to measuring sustainability

There are several key conceptual frameworks used by the ABS in producing economic, environment and social statistics. The internationally endorsed *System of National Accounts* (SNA) provides the conceptual base for the Australian national accounts. It also provides detailed international standards that are used in compiling a wide range of other economic statistics. As previously noted, the United Nations *System of Integrated Environmental and Economic Accounting* (SEEA) is being used to guide developments in Australia's environment statistics. For social statistics, the ABS *Measuring Wellbeing* framework describes their scope and conceptual base and sets out an integrated system for their description, development and analysis. ABS has also recently developed a framework of indicators to measure and analyse national progress. These indicators were presented in the ABS publication *Measuring Australia's Progress.*

Each of these frameworks is relevant to measuring sustainability, as explained in the following paragraphs.

The system of national accounts

The System of National Accounts (SNA) is a well-established methodology for producing a coherent, consistent and integrated set of macro-economic accounts that cover all aspects of economic activities. The most recent version of the SNA was issued in 1993 by the Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank.

The SNA consists of a number of flow accounts -- covering production, income and accumulation -- and a balance sheet account. It is the balance sheet account that is most relevant to the issue of sustainability. The balance sheet shows, at a point in time, the value of an economy's assets and liabilities; the difference between the two equalling net worth. By looking at balance sheets for different points in time, it can be established how an economy's net worth is changing over time. If net worth is increasing (or at least remaining constant), then it could be said that an economy is operating sustainably. This analysis is improved if the balance sheets are prepared in real/volume terms and the ABS produces both sets of data on an annual basis (we are not aware of any other country that does so).

But there are significant limits to the use of balance sheets as an indicator of sustainability. First, only assets that are considered to be "economic" are included on the balance sheet. For an asset to be included on an SNA balance sheet it must be (a) under the control of an institutional unit and (b) capable of delivering economic benefits to the owner. The value assigned to the asset is the (market) value of these economic benefits. While this means that some assets that are "environmental" in nature - such as land, sub-soil assets and forests - are included, other environmental assets such as the air and (for the most part) water are not included. Therefore the harmful effects of economic activity on these assets are not reflected in the balance sheet. Furthermore, for those environmental assets that are included on the balance sheet, only their economic values are recorded. This means, for example, that depletion of sub-soil assets is reflected on the balance sheet, but changes in bio-diversity within forests are not.

Second, balance sheets provide no information about human capital. They do not show, for example, whether there is an increase (or perhaps even a decrease) in the levels

of educational attainment within a community. Nor do they show whether people are living longer, or whether they are more or less healthy.

Third, the balance sheets do not show the impacts of economic activity (and other influences) on what might broadly be termed "social capital". This type of capital, which can be difficult to describe, could be influenced by things such as crime rates, the levels of unemployment, income inequality, the extent of volunteerism, and the ability of persons to participate in a full range of socio-economic activities. It is clear that there could be externalities from economic activity that has (potentially both positive and negative) impacts on these dimensions. But it is possible that these dimensions may also be affected by non-economic influences.

Of the flow measures available in the national accounts, both income and saving are relevant to the issue of sustainability. But as for balance sheets, no allowance is made for either positive or negative impacts on environmental, human or social capital in deriving the income or saving measures. Even though the economic aspects of environmental assets are reflected on the balance sheet, the economic depletion of these assets is not reflected in income, and hence saving, measures in the system. Furthermore, certain influences on economic wealth, such as the impact of natural disasters and discoveries, are not reflected in the system's income and saving measures.

Of course, the limitations of the SNA in providing a comprehensive measure of sustainability are well recognised. (Indeed the SNA makes no pretence to providing such a comprehensive measure.) But the core framework can be re-cast or extended to provide more information on sustainability, particularly to the extent that sustainability is affected either directly or indirectly by economic activity. This is normally achieved through the development of satellite accounts.

There are two types of satellite accounts. In the first type, the underlying concepts of the SNA are not changed, but classifications etc are altered to give a greater focus on a particular type of economic activity, such as that associated with tourism, environmental expenditure, or health expenditure. In this type of satellite account, non-economic measures, such as life expectancies in the case of a health satellite account, can be introduced in such a way that the relationships between economic activity and the non-economic measures can be studied. In the second type of satellite account, the SNA concepts are altered, but in such a way that they can be linked back to the "core" concepts. This type of satellite accounting enables, for example, a more comprehensive treatment of environmental assets, or the specific recognition of human capital as an asset, or the treatment of 'unpaid' activities such as household work and voluntary work as production. The main difficulty with constructing the second type of satellite accounts is the problems associated with assigning monetary values to activities that are essentially non-economic in nature.

The system of integrated environmental and economic accounting (SEEA)

The purpose of SEEA is to:

- explore how sets of statistical accounts can be compiled which will permit investigation and analysis of the interaction between the economy and the environment; and
- enlarge the scope of the SNA in order to develop a coherent, comprehensive accounting framework which allows the contribution of the environment to the

economy and the impact of the economy on the environment to be measured objectively and consistently.

Only by integrating the economic and environmental dimensions can the implications for environmental sustainability of different patterns of production and consumption be examined or, conversely, can the economic consequences of maintaining given environmental standards be studied.

The SEEA accounting system contains four categories of accounts which cover both flows and stocks, in physical and monetary terms, as well as adjustments to the SNA. Wherever possible SEEA uses the same definitions and classifications as the SNA so that environmental and economic data can be fully integrated and easily analysed and modelled. This is not the case with International Energy Agency and Intergovernmental Panel on Climate Control standards and classifications for compiling energy balances and greenhouse gas accounts (which, for example, do not use standard industrial classifications and whose data can not be readily reconciled and modelled with other economic data).

The latest draft (2002) of SEEA notes that it can serve as at least a partial framework for measuring the most common interpretations of the concept of sustainable development. As noted earlier, ABS has summarised these interpretations into six alternative views. Each view, and the usefulness of SEEA for informing the view, is discussed below.

Preservation of national wealth

The welfare of future generations is to a large extent determined by the capital base of a country, how well capital is used and whether capital is being built up or eroded. The capital base can be considered to comprise the traditional measures of capital covered by the SNA (produced assets, non-produced assets and financial assets and liabilities) as well as other aspects of wealth.

SEEA describes techniques for valuing two aspects of wealth not covered by the SNA. These are:

- quality of the environment from a human perspective (including the aesthetic and health dimensions that are components of the amenity of the environment); and
- biological diversity, essential ecological processes and life-support systems and the service functions that the environment provides (including sink functions).

By providing these additional valuation techniques and by embracing a broader concept of what constitutes assets and wealth, SEEA provides an enhanced basis for considering whether national wealth is being maintained.

Rising per capita income and rising levels of wellbeing

Rising per capita income in real terms is regarded by some as evidence of sustainable development. However, the many other important aspects of wellbeing also need to be measured to provide a comprehensive picture that adequately informs this view of sustainable development.

A common measure of change in material living standards and aspects of economic wellbeing is real net national disposable income per capita, or alternatively GDP per capita. SEEA describes a variety of adjustments that can be made to national income or

product measures, some using non-market valuation techniques and modelling, to enhance the usefulness of the measures for sustainability analysis.

One such adjusted measure which is gaining wider acceptance and which uses market valuations is 'depletion adjusted net domestic product' (dpNDP). This accounts for the reduction in national wealth associated with decreases in the stock and value of natural resources (such as sub-soil assets and native forests). Other measures include 'damage adjusted net national income' (daNNI), which treats damage to human health (for example) as a decrease in welfare and something that income should be adjusted for (even though there is no absolute value placed on welfare); and 'environmentally adjusted net domestic product' (eaNDP) which uses a maintenance cost approach to try to estimate what the accounting entries would have been for the same level of economic activity if all the costs associated with maintaining the environment and preventing degradation had been incurred and internalised within market prices.

Strong sustainability (never using renewable resources in excess of their natural regeneration)

The SEEA framework includes natural resource accounts for minerals, energy, water, biological resources (timber, fish, etc), land and soil. These accounts can be used to assess whether there is any depletion and degradation of resources taking place and thus whether economic activity associated with the various natural resources is being undertaken in a sustainable manner. In this context, depletion is viewed purely in quantitative terms (e.g. ensuring that there is no decrease in hectares of forest, tonnes of fish biomass, etc). Degradation can involve assessments of changes in water quality or soil fertility (as examples).

Weak sustainability (replacing any natural resources used with alternative resources of an equal value)

Measures of 'weak' sustainability can be derived from the national balance sheet, produced in Australia by the ABS as part of the standard national accounts. The trends in the different components of the balance sheet and national net worth show whether decreases in one asset class (e.g. the value of timber or sub-soil assets) are being balanced by increases in the value of other asset classes within the SNA boundary (such as produced assets or financial assets). It is interesting to note that, in the Australian context, the quantity (and value) of economically exploitable sub-soil assets has risen over the last decade because of new discoveries and improvements to technology.

Resource efficiency: using natural resources prudently and efficiently

In this view of sustainable development the requirement is that non-renewable resources should be used prudently and efficiently, with care that the same function is available to future generations. Physical flow accounts described in SEEA can be used to assess:

- whether a country is becoming more material and energy intensive or less (and how its production functions and efficiencies change with new technology and compare with international counterparts);
- to what extent renewable resources are being substituted for non-renewable resources; and

- to what extent recycling is taking place.

Some of this analysis may require standardising for population differences and the impacts of differing patterns of international trade.

Target dependent sustainability: Not consuming certain resources beyond a critical level and not using sink functions beyond their assimilative capabilities

The notion here is that countries (or indeed the planet) should have targets beyond which they should not consume certain resources or pollute or degrade the environment. Examples of this are energy self sufficiency targets; greenhouse gas emission targets associated with the Kyoto protocol; air and water quality targets; and targets associated with preservation of biodiversity (such as kangaroo populations, percentages of the area of biodiversity regions set aside for national parks, etc). The SEEA framework of accounts can be used to produce measures to inform judgments about such targets and to monitor performance against the targets.

ABS well-being framework for social statistics

The broad framework ABS uses to develop and organise its social statistics program was published in *Measuring Wellbeing: Frameworks for Australian Social Statistics* (ABS Cat. no. 4160.0) in 2001. This framework describes the scope of social statistics and the linkages both within this field of statistics and with economic statistics. It also describes commonly used definitions, classifications and counting rules and where relevant is consistent with national accounting standards. Its systematic approach supports the identification and analysis of data needs and helps to ensure that a comprehensive and well balanced array of data items are collected across the social statistics program. It also facilitates integration across the social and economic fields, particularly in areas such as economic resources and work.

The concept of wellbeing is central to the framework. This multifaceted concept recognises a range of fundamental human needs and aspirations, each of which can be linked to an area of social concern. These needs and aspirations are the focus of government social policy and service delivery, and are reflected in many of the structures of government. While the framework does not discuss the concept of sustainable development, it does recognise links between wellbeing and sustainability. As noted earlier, these links are explicit in the NSESD approach to defining sustainable development and one of the SEEA views also focuses on wellbeing and how it changes over time.

Key dimensions

A number of key areas of social concern form one dimension of the framework. The areas identified are: Population; Health; Family and community; Education and training; Work; Economic resources; Housing; Crime and justice; and Culture and leisure. Each of these areas has its own more detailed framework, or set of frameworks, and is explored through a series of questions:

- How does this area relate to wellbeing?
- What are the key social issues that need to be informed?
- What groups are at risk of disadvantage?

- What are the social and economic transactions that affect individual wellbeing?
- What detailed frameworks relate to this area?
- What definitions, classifications and units of measurement will result in effective social indicators?
- What data sources relate to this area?

Another dimension of the framework focuses on a variety of population groups which are of special interest to the community and to governments. These groups include, for example, older people, children, youth , families with children, the unemployed, lone parents, people with disabilities, carers, recipients of various government benefits, low income earners, Aboriginal and Torres Strait Islanders, and people whose language background is other than English.

These two basic dimensions of the framework are brought together in the form of a matrix showing areas of social concern by population groups. The scope of social statistics in Australia is broadly defined by reference to this matrix and the relationship of its elements to the various aspects of human wellbeing, both at the level of the individual and for society as a whole. The ABS aims to provide information about the elements of this matrix over time through its work program activities.

Sustainability is one of the themes that flow through many of the social issues identified for each area of concern. For example, sustainability is discussed in relation to population growth and population ageing; city growth; the increasing costs of the health system; the changing nature of work (such as growth in part-time and casual employment); trends in savings patterns and their retirement income implications; and the changing distribution of economic resources between 'richer' and 'poorer' households. Through a focus on measuring and analysing changes over time in the various aspects of wellbeing, the framework can assist in the systematic description and development of indicators relating to sustainable development.

Application of the broad framework

A practical illustration of the analytic application of the framework is the annual ABS publication *Australian Social Trends.* It is structured according to the framework's areas of concern and draws on a wide range of data, sourced from both ABS and other agencies, to present a contemporary picture of Australian society. For each area of concern it provides a set of national and State/Territory indicators which describe how key aspects of wellbeing have been changing over time and how circumstances differ between geographic areas. It also provides comparisons with other countries.

The framework has been central to ABS work in social statistics for many years and has evolved to accommodate changing perspectives and information needs over that time. Its flexibility suggests it will maintain its value well into the future. While very different from the accounting frameworks used in describing the economy and the environment, it has performed an important complementary role as an integrating tool in social statistics.

Detailed frameworks for particular fields of social statistics

Detailed statistical frameworks have been developed, or are under development, for each area of social concern to support analysis of particular social issues. These map the conceptual terrain for that area and provide, along with detailed statistical standards, the

foundations on which integrated statistical datasets can be built. Frameworks of this kind have been developed and published for areas such as health, labour market, learning, and household income, expenditure and wealth. Frameworks are also under development in areas such as social capital, crime and justice, and sexual assault.

Measuring Australia's progress

In April 2002 ABS released a new publication, *Measuring Australia's Progress* (MAP), which attempts to answer the question *Is life getting better in Australia?* It uses a suite of indicators to consider some of the key aspects of progress and how they are linked with one another. The publication does not claim to measure every aspect of progress that is important. Nor does it consider all of the many different ways that parts of Australia and groups of Australians are progressing. But it does provide a national summary of many of the most important areas of progress, presented in a way which can be quickly understood.

Progress and sustainability are intimately linked. However, suitable measures of sustainability have not yet been agreed or developed for many of the different aspects of progress. Recognising this, the publication does not enter into any direct discussion of sustainability. For some areas of progress it does report on whether levels of capital are being maintained but the primary focus is on whether various aspects of life - environmental, social and economic - are improving.

Design of the publication involved choosing a presentational model, identifying the dimensions of progress, selecting the indicators that would give statistical expression to those dimensions, and deciding on a more compact subset of headline indicators. With no definitive national or international approach to measuring progress, three possible presentational models were considered: the one-number approach; the integrated accounting framework approach; and the suite of indicators approach. The ABS settled on the indicators approach as its preferred model. In our view this approach strikes an appropriate balance between the simplification of the one-number approach and the complexity of the accounting approach. It also avoids some of the measurement issues associated with the other two approaches.

Progress dimensions

The framework within which the indicators were developed and organised has 3 broad dimensions, covering the economy, society and the environment. Each of these broad dimensions contains a number of finer dimensions. For example, the society dimension has separate dimensions for key areas of social concern - health, education and training, work, economic disadvantage and inequality, housing, crime, and social attachment. It also has separate dimensions for other expressions of or influences on social progress, specifically communication and transport, culture and leisure, and governance, democracy and citizenship.

Decisions on which indicators to present within each dimension were made after reviewing thousands of potential indicators and assessing them against a number of criteria. For some dimensions of progress (e.g. social attachment), it was not possible to compile an indicator that satisfied all of these criteria. In such cases proxy measures were used as interim indicators pending further statistical development work.

A wide ranging consultation process, along with advice from numerous experts, helped the ABS choose the areas of progress and the best indicators to measure each area.

Of the 90 indicators chosen, 15 were selected for the headline set. Deciding on the headline set was easier for the economic dimension of progress than for the social and environmental dimensions. For example, it was not possible to select just a couple of indicators to encapsulate progress across the key areas of social concern, so separate headline indicators were included for each area. As a result, the headline suite shows 2 economic dimensions, 7 social dimensions and 6 environmental dimensions.

Headline dimensions	Headline indicators	Supplementary indicators
Health	Life expectancy at birth	Proportions of people surviving to ages 50 and 70; Infant mortality rate; Burden of disease
Education and training	People aged 25–64 years with a vocational or higher education qualification	Education participation rate for those aged 15–19; Year 7/8 to Year 12 apparent retention rate
Work	Unemployment rate	Extended labour force underutilisation rate; Long-term unemployment rate; Retrenchment rate; Casual employees; People in part-time jobs; People in jobs with longer hours (50 hours a week or more); Average hours per week, full-time workers
Biodiversity	Extinct, endangered and vulnerable birds and mammals	
Land clearance	Annual area of land cleared	
Land degradation	Salinity, assets at risk in areas affected, or with a high potential to develop, salinity	
Inland waters	Water management areas, proportion where use exceeded 70% of sustainable yield	Water diversions: Murray–Darling Basin; River condition (biota) index; Net water use; River environment index
Air quality	Fine particle concentrations, days health standards exceeded, selected capital cities	Highest one hour averages of SO2, selected regional centres; Days when ozone concentrations exceeded guidelines, selected capital cities; Consumption of ozone depleting substances
Greenhouse gases	Net greenhouse gas emissions	Total greenhouse gas emissions (including land clearance); CO2-e emissions, net, per capita and per $ GDP
National wealth	Real national net worth per capita	Real national assets and liabilities per capita; Real net capital stock per capita; Economically demonstrated resources (minerals and energy) per capita; Real net foreign debt
National income	Real net national disposable income per capita	Real Gross Domestic Product per capita ; Proportion of the population in work; Terms of trade
Economic disadvantage and inequality	Real equivalised average weekly disposable income of households in the second and third deciles of the income distribution	Real equivalised average weekly disposable income of groups of higher income households; Children without an employed parent; Real equivalised weekly disposable income of households at selected income percentiles; Ratios of income of households at selected income percentiles; Share of total income received by households in low and high income groups; Gini coefficient; Proportion of households with income below both the half mean and half median income of all households
Housing	*No headline indicator*	Households with housing affordability problems; Households with insufficient or spare bedrooms
Crime	Unlawful entry with intent and assault (victimisation rates)	Homicide rate; Imprisonment rates
Social attachment	No headline indicator	Attendance at live performances; Participation in organised sports; Voluntary work; Marriage and divorce rates; Persons living alone; Waking-time spent alone; Homelessness; Suicide and drug-related death rates (indicators in the *Work* dimension are also relevant)

Commentary that accompanies the indicators discusses trends in progress over the last 10 years or so together with differences within Australia and the factors influencing change. The publication also discusses how some of the dimensions of progress are linked with one another, either through trade-offs or reinforcements. The ABS has been careful to explain that overall progress should not be assessed by simply counting the numbers of areas getting better and subtracting those getting worse. It also acknowledges

that some analysts will assign greater importance to some aspects of progress than to others.

It is possible to arrange the set of indicators in different ways to display progress from different analytic perspectives. For example, the publication discusses how the indicators can be grouped into broad categories of wealth. Four categories of wealth are identified: human capital, natural capital, produced and financial capital; and social capital.

Future measurement and reporting of progress

ABS is continuing to develop the framework and suite of progress indicators, in consultation with government, academic, community and other representatives. The outcomes of this work will be reflected in the second edition of the publication in early 2004. Various changes to the publication, including giving more prominence to the area of *governance and citizenship*, elevating the *productivity* dimension to headline status, and combining the dimensions of biodiversity, water and land into one overarching dimension - the *natural landscape* - are being discussed. ABS also intends giving a more detailed articulation of MAP's underlying framework, and including feature articles on aspects of progress, including one comparing Australia with other OECD members.

Environmental accounts

ABS has produced several environmental accounts:

- Energy and Greenhouse Gas Emissions Accounts, Australia 1992-93 to 1997-98
- Water Account for Australia, 1993-94 to 1996-97
- Fish Account, Australia 1997
- Mineral Account, Australia 1996
- Environment Protection Expenditure, Australia 1995-96 to 1996-97
- Environment Expenditure, Local Government, Australia 1999-2000

In addition to these accounts the annual National Balance Sheet which ABS produces includes three natural resources: land, subsoil assets (minerals and fossil fuels) and native standing timber (see ABS Cat. No. 5241.0.40.001).

The second edition of the water account will be published later this year (2003). New editions of the energy, minerals and environment protection expenditure accounts are planned but the earliest any of these could be ready is 2005. Beyond this the ABS aims to produce land use and forest accounts, but these are still embryonic.

The environmental accounts can be used to assess some of the six broad interpretations of sustainability put forward in regard to the SEEA. In this part of the paper we use data from the energy and greenhouse gas emissions accounts to demonstrate how aspects of sustainability can be assessed. For example, in terms of national wealth, the account shows that net present value of energy resources was $76 billion in 1998, with natural gas and black coal accounting for 70% of total value (see Table 1 below). The estimated value of energy assets has doubled since 1992-93, mainly as a result of increases in the net present value of these two products. By this criterion energy resources have been a positive contributor to changes in national wealth, and usage of these resources has therefore been sustainable.

Table 1. **Net Present Value of Energy Assets (millions of dollars)**

Resource	1992	1993	1994	1995	1996	1997	1998
Black coal	3,282	8,164	7,830	12,824	11,706	16,363	25,019
Brown coal	169	288	428	488	541	663	659
Uranium	2,187	1,962	1,631	1,535	1,532	1,642	1,909
Crude oil	13,385	15,646	17,909	18,031	16,644	14,546	12,821
Condensate	2,575	3,196	3,399	4,292	4,553	5,496	5,501
Natural gas	14,770	18,597	20,247	25,476	26,384	28,424	27,904
LPG	1,253	912	1,168	1,682	1,851	2,244	2,090
Total energy assets	**37,621**	**48,765**	**52,612**	**64,328**	**63,211**	**69,378**	**75,903**

Source: ABS Cat. No. 4604.0

The energy accounts can assess strong and weak sustainability. Australia has an abundance of fossil fuel and mineral reserves (see Table 2 below). While strong sustainability is theoretically impossible to achieve given that these resources regenerate over geological timescales (hundreds of millions of years), in practice discoveries and new technology mean that additional economically viable resources become available. Sustainability can be assessed by looking at the stock of energy resources and at what rate they are being used. In 1998, the expected life spans of the demonstrated black and brown coal resources were calculated at over 200 and 700 years respectively.

Table 2. **Demonstrated sub-soil energy assets, 1998**

Resource	Economic Demonstrated Resource(a) (Petajoules)	5 year lagged moving average of resource life (Years)
Black coal	1,379,700	258
Brown coal	398,670	744
Crude oil	8,880	9
Natural gas	53,040	48
Condensate	7,141	33
Liquefied petroleum gas	4,576	45
Uranium	285,290	131

(a) Refers to that part of demonstrated resources for which extraction is expected to be profitable over the life of the mine given current prices and costs.

Source: ABS Cat. no. 4604.0

One example of target dependent sustainability is the promoting of greater use of renewable energy, with the aim of achieving greenhouse gas reductions. The energy account shows that in 1997-98, renewable energy sources provided a little under 6% of Australia's domestic energy requirements. Government initiatives have set a mandatory target for electricity retailers to source an additional two per cent of their electricity from renewable energy sources by 2010. Future accounts will be able to assess progress towards this target.

The relative efficiency of industries with regard to energy use and production of greenhouse gases can be assessed by looking at the energy account data in combination with other economic data, for example energy use per dollar of production or greenhouse gas emissions per dollar of production.

Other approaches and measures related to aspects of sustainability

A number of other developments underway in ABS will also assist research, discussion and decision-making on sustainability issues. These developments include national and sector balance sheets expressed in nominal and real terms; satellite accounts on various topics; measures of human capital; a framework and indicators of social capital; a framework and indicators of a knowledge-based economy and society; and improved measures of the distribution of household income and wealth.

National and sector balance sheets

The national income, expenditure and product accounts, input-output tables and national and sector balance sheets complete the Australian System of National Accounts. The sets of accounts form an integrated system in that income, production and expenditure transactions ultimately lead to changes in the stock of Australia's economic assets and liabilities recorded in the balance sheets. At the same time, economic assets recorded in the balance sheets provide the capital service inputs into current and future production, so they are an important determinant of the level of our current and future incomes and consumption. The balance sheets therefore provide important information on the sustainability of the economic system. If the stock of assets and net worth are increasing over time it would indicate that income levels into the future can at least be maintained.

The ABS has published a comprehensive set of national and sector balance sheets since 1995 (data are available back to 1989). These include the value of produced and non-produced assets and financial assets and liabilities. Estimates of the stock of non-produced (natural resource) assets are described as "experimental" because of the indirect method in which the values for some natural resources (sub-soil assets and forests) are derived. Nevertheless, they are regarded as reasonable indicative estimates of the value and trends in Australia's natural resources over time. The accumulation and revaluation accounts track the determinants of year to year changes in the value of assets and liabilities. Changes in values result from new capital formation less consumption of fixed capital (depreciation), the discovery (or renewals) of natural resources less their depletion, financial transactions, and revaluations of assets and liabilities due to price change.

Real/volume balance sheets at the national level (not by institutional sector) were released for the first time in 2001. They are designed to remove the effect of price changes in order to allow the analyses of changes in the value of Australia's assets, liabilities and net worth over time free of the direct effects of inflation. While volume estimates for the major categories of produced assets have been available for many years in Australia's national accounts, the focus of the new work was on volume estimates for stocks of non-produced, non-financial assets and real estimates of financial assets and liabilities, so as to derive an estimate of 'real' net worth. These estimates are also described as "experimental" because, like incomes, financial assets and liabilities cannot be decomposed into price and volume components so it is impossible to derive conventional volume indexes for them. Instead, they are deflated by a broad based price index in order to measure changes in the purchasing power of financial assets and liabilities over a designated numeraire of goods and services, and are referred to as "real" estimates.

Satellite accounts

The 1993 version of the System of National Accounts (SNA93) provides for a set of "satellite accounts" that develop certain fields of analytical interest as an adjunct to the core national accounts. They may explore certain areas in more detail, adopt different scopes or concepts or link physical and monetary data. They have the status of being compatible with the national accounts concepts and definitions, and therefore have direct linkages to and have the associated statistical integrity of that system. Many of these accounts can be seen to relate directly or indirectly to aspects of economic and social sustainability. Work undertaken to date in the ABS is outlined below.

Unpaid work and household satellite accounts

Households can obtain goods and services by purchasing them in the market or they can produce them themselves using their own capital and labour. The former are fully captured in the national accounts while by convention the latter are only partially captured. The own-account production of all goods used for own consumption or capital formation is included as are housing services provided by owner occupied dwellings, but all other services produced in the household for own use such as cleaning, food preparation, servicing and repair of goods, caring and instruction of children are excluded. The value of volunteering services provided to others is also excluded from the value of production and consumption. While SNA93 explicitly recognises that these activities are within the concept of economic production, for a variety of reasons they are excluded from the production boundary defined for the national accounts.

In order to properly compare consumption per capita or standards of living between communities or nations it is clear that the production/consumption boundary should be redrawn to include the production of all services for own use. Even within a nation intertemporal comparisons over a long time period can be distorted as economic activity moves across the production boundary over time. The tendency for households to purchase from the market what they used to provide for themselves (such as cleaning services, takeaway food) is reflected as a growth in the level of GDP even though the production and consumption of those services may not have increased overall.

Australia, like a number of other countries has put considerable effort into measuring the value of unpaid work (and own consumption and capital formation). Time Use Surveys have been conducted for 1992 (pilot survey) and 1997 and it is proposed to collect time use data from households again in 2005-06. The value of unpaid work has been compiled for 1992 and 1997 using input methods and it proposed that the valuation work be updated whenever new time use data become available. The results have been released as a "satellite account" to the national accounts. The ABS would also like to investigate the possibility of interpolating between and extrapolating from benchmarks and some work has already been undertaken to investigate the demographic *versus* behavioural influences behind changes in time use patterns. There is also a longer term aim to integrate the work into a more substantial satellite account for household production.

Non-profit institutions satellite account

Non-profit institutions (NPIs) play an important role in the provision of welfare, social and other services in Australia. They are an important part of the social fabric because of the wide community involvement through donations and volunteering. The

output and value added of non-profit institutions are already included in the national accounts, but in Australia each is indistinguishable in the accounts. Market services are valued in the usual way whereas non-market services are valued 'at cost'. However as mentioned above, the value of volunteer services provided to and by NPIs is excluded from the national accounts. An NPI satellite account brings together all of the market and non-market transactions of NPIs into an account, including an estimate for the value of volunteer services.

The ABS released a satellite account for NPIs in 2002. It is planned to update the account some time in the future.

Tourism satellite account

For many countries, tourism is a key source of income now and into the future. Actions which may damage the tourism potential of a country can have significant implications for the sustainability of their economies, or conversely actions to promote tourism potential can be an important source of future economic growth. Countries that are reliant on tourism for a significant proportion of their income may also be vulnerable to world events outside their control.

"Tourism" is not an industry in the national accounts or industry accounts more generally as it refers to the status of the customer as a visitor rather than the good or service produced. Because of this it is not possible to compile a comprehensive set of economic statistics for tourism by direct collections. Instead, the output and value added of the tourism industry has to be modelled within the supply and use tables of the national accounts system. This is what is referred to as a tourism satellite account.

The ABS has produced a tourism satellite account for each of the years from 1997-98 with the latest update in progress for 2001-02.

Environmental satellite account

Environmental satellite accounts focus on the interaction between the environment and the economy. As discussed earlier in this paper, SEEA provides a framework for such accounts and ABS work in this area is being guided by that framework.

In the context of the national accounts, the criticism is often made that the concept of income does not account for the run down or addition to environmental assets resulting from the economic process i.e. it is not a sustainable concept of income. ABS has published experimental estimates of income adjusted for the depletion of natural resources in a satellite account context (see the June quarter 2002 issue of *National Income, Expenditure and Product*, ABS Cat. No. 5206.0). While this represents progress towards a concept of sustainable income it still falls short of an ideal concept as it does not include a deduction for the damage of environmental assets more generally.

Other satellite accounts

ABS has also made progress in scoping and developing frameworks for some other satellite accounts that touch on aspects of the sustainability issue. At the present time, a substantial amount of work has been completed on the development of frameworks for satellite accounts on information and communication technology (ICT) and on education and training. Some early work has also been undertaken to scope a sport and recreation satellite account. The first of these accounts is designed to provide information on the supply and use of ICT products in the economy and is an important indicator of a nation's

connection to the "new economy". The rapid growth in the production and use of ICT products is thought to be an important factor in the strong, low inflationary growth in some countries over the past decade or so. A pilot study has been undertaken with a view to compiling a more substantial ICT account for 2002-03.

Education and training and sport and recreation satellite accounts would focus on aspects of the development and maintenance of human and social capital. As is the case for the other satellite accounts, they would aim to group together common activities that may be spread across a number of conventional industries and to use the supply and use framework to integrate the data. There is also the potential to extend the SNA production boundary by developing new concepts such as treating education and training as an input to the production of own-account human capital. While a detailed framework has been developed for education and training and some thought is being given to sport and recreation, resources are not available to proceed further with the compilation of these accounts at the present time.

Household income and wealth distribution measures

ABS is undertaking a major program of work to upgrade its measures of household income, including measures of income distribution across the population and over time. It is aiming to improve the methodology for collecting, deriving and presenting these measures and provide greater comparability with data on income benefits from administrative sources. In undertaking this work, consideration is also being given to implementing the recommendations of the Canberra Group on household income statistics and to improving the measurement of an extended income concept - final income - which adjusts disposable income (private income plus direct government benefits less direct taxes) to include the net effect of indirect government benefits and indirect taxes. Investigations are also proceeding into the treatment of non-cash income and salary sacrificing across a range of surveys with the aim of clearer delineation of the income concept being measured and more accurate and consistent reporting in social and economic settings.

A strategy to provide measures of the changing composition and distribution of wealth across Australian households is also being implemented. These measures will be consistent with the measures of household income and relatable to national accounting measures. Bringing the distributional data for income and wealth together will provided deeper insights into how economic disadvantage and inequality of households are changing over time. As part of this strategy, in September 2002 ABS released a paper *Experimental Estimates of the Distribution of Household Wealth, Australia, 1994-2000,* which reported the findings of a study that melded a range of existing data sets to construct experimental wealth data dissected by household characteristics. ABS is also planning a six yearly direct collection of data on household wealth in conjunction with its household income and expenditure surveys, starting from 2003-04.

Human capital measures

Discussions about sustainability often consider whether a nation is preserving its capital stock. As indicated earlier, human capital - the knowledge, skills and attributes embodied in people - is often considered to be one of the four broad types of capital stock (alongside social, natural, and produced and financial capital).

Later in 2003 the ABS plans to release a working paper *Measuring the Stock of Human Capital for Australia*, which will include the first official estimates of the dollar

value of a key dimension of Australian human capital. The estimates are calculated using the 'lifetime labour income' approach. Using this method, we measure the stock of human capital as the discounted present value of expected lifetime labour market income. Expected income streams are derived by using cross-sectional information on labour income, employment rates and school participation rates. This approach is also able to account for the effect on human capital formation of current schooling activities – that is, it can account for additional human capital embodied in those individuals who are still participating in formal education and who anticipate improved employment and income prospects as a result.

Using the Population Census data for 1981, 1986, 1991, 1996 and 2001, the study provides five snapshots of age-earnings profiles for four categories of educational attainment for both men and women over the twenty year period. Based on these age-earnings profiles, the study derives per capita measures of lifetime labour market incomes for each age/sex/education cohort, and applies these per capita measures to the number of people in the corresponding cohort. It then aggregates across all cohorts to estimate human capital stock.

The estimates are confined to people aged 25 to 65 years. Separate estimates, for that age range, will be given both for the population and for those people in the labour force.

Social capital framework and indicators

In Australia, social capital has emerged as an area of considerable interest to policy makers, social analysts and researchers. This interest has led to a demand for measures of social capital to enlarge understanding of society, its functioning and social wellbeing and to inform policy development and research. Measures of social capital have the potential to provide additional explanatory variables for social outcomes that the current range of socioeconomic and demographic indicators may not adequately explain. ABS has been undertaking a range of investigation and development work in this field.

The initial work has focussed on understanding, describing and defining social capital in the context of other types of capital (natural, produced and financial, and human) and as a contributor to wellbeing. Following consultation with stakeholders, ABS is using the definition of social capital adopted by the OECD to guide its work.

Current effort is centred on developing and refining a framework covering the different dimensions and components of social capital in a way that will facilitate their measurement, and on developing indicators that capture these elements. A range of ABS and non-ABS collections are being analysed for potential indicators and to identify data gaps. A paper describing the framework and defining the indicators will be published later this year. Data items to support priority indicators will be specified for inclusion in an ABS survey to be conducted in 2005-06.

Knowledge-based economy and society (KBE/S) framework and indicators

In August 2002, the ABS released a discussion paper, *Measuring a Knowledge-based Economy and Society - An Australian Framework*. The proposed ABS framework draws on work done by a number of organisations and individuals. In particular, it builds on work of the APEC (Asia-Pacific Economic Co-operation) Economic Committee and the OECD Growth Project.

ABS proposes a KBE/S framework model with five dimensions. Three core dimensions, “innovation and entrepreneurship”, “human capital” and “information and

communications technology", provide the focus of the framework and define the key characteristics of a KBE/S. In addition, there are two supporting dimensions: a "context" dimension and an "economic and social impacts" dimension. The context dimension is very broad and incorporates a number of background elements and preconditions, such as business environment and effectively functioning markets. The dimension on economic and social impacts is included in the framework on the presumption that a KBE/S has an impact on the economy and society.

Within each dimension are characteristics. A characteristic is an aspect of a dimension which has been used to both further describe the dimension and to give it some structure by splitting it into more understandable elements.

Finally, statistical indicators provide quantitative measures of characteristics. In the proposed framework, an indicator is defined as a single figure or a small data set showing a broad dissection (for instance by broad industry, age group etc). Where possible, time series and/or internationally comparative views will also be shown.

The next phase in the KBE/S project is to populate the framework with statistical data and to disseminate those data. The discussion paper sought comment and feedback on several aspects of the framework, including the relevance and range of indicators proposed. Considerable feedback has been received and, overall, the comments indicate that the published framework is acceptable as a working basis for organising statistics across this very wide-ranging area.

Our intention is to gradually build up a KBE/S statistical data product over time rather than attempt to cover all possible indicators in the first release. Development of indicator data for the product is reasonably well progressed and ABS is aiming for a first release around June 2003.

Conclusion

A range of different approaches are proving useful for analysing sustainability issues in Australia. Some of these approaches are based on accounting frameworks. Others are based on frameworks that provide measures of the changing levels of wellbeing or indicators addressing a particular theme or topic. No single approach adequately covers all dimensions of interest. Particularly in the social field, a variety of approaches are needed to support research and evidence-based decision-making. The suite of indicators approach has been of particular value in bringing the social, environmental and economic dimensions together to provide an overall perspective on national progress in Australia over the last decade.

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