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**SUSTAINABLE DEVELOPMENT AND THE CAPITAL APPROACH:
CONCEPTUAL AND PRACTICAL ANALYSIS**

Submitted by Statistics New Zealand¹

ABSTRACT

The capital approach, or the measurement of economic, societal and environmental productive capability over time, is rapidly being considered as a system that enables more effective indicator development for sustainability assessment. There is vast experience using the capital approach to measure national performance with the System of National Accounts (SNA). While there has been progress in this area, exemplified by the development of the Systems of Environmental and Economic Accounting (SEEA), there is still much under debate, from the definition of domain boundaries to the valuation of non-traded ecosystem services. Demand for sustainable development indicators at sub-national level raises a number of issues related to data collection and analysis methods required to enable regional level analysis. New Zealand has carried out a number of initiatives with varying degrees of success that have provided important learning opportunities for future development in this space.

INTRODUCTION

1. Human development has been a rapid and invasive process upon the earth, as is attested by the, now famous, Night Lights picture published in National Geographic (1998). This picture highlights the fact that there are few places left where human development has not made a permanent mark on the landscape (Deutsch et al, 2003). This rapid expansion is having an impact upon natural productive systems and ecosystems cycles, giving rise to a number of social and economic issues that may constrain future development (Bossel, 1999).
2. The recognition that existing policy frameworks were not sufficient to account for the rate and impacts of human development has led to the integration of several areas of study and

¹ Prepared by Martin Brown-Santirso.

policy. In 1987, the Brundtland Report grouped these challenges into the concept of ‘sustainable development’, which was defined as: “*development that meets the needs of the present without compromising the capacity of future generations to meet their own needs*” (WCED, 1987). Sustainable development has been legitimised by landmark international agreements such as Agenda 21 (1992), The Rio Declaration (1992) and the Kyoto Protocol (1997). However, there has been disagreement as to what the concept means in practical terms and how countries are to achieve sustainability, as such, there has been little agreement on how to measure it.

3. A number of approaches have emerged to assess sustainability as a result of policy demands for more encompassing information on economic, social and environmental issues. Measurement of progress indicators or headline indicators are seen as an efficient means of assessing human impacts on the environment. Others focus on wellbeing and examine the human, economic and environmental domains from a societal perspective². However, more sophisticated measures were seen as necessary to enable effective policy decisions on managing development into the future. Capital theory, or the measurement of economic, societal and environmental productive capability (assets) over time, is gaining momentum as a system which will enable more effective indicator development.

4. The central idea of the capital approach, in terms of sustainable development, is that the stock of capital that is currently used to meet the needs of the present, be passed onto the next generation intact or enhanced (Victor, 1991). While conceptually accessible, the capital approach presents operational challenges as not all elements of sustainability can be easily measured or defined. For example, the consideration of this approach does not address how and who will maintain these stocks into the future.

5. This paper discusses the use of capital theory in terms of sustainable development, for conceptualisation and indicator development. The paper draws attention to some of the difficulties capital theory has when is applied to this field, as well as some of the strengths that make it valuable. This paper then discusses measuring capital at different scales (global to regional) and some of the issues faced in this regard. Finally, there is a summary of the New Zealand experience with sustainability indicators and progress reporting.

THE CAPITAL APPROACH AND SUSTAINABLE DEVELOPMENT

6. The term ‘capital’ was first used in economics to describe entities such as buildings and machinery that enable future economic production (NRTEE, 2003). The capital approach, therefore, analyses assets or capital goods as means of production that will produce a flow of services into the future. This approach provided the theoretical basis for the development of the System of National Accounts after World War II. There are a number of general characteristics associated with capital assets. Smith (2006) highlights the following as central to this analysis:

- capital goods are not valuable on their own, but rather the for services they provide;
- capital goods depreciate over time, in others words, the quality of services produced declines as the goods age.

7. In terms of sustainable development, enough capital goods or assets are required today to generate the flow of goods and services that generate wellbeing to meet present human needs. In this context, capital includes assets outside the economy, such as ecosystem services and many aspects of society which provide services that enable the preservation of life. Also

² For example, “The Social Report” published yearly by the Ministry of Social Development.

explicit, is the need to maintain these assets and to provide investment to prevent the deterioration of the services produced over time, so future generations have an equal or better opportunity to meet their needs.

8. Any attempts in measuring or reporting progress towards sustainability have traditionally considered three domains: the economy, society and the environment with a focus on their wellbeing. The boundaries of these domains have long been a topic of international debate, as the dynamic interactions between domains are complex. However, there is general agreement that if all three domains have high degrees of wellbeing and the capital levels are maintained, then the system is sustainable.

9. Given that the capital approach to sustainable development has its foundations in economics, from the three pillar concept of sustainability, the concepts of economic capital, social capital and natural (environmental) capital arise. Each of these capitals is complex and are often further divided into component capitals that interact to produce the flow of goods and services that generate wellbeing.

10. From this multi-dimensional conception of sustainable development, two main postulates of sustainable development based on the capital approach have emerged: 'weak sustainability' and 'strong sustainability'. Weak sustainability is predicated on the basis that it is the sum of all capitals that must be maintained, assuming a high level of substitutability between them. In other words, depletion of natural capital can be offset by equivalent gains in other capital stocks (e.g. economic). Victor (1991) argues that while this premise may prove to be unfounded, it is worth considering the role of substitution in alleviating pressures on a resource base.

11. On the other hand, strong sustainability states that each of the capital stocks provides a unique set of services to sustainability and hence they cannot be substituted³. This has been extensively argued, particularly in the case of natural capital (Kunte *et al*, 1998. Deutsch *et al*, 2003, Victor, 1991). Natural capital provides a wide range of services and resources that cannot be mimicked or replaced by services from the societal or economic capitals. This argument has given rise to the concept of 'critical natural capital', and includes services provided by processes such as photosynthesis, that are essential for the survival of ecosystems, and thus, human survival.

MEASURING CAPITAL

12. Given the extensive historical use of capital theory (e.g. System of National Accounts), there is a well-developed body of thought around it (Smith, 2006). This has led to a refinement of methods that provide clear guidance on what to measure, what to exclude and often how to measure it. While a capital approach has a number of strengths when it is applied to sustainable development there are also a number of issues and difficulties that become clear when the concept is put into practice.

13. When sustainable development is put in terms of the production of goods and services that generate wellbeing, the economic notion of capital presents an overall sound framework for measuring production capacity. That is, produced goods and services require capital inputs and as long as the capital stocks and the factors that increase production (investment) or decrease it

³ There are arguments for a degree of substitutability, but this would be very limited and will depend on the nature of each resource in terms of capital, timeframes, available technologies, etc.

(depreciation) are measured, we should be able to report on the state of the whole system and thus sustainability.

14. Reality, however, is that resources across different capitals are highly variable and interact in different ways with 'productive systems', and often, these interactions can not be measured in terms of capital. This raises issues of measurability, comparability, and sometimes clashes with the meaning of capital stock. For example, the set of services provided by a stay-at-home mother cannot be fully accounted in terms of capital. Furthermore, lack of agreement with regards to the boundaries and relationships between the domains has resulted in varying assumptions and changing methodologies in data collection and analysis.

ECONOMIC CAPITAL

15. The capital approach has evolved from the specific purpose of better understanding the productive capacity of an economy. As such, with the System of National Accounts as its central framework, it has become efficient at accurately measuring economic capital and its relationships with resources and labour inputs. It allows analysis of the trade-offs required to maximise the flow of goods and services from the available capital. It is worth noting that this analysis is restricted by the availability of information on market (or estimated) values for the resources entering the production cycles (Alfsen and Greaker, 2006).

NATURAL CAPITAL

16. There has been considerable research on the conceptualisation and measurement of natural capital (Deutsch, *et al* 2003. Victor, 1991.). However, there are still obstacles as there are clearly distinct resources with a unique nature. Each of these resources will impact an economy and society in different ways and the approach to measuring them varies. The lack of market prices for many natural resources means that a number of them cannot currently be measured at all. Furthermore, these considerations do not account for qualities such as the capacity of the environment to assimilate waste. Victor (1991) writes "little attention is given to the sometimes useful distinction between renewable and non-renewable, exhaustible and non-exhaustible".

17. There are also discussions about the considerations of reversibility in the natural capital accounting process. Classical economic theory assumes that effects in the markets are reversible and if a market is out of equilibrium, it will return to it or find a new equilibrium. In the physical world this is often not the case. When an ecosystem is pushed beyond certain boundaries changes can become irreversible. For example, the well documented collapse of the Newfoundland cod.

18. In the lack of agreement for a particular method, researchers and agencies apply different notions when assessing natural capital. Alfsen and Greaker (2006) analyse the current method as used by Statistics Norway, which measures natural capital as a "stream of resource rents". They mention a detailed methodology that does its best to provide a measure of national wealth, but still does not include of a large number of resources, such as ecosystem services. This is not due to a failure of the methodology, as current methods are specifically designed to measure resources for which prices are available. There are also arguments questioning the validity of measuring all resources in terms of monetary value, in particular assigning monetary value to qualities like amenity value. (Bossel and Bossel, 2000. Max-Neef, 1991)

19. Deutsch et al. (2003) discuss the development of natural capital indicators in terms of 'critical natural capital' and the importance of ecosystem services (and ecosystem resilience) to economic and social wellbeing. However, current methods cannot provide an account of these services in a form consistent with other resource accounting methods. This creates issues of comparability that would enable analysis of trade-offs between different uses of a resource and its preservation (Smith, 2006).

SOCIETAL CAPITAL

20. In a similar manner to natural capital, societal capital can be viewed from different perspectives and is often subdivided into a number of component capitals:

- social capital: includes "the networks of shared norms and understanding that facilitate co-operation within and between groups" (OECD, 2001);
- human capital: comprises the "knowledge, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic wellbeing" (OECD, 2001);
- cultural capital: "is the set of values, history, traditions and behaviours which link a specific group of people together" (Spellerberg, 2001);
- Institutional capital: is "the range of formal and informal civic, political and legal arrangements that underpin market activity and civic life" (OECD, 2001).

21. The different forms of societal capital give rise to different conceptual and practical measurement methods which generate issues such as a lack of comparability, both with other forms of human capital and with economic information. Many of these limitations are well understood and there has been much work aimed at more inclusive measures (Hamilton and Ruta, 2006).

22. As with natural capital, there are resources for which a monetary value can be estimated, such as the value of skilled labour in the productive process, enabling a degree of comparability with national accounts information. While this represents a clear link between societal elements of sustainable development and the economy, it is not representative the full extent of the social wellbeing generated from a highly skilled labour force, as not all the service flows can be captured in one measurement.

23. Also, in societal capital, most capital assets cannot be valued in monetary terms, as is the case of social and professional networks or social norms. These elements of social capital are important to societal development as they provide a stream of benefits into the future, yet they are seldom properly covered in progress reporting or are covered only in relation to their contribution to economic value. (Hatfield Dodds and Pearson, 2005)

CAPITAL AT NATIONAL AND SUB-NATIONAL LEVELS

24. In the time since the Agenda 21 agreement, sustainable development has been incorporated into official policy in many countries. The development of Agenda 21 initiatives and programmes that followed required effective information on which to base decisions as well as track progress. The ensuing need for information has generated a worldwide proliferation of sustainable development frameworks and indicator reports.

25. The notion that sustainability begins at the small (even individual) scale (Bossel and Peet, 2000) and feeds into larger community, city and national outcomes generates the need for this

information to be available at different levels. In this regard, there are few additional difficulties from a conceptual perspective, but there are a number of practical obstacles that make sub-national statistics difficult to produce at best.

26. One of the first issues with producing information at different levels (regional in particular), is the production of significant data for smaller scale users. By in large the processes involved in data collection are aimed at obtaining nationally robust measures. Creating similar measures at the regional level requires greater amounts of data and associated data analysis capabilities. In terms of data gathering, there are other issues such as geographically referenced sample design. These considerations imply considerably greater costs for producing statistics against which the benefits of such undertaking must be measured. Administrative data has been seen as a potential opportunity in this regard, but it is important to consider the way data is collected and whether the product can support robust regional analysis.

27. With the increased mobility of modern transportation, there are more and more cross-boundary movements of goods, services and people. This creates problems with allocating capital to a particular region. One of the most common examples of this is the case of the commuter workforce, where is the capital assigned? To the region where the worker resides, or the region where the productive activity takes place? This is an issue internationally, as in the case of carbon accounting for international travel. At regional scale, transport becomes easier and this issue becomes more significant when accounting for capital.

28. Another significant issue with creating measures of capital that is relevant at different levels is comparability. More than just having sufficiently robust data, the information generated must be comparable against information for other regions, as well as other levels. To accomplish this, there has to be a uniform system of classifications, and uniform methodologies to ensure that comparisons are like with like. The nature of sustainable development implies that the needs of all human-beings are met; as such it is necessary to provide significant ways of measuring progress that are relevant to all.

29. Finally, a problem that assails all national statistical agencies when they try to generate statistics at progressively more detailed levels is that of confidentiality. As the resolution of data increases, so does the influence of larger unit-respondents on a particular indicator to the point of being identifiable through the statistics. As statistical agencies strive to fulfil an increasing need for localised data, it is also important to prevent potential damage to individuals and businesses through divulging sensitive information.

ALTERNATIVE SYSTEMS

30. The preceding analysis indicates that capital theory is a good starting point for conceptualising sustainable development and aiding the production of indicators. The analysis also makes clear that current capital based techniques cannot fully account for all aspects of sustainable development. In this context, it is worth considering that there are alternative approaches and that perhaps capital based approaches could be complemented with other approaches in those recognised weak spots. Bossel and Peet (2000) argue that sustainable development is too complex to be encompassed by a single measure or approach, and that the only way to properly cover highly complex systems is to use a method which reflects this complexity.

31. Bossel and Peet (2000) propose a framework that analyses sustainability from a systems science perspective. They argue that all systems have a number of fundamental properties (or needs) determined by the environment the system evolved in. These fundamental properties are expressed as a set of basic needs that are constant, few and classifiable, all systems have these same needs and the only thing that changes is the way they are met. The framework views the sustainability of a system as a function of the degree to which the basic needs for that system are met. Therefore, developing a set of sustainability indicators involves measuring the levels of the satisfiers of a particular system against those required for sustainable development.

32. Another popular approach involves the use of composite measures that are said to be representative measures of sustainable development. While composite indicators can be easier to communicate, there are methodological issues including the selection of appropriate weightings and choice of variables within these measures. Well-known composite indicators include the Genuine Progress Indicator (GPI), which takes the consumption measure of GDP and carries out a number of adjustments such as accounting for income distribution; subtracting the cost of crime and pollution and adding the value of volunteer work; the Human Development Index (HDI) proposed by the United Nations; the Ecological Footprint; and the Index of Sustainable Economic Welfare (ISEW).

33. Other systems include; the pressure-state-response style frameworks that are effective at finding causality for a particular variable, but are criticised for being blind to dynamic relationships among the many variables of the environment. Thematic approaches to sustainability indicators which attempt to describe all the facets of a community, but are seen to be lacking in organisation and creating unnecessary large amounts of information. Lastly, the compass approach (Atkisson, 2000) rates a number of thematic indicators on scale from 1 to 100 and then averages the scores of indicators in the same pillar of sustainability to generate aggregated scores.

CAPITAL APPROACH IN SUSTAINABLE DEVELOPMENT FRAMEWORKS

34. Today there is a myriad of sustainable development related publications; papers that evaluate different approaches of analysis; analytical reports advocating the use of a particular approach; and reports that track progress towards sustainable development. While the results of this explosion of information has been criticised as fragmented, parochial and lacking organisation (Bossel and Peet, 2000), there have been some concerted efforts to develop frameworks that attempt to enable uniform sustainability assessments. One such attempt is the development of a standardised approach to developing sustainable development indicators by the UN and the OECD so nations can monitor and compare their performance (Patterson, 2002). It is worth noting that, to date, there is no framework that has been widely accepted as wholly representative of sustainable development.

35. Traditionally development indicator frameworks use measures derived from applications of the capital theory, mostly in the economic pillar, for example, most indicator sets include GDP or GDP per capita as headline indicators. Other indicators used this way include the trade balance or investment in R&D, in essence measures derived from the System of National Accounts. These measures have usually been complemented with thematic indicators to provide a measure of social or environmental issues. These, however, are seldom adequately covered except by measures directly related to economic contributions (Hatfield-Dodds and Pearson, 2005).

36. More recently there has been an increasing focus on better representations of all the different forms of capital, leading to sustainable development indicator frameworks that are more comprehensive. The MONET framework produced by the Swiss Federal Statistical Office in 2004 and the Measuring Progress Towards a More Sustainable Europe report published by Eurostat in 2005 are good examples of this. On the other hand, while there has been much work on the development of natural and social capital measurement, there is still much work needed to develop a system that creates a seamless measure for all forms of capital.

THE NEW ZEALAND EXPERIENCE

37. New Zealand's experience with sustainable development indicators began in the early 1990s with efforts by the Ministry for the Environment and the then Department of Statistics to promote state of the environment reporting (Patterson, 2002). The initial attempts to provide comprehensive sustainability reporting resulted in the publication of several reports with a focus on the environment, such as Measuring Up (Statistics New Zealand, 1992) or the State of the Environment (Ministry for the Environment, 1997).

38. In more recent years there has been greater effort put into developing indicators that would serve policy-making and link the different components of sustainability. The results were a more comprehensive view of sustainability reporting that included more elements of society and culture, as well as a more organised approach to the interfaces between the domains. Examples include the Monitoring Progress towards a Sustainable New Zealand (Statistics New Zealand, 2002) report or the Quality of Life in New Zealand's Largest Cities projects.

39. Aside from these projects there have been a number of indicator reports for specific sectors or regions such as the Social Report (Ministry of Social Development, 2005) which is aimed at reporting on New Zealand's wellbeing from a societal perspective. Also the Economic Development Indicators (Ministry of Economic Development, 2005) which aims at reporting on various aspects of New Zealand's Economy.

40. While all these efforts cover the main areas of sustainable development, most of them have been developed in isolation, lacking a common framework to link them together. Also, there has been a lack of continuity as several of the mentioned reports have been one-off projects with no regular follow ups.

41. Legislative requirements are increasingly fuelling a demand for information in all areas of sustainability at more localised levels. For example, the Local Government Act (2002) requires that all local authorities draw up long term community plans and report every three years on progress towards the community objectives set out in those plans. The requirement for the information and the lack of a consistent national framework has resulted in local and regional authorities producing their own information from a combination of local sources, national estimates and modelling. It is of note that these regional statistics are often well researched and meet reporting standards, but they are seldom comparable across regions or to national statistics.

42. New Zealand has little experience in using capital theory to derive sustainable development indicators. The only indicator framework developed to date that has explicitly employed the capital approach was Monitoring Progress towards a Sustainable New Zealand published in 2002 by Statistics New Zealand. This report uses the central idea of maintenance of capital to select a number of indicators that represent each major type of capital. It is worth

noting that no attempt has been made to generate a capital valuation of environmental or societal goods and services.

43. Statistics New Zealand has also established a set of natural resource accounts based on the framework set out in the System of Environmental and Economic Accounting (2003). Since 2001, accounts for energy, minerals, fish, marine, environmental protection expenditure, forests, and water resources have published⁴, currently under development are a land statistics account and a waste account.

44. In summary, there has been a flurry of activity in the sustainable development space in New Zealand, from setting official policy to progress indicators development. These efforts are effective in covering a specific area but lack cohesion or common overarching goals to guide the multiple efforts. Table 1 illustrates the areas of information for which New Zealand currently capital based information.

Capital stock	Availability	Basic indicators
Economic Capital		
National Balance Sheet	Not yet available	Value of NZ assets over time
Financial capital stock	Not yet available	Value of NZ financial stock over time
Productive capital stock	Available (SNA)	Value of NZ productive stock over time
Environmental capital		
Natural Resource stocks	Partial	Quantity and value of natural resources stocks over time
Natural capital (Ecosystem services)	Not yet available	Quantity and 'value' of environmental capital over time
Societal capital		
Human Capital	Available (short time period)	Quantity and value of human capital stocks
Social Capital	Experimental	Value of social capital
Cultural capital	Not yet available	Value and quantity of cultural capital (over time)
Institutional capital	Not yet available	Availability of Regulation and security

CONCLUSIONS

45. The capital approach has a number of attributes that closely match many of the requirements to encapsulate sustainable development and provide a consistent way of reporting progress. Such attributes include timeframe aligning, a consistent language, and a consistent way of viewing the components involved in sustainability. On the other hand, sustainable development is highly complex, with a large number of dynamic relationships and a multitude of unique resources, which generate obstacles for accurate assessment.

⁴ For further information refer to the following website: <http://www.stats.govt.nz/NR/exeres/CA9EEA72-2B28-4EAB-A2F0-6DD40E83F93B.htm>

46. The capital approach is an important tool to produce measures of sustainable development as it has scope in all three domains of sustainability. Through the System of National Accounts, economic capital can be fully accounted for; similarly, elements of the societal and natural capital can be partially accounted through their participation in production processes. Where the capital approach is currently limited, other approaches should be considered to complement capital measures. This would ensure enough information is available on a consistent basis for policy making in all relevant areas of sustainability.

47. Also, sustainable development information is required at all levels of governance with a high degree of comparability across regional and national boundaries. The main implications indicate that data collection and the ensuing analytical methodology should be designed to meet the increasing need for regional information, and remain relevant for national and international comparisons.

48. Finally, despite the drawbacks, the establishment of an international reporting framework based on the capital approach would represent a step forward for sustainability. It will increase international comparability and transparency as well as give momentum to research and development of more complete capital based reporting methods.

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