SUSTAINABLE DEVELOPMENT AND POLICY:  
A BRIEF REVIEW OF THE  
LITERATURE & CURRENT PRACTICE  

Final Report to the  
Government Economic Service Group  
on Sustainable Development  

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SUSTAINABLE DEVELOPMENT AND POLICY: A BRIEF REVIEW OF THE LITERATURE & CURRENT PRACTICE

Executive Summary

The objectives of this review are two-fold: (i) to provide an exploration of the options for the overarching (‘high-level’) framework which establishes the principles about what sustainable development (SD) is and how it is achieved; (ii) assess more specific options for incorporating SD into policy and project appraisal in order to assess better how these actions contribute to SD.

Sustainable development has been interpreted in many ways. However, one prominent theme has led to an examination of how changes in wealth – or capital – now might lead to changes in future well-being. Put this way, sustainability is concerned with development prospects. This capital approach to sustainability involves a major task in tracking changes in a wide variety of assets that comprise the wealth of, for example, nations.

It is possible to broaden this agenda still further to consider distribution within the current generation, ‘social sustainability’, economy-environment linkages, the impact of the United Kingdom on sustainability ‘elsewhere’ and so on. Arguably, however, it makes sense firstly to think about SD from the more ‘narrow’ wealth-based frame of reference and to broaden where there is a compelling case to do this (i.e. where it would enhance substantially our understanding of the SD policy problem). Defining the SD problem too broadly risks an outcome whereby almost all policy actions can be defended as contributing to sustainability. This plays unnecessarily into the hands of those who argue that the concept has little meaningful to offer.

Nonetheless, many national governments, as revealed in a number of official SD strategies, have adopted a broad interpretation of what SD is. Proponents of this approach would argue that it is simply the outcome of extensive deliberation amongst those with a stake in the SD strategy shaping process and is capable of being understood by a broad audience. The result is frequently then a high-level policy framework with an emphasis on SD as maintaining a healthy economy, a just society and living within environmental limits. The UK Strategy largely fits this mould.

Its strengths notwithstanding, this approach appears to be less useful for guiding thinking on how SD might be incorporated into policy. At the very least a bridge is required between that particular objective and the high-level policy framework. An advantage of the capital approach is that it leads logically to a response to issue in terms of how policies and projects contribute to wealth (either overall or to its parts). Thus, if some sort of ‘asset check’ is thought to be a useful contribution to understanding how policies or projects contribute to SD, it may be augmenting the existing high-level framework (in the UK’s SD Strategy) with something based around the capital approach is a useful step forward.

At present, within the UK Impact Assessment (IA) process, one bridge between the SD Strategy and appraisal is the Specific Impact Test on sustainable development. This test is itself an annex to the main evidence base about the costs and the benefits of a policy proposal. Given that this appraisal of costs and benefit is the more focal
apparently to the IA process, it is also important to ask in what ways the contribution of a policy or project to SD can be evaluated using CBA (and in what ways it cannot). If cost-benefit analysis (CBA), for example, is found wanting in this respect then clearly there remains a potentially important strategic role for some distinct form of sustainability assessment (maybe in its current form, or similar, or recast as an ‘asset check’).

It is important not to lose sight of the possibility that conducting state-of-the-art cost-benefit appraisals can go a considerable way in assessing how an action contributes to SD. One basis for this assertion is the ever more routine use of non-market valuation methods to estimate ‘shadow prices’ for e.g. environmental changes brought about by policies and projects. Furthermore, established UK guidance for using a declining (social) discount rate clearly gives far greater weight to impacts in the distant future (than previous practice).

Nevertheless, the SD agenda poses a number of challenges for CBA. Foremost amongst these are concerns about whether the values being placed upon environmental changes properly reflect what, for example, is lost when natural assets are degraded or destroyed. A general complication is the difficulty of knowing the value that future people might attach to changes in natural assets which occur as a result of current decisions. There are a number of different considerations (from psychology and behavioural economics as well as work-in-progress in understanding the functions and services provided by ecological assets) that imply that future values could be either substantially higher or lower (than those values revealed or expressed by people now). Valuing the changes in future amenities, provided by natural assets, therefore present complex issues for practitioners which usefully could be examined further in future official CBA guidance.

A related specific issue is the whether the relevant ‘shadow prices’ that we use in practice capture correctly the substitution possibilities between natural assets and other forms of wealth. This is the question of strong versus weak sustainability. Weak sustainability assumes that there are no fundamental constraints on substitutability. By contrast, the strong sustainability assumption is that some amount of nature must be conserved in order to sustain well-being. It is fair to say that the academic literature on SD is long on debate about which characterization is correct and short on practical answers to this question. However, there are signs of evolving knowledge on this issue by perhaps quantifying and valuing stocks of ecological resilience (and changes in those stocks), estimating the future value of amenities provided by natural assets which are characterized by poor substitution possibilities and, more broadly, the increasing effort being devoted to understanding the importance and value of ecological services.

If it is known that a natural asset is unique and cannot (or should not) be substituted, there are a number of different, but often interrelated, ways of conducting CBA in the presence of such constraints. Options include calculating the shadow price of the sustainability constraint analogous to the process that informed the UK’s existing advice on the shadow price of carbon. Another variant makes use on the long-standing concept of a safe minimum standard (SMS). This reverses the onus of proof, implied by a cost-benefit appraisal, away from assuming that development is justified unless
the costs to the environment are shown to be very high, to a presumption that conservation is the right option unless the sacrifice that it entails is very high.

If it is thought that different components of a natural asset themselves can be substituted for one another (e.g. wetlands in different geographical locations) then it might be possible to incorporate, into cost-benefit appraisals, the idea of compensating projects. This would require any action that reduces the stock of say wetlands to be compensated by a physical project which generates an off-setting replacement (by creating a new, or enhancing an existing, wetland). Assuming that the ‘off-set’ is at least a satisfactory substitute for what is lost, costing in such a replacement becomes an essential part of CBA. Questions remain about the efficacy of such compensating investments remain but, interestingly, this thinking (as well as the idea of a SMS) appears to have influenced recent conservation policy in the European Union (e.g. the Habitats Directive).

There remains a challenging agenda to identify so-called critical natural assets (those aspects of the natural world characterized by poor substitution possibilities) and, more ambitiously, the levels at which these stocks should be conserved. Yet this is a challenge that must be faced. Sustainability constraints, as for any policy objective or restraint, need to be properly justified rather than asserted or assumed with inadequate basis. Inevitably, however, there is significant uncertainty about what aspects of nature are critical and what aspects are not. Moreover, this uncertainty about the world in which we live is likely to remain.

As a result, discussion about how to achieve SD, and to incorporate it into policy and project appraisal, inevitably must be concerned about how to make decisions in the face of this uncertainty. Combined with other characteristics of certain natural assets such as irreversibility, this uncertainty understandably has been used to recommend that decisions need to be weighted more heavily in favour of precaution. Ideas such as the SMS, for example, exemplify this precaution as a (strong) sustainability constraint. Nonetheless, such approaches do not tell us necessarily where we should draw the line in terms of what we should be cautious about and to what extent. As a result there is a need to understand further the value of ‘keeping options open’ upon which sustainability constraints are implicitly premised.

A question remains about the role of sustainability assessment defined in general terms here as any element of the appraisal process that has an explicit and deliberate focus on sustainable development. The advantage of these assessments is that they tend to cover possibly important elements of the SD policy problem that CBA does not. Nevertheless, an interim conclusion is that, as a practical matter, these assessments including the sustainable development test in the UK IA process are prone to be too broad and vague to be useful currently. At the very least, there is a need for a critical audit to reflect fully on the value of these exercises; how well these tasks tend to be performed in practice (given the broad and time-consuming terms of reference that SD test typically specifies), how they change thinking about policy design over the longer term and so on.

This point notwithstanding, it is likely that there remains an important function for sustainability assessment as a complement or an adjunct to other appraisal methods such as CBA. One obvious option for these assessments, in the future, is to recast then
in the form of an asset check. In other words, this would entail asking about the relationship between the policy or the project and its effects on the assets that comprise the wealth of an economy. This usefully could augment the cost-benefit approach by focusing more explicitly on assets as well as raising the issue of which assets are critical.

There is a hierarchy of further choices that follow from an asset-check approach. Perhaps, for example, it is the overall wealth of the nation (including its natural wealth) that is the relevant focus. An advantage of looking only at this bigger picture is it accords with the view that sustainability is about the property of a development path rather than a requirement of any single action. This approach would allow an assessment of the implications for development prospects of the ‘entirety’ of decisions (and priorities and options for affecting that path, if needed, could then be determined). Put this way, an overall asset-check is just wealth accounting by another name. Yet, perhaps what needs to be assessed also involves demonstrating what assets are before some proposed action and what they are likely to be after each project or policy. A cost-benefit appraisal can answer this question in a number of respects but it might be argued there is at least a case to consider about complementing this with an asset-check on a proposal-by-proposal basis.

An asset-check possibly still implies an assessment agenda that is at least comparable, in terms of its breadth and depth, to sustainability assessment as it currently stands. This is both a strength and a weakness. That is, the practical implication of its breadth and execution might mean that an asset-check has the same tendency as ‘conventional’ sustainability assessment to lead to possibly uninformative assessments of a proposal’s worth in SD terms. This comment is particularly relevant to an asset-check applied on a proposal-by-proposal basis rather than overall. Breadth, nevertheless, is at the same time desirable if a goal of sustainability assessments is to take stock of the actions of different branches of government and how these contribute to sustainable development. Hence, while much of the SD debate has understandably focused on how to monitor and manage natural assets, development prospects are also determined by stocks such as human capital, knowledge and, ultimately, factors such as social cohesiveness (via ‘social capital’).
1. **Background to This Review**¹

The primary purpose of the current review is to inform the thinking and on-going deliberations of the Government Economics Service Group on Sustainable Development (GES-GSD). The terms of reference for the GES-GSD present a complex challenge. However, the basic question posed can be summarized relatively succinctly: is there any straightforward means of assessing how actions, of different branches of government, contribute to sustainable development? The specific objectives of this review are, in turn, two-fold.

- Firstly, to provide an exploration of the options for the overarching (‘high-level’) framework which establishes the principles about what sustainable development (SD) is and how it is achieved.
- Second, to assess more specific options for incorporating SD into policy and project appraisal in order to assess better how these actions contribute to SD.

The report itself begins by briefly defining what sustainable development is and what needs to be done to achieve it. We then turn to an examination of how national governments typically have interpreted SD and whether, in the case of the United Kingdom, there is a case for revisiting the (high-level) policy framework and, if so, what are the options. Next, appraisal options – in order to inform the SD objective – are examined including the link between cost-benefit analysis and sustainability and proposals for ‘sustainability appraisal’. This is followed by Annexes which provide more background detail related to some of these themes.

2. **Defining Sustainable Development**

In order to discuss how sustainable development might be incorporated into policy and projects, firstly what is needed is a proper understanding of what sustainable development is. Unfortunately, there is no unified theory of sustainable development and, indeed, it has been clear for some time that concern about SD is, to say the least, broadly based and spans a large number of academic disciplines and policy interests. For example, the Brundtland Report (WCED 1987) viewed sustainable development as serving many different (and possibly competing) goals: economic development, a better environment and a particular concern for human needs both now and in the future. If anything, in the two decades since, the debate has become broader still.

It is arguable, however, that the closest thing we have to a theory of SD can be found in discussions to which economists have contributed (or perhaps influenced, in part, by economic ideas and thinking). Even if those discussions are believed to be far from the last word about what SD is and what needs to be done to achieve it, these ideas at least serve as a useful and coherent starting point. Widely known as the *capital approach*, SD – from this particular perspective – is about how current decisions have an impact upon future (human) well-being. More specifically, Pezzey (1989) defines SD in the following way. Development is sustained along a development path if well-

¹ I am grateful for extremely valuable comments on earlier drafts of this report from members of the Government Economics Service Group on Sustainable Development, Dieter Helm, Cameron Hepburn and Anthony Heyes as well as other participants of a Defra Environmental Economics Academic Panel meeting.
being (per capita) does not decrease at any point along the path. There are a number of other ways of thinking about this problem such as perhaps in terms of future opportunities. However, it is the ‘well-being’ terminology that, by-and-large, is the more familiar.

The next step is to think of wealth as the basis of future well-being: that is, the wealthier an economy is today the greater the level of well-being its citizens can enjoy in the future. This also means, of course, that current changes in wealth can have consequences for that future well-being. For example, if current actions were to result in a decline in wealth then it is entirely possible that this will lead to falls in future levels of well-being. If so, then – on Pezzey’s definition – these current actions are unsustainable.

To reiterate, development prospects – from this perspective – are determined by current wealth and what is happening to this wealth. In turn, one way of monitoring wealth is by looking at the value of all assets in an economy; broadly construed to include natural assets, human capital and so on. In terms of indicators, this has led to a search for measures of ‘comprehensive’ or ‘genuine’ wealth as well as measures that track what is happening to these assets over time: i.e. ‘comprehensive’ or ‘genuine’ saving (or investment). (See Annex 1 for a detailed discussion of the literature that has given rise to this approach.)

There remains a long-standing argument (worth noting at this point but which we return to at various stages throughout this report) over whether particular assets need to be conserved in order to sustain development. This is the so-called weak versus strong sustainability debate. For weak sustainability, there is no special place for the environment as such. Put another way, it is the ‘overall’ portfolio of wealth bequeathed to the future that matters. As long as the (real) value of this portfolio is held constant it matters little that its constituent parts change over the development path. Strong sustainability, by contrast, requires that the environment is accorded explicit and special protection. There are a number of variations on this position but, generally, it requires that ‘natural wealth’ should (in some way) be preserved intact through specific conservation rules. Hence, strong sustainability should represent the greater policy challenge because current human actions would be significantly more constrained (as certain development paths would be effectively ‘off-limits’).

So long as it is not being argued that all natural assets must be conserved (and typically it is not) then there is a guiding role for insights from both approaches (Pearce et al. 1996). For example, most interpretations of strong sustainability tend to argue there are certain critical resources that are both crucial for human development and have no substitutes. This also implies, of course, that not all of nature is critical. Hence, much of the middle-ground, within the capital approach to sustainability,

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2 In addition, some would define SD so as to prohibit not only current actions that come at the expense of the future, but also increases in current well-being that further broaden the gap between say rich and poor.

3 An Annex (to be provided in the next draft) will set out in more detail developments, and evolving issues, in the theory and practice of this capital approach to SD.

4 Nevertheless, in any given year, according to the World Bank savings data-base (e.g. World Bank 2008), up to about 30 countries are not saving enough, elsewhere in the economy, to cover their depletion of natural resources. So even by a so-called weak sustainability criterion a clear signal is provided that a very real problem for the development prospects of these countries exists.
could well centre on identifying critical assets, understanding how they function and what their importance is and, finally, managing these resources accordingly. Unfortunately, significant uncertainty remains – and indeed is likely to remain – about which natural assets are critical and which are not. Hence, there is corresponding uncertainty about the location of this middle-ground. Discussions about how to achieve SD inevitably must be concerned about how to make decisions in the face of this uncertainty.

3. Overarching (High-Level) Framework

The visions and frameworks that national governments have evolved to meet the SD challenge are typically the province of sustainable development strategy publications. Many of these strategy documents begin with a single sentence defining SD, commonly quoting or paraphrasing the ever-focal Brundtland definition, but more often than not then appending supplementary statements either clarifying or adding a little further detail. These strategies typically then proceed by identifying how SD (as defined) is achieved with reference to objectives and aspirations in (usually) to three domains: economy, environment and society. The United Kingdom (UK) approach is illustrative of this although it is distinctive for identifying ‘living within environmental limits’ and ‘achieving a just society’ as ends and further identifying a ‘sustainable economy’ among other things (specifically, ‘good governance’ and ‘sound science’) as a means of attaining these ends.

An excellent, and comprehensive, review of national government interpretations of SD is provided in a recent report by an UNECE Working Group on Statistics for Sustainable Development (henceforth: WGSSD 2008). This publication specifically is concerned with one element to which governments have used SD strategies; namely, to guide thinking on which indicators are needed to monitor progress towards stated SD objectives. Nevertheless, much of its characterization of official SD responses and a number of its conclusions are relevant in the current context as well. Broadly speaking, according to WGSSD (2008), the SD policy community is divided into two camps:

- The first is a future-oriented view. On this perspective the logical focus of SD is on intergenerational issues. This then leads naturally to, what is now widely known as, the capital approach (along the lines described previously) as a guiding principle of SD.

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5 This states that SD is “development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, p43).
6 For example, in the Norway case, this codicil to the Brundtland definition is: “To achieve such development, ecological and economic policy considerations must be integrated”. For the Canadian Federal Government it is: “… the efficient and environmentally responsible use of all of society’s scarce resources - natural, human and economic”. And for New Zealand: “… looking after people, taking the long-term view, taking account of the social, economic, environmental and cultural effects of our decisions, and encouraging participation and partnerships”.
7 United Nations Economic Commission for Europe.
• Those in the second camp take an integrated view where the focus is on both present and future issues. These are frequently organized around broad policy themes or domains reflecting the social, economic and environmental.

Essentially then, it is one or other (or perhaps some mix) of these two approaches that provides the choice of (high-level policy) framework from which more specific guidelines (on integrating SD into policy and projects) logically should flow.

Most economists (among others) would view, admittedly with some qualifications, the capital approach as the ‘only game in town’ for understanding what SD is and how it is to be achieved and, by implication perhaps, the high-level policy framework for a SD Strategy. The arguments for this approach derive in part from its intuitive appeal, insofar as entreaties to manage wealth sensibly chime with popular notions of ‘not eating into one’s capital’ or ‘not selling the family silver’. More significantly, this capital or wealth-based approach has proven useful, over at least the past two decades, in establishing the core theoretical notions that underpin much of current academic thinking about sustainability. It also has led to insightful analytical implications as well as practical guidance on the measurement of SD (see Annex 1).

Despite this, however, the majority of governments – that have prepared SD Strategies – have implicitly placed a substantial premium on breadth and pragmatism rather than the future-oriented or capital approach. For example, the United Kingdom approach falls within the latter camp viewing the nation’s SD problem through an integrated and policy-themed lens of what is happening to the economy (it must be healthy), society (it must be just) and the environment (its limits must be observed).

Why has the capital approach been largely downplayed in national SD strategies and does its eschewal matter? In addressing the former question first of all, one accusation that might be directed at the capital approach is that it is too ‘narrow’ and neglects a wider range of factors that policy-makers believe to be important. Of course, the issue here is not whether these issues are important as such but whether they are pertinent to understanding SD. On the one hand, narrowness seems a hard argument to sustain given that the capital approach encompasses resource stocks, environmental liabilities, human capital, knowledge stocks and, ultimately, perhaps social cohesiveness (via social capital). On the other hand, WGSSD (2008) interprets this charge of undue narrowing as too restrictive a focus on future well-being. An argument in favour of the future-oriented approach is that the political process takes care of the present such that the focus on ‘capital’ redresses the balance. The contrary view is that this neglects long-standing concerns about intragenerational equity, which notably were central to the Brundtland Commission with its emphasis on poverty within the present generation. Needless to say, distributional concerns in the ‘here-and-now’ also are frequently central to political thinking, and thus policy formation, more generally.

Explanations vary as to why present generation inequities might make development unsustainable. Perhaps it is argued to be commonsensical: that is, if one is worried about equity between generations it seems logical also to care at least as much about

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8 Nor does the approach make judgements about the substitutability (in terms of maintaining produced output and generating well-being) between natural assets and other forms of wealth. Put another way, whether one believes that the best response to the world we live in is best characterised by weak or strong sustainability, maintaining capital, in some form, remains at the heart of the SD problem.
equity within the current generation. Maybe it is thought that there is a mechanism whereby a development path is unsustainable because there are huge disparities in well-being or opportunities within the current generation. Few contributions have sought to make this link formally although the ‘poverty and environment’ literature certainly has pointed in this direction. This suggests that what some have in mind when defining sustainable development is to prohibit not only current development that comes at the expense of the future, but also increases in current well-being that further broaden the gap between say rich and poor. This in itself, however, does not explain why the capital approach has been neglected in SD strategies. The approach is still relevant but with an added emphasis perhaps on how assets are distributed within the current generation. However, it is arguably the case that capital approach proponents have been at fault for not making this point sufficiently strongly in the past.

It is plausible that restriction of scope is not necessarily the sole issue (when the notion of capital is broad and where the basic SD definition can be extended in sensible ways). It is possible though that narrowness is relevant because some find fault with the largely economic rhetoric of the capital approach. So while, for example, an organization such as The World Bank has found the capital approach useful for conveying to Finance Ministries how environmental degradation affects the balance sheet, broadly construed, of a nation, it may be that this same terminology, and approach, is unappealing for a wider (non-economic policy or public) audience for which national SD strategies are intended.

More generally, there has been very little, if any, attempt (in the academic literature) to understand the political economy of how SD has been interpreted by governments in practice and, for example, the indicators that have emerged subsequently to monitor these SD visions. In the case of choosing indicators, however, one might speculate that once a new (apparently cross-cutting) policy challenge such as SD emerges as a government objective then it stands to reason that representatives of particular policy domains will want their own areas to feature prominently and be represented within indicator sets. Ultimately, this could favour an integrated approach as the option that would command the most support. Put another way, given its potential breadth there is something almost for everyone. A more encouraging view of this process is presented in WGSSD (2008). There it is argued that the legitimacy of this integrative approach is enhanced because of its very emergence from typically wide consultation both within and outside government.

Turning now to the consequences of this evident official downplay of the capital approach, in SD strategies, it is clear that the two approaches are not wholly at odds with one another. The capital approach is itself concerned with assets – both tangible and intangible – within all of the policy domains (environment, economy and society) identified in the integrative approach. In the case of the indicators that emerge from either approach, WGGSD (2008) argues that there is a remarkable degree of overlap between those indicators suggested by the capital approach and those suggested by the policy-based approach. This is an interesting finding although it would perhaps be more surprising if there were hardly any convergence at all. There is almost bound to

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9 This is in contrast to the way in which policy analysts have sought to understand why different environmental policy instruments are selected in some contexts but not others and some countries but not others.
be a number of indicators within a policy-based approach that can be construed as also relevant to the capital approach. Indeed, the capital approach (future-oriented) is a sub-set of the policy-based approach (current- and future-oriented) so this ought to be the case. However, it is also likely that pragmatism, amongst other considerations, will mean that even those following a capital approach cannot resist broadening by adding indicators which are only tangentially related to the future-oriented view of SD; thus increasing the chances of overlap. This congruence between approaches might indicate that there is less at stake in choosing between the two approaches than at first meets the eye.

Nevertheless, it would be a mistake to conclude that the choice between the two approaches does not matter. Table 1 summarizes the advantages and disadvantages of either approach in this respect. If the available options, for an overarching (high-level) framework, essentially allow starting over (and so re-inventing the UK’s SD framework) then the choice, for sake of argument, is between continuing with the existing integrative approach and replacing it with the capital approach. The reality, however, is likely to be that a ‘clean slate’ is not an option and, in this case, the problem essentially boils down to choosing the status quo or augmenting the current framework with something that more closely resembles the capital approach.

Table 1: Options for a (High-Level) Framework for Policy Making

<table>
<thead>
<tr>
<th>Option</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
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<tbody>
<tr>
<td>Maintain/ build on existing</td>
<td>Evolved as outcome of consultation and discussion.</td>
<td>Difficult to see how approach in itself addresses question of how to</td>
</tr>
<tr>
<td>(integrative/policy-themed)</td>
<td>What has changed that will take us away from a similar outcome if the</td>
<td>evaluate contribution of policies/ projects to SD</td>
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<tr>
<td>framework</td>
<td>process is repeated?</td>
<td></td>
</tr>
<tr>
<td>Capital approach</td>
<td>Logical conceptual basis for guiding SD with focus still broad on large</td>
<td>Focus too narrow (on future well-being)/ economic?</td>
</tr>
<tr>
<td></td>
<td>range of assets</td>
<td>Few (no?) countries appear to have adopted in its pure form</td>
</tr>
<tr>
<td></td>
<td>Extends naturally to question of how to evaluate contribution of policies/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>projects to SD (‘How does action contribute to wealth?’)</td>
<td></td>
</tr>
<tr>
<td>Mixed approach? (Both approaches</td>
<td>Avoids throwing the ‘baby out with the bathwater’</td>
<td>Resulting framework could be a hotchpotch and might be unlikely</td>
</tr>
<tr>
<td>‘side-by-side’ in some way)</td>
<td>While there is a case to use the capital approach (in some amended form)</td>
<td>simply to be the ‘best of both worlds’ (although there are precedents for this</td>
</tr>
<tr>
<td></td>
<td>to guide SD strategy, indicator choice etc., if this is not possible</td>
<td>compromise elsewhere)</td>
</tr>
<tr>
<td></td>
<td>then remains a strong case to use approach to guide thinking on issue on</td>
<td></td>
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<tr>
<td></td>
<td>how to incorporate SD into policies</td>
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Interestingly, there are precedents in a few countries for this mixed approach. Switzerland, for example, complements its three-dimensional model (social, economic and environmental) with the capital approach (Federal Office for Spatial Development, ARE, 2004). The Belgian Federal Report on Sustainable Development (2005) refers
to using the capital approach to trace how driving forces affect assets broadly construed. One aspect of the Canadian approach is that it uses the notion of capital but focuses it more narrowly on accounting and management of natural capital only within a national natural resources management policy framework.

The resulting (mixed) framework arguably becomes even more congested with concepts and terminology. However, in a number of other respects, the compromise might be appealing. Most relevant to this current review, whatever its strengths, the integrative approach is not an obvious beacon to guide more detailed thinking about how to incorporate SD into policy and projects. At the very least a bridge is required between that particular objective and the high-level policy framework.

Integrative approach, however, simply may be too broad to be meaningful in this way, viewing everything present and future, across all policy domains as relevant to SD. There are two possible risks here. One is that it will result in a tendency for more specific departmental policy documents to construe almost any of their activities as contributing significantly to SD. If so, then at best such exercises have little practical value; at worse they could be counter-productive in the sense of being ‘grist to the mill’ to those who oppose the idea that SD has anything meaningful to offer policy-thinking. And while the integrative approach reflects undoubtedly laudable goals – i.e. a healthy economy, just society and living within environmental limits – real policies are more likely to involve hard choices between desirable but competing objectives such as these. Incorporating SD into policy and projects then must find some way to evaluate the contribution of actions to SD in the face of trade-offs.

The capital approach does not necessarily deal with trade-offs either, at least in abstract form (i.e. simply stating that there are assets upon which development prospects hang). However, the approach is capable of such logical extension by looking perhaps at the way in which policy actions contribute to wealth (either overall or to its parts) and whether this justifies costs (see, for example, Arrow et al. 2003 and the more detailed discussions in Annexes 1 and 2 in this report). More generally, the emphasis on wealth and assets does provide a distinctive focus that arguably circumscribes how e.g. policy departments can describe their actions: that is, to what extent do these actions create or destroy assets? It does so, of course, by narrowing the scope of SD (which presumably for proponents of the integrative approach is itself a drawback). Nevertheless, the addition of the capital approach might provide a bridge that is lacking in the existing UK national SD framework. Ultimately, whether this is useful might well depend on the extent, for example, to which ‘asset checks’ might become a more formal part of the impact assessment process. It is to these issues that we now turn.

4. Incorporating Sustainable Development in Policies and Projects

Incorporating SD into policy and projects involves a rich and complicated array of considerations. It firstly must entail finding some way of assessing the contribution of these actions to the SD goal given that sustainability is best conceived as a property of a development path rather than a requirement of any single aspect or action. A second, but no less important, challenge is what judgement can be made about whether the estimated contribution to SD justifies the action. Currently, in the UK, the SD element
is subsumed partly within the impact assessment (IA) process. Whether a proposed action is in line with ‘SD principles’ is thus one of the Specific Impact Tests within the IA template: i.e. an adjunct to the information presented about the costs and benefits of a proposal. Questions that arise from this include:

- The substance of and insight provided by the existing ‘SD test’ within the impact assessment process;
- The extent to which incorporating SD into policy and project appraisal is needed at all or whether existing appraisal methods – specifically CBA – already provide adequate signals about sustainable development;
- Whether there are revisions or extensions to CBA itself which would incorporate better SD concerns;
- If a separate SD test is retained as part of the IA process, what form should it take?
- The prominence given to SD relative to other aspects of the IA and, what to do in the event of possible conflicts with the outcome of the SD test and, for example, the cost-benefit test.

In what follows immediately, we review some of these issues.

**Sustainable Development and Impact Appraisal Currently**

Any department or agency in government wanting to enact a new policy measure likely to have a significant economic, environmental or social impact needs to complete a detailed Impact Assessment (IA) before the measure is approved. Cost-benefit analysis (CBA) is an explicit and integral part of this assessment as are a range of additional Specific Impact Tests – twelve in all – including ‘sustainable development’ and ‘carbon assessment’. The IA template requires that policymakers explain why exactly a proposed intervention is necessary and why this proposal was selected over alternatives. The cost-benefit test – as well as the physical and monetary information used to conduct this test – appears focal to making this case. Such information must be included within the main evidence base: i.e. the main text of the IA template. Specific Impact Tests – including the SD test – are typically included as annexes.

An illustration of this SD test is provided in the impact assessment for the recent UK Marine Bill (Defra 2008). It is arguable that the actual detail – essentially, a paragraph – provided in this published IA makes it difficult to judge exactly how the assessment that the “Bill’s proposals will help the UK Government achieve its sustainable development objectives” (p87) was made. The checklist of Specific Impacts Tests available on the Department for Business, Enterprise and Regulatory Reform (BERR) website\(^\text{10}\) indicates that there two elements that, in principle, are intended to inform this judgement. First, it involves a consideration of the eleven other Specific Impact Tests (spanning a broad range of social, economic and environmental considerations). Second, it involves an assessment as to whether the proposal is consistent with ‘SD Principles’ (referring again broadly to the UK’s five SD principles; i.e. a just society living within environmental limits supported by a healthy economy, good governance and sound science).

To reiterate then, the SD test – as it currently stands – requires that the IA refers back to supplementary evidence already provided elsewhere in other annexes and asks further that a proposal’s SD credentials are assessed against a number of desirable but very broad and rather vague overarching objectives or SD attributes. It seems reasonable to speculate that this approach could be unlikely to provide meaningful and new insights about the merits or otherwise of a proposal. Unfortunately, given the scope of this review, it has not been feasible to evaluate whether this speculation is justified or not. Nevertheless, it seems significant that even in the context of marine management legislation which should be fairly straightforward to justify in SD terms it is not immediately obvious what the SD test is and, just as importantly, what it adds.

There are a variety of tools related to the SD Specific Impact Test that offer perspectives on the SD credentials of proposals. Defra’s SD ‘filter’, for example, appears to be analogous to the ‘competition assessment filter’ used in IA and, interestingly, is intended to shape thinking about ‘SD issues’ at a relatively early stage of a proposal’s evolution. The link to the SD Specific Impact Test is that the same questions asked there are also the central features of ‘Stretching the Web’. The ‘web’ concept comes from the visual configuration of the questions in a spider web-like form. A line running around the outer perimeter of the web has a maximum positive impact on SD, hence the ‘stretch’; a line running along the very inside around the hub of the figure, or where ‘bites’ appear in the line, detract from sustainable development.

The Hazardous Waste Unit’s IA of the regulatory changes that it proposed to stay in compliance with the Hazardous Waste Regulations (2005) refers to using this particular tool. Specifically, it states that: “The sustainable development filter was applied to assess the risk of a significant detrimental effect on competition. Analysis of the ‘stretching the web’ filter indicated either a neutral or beneficial effect of the policy proposal on sustainable development.” (Defra 2009, p6). Generally, however, up-take of the ‘filter’ concept seems to be limited to date (and, even in the Hazardous Waste published IA example, mention of SD is restricted to the above quotation; no further clarification is given). This conclusion relates to the use of the ‘filter’ terminology and tool rather than suggesting that SD Specific Impact Tests are wholly ignored in current and past IAs. Nevertheless, this does illustrate a broader point. The existence of official procedures and guidelines does not guarantee effective use in practice. In fact, the great disadvantage of an ever-growing informational burden placed either on specific appraisal methods (e.g. CBA) or the appraisal process (e.g. Specific Impact Tests) might well be an increased likelihood that guidelines will not be followed or will be interpreted both flexibly and arbitrarily.

Needless to say, comments on the possible shortcomings of existing procedures are easier to make than articulating how these criticisms can be used to forge a positive response as to future options. Moreover, given the diversity of policies and projects – as well as the branches of government responsible for bringing these actions about – any such framework must be at the same time both coherent and broad. Much of the evidence, however, is that these objectives frequently pull in different directions. It is worth noting, however, that a number of countries such as Canada, Switzerland and Norway for example, appear to be going through a similar process as that being conducted by the GES-GSD. This suggests that there is much to learn from analogous efforts in other countries to understand how, in practice, SD can be incorporated in
policy. And that, moreover, this experience gained elsewhere should be investigated more systematically than has been possible given the scale of the current review.\footnote{At the international level, the processes which resulted in the conclusions of WGSSD (2008), in the context of developing a consistent and streamlined set of sustainability indicators, as well as shape the direction of on-going efforts to elevate the United Nations’ resource and environmental accounting framework to an International Statistical Standard offer scope for further learning about reconciling disparate viewpoints about SD and related matters.}

Cost-Benefit Analysis and Sustainable Development

As it stands, cost-benefit analysis is a focal element of the UK impact assessment process. Undoubtedly this economic approach is just one element of a policy decision. Equally, the quality and comprehensiveness of economic appraisals presumably varies in practice across proposals. Nonetheless, this growing emphasis on explicit cost-benefit thinking is a significant development. Moreover, it is fair to say also that the UK is in the vanguard in translating progress made in the theory and practice of non-market – particularly environmental – valuation into official appraisal and evidence gathering. The ever-more routine official use of these methods is now codified in publications such as HM Treasury (2003). Just as importantly, official recommendations about time-varying social discount rates allow much greater prominence (relative to previous practice) to be given in appraisal to impacts of policies and projects that arise in the distant future. This will help ensure that concerns about the future consequences of current actions are not simply assumed away by the ‘tyranny of discounting’.

All of these developments have a critical role to play in ensuring that cost-benefit appraisals, in principle, have the potential for signalling whether proposals represent a move towards (or away from) SD. Another way of looking at this is to say that a project or policy which has positive net benefits – and where all of the relevant changes the action brings about have all been valued at their correct shadow prices or social values – can be said to have increased wealth (see, for example, Arrow et al. 2003). In other words, the proposed action will add actual assets to the national (or perhaps global) balance sheet or will increase the economic resources that potentially are available for the future.

However, to trust that CBA alone can provide information about the consequences of a decision for sustainable development is to rely on a number of strong assumptions that are unlikely to hold in practice and even, in some cases, in principle. Put another way, there is little ground to simply assert that on its own CBA is enough. Note that this is not the same thing as saying that CBA is not needed at all (it remains an important element of informing any public decision). Nor does it mean that CBA cannot tell us anything at all that is useful about the consequences of a policy or project for future generations. On its own, however, demonstrating that a proposed action’s (monetary) benefits outweigh its costs may not be enough to justify confidence that the action also contributes to development being sustained for, at least, three reasons.

- Firstly, there must be practical concerns about extent to which the quality and comprehensiveness of economic appraisals varies across actual proposals. In this case, there is a job to do in terms of ensuring that official CBA consistently
conforms to best practice about say environmental valuation as laid down in official guidelines. And, more ambitiously, do the guidelines reflect the knowledge frontier given that this is a rapidly developing field?

Furthermore, given that concern about SD is based explicitly on judgements about distributional outcomes, this also reinforces the need for official guidance to be followed in practice on minimum requirements for reporting how costs and benefits are distributed over time and across groups. If SD is defined broadly (as it tends to be in national SD Strategies) then the logic is more straightforward. CBA is not enough because it cannot possibly cover the breadth implied by these high-level frameworks. If SD is conceptualized less broadly, and even if it is understood only within the narrowest interpretation of the capital approach, then this assertion arguably will still be correct generally for the additional reasons outlined below.

- Secondly, attention also needs to be given to the bigger picture as to whether enough is being saved overall for the future (and what is being saved in particular).

The original insights about whether economies were on a sustainable path or not were established in abstract but simple models where development was ‘optimal’ – in the sense that there were no market or institutional failures only a depletable (but ultimately replaceable) natural resource that could be substituted for by a reproducible asset (see, for a review, Annex 1 of this report). Such an economy might be unsustainable simply because it does not save enough for the future. That is, for some reason, it consumes too much of the proceeds of resource depletion possibly. Just as importantly, there could be systemic problems such as evaluating future prospects – and thus estimating (genuine) saving – using observed rather than ‘sustainability prices’12 (again, this is a different point to the matter of correcting prices for market, and other, failures). The point here is that there might be some sustainability problem at the aggregate (i.e. ‘macro’) level that appraisal at the policy or project level is not picking up.

- Thirdly, in any discussion about the loss of natural assets that arise when a policy or project is enacted, the question of importance looms large. That is, are the losses, for example, tolerable? This does not mean that the losses should be tolerated or that they ‘do not matter’. Rather it refers to whether these losses can be viewed, in the round, along with the rest of the costs and the benefits that arise because of the action. Clearly, a CBA requires that the change in a natural asset can be valued. Moreover, being confident that this appraisal has taken adequate account of the future consequences of losing this asset now amounts to having assurance that the (relative) price of the services that otherwise would have provided are correct. Environmental valuation has come a long way. But there is bound to be uncertainty about this issue particularly if what is involved is a complex ecological service.

All this suggests two complementary paths. One is to continue to improve the reach and accuracy of valuation methods across a greater range of natural assets. In this way, the practice of CBA will be improved in order to better reflect, for example, the losses

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12 See, for example, Pezzey (2004).
that are endured as natural assets become increasingly scarce. The other is to consider how much of nature we should put beyond straightforward cost-benefit thinking. Perhaps, as an illustration, we have reason to think that what might be lost is critical and that it is not possible currently to say, with necessary confidence, what is the value of this loss (even within some broad range). That assessment itself will have implications for CBA practice: i.e. it places cost-benefit appraisal within a sustainability constraint (thus putting some trade-offs effectively ‘off-limits’). But it also suggests at the very least the need for supplementary appraisal of elements of sustainability not covered directly within a CBA. The basic point stands, therefore, CBA is not enough and dissatisfaction, for example, with current SD tests do not mean that no test is needed at all.

Improving, on the one hand, the practice of CBA – how environmental valuation takes future values in account generally and how increasingly scarce resources whose services cannot easily be replaced are valued more specifically – and, on the other hand, looking for a distinct, and perhaps more direct, test of sustainable development both strike us as entirely reasonable, and complementary, responses to the challenge of assessing the consequences of actions for sustainability. In the remainder of this section, therefore, we consider what options are implied by looking at evolving valuation issues as well as the implications of sustainability constraints for CBA. A subsequent section then looks options for a distinct sustainability assessment.

Evolving Issues in Valuation and Sustainable Development

A pre-eminent concern about whether choosing policies and projects with positive net benefits simultaneously can deliver SD (or at least, as in Stavins et al. 2003) deliver the prospect of SD if it is desired) is whether the holy grail of knowing the value of ‘everything’ is within the grasp of policy analysis. In the same vein, it also must be asked whether the values that we actually possess and can place on e.g. changes in natural assets are ‘correct’ in the sense of adequately describing the importance of these assets. This uncertainty is not only restricted to valuation: i.e. assigning ‘shadow prices’. Forecasting physical changes to e.g. ecosystems that arise from some policy intervention or project – especially over long time periods – is also likely to be a highly uncertain endeavour. Valuation of these future changes clearly adds an extra element of uncertainty. This does not mean that valuation should be avoided. Knowing whether the benefits of an action outweigh its costs is one critical element of making a good decision or not (Randall 2002). However, it does require that uncertainties are acknowledged explicitly and the research challenge represented by this is met.

An excellent review of the challenges that arise from valuing future costs and benefits, and particularly those issues related to changes in natural assets, is provided by Horowitz (2002). Clearly, we cannot possibly know exactly what future preferences will be – that is, what future people will value – beyond those things we feel confident will continue to be required for survival or basic functioning. The usual practical response to this uncertainty is to assume that future people have the same preferences as those living in the present. This means that, other things being equal, estimates of e.g. willingness to pay elicited or revealed in the here and now (and reflecting how current people value some environmental change) are used to value changes in the future. As an illustration, this might entail applying “today’s” value of a statistical life
as the shadow price of a fatality prevented in say 100 years’ time because of climate change mitigation now.

One difference between WTP now and WTP (to avoid the risk of fatality) in the future will be the discount rate used. However, the valuation problem raises distinct issues to how future values should be discounted. Horowitz notes that, even if the preferences held by present and future people are identical, there are at least two important determinants of WTP that might change over time. The first of these is income. If, for example, it is reckoned that future people will be richer than people now then WTP should be adjusted to reflect the fact that future people will value the same change more highly. The basis for this would be an assumption that what is being valued – in this case, a reduction in fatality risks – is at least a normal good. The second determining factor is environmental quality. In this instance, if it is thought that environmental amenities will become more scarce in the future then it is plausible that the (marginal) value that will be placed on future losses of this amenity will be higher (than now).13

In the case of changing incomes, the information that must be sought to boost estimates of future values is the income elasticity of WTP. So, for example, an ‘income elasticity of WTP’ value of 0.3, for purposes of illustration, would suggest that if future people have twice as much income as people today then WTP, in this future, will be 30% higher than now. Estimates of income elasticities are relatively available (although by-and-large this evidence comes from cross-sectional studies in e.g. stated preference surveys rather than time series) (see, for a review, Pearce et al. 2006). Also needed is an estimate of future income growth about which we might be uncertain (especially in the distant future). Indeed, incomes might fall in the future if sustainability threats are genuinely large. Current UK official CBA practice indicates that it is not uncommon to ‘uplift’ the values of e.g. landscape amenities (in the case of transport policy appraisal) and statistical illness (in the case of health policy appraisal) in order to take to account of the effect of rising (future) incomes on WTP. In the case of changing environmental quality less is known, although Horowitz (2002) for example outlines a handful of studies that throw some light on how marginal values change in the face of changing environmental quality. Clearly, there is more work to be done here in understanding this crucial issue. There are, however, additional but related complications to consider.

One such complication can be summed up by asking whether estimated values adequately reflect substitution possibilities between nature and other forms of wealth. We have had cause to refer to this critical issue at a number of points elsewhere in this report. However, it is worth noting – in the context of how to value changes in the service flows that future people will enjoy from natural assets – recent contributions from Hoel and Sterner (2007) and Sterner and Persson (2008). Both of these papers show how the value (or shadow price) of a scarce environmental amenity might increase over time. To calculate this, a number of assumptions must be made (ideally based on evidence). Most notably, a judgement needs to be made about the ease (or difficulty) with which particular natural assets can be replaced. To use the

13 To use the jargon, the impact of changing incomes and environmental quality means that, for example, changes in natural assets have distinct effective discount factors, an insight that goes back at least to contributions by, for example, Krutilla and Fisher (1974).
terminology, this is summed up by the ‘elasticity of substitution’. The higher the value of this elasticity (reflecting the greater difficulties of replacing a natural asset with another type of wealth), the faster is the increase of the price of an environmental amenity as the natural asset (giving rise to that amenity) becomes more and more scarce.

Although the exact details are a little involved, the proposal is that a lack of substitution possibilities for a scarce resource provides a further reason to boost estimates of future willingness to pay to be used in a CBA that seeks to value what is lost when this resource is destroyed or degraded. Put another way, there is reason to assert that, if natural assets become scarcer, future changes in the amenities provided by those assets will be valued more highly (at the margin). This tendency will be reinforced where the asset in question is characterized by poor substitutability (such that the amenities that it provides cannot easily be compensated for by increases in other goods and services that future people might value).

The complications do not stop here. Nor do these additional considerations all work in the same direction of saying that WTP in the future is higher than now. For example, Horowitz (2002) reviews a number of compelling psychological factors that plausibly could come into play when thinking about how future people might value, in particular, environmental losses. Among these is the notion of reference dependence. This refers to the observation that people have an inclination towards valuing changes relative to some reference point: typically, the current situation that they face. Of course, if environmental quality is itself changing over time then so is the reference point against which change is evaluated.

As an illustration, suppose that some unique area of wetland is threatened by a large infrastructure project and that, if the project goes ahead, the ecological losses that occur (e.g. to resident and migratory birds and aquatic species) are irreversible. Current people will value this change relative to the existing reference point: i.e. the fact that in the here and now the wetland (in its present form) exists and will be permanently altered by the project. Willingness to pay values – perhaps elicited using some sort of stated preference survey – might well indicate that current people value the continued existence of the wetland highly. Future people, on the other hand, plausibly might not attach any particular importance to the (past) loss of the wetland and the fact that the wetland services that they enjoy are lower. This is because their reference point is a world without this area of wetland: i.e. the economic appraisal is looking at the gains and losses that occur if the project goes ahead.

Horowitz argues that reference dependence is particularly relevant when thinking about existence values rather than, to use an extreme example, when the resource that is under threat is critical to human survival or well-being. Even then, reference dependence is likely to be a matter of degree and there remain questions about whether or how the current generation should take account of such ‘future preferences’ in appraisals. Nevertheless, taken together with concerns about how to account correctly for the changing relative prices of the goods and services provided by natural assets affected by current decisions, this suggests that there is some way to go before we can be fully confident that actual cost-benefit appraisals are an adequate reflection of the complexity of the underlying issues. This is not intended to contradict our earlier comment about the usefulness of the current trend towards using CBA to
inform decisions. Rather it suggests that this process would be enhanced through further consideration of these issues in future official appraisal guidance.

**Strong Sustainability and Economic Appraisal**

The strong sustainability assumption states that some amount of nature must be conserved in order to sustain well-being. There are a number of related ways in which this assumption can be incorporated into a cost-benefit appraisal in addition to the recent contribution of e.g. Hoel and Sterner (2007) discussed previously. These include:

- Conservation rules such as safe minimum standards
- Compensating or shadow projects
- Calculating the shadow price of the sustainability constraint

**Safe Minimum Standards**

Concerns about strong sustainability are essentially to do with the risk that losses in natural assets – perhaps beyond some threshold – could have dramatically adverse consequences for human well-being in the future. It stands to reason, therefore, that insuring against possibly catastrophic risks is a desirable objective of policy. One means of achieving this end might be to observe conservation rules. CBA then has to work within these rules: i.e. subject to these constraints.

Of course, the consequence of observing these constraints might itself be very costly. Is any trade-off ruled out in such circumstances? One answer to this question is based on an idea which has been around for a while: namely, a ‘safe minimum standard’ (SMS) (Ciriacy-Wantrup 1968; Bishop 1978). What the emphasis on SMS does is to reverse the onus of proof, away from assuming that development is justified unless the costs to the environment are shown to be very high, to a presumption that conservation is the right option unless the sacrifice that it entails is very high. Randall (2007) envisages the point at which society can justify ignoring the SMS to be when the current generation risks impoverishing itself (and perhaps its survival prospects) if the commitment to the SMS is honoured. Put another way, once a SMS is identified, it only should be breached in truly exceptional circumstances. However, it is likely that society might wish to draw this line less strictly than this and so questions remain about how to identify whether the cost of defending the SMS is too high. Kopp and Portney (1999), for example, propose the use of mock referenda to arbitrate decisions which impose large costs or benefits on the far-off future.

**Compensating Projects**

In some cases there could be a degree of flexibility in terms of how a sustainability constraint is respected. For example, perhaps a cost-benefit rule can be specified which is subject to the requirement that natural capital is kept intact overall. This idea of shadow or compensating projects (Barbier et al. 1990; Hanley and Spash 1993) thus requires any action that reduces the stock of say, wetlands, is offset by a physical project which generates an off-setting replacement; by creating a new wetland. This means that the principle of (strong) sustainability becomes applicable to the portfolio of projects rather than any specific intervention. It also means that costing in such a
replacement would be an essential part of cost-benefit analysis (Hanley and Atkinson 2003).

Considerable challenges exist in incorporating this idea into actual appraisals. An example of some of these issues is discussed by Hanley and Atkinson (2003). They ask whether, in the case of a development project which threatens the destruction of an area of ancient woodland, a newly-planted woodland of equivalent size provides an acceptable offset? One answer might be to provide an area of land that somewhat in excess of what was lost and so perhaps to err on the side of caution. (Although we might well be unsure how much bigger the new woodland needs to be.) But if the new wood is planted on an area of heathland then an offset presumably must be created for the implied loss of the latter.

These are issues with considerable practical import given growing interest in biodiversity offsets and compensatory projects in the US (via e.g. the Endangered Species Act) and the European Union. In the case of the latter, this thinking – as the well as the notion of a SMS – appears to have influenced conservation policies such as the EU Habitats Directive (Pearce 2004). Thus, the Habitats Directive (and other related regulations such as the Birds Directive) is analogous to a constraint on the loss of natural assets in its requirement that the ‘stock’ of (designated) Natura 2000 sites be conserved. Moreover, the Habitats Directive Guidance (European Commission 2007) requires that development options are chosen which are the least damaging for a Natura 2000 site. There is a rider to this constraint stating that damage is permitted if there “imperative reasons of overriding public interest” (p2). However, if damage follows as a result of some development option being adopted by all compensatory measures to ensure “overall coherence of the Natura 2000 network” (p2).

Valuing the Sustainability Constraint

One final variation on incorporating this point about strong sustainability would be to calculate the shadow price of the sustainability constraint. In many senses, this is what the UK’s shadow price of carbon is reflecting: that is, a “SCC [social cost of carbon] consistent with [the] range of atmospheric concentrations of carbon identified by the Stern Review as the target for global action” (Defra 2007, p1). Whether or not that particular target is consistent with strong sustainability, the basic analogy holds. It would be interesting, therefore, to examine further how this approach might be extended to other types of environmental problem and natural assets if adequate grounds can be made for the constraint.

Postscript: Identifying Critical Natural Assets

Specifying sustainability constraints, in any of these ways, requires that policy-thinking grapples with the weak versus strong sustainability debate. If the option of expanding the use of sustainability constraints in economic appraisal of policies and projects is investigated further then it is crucial that these constraints are properly justified. Essentially, this is a problem of identifying critical natural assets or capital. But at the heart of this endeavour is the question of how much of nature should be conserved?
One immediate problem in answering such a question, however, is that it typically involves working with a literature – and body of knowledge therein – which is at least one step removed from being straightforwardly operational. This does not mean these ideas have no value. Rather it means that more work is needed to bridge the gap to meet the practical requirements of appraisal. We review some recent contributions in more detail in Annex 2 but note, in the remainder of this section, some of the main and emerging issues.

- Directly relevant empirical evidence about substitutability is at a premium even for commercial natural resources. A recent exception is Markandya and Pedroso-Galinato (2007) and it is to be hoped that such work – along with other contributions such as Hoel and Sterner (2007) and Sterner and Persson (2008) – could signal a renaissance in the empirical investigation of these issues by economists.\(^\text{14}\)

- Another recent development takes a different, but equally promising, tack (Walker \textit{et al.} 2008; Mäler 2008; Mäler \textit{et al.} 2009) starting with the concept of ecological resilience. In this approach, resilience – the ability of an ecosystem to recover from shocks and stresses – is characterized as a stock. In other words, resilience is – in principle – just like any other form of wealth and has a distinct asset value that can be increased or decreased as a result of policies and projects. Nevertheless, it is a form of wealth that is characterized by complexities such as thresholds which must be adequately accounted for.

- There is an interesting parallel literature which has sought to identify and categorize critical natural capital with reference to its functions and so on (such as Ekins \textit{et al.} 2003). The tendency here is to define criticality in rather broad terms but this work is important not least for tackling directly the issue of what is critical natural capital in a coherent and systematic fashion.

- The issues that arise in this work are bound to become better understood by increasing expertise in accounting for the services provided by ecosystems (Daily 1997) and the value of these services (Daily \textit{et al.} 2000). Challenges remain but nevertheless there is reason to view positively the significant efforts being put into this work-in-progress and currently being summarized in the EU/UNEP review on ‘The Economics of Ecosystems and Biodiversity’ or TEEB. Previous concerted endeavours, in particular the Stern Review and subsequent debate, indicate what has been achieved in the climate change context.

- Experience is being gained in how resource compensation or ‘equivalency’ might work: i.e. the shadow projects discussed in the previous section. For example, in Europe, there is emerging work in the context of the EU Liability Directive (see, for example, REMEDE 2008).

- Finally, much of the middle-ground in discussions about SD has wisely centred on identifying critical assets, understanding how they function and managing these resources accordingly. However, there remains considerable uncertainty about the

\(^{14}\) There is also a literature that looks at alternative (but related) indicators of scarcity such as resource prices (see, for example, Krautkraemer 2005).
location of this middle-ground and this uncertainty will, in all likelihood, remain. Incorporating SD into policy and projects will also need to take explicit account of decision-making in the face of this uncertainty (see, for example, Pindyck 2007).

Evidently, there are significant complexities in making advances in estimating ecological values: i.e. estimated money values of ecological services. Indeed, some might even conclude that such is the enormity of the task ahead that the question naturally arises as to whether estimates of monetary values that emerge from this work can ever be sufficiently robust for policy. Clearly, any sensible response to this question must firstly begin with a proper understanding of what ‘robust’ means in this context (and what benchmark is it being measured against). But possibly implicit in asking the question is the judgement that guidance provided, in the absence of valuation, will provide – on average – a better decision. Clearly, any such claim in itself also demands careful scrutiny.

What is beyond doubt, however, is that estimated ecological values should not be used unquestioningly in policy analysis. That is, due recognition must be made of uncertainties that might, in some part, belie these data. But the issues at stake, as they relate to decision-making, are complex. Disregarding information on ecological values altogether, on the other hand, does not necessarily increase the certainty that a good decision is made if what is ignored is a critical factor that should be brought to bear on how to make decisions (Pearce et al. 2006).

**Options for Sustainability Assessment**

A question remains about the role of sustainability assessment defined in general terms here as any element of the appraisal process that has an explicit and deliberate focus on sustainable development. The advantage of these assessments is that they tend to cover possibly important elements of the SD policy problem that CBA does not. Nevertheless, as we have discussed previously in this report, an interim conclusion is that – as a practical matter – these assessments including possibly the sustainable development test in the UK IA process are prone to be too broad and vague to be useful currently. This is an interim conclusion because it has not been possible given the scope of this review to come to a more complete or well-founded assessment. Nonetheless, at the very least, there is a need for a critical audit to reflect fully on the value of these exercises to date. This scrutiny could cover how well these tasks – e.g. the SD Specific Impact Test and so on – have tended to be performed in practice (given the broad and time-consuming terms of reference that SD test typically specifies), whether the reporting requirement has changed thinking about policy design over the longer term and so on.

These points notwithstanding, it is likely that suitably conducted there remains an important function for sustainability assessment as a complement to other appraisal methods such as CBA. It also seems appropriate that – as now – this test be an adjunct to the main appraisal. Arguably, it could merit greater priority or emphasis in the scheme of Specific Impact Tests which appear it seems in no particular order. The critical issue is what form should this particular element of assessment take assuming that the reason for asking this question is dissatisfaction with sustainability assessment as it currently tends to be practiced within the official IA process.
The obvious option for these assessments is recasting in the form of an asset check: that is, the relationship between the policy or the project and its effects on the assets that comprise the wealth of an economy. This might usefully augment the cost-benefit approach by focusing more explicitly on assets as well as raising the issue of which assets are critical.

The idea of an ‘asset check’ for assessing the sustainability of projects or policies is not new. In many ways, it straightforwardly follows the logic of the wealth accounting approach and, in the context of impact assessment, was proposed by the late David Pearce in the late 1990s as a contribution to a report that has remained in the grey literature and which sought to review thinking about development project appraisal (ITAD ltd 2001). Other initiatives have also evolved this asset check idea. Notably in the UK this includes the guidelines produced by the Countryside Agency (formerly Commission) and partner institutions on ‘Quality of Life Capital’ (Countryside Agency 1997). Therivel (2009), writing in the context of the EIA community, notes that there has been little uptake of this approach and, furthermore, that it is now largely ‘mothballed’. However, the idea of an ‘asset check’ could well merit revisiting as a means to saying something of genuine substance about the contribution of policies and projects to SD.

Different assessment choices then flow from this over-arching asset check approach.

- For example, perhaps what is to be assessed involves demonstrating what assets are before some proposed action and what they are likely to be after the intervention. This is what Pearce (in ITAD, 2001) had in mind in contrasting different outcomes of a development project when it secures an acceptable rate of return (i.e. the standard idea of project sustainability) but may not contribute satisfactorily to various assets bases. For each project intervention, an assessment of the ‘baseline’ value of the relevant asset stocks would be required: i.e. the size of the asset stock at any point of time. The effects of the project on these assets then would need to be estimated. In principle, this would allow an assessment of the contribution of an action to sustainability over and above that signal which is provided by, for example, a cost-benefit test.

- Perhaps it is the overall wealth of the nation including natural wealth (the ‘state of the environment’) that is a relevant focus as either an alternative or a complement to a proposal-by-proposal based approach. Looking at the bigger picture (rather than solely in terms of a proposal’s contribution to that picture) reflects most clearly the perspective that sustainability is about the property of a development path rather than a requirement of any single action. This might mean conducting proper (social) CBA of the impacts (as broadly construed as possible) of public projects and policies but without perhaps the need for a specific, and adjunct, test for sustainability. However, the overall implication of these actions for sustainable development (and sustainability more generally) would be scrutinized within the context of some broader (national) assessment.

These two options themselves are not mutually exclusive. It would be possible, therefore, that what is sought is not just knowledge about whether development appears to be sustainable in the round but also how ‘individual’ actions or programmes have contributed. Questions clearly also need to be asked about how
precise this assessment of wealth creation can be. It is fair to say that the asset check idea has had more practical prominence at the national level. And so it is easier to see what can be achieved here by looking at experience that has been gained thus far. Examples of an ‘asset check’ at the aggregate level include most notably World Bank (2006) but also Arrow et al. (2007) and Randall (2008).

While evaluating sustainability ultimately requires information about changes in wealth, it is also worth knowing how much wealth, for example, that a national economy has – in total – at a point in time. The methodology that the World Bank uses to value this total wealth is described in World Bank (2006) and Ruta and Hamilton (2007). Rather than summing up the components of wealth – produced capital, natural capital and intangible capital – the estimation proceeds by first estimating total wealth (defined as the present value of consumption: i.e. the discounted value of future consumption). The next step is to separately estimate both the value of produced capital (e.g. buildings and machinery as well as urban land) and natural capital. The latter is composed of subsoil assets, agricultural and protected land and forests. The difference between total wealth and the sum of produced and natural capital is termed intangible capital. In other words, intangible capital is a residual that, by construction, captures all those assets that are unaccounted for in the (tangible) wealth estimates. In turn, this residual is reckoned to reflect human capital and possibly social capital (see the section that follows for a more detailed discussion).

The Bank methodology is, in effect, a cross-country asset check at a given point of time. Similarly, the Bank’s estimation of genuine saving – savings adjusted for a range of net changes in assets (and, in the case of natural assets, covers only certain commercial natural resources and pollution damage from CO₂ and particulate matter) provides a check as to how much more (or less) (real) wealth an economy passed on in comparison to last year. By necessity, the approach is broad-brush. The reason for this is that the method must be applied consistently across the numerous (upwards from 150) countries covered in the World Bank’s database. While this does not diminish the value of these exercises, it does mean that work is needed to refine country-specific estimates to better take account of the stock of, and investment in, human capital. Tentative steps in this direction can be seen in, for example, Arrow et al. (2007) which attempts to construct a detailed wealth account (including the effects of population and technological change) for the United States and China.

The common feature in these approaches is a desire to place all of these wealth estimates, and their changes, in monetary form. Of course, we have dealt elsewhere in this report with concerns that it might not be possible currently, at least with confidence, to value certain types of natural assets in a way that does justice to concerns about limited substitution possibilities. Interestingly then, Randall (2008) provides what amounts to, in effect, an asset check of changes in Australia’s total, as well as natural, wealth. Randall’s point is that current measures of genuine saving – with their emphasis on commercial natural resources (but with notable absences such as fisheries) and limited coverage of pollution damages is only a starting point for thinking about national sustainability. To illustrate this, he takes a number of physical indicators from official Australian resource assessments and assesses the likely direction of ‘overall’ change in natural assets given recent trends in the physical extent or quality of a large number of resources covered by these publications.
The evidence, as he interprets it, indicates over-committed and over-used groundwater and possibly diminishing quality of remaining above and below surface water resources. Forest plantation is expanding but set against this is the destruction of native forest as a result of land clearance. More generally, many species and ecosystems – particularly plants along river margins and resident species such as frogs and waterbirds – are under threat. And while the productivity of agricultural land is increasing, this appears to have been achieved at a cost of more soil loss and degradation (through e.g. increased salinity). Given the general (adverse) direction of these changes, Randall (2008) concludes that Australia’s genuine saving – as it would appear in e.g. World Bank publications – is an underestimate (possibly significant so) of how much net wealth Australia actually has created in recent years. Of course, this might simply seem commonsense and little different from the conclusions that could be drawn from existing ‘state of the environment’ (or similar) reports. Importantly, however, the ‘asset check’ approach helps clarify what signals are revealed by existing, and appropriate, data when placed within a consistent and coherent approach to thinking about sustainable development.

It is more difficult to draw concrete and specific proposals for an asset check on a proposal-by-proposal basis as the literature here is surprisingly lacking in good quality examples. Pearce (2003) perhaps comes closest in an application of asset check ideas to the UK construction sector and, in doing so, considers a range of monetary and non-monetary data. With regards to translating this to project or policy appraisal, the analogous approach to current sustainability appraisal, in UK IA, would be some broad brush (and/or ‘tick-box’) qualitative (or tentatively quantitative) assessment of the assets affected by a proposal. This would change the rhetoric of these assessments and, with regards to substance, sharpen the focus compared to the reference point of broad SD principles. As such this approach might be more useful at the proposal design stage – i.e. shaping thinking along the lines of the current ‘stretching the web’ idea – than at the end of the appraisal process.

Another direction might be to focus on the CBA of the proposal itself and look at those components of these streams of costs and benefits that could be interpreted as adding to the ‘balance sheet’ (broadly construed). This is what was envisaged in the asset check proposed by Pearce (in ITAD 2001). This could be useful as it would focus on how a proposal creates or destroys assets in economic terms. Additionally, if the appraisal has been conducted not just relative to the status quo but also in comparison to alternative levels of intervention then the asset check could also say something about how mutually exclusive proposals differ in terms of their contribution in this regard. Typically, however, projects or policies entail outlays now for benefits in the future: e.g. by investing in things such as structures, people or our natural surroundings. A legitimate question remains as to the degree of insight that might be gained from unpicking a CBA further along these asset check lines. Equally, it might prove valuable to have some picture about what particular assets are being built up and what assets are being lost (or liabilities being created) in this way.

A distinctive and possibly new element of a proposal-by-proposal asset check, however, could be the extent to which it incorporated information about criticality of, for example, some of the natural assets affected by proposals. This assumes the existence of information about dimensions of criticality such as thresholds, the distance of the current stock of a critical resource from its threshold and other
complexities that characterize e.g. ecological assets. A sustainability assessment would be an appropriate place in the IA process to air these issues especially if these currently are not amenable to incorporating directly within the cost-benefit appraisal. Although these studies did not look at such issues, this sort of extended quantitative assessment is roughly akin to the asset checks in Pearce (2003) and Randall (2008) as previously described.

There remains a number of practical issues (e.g. ‘what would an asset-check look like?’) and conceptual questions (e.g. ‘what can be sensibly said about criticality?’) to resolve. Interestingly, however, an asset check still implies an assessment agenda that is at least comparable, in terms of breadth and depth as sustainability assessment as it currently stands. This is, however, both a strength and a weakness. If overly broad and vague there is nothing to stop an asset check approach leading to similarly bland assessments of a proposal’s worth in SD terms, as arguably at least some current sustainability assessment practices appear to produce. An overall asset check – accounting for the wealth of the nation in effect – would still be a useful exercise. This approach would allow an assessment of the implications for development prospects of the ‘entirety’ of decisions (and priorities and options for affecting that path, if needed, could then be determined).

In other respects, the focus on an asset check necessarily narrows the scope of sustainability assessment. But clearly, breadth is desirable if these assessments are to take stock of the actions of very different branches of government and how these contribute to sustainable development. Hence, while much of the SD debate has understandably focused upon on how to monitor and manage natural assets, development prospects are also determined by stocks such as human capital, knowledge and, ultimately, factors such as social cohesiveness (via ‘social capital’). In the remainder of this section, we review in a little more this social aspect of assessment as well as the issue of ‘sustainability elsewhere’.

Social Capital and Sustainability

“Social sustainability” can be traced to the Brundtland Commission emphasis on the role of the essential needs of the world’s poor (WCED, 1987). This particular concern suggests that distributional issues and other perceived injustices that occur within the current generation are also relevant to the policy-maker’s problem. A distinct issue is the link between ‘social capital’ and sustainability (see, for a discussion, World Bank 1997; Dasgupta and Serageldin 1999). While the social capital concept dates back at least as far as contemporary concerns about sustainable development, speculation about the link between the two – while inevitable – is more recent.

There is some debate (e.g. see various chapters in Dasgupta and Serageldin 1999) about what social capital is and whether it conforms to usual notions about what an asset is. While this debate remains unresolved, what is clear is that social capital is highly intangible and provides a wide variety of functions although echoing the concerns that economists have about the sustainability debate itself, Dasgupta and Serageldin warn that too broad a definition risks this concept too being rendered essentially meaningless. With regards to definitions themselves, Putnam (1993) speaks of social capital as comprising certain features of social organization: the relationships between individuals, between institutions (including government), and between individuals and institutions.
This, in turn, might include norms of behaviour, networks of interactions between people and between institutions, and trust between people. Other definitions exist, overlapping with one another but nonetheless providing distinct insights. Sobel (2002), for example, cites Bourdieu’s (1986) earlier notion that social capital is an attribute of an individual in a social context and that it is something that can be acquired and used to produce economic gains.

What is the role of social capital in the development process? This is particularly interesting as it relates to what many have instinctively felt regarding the implications of current social issues for sustainability. Social capital may, as some have argued, account for the dynamism of some economies and even for lower environmental damage than might otherwise occur.

- With respect to the former there may be an ‘economic pay-off’ from social capital whereby conditions favourable to economic growth are fostered by a climate of trust between agents (Knack and Keefer 1997). More generally it has been argued that better performing societies have less conflict between social groups, more participatory decision-making procedures, greater trust between economic agents and so on (World Bank, 1997).

- With regards to the latter, there could also be an ‘environmental pay-off’ whereby, for example, strong community ties help enforce ownership regimes and management systems for common property such as the natural resources that are communally held. The argument is that, other things being equal, the stronger the social ties the less likely the management system is to collapse.

Some forms of social capital – close interpersonal and inter-institutional arrangements – may not always be good for sustainable development. These problems might be summarized as the creation of ‘rent’ by restrictive activity and through lobbying of government and others. However, not all negative effects might be the result of such deliberate actions. Di Falco and Bulte (2008) provide a recent example of this whereby close family ties in developing countries may have a ‘cost’ in terms of reducing incentives to save (out of income) and thereby provide the economic resources needed to invest in assets that might generate future well-being.

World Bank (2006) discusses the results of an analysis of its cross-country data on wealth and, in particular, intangible capital: i.e. this is the residual that captures all those assets that are unaccounted for in the Bank’s (tangible) wealth estimates. The larger that this intangible capital residual is, in any particular country, the larger is the difference between (the present value of) consumption and the tangible assets that can be observed to contribute to this wealth. One reason for a larger residual might be higher levels of ‘social capital’. Thus, it has been found that different societies can have broadly equal endowments of other forms of capital, but that certain societies perform better in terms of economic and social development. Social capital might be an important piece in the puzzle in terms of understanding why this is the case.

There are other elements and, in turn, determinants of this residual of course. These might include assets such as human capital (the skills and know-how embodied in the labour force) and those elements of governance elements that boost the productivity
of the economy (Ruta and Hamilton, 2007). In fact, the assessment in World Bank (2006) of the major determinants of the intangible capital residual finds three factors – average years of schooling per capita, rule of law, and remittances received per capita – which appear to explain 89 per cent of the total variation in the residual across countries. Rule of law accounts for the largest share of this total followed by schooling.

Pearce and Atkinson (1998) suggest that concern about social sustainability, as well as encompassing concern about current distribution and the well-being of the very poorest now, might lead to an additional stress on not allowing the stock of social capital to decline further. One reason for this might be that the symptoms of its decline are ‘intolerable levels’ of social unrest, crime and so on. Strong sustainability, therefore, might therefore take another form – socially strong sustainability – to that which is usually focused upon (environmentally strong sustainability). The essential point is that the concept of strong sustainability raises issues about substitutability between assets, and just as this has sharpened the environmental debate, similar issues arise in this context as well.

This is not to suggest that this form of capital is easy to measure in a manner consistent with how other forms of wealth are quantified. It may also be that ‘social capital’ is not really capital at all as, for example, Solow (1999) and Arrow (1999) in essence both have argued. Even so, social cohesiveness – and related notions – might still contribute to positive economic and societal outcomes. Similarly, the breakdown of ‘social capital’ might be reflected in more crime, more violence, family breakdown etc. More specifically, a clear link to sustainable development remains if such social processes contribute to the assets that a society holds (or the operation of these assets) and wealth more broadly (via its influence, as in e.g. World Bank 2006, on the present value of consumption). Social capital thus becomes the ‘glue’ that holds society together (Pearce and Atkinson 1998) now and into the future.

A number of indicators of social capital have been proposed (e.g. World Bank 1997). An example, for the United Kingdom, is Harper and Kelly (2003) which, in turn, discusses a recent research project conducted by the Office for National Statistics. The ‘UK social capital measurement framework’ outlined in that paper includes indicators under the sub-headings of social and civic participation, social networks and support, reciprocity and trust and, finally, community views on their local area. More recently, WGSSD (2008) has sought to re-examine the question of social capital indicators in the context of providing a handful of candidate measures that might form part of an internationally comparable set of official national sustainability indicators. Again, these include the usual indicators on group and network memberships, levels of trust and so on. In addition, however, WGSSD speculates that this set might also include social outcomes such as crime levels as well as broader governance and institutional indicators.

What about the prospects for assessing a project or a policy’s contribution to social capital? In principle, it would be interesting to know how, and in what ways, an intervention led to a change in social cohesiveness. Indeed, some social policies

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15 The intangible capital residual also includes those errors and omissions in the estimation of produced and natural capital.
surely have this as one objective by strengthening local institutions or seeking to affect the rate of family breakdown. Other policies including those which seek to bring about environmental improvements might make use of ‘social capital’ or some form of trust in say voluntary or negotiated agreements. Different environmental policies have distinct influences in terms of ‘crowding-in’ (or perhaps ‘crowding-out’) the environmental motivation of citizens and households. In this way, social awareness and social relationships can reinforce (or otherwise) positive environmental outcomes (Frey 1997). Emphasizing the role of (and contribution to) these social processes in evaluating the contribution of particular policy actions is unlikely to lend itself to precise scrutiny. Yet, even if this was the case, an overall assessment of sustainability (say through an asset check) might allow a more tangible assessment to be made by making use of what is known about social capital indicators at the aggregate level.

Sustainability ‘Elsewhere’

As a practical matter, discussions about the sustainability of development paths have often been interpreted as saying something about the future prospects of national economies. This is not always the case. Within the academic literature, it has been variously asked how regions, local districts (e.g. cities), economic sectors and corporations can be ‘sustainable’ (see, for example, Rydin 2007; Gray and Bebbington 2007; Tisdell 2007). Part of the discussion about the ecological footprint of populated areas has in mind some notion that the global population has environmental and resource limits within which it must live and that, furthermore, some countries or regions are consuming more than their fair share and, thereby, appropriating sustainability (specifically, ‘carrying capacity’) from elsewhere (see, for example, Rees and Wackernagel 1994).

A similar view is exemplified by Martinez-Alier (1995) who claimed that estimates of genuine saving (savings net of resource depletion and environmental degradation) appear to suggest that unsustainable countries tend to be located in the developing world. His specific question is then whether an ‘ecological balance of payments’ analysis would show that developed countries were actually unsustainable when global resource flows are taken into account. The implication here is that developed countries by relying on imports of natural resources from the developing world are ‘responsible’ for resource depletion elsewhere. According to Martinez-Alier’s reasoning, if the exporting country is making inadequate provision to re-invest the proceeds of this depletion then the importing country is responsible for the non-sustainability of the development path that the exporter might find itself upon.

Re-attributing national responsibility in this way is far from straightforward either in principle – i.e. what is the political or economic basis for saying that an importer is outcome responsible in this way (Miller 2007) – and, in practice – e.g. how should ‘responsibility’ be assigned where, for example, Japan’s imports of timber from Malaysia and Indonesia are embodied in goods that are subsequently exported to, and consumed in, the United States (Proops and Atkinson 1998; Proops et al. 1999; Atkinson and Hamilton, 2003). Analogous concerns about outcome responsibility, however, can be detected in the on-going debate between assessing a country’s contribution to climate change on the basis of its production emissions (some of which will be embodied in exports bound for elsewhere) and consumptions emissions.
(which includes those emissions embodied in the imports of goods consumed within a country) (see, for example, Peters and Hertwich 2008; Pan et al. 2008; Atkinson et al. 2009). A large part of that discussion, however, has been used to explore ways of discouraging non-participation in a future climate change agreement.

These complications aside, the issue of sustainability elsewhere (i.e. beyond the national boundary) or at the global level remains an interesting challenge. Responding to this challenge has resulted in a mini-literature on, for example, the sustainability of trade policies and agreements. This consists, firstly, of an assessment of the ‘sustainability threat’ to a proposed trading partner arising from an agreement and, secondly, the identification of so-called ‘flanking measures’ to mitigate this threat. The European Commission uses Trade Sustainability Impact Assessments (SIAs) in its multilateral, regional or bilateral trade negotiations. On-going work in the OECD has sought to build capacity among developing countries in SIAs more generally as a complement to these exercises (see, for a discussion, Kirkpatrick and George 2008).

In practice, sustainability in these trade assessments is defined in the same broad terms as SIA in other context: i.e. what are the impacts of a trade agreement on the economy, society and environment on the parties to that agreement? Previous comments about the implications of the sheer breadth of these assessments notwithstanding, trade SIAs at least provide the basic tools to trace the impacts of UK behaviour on sustainability (or environmental or other development outcomes) elsewhere if this information is needed. Nor is there anything to prevent giving such assessments more ‘focus’ by emphasizing the extent to which UK behaviour has an ‘influence’ on assets elsewhere.
Annex 1: Economic Sustainability – Wealth and Well-being

The economic approach to thinking about sustainability has been summarized in a number of sources including Mäler (2007), Pezzey and Toman (2005) and Hamilton and Atkinson (2006). Early contributions to the contemporary literature such as Pearce and Atkinson (1993) employed basic intuitions concerning assets and sustainability but owed much to theoretical contributions by, for example, Solow (1986) and the pioneering asset accounting study of Repetto et al. (1989). Sustainability, it was argued in these contributions, can be equated to non-declining values of all assets including natural resources. The consequence of this conceptualization is that changes in asset values, measured by net saving, should signal whether an economy is on a sustainable path. Soon afterwards, Hamilton (1994) coined the expression ‘genuine savings’, and it is this terminology that is now widely used, to describe this indicator. The focus of this work has been largely on the sustainability of national economies (although see, for example, Arrow et al. 2003 for a discussion of the links of this work to projects and policies).

Subsequent research has refined the theory of economic sustainability and placed this formal analysis more clearly within a lineage of economic thought dating back not just to Hicks (1946) but before that to Fisher (1906) and after that Samuelson (1961) (see, for a discussion, Mäler, 2007 and Atkinson et al. 2008). While these recent contributions differ in their exact details, they share general precepts in using growth theory to firmly establish the linkage between (net) savings, social well-being and sustainable development (see, for example, Hamilton and Clemens 1999; Dasgupta and Mäler 2000; Asheim and Weitzman 2001; Hamilton and Hartwick 2005; Hamilton and Withagen 2007).

The intuition of these theoretical contributions is straightforward enough. Total wealth is typically conceived as the value of all assets in an economy. To measure sustainability it is important that wealth measurement spans as wide a range of assets as possible, including assets with negative shadow prices such as pollution stocks. It is this wealth that is the basis of future well-being: that is, the greater the (real) value of current wealth, the greater the level of well-being that can be sustained into the future. It stands to reason, therefore, that current changes in wealth must have consequences for future well-being. For example, if a decline in wealth now leads to falls in future levels of well-being then this economy would not be sustainable by Pezzey’s (1989)

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16 The World Bank currently uses the term adjusted net saving to describe this indicator however. Arrow et al. (2003) refer to genuine investment (although this is because they assume a closed economy where saving equal investment). More recently, Dasgupta (2009) talks of comprehensive saving or investment in reference to this same indicator of the (real) value of the change in an economy’s assets. Similarly, in terms of the stock or wealth measure, World Bank (2006) and Hamilton and Atkinson (2006) refer to total wealth while Dasgupta, (2009) refers to comprehensive wealth and, elsewhere earlier, inclusive wealth.

17 In fact, there are two sides to the wealth coin. When economists talk about wealth they are typically referring to social welfare. This is defined as the present value of consumption: that is, the discounted stream of consumption now and in the future. This consumption is construed broadly given that it derives not just from the enjoyment of material goods and services but also amenities and so on provided by the environment. However, if wealth can also be measured by the value of assets then tracking changes in assets, in the here and now, tells us something about what is happening to social welfare. It follows that changes in wealth give us clues about changes in social welfare (i.e. well-being in the future) and sustainability.
definition (but see also final section of this Annex).\footnote{This makes apparent the need for future-oriented or wealth-like measures for measuring development prospects. Measuring current well-being does not reveal whether this well-being can be sustained in the future. This applies to current measures of income, consumption or, for that matter, some measure of current well-being such as life satisfaction.}

Hence, Hamilton and Clemens (1999) show that genuine saving — defined as the change in real asset values — is equal to the change in social welfare. Put another way, genuine saving provides a signal about the direction (and magnitude) of change in total (or comprehensive) wealth. Hamilton and Clemens go on to show that that negative levels of genuine saving must imply that future levels of well-being over some period of time are lower than current levels — i.e. negative genuine saving implies unsustainability. This particular finding is obtained by looking at the optimal development path for an economy. Of course, ‘real world’ economies are not optimal and, indeed, much of modern environmental and resource economics is premised on exactly this observation. Where does this leave conclusions about the measurement of sustainability and future well-being? Contributions from Dasgupta and Mäler (2000), Arrow et al. (2003) and Hamilton and Withagen (2007) have all relaxed the assumption of optimality in looking at the link between saving and sustainability. In doing so, it has been shown that — even in non-optimal economies — genuine saving is still an indicator of changes in development prospects.

Pezzey (2004) makes the point that genuine saving provides a one-sided sustainability test: if saving is negative, then there must be future declines in well-being. The opposite is not true in general: positive saving at a single point in time does not indicate necessarily that future well-being is everywhere non-declining. However, this is not the end of the story as at least two papers, looking at general policy prescriptions that will ensure economic sustainability, have found. Thus, Hamilton et al. (2006) and Hamilton and Withagen (2007) show that positive genuine saving does indicate that development is sustainable so long as it is always both positive and constant either in terms of either its rate (i.e. as a proportion of output) (Hamilton and Withagen, 2007) or its level (i.e. money value) (Hamilton et al. 2006). In both cases, following any such rule can be shown, in theory, to lead to increasing well-being over time. Put this way, the Hartwick rule (Hartwick 1977) — where genuine saving is equal to zero at each point in time in the future ensuring that well-being will be constant — is thus just one sustainability rule a government might adopt.\footnote{Specifically, this refers to a technical requirement that the rate of change in genuine saving should be kept below the interest rate. That is, if the interest rate is currently 5 per cent then the growth rate of net saving should not exceed this level. The intuition for this is that assets should not be accumulated at a rate which exceeds the ability of those investments to yield a return.}

**Population Growth**

When population is growing, existing assets have to be shared with this larger body of people. Hamilton (2003) and Arrow et al. (2004) show that, in such cases, genuine saving should be measured as saving per person minus the product of the population growth rate and total wealth per capita. The latter term reflects the diluting effect of population growth on wealth. The model from which this indicator of the change in wealth per capita emerges is based on the assumption that population growth is exogenous. This means, in this context, that population change does not respond to
Changes in wealth. Clearly, it would be useful to assess the implications for sustainability of an endogenously determined population change: i.e. where the level of wealth influences, for example, birth rates. Hamilton (2003) speculates that if the population growth rate, other things being equal, declines as wealth per capita increases then a fall in wealth per capita could lead a country into a vicious circle via an increasing population growth rates. Similarly, increasing wealth per capita could lead to a virtuous circle of declining birth rates and accumulation of wealth per capita.

Technological Change

Sustainable development is concerned with development prospects along a path stretching into the future. It is entirely plausible, and indeed to be expected, that technological change will intervene to alter the nature of this path. Indeed, much of modern growth theory has been predicated on the primacy of technological change in driving development. These points have been made forcefully in Nordhaus (1995), Weitzman (1997) and Weitzman and Löfgren (1997). For example, in the latter contribution, the authors calculate a premium for the US economy, reflecting the value today of future technological change, that should be added to current measures of genuine saving. At about 41% of US Gross National Income (GNI), this has profound implications for measuring sustainability. Arrow et al. (2004) similarly show how estimates of the change in per capita total wealth go from negative to positive in e.g. India and Pakistan once evidence about technological change is brought into the reckoning although remains negative for the Sub-Saharan Africa and the Middle-East North Africa regions.

All this suggests, as many have long held, that not only does technological change play a significant role in determining prospects for sustainable development, it could play a decisive role. Clearly, this issue merits serious consideration. However, the implications for measuring development prospects may be less dramatic than it at first appears if new knowledge creation is a costly process influenced by a variety of incentives (Pemberton and Ulph 2001; Hamilton and Atkinson 2006). This appears to result in a more modest proposal of treating, for example, research and development expenditure as an investment (and thus boosting estimates of genuine saving by a few percent of GNI in the majority of cases).

Resource Trade

Within the literature on economic sustainability the issue of how trade affects sustainability has been defined rather narrowly. Essentially, this has entailed an assessment of how capital gains (or losses) earned on resources extracted in the future affect measures of sustainability. What this amounts to is a requirement that future resource price changes be reflected in current measures of genuine saving (Hamilton and Bolt 2004). This is a rather different question to the one frequently asked about the link between resource trade and sustainability. That perspective is illustrated by Martinez-Alier (1995) who claimed that estimates of genuine saving appear to suggest that unsustainable countries tend to be located in the developing world. His specific question is then whether an ‘ecological balance of payments’ analysis would show that developed countries were actually unsustainable when global resource flows are taken into account. A different but perhaps more plausible view, however, is that the onus is on resource extracting countries to make provision for the loss of domestic
natural assets whether for export or not (Atkinson and Hamilton 2003). Nevertheless, this does not mean that tracing resource trade flows is without interest. Such findings could form the basis of policies to assist exporters in adopting prudent resource and public investment policies.

**Strong Sustainability**

A key strand of the sustainability literature, dating at least back to Pearce *et al.* (1989), looks at the question of strong versus weak sustainability. Weak sustainability assumes that there are no fundamental constraints on substitutability between say natural assets and other forms of wealth. By contrast, the strong sustainability assumption is that some amount of nature must be conserved in order to sustain well-being. While we discuss the implications of a lack of substitution possibilities for sustainability in greater detail elsewhere in this report, it is worth noting that the formal models that underpin insights about economic sustainability are agnostic on the question of the degree of substitutability between different assets such as between produced and natural assets. This is important because it is often claimed that economic sustainability is essentially about weak sustainability. Contrary to this claim, however, genuine saving is not an indicator of weak sustainability per se. If limited substitution possibilities can be reflected in higher relative prices for changes in natural assets, then this can be reflected in a comprehensive measure of net savings within an economy.

**Estimating Total Wealth**

Evaluating sustainability requires information about changes in wealth. However, it is also to know the total wealth that, for example, a national economy has at any point in time. The methodology that the World Bank uses to value this total wealth is described in World Bank (2006) and Ruta and Hamilton (2007). Rather than summing up the components of wealth – produced capital, natural capital and intangible capital – the estimation proceeds by first estimating total wealth (defined as the present value of consumption – i.e. the discounted value of future consumption). The next step is to separately estimate both the value of produced capital (e.g. buildings and machinery as well as urban land) and natural capital. The latter is composed of subsoil assets, agricultural and protected land and forests. The difference between total wealth and the sum of produced and natural capital is termed, in e.g. World Bank (2006), intangible capital. In other words, intangible capital is a residual that, by construction, captures all those assets that are unaccounted for in the (tangible) wealth estimates.

**Well-being and Sustainability**

Typically, the literature on the theory of economic sustainability looks at development paths where well-being is falling, constant or increasing. Diminutions in well-being along such paths are unsustainable and it follows that decisions-makers concerned about sustainable development should avoid policies which might have this result. That is, actions should be consistent with at least maintaining well-being or having it everywhere increasing. There remains a more nuanced question about why society would choose these paths. That is, could a short term dip in well-being at some point along a development path be tolerated if say the upside of this is higher well-being at all other points along that path? Moreover, what if well-being along this unsustainable
path is always higher than under a sustainable counterfactual path? In strict terms, this economy is unsustainable. However, this might strike all but the most ardent of sustainability proponents as a price worth paying for (on average) enjoying otherwise higher levels of well-being.

There are a number of issues here:

Firstly, distinguishing between distinct but plausible development paths is a matter of social choice rather than doggedly following the rules that emerge from relatively abstruse models. Decision-makers must still judge whether any resulting sustainability rule is sensible or not (just as decision-makers typically choose to use cost-benefit thinking as one input only to a decision rather than the decision itself). Assuming that we are comparing realistic development paths describing plausible future prospects under different actions then the basis for debate about which is the desirable or morally defensible path at least is established.

Second, in this context, thinking about sustainable development is important for making explicit the consequences of acting in a way that shows that no concern for the future: that is, the ‘opportunity cost’ (to future generations) of unsustainable actions now.

Third, much of the reason why many are concerned about development prospects is that it is feared that current actions might lead to a future where well-being declines precipitously. That is, where resource dependent countries have allowed the proceeds of depletion (i.e. resource rents) to dissipate and so have failed to diversify their economies so as to take the place of an unsustainable activity. Or where some environmental asset – itself an important source of well-being which cannot be properly replaced – is being run down to precariously low levels. Or perhaps social cohesiveness or trust has broken down to such a degree that some future trajectory of economic activity – that depends upon the constancy of these social arrangements – is jeopardized.

The point is that if comparing unsustainable and sustainable paths amounts to a fairly trivial comparison then there is little at stake in the current debate. However, many believe that the judgement is actually a more difficult one between current actions which could lead to a future that might be considerably worse off than the present and avoiding this path at a (possibly substantial) cost to the ‘current’ generation. Put this way, the issue seems to boil down to something like a cost-benefit problem. Indeed, it might be strange if an economic approach to thinking about policy wholly left this logic behind. However, it is an approach that puts concerns about intergenerational justice far more centre-stage than conventional CBA and, moreover, places a far explicit focus on how the current generation manages the total wealth (and its components) that it inherited.
Annex 2: Substitutability and Sustainable Development

Although the capital approach does not require particular assumptions to be made about the relative importance of different assets, such speculation is inevitable. Indeed, it is the source of one of the great sustainability debates, the answer to which in no small part determines the likely extent of sacrifice required by the present generation in adjusting and adapting behaviour. This debate is typically characterized in terms of whether development should be weakly sustainable or strongly sustainable.\(^\text{20}\)

For weak sustainability, there is no special place for the environment as such. Put another way, it is the ‘overall’ portfolio of wealth bequeathed to the future that matters. As long as the real value of this portfolio is held constant it matters little that its constituent parts change over the development path. Strong sustainability, by contrast, requires that the environment is accorded explicit and special protection. There are a number of variants on this position. Most generally, it requires that ‘natural wealth’ should (in some way) be preserved intact through specific conservation rules. Strong sustainability should hence represent the greater policy challenge, because current human actions would be significantly more constrained (as certain development paths would be effectively ‘off-limits’). One reading of this debate is that there has been little progress in made towards its resolution in the past two decades. On this view, uncertainties about what aspects of nature should be conserved largely still prevail now. That said, there has been a significant effort to understand the links between ecology and economics as well as a smaller literature that has focused more specifically on the substitution issue itself. In this Annex, we review a number of these developments.

Ecological Resilience

Walker et al. (2008) do not look directly at the issue of substitutability as such but instead investigate the related notions of ecological resilience and ecological thresholds. This is defined as the ability of an ecological system to resist shocks without changing its state. These disturbances, for example, might include overexploitation of species or cumulative stresses, on e.g. aquatic ecosystems, caused by pollution and excessive nutrients (Adger 2007). The greater the disturbance, or its persistence, the greater is the chance that the ecosystem will switch to some new state which provides a lower level of ecological services. In a more resilient ecosystem, however, the risk of this adverse change in state is less. The innovation in Walker et al., following the theoretical work of Mäler et al. (2007) and Mäler (2008), is to treat resilience as a stock. In other words, the ability of an ecosystem to withstand shocks has a distinct asset value which can be degraded (or otherwise) over time. Assessing whether an economy is on sustainable development path necessitates that account is taken of changes in stocks of resilience alongside changes in other assets.\(^\text{21}\)

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\(^{20}\) While there is some debate about when exactly this terminology entered the literature, the main ideas can be found in Pearce et al. (1989) although is also evident in the work of Herman Daly.

\(^{21}\) There appears to be no in principle requirement that any particular resilience stock must be maintained intact or threshold never exceeded. In practice, it will be an empirical question as to whether well-being is best maintained by making sure that resilience is not compromised or by compensating for losses in resilience by investing in other assets.
As things stand, practical valuation is far from any sort of comprehensive accounting for resilience. Walker et al. (2008) provide an example for agriculture in South East Australia where cultivation has led, via changes in the water table, to soil salinity problems. The stock of resilience, in this context, is the distance of the water table from its ecological threshold whereby salinity problems increase the risk of a change in ecological state. In 1991, this resilience to salinity was calculated, by the authors, to be 14 per cent of agricultural wealth within the farming catchment. Ironically, because of dry climatic conditions prevailing in South East Australia, over the period 1991 to 2001, the water table fell thereby shrinking the risk of salinity problems. In accounting terms, this aridity boosted the stock of this particular aspect of resilience: i.e. there was an increase in its (real) asset value.

Valuing this stock, unfortunately, is a relatively complex business and extending this approach beyond largely illustrative examples is in its infancy at best. Indeed, Walker et al. are themselves extremely circumspect about using their empirical example in the ‘real world’ owing largely to apparent uncertainties about the scientific and economic data. Nevertheless, debates about the significance of ecological resilience notwithstanding, this could well be the beginnings of a highly significant contribution to understanding SD in the context of changes in ecological assets. Interestingly, from the perspective of policy or project appraisal, Walker et al. (2008) also investigate the boost to wealth from a specific policy option that will lower the water table. This results in a cost-benefit test to determine whether the boost to asset values, arising from the increase in resilience, outweighs the costs of the intervention.

(Commercial) Natural Resources and Substitution

Markandya and Pedroso-Galinato (2007) revisit a subject surrounding which there has been much speculation, in the weak vs. strong sustainability debate, but far less by way of empirical substantiation. Specifically, what they examine is the ease with which natural resources can be substituted for other assets in the production of goods and services: i.e. the size of elasticities of substitution between different inputs. High values, for these elasticities, indicate that it is relatively easy to maintain production in the face of a loss of a particular input which, for example, might be an increasingly scarce natural resource. Lower values indicate that substitution possibilities are correspondingly more difficult. Empirical studies of these sort of magnitudes, such as those summarized in Berndt and Field (1981) generally predate the beginning of contemporary interest in sustainable development.

An interesting aspect of the Markandya and Pedroso-Galinato study is not just that it throws light on an old but important question but also that it does so using the World Bank’s cross-country wealth accounting database (e.g. World Bank, 2006). What is estimated, therefore, is the scope for substituting between inputs that generate the output of nations (rather than sectors of a given economy as in earlier studies). In total, four broad categories of input are included: produced capital, human resources or capital, (non-renewable) energy resources and land (made up of cropland, pasture and protected areas). The results provide tentative reassurance about substitution possibilities as the authors find a relatively high degree of substitution between natural resources and both produced capital or human resources. This reassurance is tentative because of methodological and data caveats that require further refinement. Moreover, echoing the debate between ‘old’ and ‘new’ scarcity (see Krautkraemer,
substitution possibilities involving commercial natural resources are just one element in the weak vs. strong sustainability debate. Nevertheless, this study remains noteworthy as a fresh perspective on the empirical discussion about SD.

(Non-Commercial) Environmental Resources and Substitution

Gerlagh and van der Zwaan (2002) look at the corresponding case of non-substitutability of natural assets which generate well-being directly (rather than through the creation of produced goods and services that we consume). To use the economic jargon, what these authors examine is substitutability within the utility function rather than the production function. In doing so, they distinguish between perfect substitutability – where natural assets can be replaced very easily with e.g. produced assets without reducing human well-being – and poor substitutability. The latter is so-called because what Gerlagh and van der Zwann (2002) examine is the implications of individuals having very strong preferences for natural assets rather than non-substitutability per se. Roughly speaking, however, these notions of perfect and poor substitutability in this paper correspond to the distinction between weak and strong sustainability in the wider SD literature.

While this paper stops short of an empirical examination – it offers valuable insights into the nature of the substitutability problem. One example is that substitution possibilities might be a function of the resource stock itself. That is, when the resource is relatively abundant, losses in that asset do not matter (as long as produced assets are built up in its place). However, after some threshold, substitution possibilities diminish rapidly. In other words, continued loss of the natural asset, beyond some point, cannot be compensated by increases in other forms of wealth but instead increase the prospect of dramatic adverse impacts on future well-being. This provides another reason to press the case for the urgency of research that seeks to understand the nature of, for example, ecological thresholds.

Interestingly, Gerlagh and van der Zwann see their approach as a new route that avoids the seeming impasse in the debate on discounting the far-off future and which has recently revived in the context of the climate change problem, by Stern (2007) and Weitzman (2007) to name but two contributions. Unfortunately, the sustainability literature has been at an analogous stalemate about the case or evidence for weak and strong sustainability for some time now as well. So it may be that this avenue of research simply exchanges one impasse for another. On the other hand, this would be too negative a conclusion. A more positive view is that what these authors illustrate is part of a serious attempt, by environmental economists, to engage formally with the weak and sustainability debate in a way that has been hitherto absent.

Moreover, the practical import of such theoretical insights has been demonstrated more recently by Hoel and Sterner (2007) and Sterner and Persson (2008). These papers argue, in a similar vein to earlier contributions such as Fisher and Krutilla

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22 In fact, their concept of poor substitutability is very similar to the notion of a lexicographic preference that has been the subject of a mini-literature in stated preference studies.

23 This debate is between those who favour a prescriptive approach to determining the social discount rate (i.e. what should be the discount rate be?) and those who favour a descriptive approach (i.e. what evidence is there from the market and revealed behaviour about what the discount rate is?). Typically, taking the former approach will result in far lower rates being recommended than in the latter.
(1974), that if a natural asset becomes increasingly scarce over time then its price, relative to other things that we value, will increase, perhaps dramatically. Hoel and Sterner (2007) show formally how this intuition is confirmed in a model where limits to substitutability are examined explicitly. In doing so, they demonstrate that not only will scarcity result in an increase in the relative price of a natural asset but that the magnitude of this increase will depend, among other things, on the substitution possibilities between the natural asset and other forms of wealth.

Notwithstanding important nuances, this suggests a potentially straightforward test to apply to environmental values in CBA. Where a natural asset, affected by a policy or project, is (becoming increasingly) scarce – and where perhaps we have good reason to believe that this asset is characterized by poor substitutability – has adequate account been taken of the impact of scarcity on asset’s relative price? There are a number of unknowns here; not least, what it is the actual degree of substitutability between real-world natural assets and other goods and services. However, perhaps informed judgement could be brought to bear and sensitivity analysis extended explicitly to take account of plausible assumptions about substitutability possibilities. This would also confront in part another problem of using estimates of what people are willing to pay for the services of natural assets which can be enjoyed far into the future. Given that valuation studies are constrained to estimate the WTP values of people alive now, what is frequently assumed is that these values can be extrapolated to the future in order to account for far-reaching impacts. While we have no way of making better guesses about future preferences, adjusting relative prices to take of scarcity (or at least seeing how sensitive the results of appraisals are to this consideration) seems a possible way of building up a better picture of e.g. the future loss of value that results from destroying or degrading natural assets.

24 This ‘Krutilla-Fisher’ rule – adjusting the social discount rate to take account of an increase in willingness to pay (WTP) because of the increasing scarcity of natural assets – was proposed in the context of the cost-benefit appraisal of projects with irreversible environmental impacts. Another reason for this increase in WTP was rising per capita incomes. This part of the story is not in either Hoel and Sterner (2007) or Sterner and Persson (2008); but clearly it remains a relevant additional factor.

25 These include the fact that scarcity also affects the discount rate proper. Specifically, its influence does not only work through the effective discount rate (i.e. \[r-g\]), as in Krutilla-Fisher, but also the discount rate itself \(r\). The calculation also requires an assumption about the elasticity of the marginal utility of money or consumption, a parameter around which at least some of the controversy surrounding the issue of discounting post-Stern has revolved.
References


