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Sustainable Development – Has It Run Its Course?

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Summary: The cornucopian paradigm of sustainable development eludes quantification and opens the door to advocacy and activism. Moreover, setting normative sustainability targets for an opaque development concept blurs assessment and analysis. Policy integration should focus, therefore, on what is measurable and comparable. Operational concepts of ecological and economic sustainability address the immediate interaction between environment and economy. Material flow balances and greened national accounts define and measure these sustainability concepts. Sustainable development carries some goodwill, but practical policy should tackle the environmental sustainability of economic performance and growth.

Zusammenfassung: Das umfassende Leitbild der nachhaltigen Entwicklung entzieht sich der Quantifizierung. Parteilichkeit und Aktivismus bei den Befürwortern sind die Folgen. Die Setzung von normativen Nachhaltigkeitszielen für einen verschwommenen Entwicklungsbegriff trübt Messung und Analyse. Politikintegration sollte sich deshalb auf Messbares und Vergleichbares konzentrieren. Praktische Konzepte der ökologischen und ökonomischen Nachhaltigkeit behandeln die Interaktion von Umwelt und Wirtschaft. Stoffstrombilanzen und umweltökonomische Gesamtrechnungen definieren und messen diese Nachhaltigkeitskonzepte. Nachhaltige Entwicklung ist immer noch ein attraktives Konzept; praktische Politik sollte sich aber mit nachhaltigem Wirtschaften und Wirtschaftswachstum befassen.

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1. Introduction

Sustainable development is like the Holy Grail: some go for it because of its mystic appeal; most ignore it. Governments subscribe to sustainable development in Earth Summits and at home. The United Nations includes it in Millennium Development Goals. The European Union makes sustainable development part of its Constitution, as does the hardly environment-minded World Trade Organization. Few publications on environment and/or development can resist summoning the concept for authoritative support. In reality, decision makers focus on economic performance and growth.

- At first sight, overcoming the fragmentation of economic, environmental and social policies by an integrative approach to sustainable development is convincing (WCED, 1987). Neglecting environmental impacts of economic activity could undermine economic activity itself by impairing (re)source and sink services to the economy. As far as the concept is a reminder of interactions between the environment, economy and the well-being of people, it has won its spurs. Like spurs, overuse can make it counter-productive, though. Recurrent exhortations about implementing the paradigm generate fatigue, especially in the absence of an operational definition.
- The World Commission on Environment and Development offered a definition of sustainable development as the satisfaction of current and future generations' needs (*op. cit*., p. 43). However, the human needs concept defies definition and measurement, even in its reduced form of 'basic human needs' (Bartelmus, 1994). The definition remains thus opaque. It does not specify the needs, gives no clear time frame for analysis, and does not indicate how economic growth, social equity and environmental functions concur to meet human needs, now and in the future. Equally vague variants of the concept such as human development, sustainable welfare, quality of life, or genuine progress turn the paradigm into an alluring but hazy aspiration. As a consequence, everyone can subscribe without risk of being held accountable. To industry, sustainable development offers opportunities for environmental innovation; governments adopt it for pacifying environmentalist objections to economic growth, and civil society uses it to argue against globalization. With sustainable development "all [is] in harmony" (WCED, 1987, p. 46).

2. What is sustainability? What is development?

A historical review of both concepts provides insight into attempts at burdening the all-encompassing notion of development with a yearning for permanence and stability.

- The eighteenth-century Saxon forestry and mining official von Carlowitz (1713) is credited with inventing sustainability: Timber scarcity in Europe made von Carlowitz seek "equality" between reforestation/forest growth and harvest of timber so as to ensure a "continuous, persistent and sustained utilization" (Grober, 1999, own translation). Von Carlowitz also stressed the right to food and livelihood, not only of

the contemporary poor but also of posterity; this is indeed a call for intra- and inter-generational equity – key concerns of sustainable development.

- Two centuries later, the World Conservation Strategy propagated "sustainable development" by means of conserving our living resources (IUCN *et al.*, 1980). Essentially the Strategy catered to ecological principles of maintaining the carrying capacities of ecosystems. Carrying capacity refers to the number of people a territory can sustain with its ecological services; it provides the link of ecological functions to – largely unspecified – human activity. Development, promising "long, healthy and fulfilling lives", remains a vague notion in the Strategy's follow-up version (IUCN *et al.*, 1991, p. 18).
- Definitions of sustainable development as carrying capacity and resilience of ecosystems to outside shocks (Daly, 1996; Perrings, 1995, 2006) are hardly practical for policy making and may be judgemental when setting capacity or resilience limits. Resilience and carrying capacity could be usefully applied in local agricultural settings, where economic activity is closely tied to nature's rhythm and services. Attempts at extending the definition and measurement of carrying capacity to national or even global levels suffer from assumptions about desirable standards of living, cross-border migration and trade, technological progress, and the problem of generalizing ecological equilibrium and its disruptions for a multitude of different ecosystems.
- How about 'development'? Socioeconomic development is generally seen as a process of improving the living conditions of people. The objective is to increase their individual well-being or collective welfare. Policy proclamations refer to a large variety of human needs including food, clothing, housing, health, security, education, employment and environmental quality, as well as less tangible aspirations. Deficiencies in meeting even basic needs characterize the situation in developing countries.
- Since the 1960s, the international community has sought to foster the development of underdeveloped nations through a number of 'Development Decades'. The strategies of the Decades, proclaimed by resolutions of the United Nations General Assembly, failed spectacularly. Neither the hope for trickle-down effects of economic growth in the first Decade, nor the addition of social justice in the second, nor the call for a New International Economic Order in the third, nor the return to economic growth with added social and environmental objectives in the last Decade reduced the gap between rich and poor countries (Bartelmus, 1994). It is doubtful whether the setting of targets for old, and some new, objectives in the subsequent United Nations Millennium Development Goals[1] will be more successful. In the end, income and wealth, as measured worldwide in the national accounts, continue to be the main criteria for assessing economic development in both poor and rich countries.

[1] http://www.un.org/millenniumgoals/

3. Operational definitions of sustainable development

There are basically two ways of operationalizing the combination of sustainability principles with the broad welfare notion of development. One is to focus on non-sustainability and to set corresponding ecological, social, cultural and political limits for economic activities. The other is to reduce the analysis by focusing on the immediate interface of environment and economy (Bartelmus, 2008).

3.1 Ecological sustainability

Setting limits for resilience, beyond which a natural system would be pushed into disequilibrium, cannot be generalized for the large diversity of ecosystems. This applies also to their carrying capacity for human populations. More pragmatic ecological economists focus therefore on assessing *pressures* on carrying capacity, rather than measuring carrying capacity itself. These pressures are deemed to result from demand for primary materials by an ever-expanding economy. Daly (1996, p. 69) thus defines sustainable development as "development … without growth in throughput beyond environmental regenerative and absorptive capacities".

- The advantage of this definition is that material flow accounts can be used to measure throughput as the material in- and outflows to/from the economy. This suggests an operational definition of ecological sustainability as the *dematerialization* of the economy. The question is: How much dematerialization do we need to attain sustainable development? One response is the Factor 4 target of quadrupling natural resource productivity (von Weizsäcker *et al.*, 1997). The idea is to halve material input while allowing a doubling of wealth (seen as "real wealth" or welfare) over the next few decades.
- There is ambiguity, however, in linking Factor 4 with sustainable development. The original authors seem to see sustainable development as high-wealth endowment with reduced material input. Later interpretations refer to Factor 4 as just a "guardrail" (Hinterberger et al., 2000) or a "leitmotiv" (Bringezu, 2002) for more responsible environmental policy. The EU strategy on the sustainable use of natural resources comes to a similar conclusion: "… because it is impossible [to] set quantitative targets for 'resource efficiency and the diminished use of resources'… with the current stage of knowledge and state of development of indicators" (Commission of the European Communities, 2005, p. 6). The opaque Factor X notion[2] leaves the achievement of ecological sustainability to advocacy and political negotiation.
- Dematerialization by a certain factor reflects a relatively strong sustainability notion. It focuses on the reduction of material inputs from the environment into the economy, hoping for the best in achieving some level of wealth. For example, the Factor 4 authors sought to demonstrate the feasibility of Factor 4 implementation by introducing rather optimistic assumptions (about increase in resource productivity)

[2] *Other targets include in particular "Factor 10" for industrialized countries, while allowing poor nations to catch up with rich ones (Factor 10 Club, 1994).*

into the mostly pessimistic limits-to-growth model (von Weizsäcker *et al.*, 1997, Ch. 11.3).

- In general, however, ecological sustainability seems to subordinate human needs to nature's needs for preservation. This could be argued for a "full world" (Daly, 1996, p. 49), where nature's capacity to support human proliferation and the creation of economic wealth has been exhausted. Ecological footprint calculations claim that since the 1980s the planet's 'biocapacity' has been overshot, creating an 'ecological deficit' of about 30% (WWF *et al.*, 2008). The use of a standard of global average biocapacity, selective coverage of environmental impacts, and the questionable conversion of environmental degradation into units of land area diminish, however, the validity of these estimates.
- A less generic approach to assessing the limits of sustainability is to set specific ecological and social constraints for economic production and consumption. In this manner, one would create a feasibility space for economic activities, limited by minimum and maximum consumption needs and maximum (tolerable) environmental depletion and degradation. Within this space the invisible hand of the market could generate optimality of economic performance. At the same time, the visible hand of the standard setter would tame excessive economic activity by confining it to permissible levels. Models of linear programming and activity analysis could test this definition of sustainable development as feasible development programmes. In practice, these models have served to make the "vision of sustainable development visible"; the normative and hence judgemental nature of standards and heavy data requirements thwarted, however, the nation-wide application of linear programming for the analysis of constrained (sustainable) development (Bartelmus, 2008, p. 220).
- Integrating the full range of impacts and repercussion of multi-dimensional development introduces intangible social, cultural and political concerns into sustainability analysis. These intangibles blur the sustainable development concept to an extent where it becomes prone to manipulation by interest groups and activists. For instance, the heated globalization debate and protest movements did not come to any consensus but intensified instead the polarization of economists and environmentalists. The arguments range from warnings about a race to the bottom, abandoning social and cultural standards and achievements, to considering trade liberalization as a means of environmental protection and poverty alleviation.

3.2 Economic sustainability

The drawbacks of mixing a normative approach of governmental or expertocratic setting of limits with more factual analysis of economic performance suggest concentrating on what is really measurable in an integrative fashion. Economic theory and accounting help find the scope of such analysis by assessing the immediate interaction of environment and economy. Considering capital as the 'engine' of economic growth points to the need for keeping the engine running, i.e. to replace worn-out capital goods. Extending the concept of capital consumption to natural assets obtains an economic sustainability concept of *produced and natural capital maintenance*. Maintaining the overall value of capital caters of course to a weak sustainability notion, assuming substitution among different capital categories.

- Economic models of computable general equilibrium and optimal growth picked up the notion of produced and natural capital maintenance as a minimum condition for sustaining economic performance at optimal levels (Dasgupta and Mäler, 2000; Arrow *et al.*, 2004). These models suffer however from unrealistic assumptions about perfect markets, and production and consumption patterns. They remain largely theoretical but serve the conceptualization and understanding of sustainability in term of non-declining economic welfare or constant per-capita consumption (Bartelmus, 2008).
- For the time being, relatively new environmentally extended accounts are probably the best way of capturing the environmental sustainability of (past) economic activity. There are, though, several attempts at assessing the broader concept of development by indicator sets or indices. Before dismissing sustainable development as unrealistic let us look more closely at the main tools of measuring the sustainability of both economic growth and development.

4. Measuring sustainability: from indicators to accounting

4.1 Indicators and indices

Responding to the Rio Summit's call for developing indicators of sustainable development (United Nations, 1994, ch. 40), environmental and sustainable development indicators proliferated.[3] Detailed indicator sets cover a wide range of development concerns. They can provide early warning about harmful trends and may help evaluate policy measures with regard to particular policy targets. The drawback of indicators expressed in different units of measurement is the difficulty of evaluating their relative significance for achieving sustainable development. The lack of comparability of most indicators thwarts the rational setting of priorities for environmental and economic policies. In the absence of a transparent and widely accepted evaluation system or process, advocacy and media hype may carry the day. This has made global warming *the* surrogate measure for environmental deterioration. The risk is losing sight of other pressing environmental, social and economic concerns.

- Assessing the sustainability of overall socioeconomic progress or development requires, therefore, the aggregation of indicators into meaningful compound indices. Well-known attempts are the Human Development Index (UNDP, annual), the Environmental Sustainability Index (Yale Center etc., 1997-2006), the Genuine Progress Indicator (Cobb *et al.*, 1995) and the Ecological Footprint (WWF *et al.*, 2008). All these measures suffer from a more or less judgemental selection of partially correlated indicators, a mix-up of different weighting and valuation techniques, and/or inconsistency with established accounting concepts and conventions (Bartelmus, 2008).

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[3] *Note in particular those of the United Nations (1996, 2001), the OECD (2003) and the European Environment Agency (EEA) <http://reports.eea.europa.eu/signals-2004/en>. The International Institute for Sustainable Development (IISD) keeps an inventory of sustainable development indicator initiatives*

<http://www.iisd.org/publications/pub.aspx?id=607>.

4.2 Environmental accounting

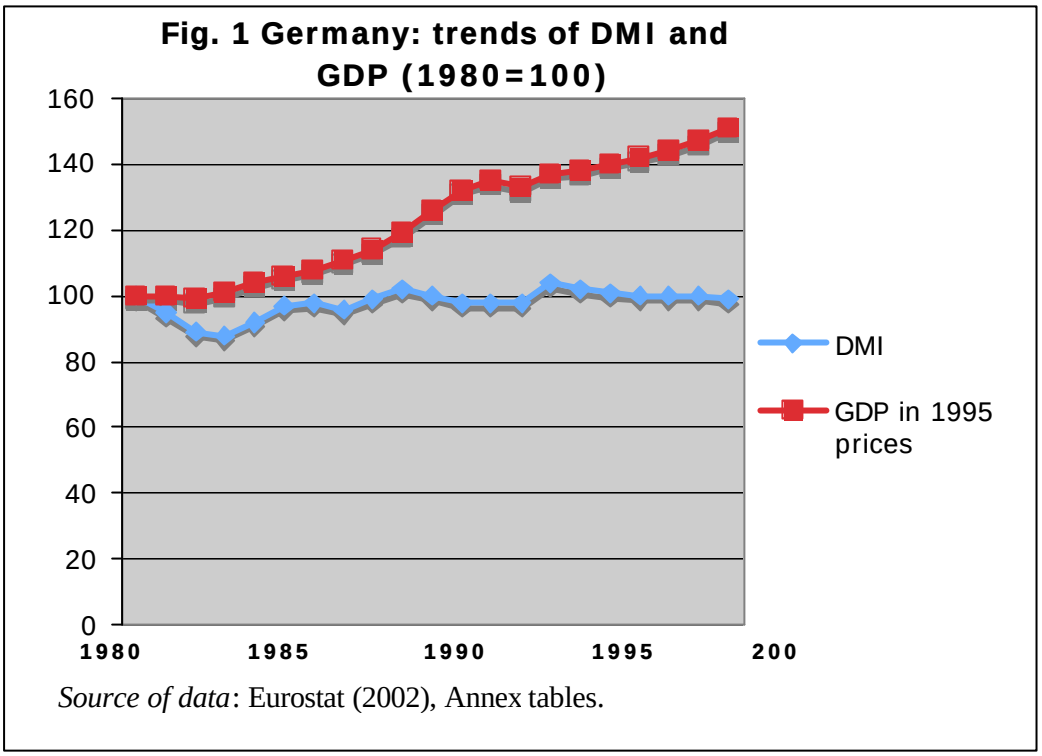
More 'balanced' accounting methods permit more transparent and systematic aggregation, and comparison of environmental impacts and costs with economic output. Physical laws of the conservation of energy and matter underlie energy and material flow balances. These physical accounts measure material and energy throughput, and – connected to appropriate standards – ecological sustainability. In contrast, monetizing the depletion of primary materials and emissions in extended national accounts allows the direct assessment of economic sustainability in terms of environmentally adjusted economic aggregates. The prototype green physical and monetary accounting tools are material flow accounts (MFA) (Eurostat, 2001; Bringezu *et al.*, 2004) and the System for integrated Environmental and Economic Accounting (SEEA) (United Nations *et al.*, 2003). Comparing the ability of MFA and SEEA to measure the environmental sustainability of economic performance and growth leads to the following conclusions:

- MFA measure environmental pressures from material throughput through the economy; they aim to assess dematerialization and ecological sustainability but suffer from weighting the significance of environmental pressures by the weight of materials and residuals
- the focus of MFA on physical material flows prevents direct comparison of environmental pressures with economic costs and benefits (output, income)
- greening the national – monetary – accounts achieves comparability of environmental deterioration, monetized as natural capital consumption, with the cost of produced capital consumption; "pricing priceless" waste absorption services that are not traded in markets requires, however, controversial maintenance costing
- maintaining the total monetary value of capital represents weak sustainability of economic growth; it ignores the complementarity of irreplaceable 'critical' capital.

Figure 1 and Table 1 illustrate the approaches of MFA and SEEA to measuring the ecological and economic sustainability of economic performance and growth.

- Figure 1 shows a scissor movement of Direct Material Input (DMI) and GDP in Germany over the 1980-2000 period. Since DMI has mostly hovered over the 1980 level of about 1.8 billion tonnes (Eurostat, 2002), this dematerialization is only relative – compared to the GDP upward trend. Extending this trend into the future does not augur well for achieving 'absolute' dematerialization, such as reaching Factor 4 or 10 sustainability targets. Similar results were found for most high-income industrialized nations (Bringezu *et al.*, 2004). Lack of data prevented the assessment of developing countries; they can however be expected to follow the path of industrialized ones.

Figure 1: Germany: trends of DMI and GDP (1980=100)



Source of data: Eurostat (2002), Annex tables.

- The aggregate results of greened national accounts in Table 1 show weak sustainability of Germany's economic performance during one particular year. Positive Environmentally-adjusted net Capital Formation (ECF) of 157 billion Deutschmarks (DM) indicates that during this year the economy was able to increase the total value of its produced and natural capital base. Follow-up studies indicate continuing weak sustainability, even after the unification of the country (Bartelmus, 2002, Table II.2). Positive trends of Environmentally-adjusted net Domestic Product (EDP = 1,884 billion DM) would give a similar picture of sustainability, but SEEA estimates are available for a few years only. Table 1 also shows that total environmental costs (of natural capital consumption) amount to 46 + 13 = 59 billion DM or about 3% of net domestic product. The few other industrialized countries, which conducted comprehensive SEEA studies, also performed sustainably in the sense of overall capital maintenance; other case studies of developing countries showed mixed results (Uno and Bartelmus, 1998). The World Bank's (2003, 2006) genuine savings[4] estimates indicate weak sustainability for industrialized countries but non-sustainability for many African nations.

[4] *The genuine (or net adjusted) savings indicator is similar to the ECF but includes education expenses as human capital formation.*

Table 1: Germany: SEEA flow accounts 1990 (billion DM)

	DOMESTIC PRODUCTION	*FINAL CONSUMPTION (households, government)*	*FIXED CAPITAL FORMATION AND CONSUMPTION*	*NATURAL CAPITAL CONSUMPTION*	*REST OF THE WORLD*
SUPPLY/ OUTPUT	6,007				779
INTERMEDIATE AND FINAL CONSUMPTION	–3,761	1,610	519		662
FIXED CAPITAL CONSUMPTION	–303		–303		
NDP	= 1,943				
CONSUMPTION OF NATURAL CAPITAL	**–46**	**–13**		**–59**	
EDP and ECF		**= 1,884**		**= 157**	

Source: Bartelmus (2002), Table II.3.

- The MFA's ecological sustainability assessment and the SEEA's economic one refer both to economic growth. As discussed, ecological sustainability is not really concerned, though, with levels of income or wealth. Rather, it seems to settle for comparing separate trends of environmental pressure and economic output. The purpose is to achieve some amount of delinkage of material flows from economic growth (Bringezu *et al*., 2004; Commission of the European Communities, 2005). Ecological sustainability differs, therefore, from economic sustainability in the intensity of relating the environment to the economy. Dematerialization confines itself to comparing the speed of growth of the economy and of environmental pressure. Capital maintenance goes for integration, costing natural as well as produced capital consumption in modified economic indicators.

5. Has it run its course?

Ecological economists tend to disregard quantifiability problems when embracing sustainable development. In their view, the "value pluralism" (Martinez-Alier, 2002, p. 47) of the multi-dimensional paradigm allows putting economic growth in its place. In order to keep it there they suggest setting 'safe minimum standards' that could curb human activity (Opschoor and van der Straaten, 1993; Perrings, 1995; Rennings *et al*., 1999; Ekins *et al*., 2003). Constraining economic activity in a feasibility framework may tame economic activity; it mixes, however, normative standards with positivist analysis, blurring the rational assessment of threats to the sustainability of human activity. Looming environmental disaster could justify such a normative and interventionist approach. Unless disaster is really *ante portas*, it may be very costly to close some or all the doors to economic growth.

- This does not deter those, who consider mainstream economics as irrelevant because of its "puzzle-solving … ignorance of the wider methodological, social and ethical issues" (Funtowwicz and Ravetz, 1991, p. 138). But we can see what happens when these 'soft' issues infiltrate 'hard' (data based) analysis. The 'coevolutionary' approach to development, which is close to the tenets of ecological and institutional economics, stresses the continuous interaction of values, knowledge, organization, technology and environment. Its protagonist concludes, perhaps surprisingly, that the complexity of coevolution makes it "impossible to define sustainable development in an operational manner" (Norgaard, 1994, p. 22); instead we should be content with a rather vague "opening our understanding to new and possibly desirable futures" (*op. cit*., p. 174).
- Ecological economists have thus not been able to come up with a practical theory or model of sustainable development. Rather, they justify the need for sustainable development with sets of indicators or indices, whose aggregative and integrative abilities can be questioned. Material flow accounts do succeed in aggregating environmental pressures. However, they are not able to incorporate these pressures in an overall development index. Instead they use gross domestic product for assessing the success or failure of decoupling strategies. The result is foregoing sustainable development analysis for measuring the potential environmental (non)sustainability of economic growth.
- Environmental economists[5], on the other hand, put their faith into the ability of markets to maintain (Pareto) optimality of economic activity by means of environmental (social) cost internalization. The greening of the national accounts and their economic indicators clarifies the connection between micro-economic environmental cost internalization and macro-economic sustainability of economic performance in operational terms: Taking natural capital consumption as a proxy for environmental damage permits the aggregation of this value in 'doubly net' indicators: EDP and ECF deduct the cost of both, environmental depletion and degradation, and produced capital depreciation, from conventional gross domestic product and capital

[5] *Distinguishing between ecological and (neoclassical) environmental economists serves expositional purposes. There are of course many (and sometimes overlapping) schools of 'eco-nomics' such as resource economics, bioeconomics, coevolutionary approaches, or industrial ecology.*

formation. As discussed above, the sustainability or non-sustainability of economic performance can then be measured as trends of these indicators.

- Broadening the narrow concept of produced and natural capital maintenance to include, in particular, human and social capital would require accounting for these less tangible production factors. Attempts at measuring these forms of capital and their difficult-to-imagine consumption are quite undeveloped. Still, ignoring losses of human and social capital, as well as potential complementarities in natural capital use, could derail sustainability analysis and policy. Produced and natural capital maintenance is a necessary but not sufficient condition for sustaining economic growth.
- What do all these challenges for assessing development and its environmental, economic and possibly even social sustainability tell us about sustainable development? Obviously, the paradigm does not provide a blueprint for implementation. Its unrealistically cornucopian scope carries the risk of benevolent negligence. Worse, interest groups might feel encouraged to advance contradictory and possibly misleading policy advice under the cloak of an incontestable paradigm. On the other hand, for achieving at least weak environmental sustainability of economic activity, integrative environmental-economic policies possess the necessary accounting and policy tools. Attaining other social, cultural or political objectives should be left to the agencies designed for their implementation, rather than mixing them up in the murky brew of sustainable development.
- Sustainable development still holds considerable social and environmental goodwill, though. Calling loudly for the demise of sustainable development might therefore harm the broad acceptance and pursuit of social and environmental goals. So, has sustainable development run its course? Yes, but one should not harp on it. Instead, integrative assessments and policies should focus on what can be reasonably well 'accounted' for. In other words, let us focus on the environmental sustainability of economic performance and growth. Particular trade-offs or synergisms of economic and environmental with other societal objectives have to be left to inter-departmental coordination and cooperation.

References

ARROW, K. (et al.) (2004), 'Are we consuming too much?', Journal of Economic Perspectives 18 (3): 147-172.

BARTELMUS, P. (2008), Quantitative Eco-nomics, How Sustainable Are Our Economies?, Dordrecht: Springer.

BARTELMUS, P. (2003), 'Dematerialization and capital maintenance: two sides of the sustainability, coin', Ecological Economics 46: 61-81.

BARTELMUS, P. (2002), 'Unveiling wealth – accounting for sustainability', in P. Bartelmus (ed.), Unveiling Wealth, On money, Quality of Life and Sustainability, Dordrecht: Kluwer, pp. 9-38.

BARTELMUS, P. (1994), Environment, Growth and Development, the Concepts and Strategies of Sustainability, London: Routledge.

BRINGEZU, S. (2002), 'Towards sustainable resource management in the European Union', Wuppertal Papers No. 121, Wuppertal Institute for Climate, Environment and Energy, Wuppertal, Germany.

BRINGEZU, S.; SCHÜTZ, H.; STEGER, S.; BAUDISCH, J. (2004), 'International comparison of resource use and its relation to economic growth, The development of total material requirement, direct material inputs and hidden flows and the structure of TMR', Ecological Economics 51: pp. 97-124.

CARLOWITZ, H.C.(1713), Sylvicultura Oeconomica, Leipzig: Braun.

COBB, C.; HALSTEAD, T.; ROWE J. (1995), 'If the GDP is up, why is America down?', The Atlantic Monthly, October: 59-78.

COMMISSION OF THE EUROPEAN COMMUNITIES (2005), 'Thematic Strategy on the Sustainable Use of Natural Resources', COM(2005) 670 final <http://ec.europa.eu/environment/natres/>.

DALY, H.E. (1996), Beyond Growth, Boston, Mass.: Beacon Press.

DASGUPTA, P.; MÄLER K.-G. (2000), 'Net national product, wealth, and social well-being', Environment and Development Economics 5: 69-93.

EKINS, P. (et al.) (2003), 'A framework for the practical application of the concepts of critical natural capital and strong sustainability', Ecological Economics 44: 165-185.

EUROSTAT (2002), Material Use in the European Union 1980-2000: Indicators and Analysis, Luxembourg: European Communities.

EUROSTAT (2001), Economy-wide Material Flow Accounts and Derived Indicators: A Methodological Guide, Luxembourg: European Communities.

FACTOR 10 CLUB (1994), 'Carnoules Declaration', Wuppertal Institute for Climate, Environment and Energy, Wuppertal, Germany.

FUNTOWICZ, S.O.; RAVETZ J. R. (1991), 'A new scientific methodology for global environmental issues', in R. Costanza (ed.), Ecological Economics: The Science and Management of Sustainability, New York: Columbia University Press, pp. 137-152.

GROBER, U. (1999), 'Der Erfinder der Nachhaltigkeit [The inventor of sustainability]', Die Zeit, no. 48 of 25 November 1999.

HINTERBERGER, F.; LUKS, F.; STEWEN, M.; VAN DER STRAATEN, J. (2000), 'Environmental policy in a complex world', International Journal of Sustainable Development 3: 276-296.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES (IUCN), United Nations Environment Programme (UNEP), and World Wildlife Fund (WWF) (1991), Caring for the Earth: A Strategy for Sustainable Living, Gland, Switzerland: IUCN.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES (IUCN), United Nations Environment Programme (UNEP), World Wildlife Fund (WWF) (1980), World Conservation Strategy, Living Resource Conservation for Sustainable Development, Gland, Switzerland: IUCN.

MARTINEZ-ALIER, J. (2002), 'The environmentalism of the poor', A report for UNRISD for the

WSSD <http://www.foescotland.org.uk/nation/ej_alier.pdf>.

NORGAARD, R.B. (1994), Development Betrayed, The End of Progress and a Coevolutionary Revisioning of the Future, London: Routledge.

OPSCHOOR, H.; VAN DER STRAATEN, J. (1993), 'Sustainable development: An institutional approach', Ecological Economics 7: 203-222.

OECD (2003). 'OECD environmental indicators – Development, measurement and use, Reference Paper

<http://www.oecd.org/dataoecd/7/47/24993546.pdf>.

PERRINGS, C. (2006), 'Resilience and sustainable development', Environment and Development Economics 11: 417-427.

PERRINGS, C. (1995), 'Ecology, economics and ecological economics', Ambio 24 (1): 60-63.

RENNINGS, K.; KOSCHEL, H.; BROCKMANN, K.L.; KÜHN, I. (1999). 'A regulatory framework for a policy of sustainability: Lessons from the neo-liberal school', Ecological Economics 28: 197-212.

UNITED NATIONS (2001), Indicators of Sustainable Development: Guidelines and Methodologies, New York: United Nations (sales no. E.01.II.A.6).

UNITED NATIONS (1996), Indicators of Sustainable Development, Frameworks and Methodologies, New York: United Nations (sales no. E.96.II.A.16).

UNITED NATIONS (1994), Earth Summit, Agenda 21, the United Nations Programme of Action from Rio, New York: United Nations (sales no. E.93.I.11).

UNITED NATIONS; EUROPEAN COMMISSION; INTERNATIONAL MONETARY FUND; OECD; WORLD BANK (2003), 'Integrated environmental and economic accounting 2003', final draft

<http://unstats.un.org/unsd/envaccounting/seea.asp>.

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP) (annual), Human Development Report, Oxford: Oxford University Press.

UNO, K.; BARTELMUS, P. (eds.) (1998), Environmental Accounting in Theory and Practice, Dordrecht: Kluwer.

WEIZSÄCKER, E.U.; LOVINS, A.; LOVINS, H. (1997), Factor Four: Doubling Wealth – Halving Resource Use, London: Earthscan.

WORLD BANK (2006), Where is the Wealth of Nations? Measuring Capital for the 21st Century, Washington, DC.: World Bank.

WORLD BANK (2003), World Development Report 2003, Sustainable Development in a Dynamic World, New York: World Bank and Oxford University Press.

WORLD COMMISSION ON ENVIROMENT AND DEVOLPMENT (WCED) (1987), Our Common Future, Oxford: Oxford University Press.

WORLD WIDE FUND FOR NATURE (WWF), Zoological Society of London, and Global Footprint Network (2008). Living Planet Report 2008, Gland: WWF.

YALE CENTER FOR ENVIROMENTAL LAW AND POLICY; CENTER FOR INTERNATIONAL EARTH SCIENCE, Information Network (1997-2006). 'Environmental Sustainability Index 2002, 2005; Environmental Performance Index 2006' <http://sedac.ciesin.columbia.edu/es/esi/>.

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