
2.1 Purpose and Content

Since the late 1980s, sustainable development has garnered much interest from government agencies, businesses, nongovernment organizations, and civic groups, resulting in policy initiatives in both the public and private sector. Yet, people and organizations citing sustainable development as an objective often lack a firm grasp of the origins and true meaning of the concept. Such an understanding is important as it provides a holistic perspective on development against which a sectoral—e.g., transportation specific—focus on sustainability can be considered. This chapter explores the evolution of sustainable development through the perspective of international conferences and publications often referred to in discussions of sustainability. The chapter then introduces the challenges that are frequently confronted when trying to conceptualize sustainable development through different disciplinary lenses. It concludes with a discussion of the need to adopt a holistic and integrative approach to the design of policies and initiatives aimed at achieving more sustainable forms of development.

2.2 The Emergence of Sustainable Development

The concept of sustainable development obtained formal international recognition at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. However, it is possible to trace the roots of the concept back to the 1950s/1960s, when developed nations were becoming increasingly aware that the local or regional environment was being stressed by rapid industrialization.¹

¹ The discussion in this section draws from Hall and Ashford (2012) and Ashford and Hall (2011).

2.2.1 The Formation of Environmental Movements

Although events such as the London Smog of 1952–1953 illustrated the dangerous effects of pollution (Bell and Davis 2001; Davis et al. 2002), it was the publication of Rachael Carson's book *Silent Spring* in 1962 that focused public attention on the negative impacts of industrial activities (see Fig. 2.1 for a timeline of sustainability-related events). Carson described the potential dangers of the excessive use of pesticides (such as DDT) and argued that it served the interests of chemical companies, industrial agriculture, the military, and universities to ignore these dangers, promote their use, and continue their development. "*Silent Spring* altered a balance of power in the world. No one since would be able to sell pollution as the necessary underside of progress so easily or uncritically" (Hynes 1989, p. 3).²

In parallel with the growing distrust of the government-industry complex, arguments warning the environmental problems associated with the prevailing development model of rapid industrialization and economic growth began to surface. Two classic publications which supported this movement were "The Tragedy of the Commons" (Hardin 1968) and *The Population Bomb* (Ehrlich 1968). Hardin (1968) highlighted the natural tendency of private actors to exploit the public/environmental commons to the point where it can no longer support economic activity. Ehrlich (1968) expressed concern that the appetite of a growing population may not be met by a fixed resource base—a similar argument to that made in *Limits to Growth* (Meadows et al. 1972). The latter report was novel in its use of computer simulations to illustrate potentially disastrous future consequences of the continuation of current production and consumption patterns.

In response to public concern in the USA, Congress passed the National Environmental Policy Act (NEPA) and signed it into law on January 1, 1970. NEPA was designed to ensure that the entire federal bureaucracy considered the environmental impacts of its actions (Blumm 1990). Since its passage, more than 100 countries around the world have adopted similar procedures for environmental impact assessments (Jay et al. 2007). In addition to placing the environment on a more equal footing with development, the act influenced the Brundtland concept of sustainable development that followed some two decades later (see Sect. 2.2.5). NEPA required the federal government to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations" (Sec. 101, (b), 1 [42 USC § 4331]). Intergenerational considerations now form a central element of the idea of sustainable development.

² Outside of the UK and the USA, a similar environmental awareness was emerging in other developed regions. In Japan, problems such as the "Minamata" disease (caused by mercury poisoning in the city of Minamata) starkly revealed the downsides of heavy industrial development.

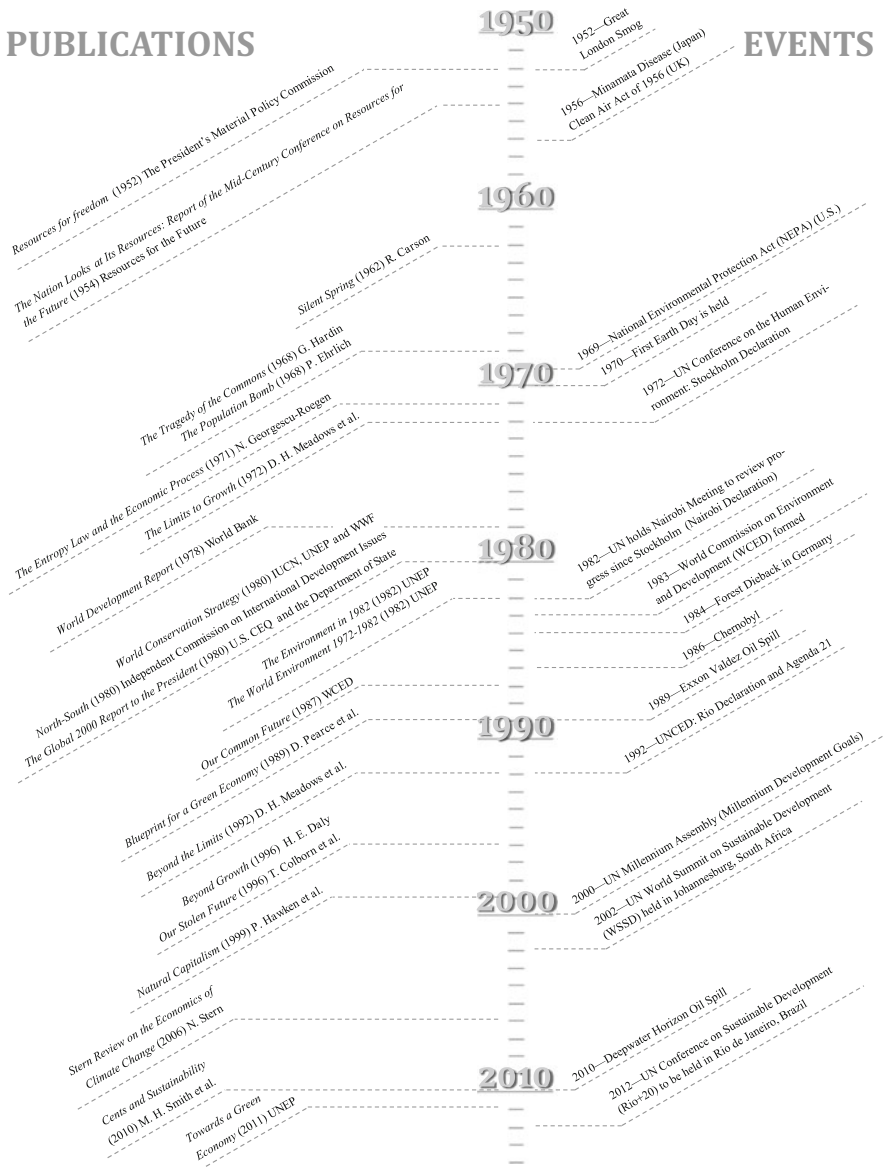


Fig. 2.1 Timeline of key events and publications

2.2.2 The 1972 Stockholm Conference

As a result of growing environmental concerns within industrialized nations and an awareness that these challenges were not confined by national borders, the United Nations held a Conference on the Human Environment in Stockholm in 1972.

The Stockholm Conference brought together the topics of ecosystem integrity, biological diversity, and human health and the issue of ecological and resource limits to growth. The conference discussed the potential problem with toxic substances (in its Action Plan), but this environmental concern remained primarily the focus of national legislation during the 1970s. Toward the end of the 1970s, the international community began to discuss the related concerns of ozone depletion and greenhouse gas emissions. However, it was not until the second half of the 1980s and the 1990s that international action was taken to address ozone depletion and global climate change, respectively.

The Stockholm Conference is considered a defining moment for two reasons (Caldwell and Weiland 1996)—it identified the critical need for all nation states to establish environmental policy at the national level and informed the world community of the vital role that a healthy biosphere plays in sustaining life, placing a concern for the environment on national agendas. The Stockholm Conference also led to the creation of the United Nations Environment Programme (UNEP) to provide the UN with the institutional capacity needed to address and coordinate the recommendations put forward in the Stockholm Action Plan and, more generally, to advocate for the protection and improvement of the environment.

Although the Stockholm Conference and its agreements were influential in advancing concerns for the human environment, many suggest that the conference's major impact came from the intense pre-conference deliberations and from its role as a catalyst for an explosion of literature that raised the world's consciousness about the natural environment (Dernbach 1998; UNEP 1982a, b; Emmelin 1972; Strong 1972; United Nations 1972).

2.2.3 The 1980 World Conservation Strategy

One of the foundational texts on sustainable development is the International Union for Conservation of Nature and Natural Resources (IUCN) et al.'s (1980) *World Conservation Strategy* (WCS). The WCS is a synthesis of decades of debate in the international community over the need to protect the environment while continuing the process of development. The WCS used the term “sustainable” to describe development that takes “account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as short term advantages and disadvantages of alternative actions” (IUCN et al. 1980, p. 18). Acknowledging that “[c]onservation and development have so seldom been combined that they often appear—and are sometimes represented as being—incompatible” (*ibid.*, p. 18), the WCS proceeds to develop its case as to why conservation and economic and social development are mutually supportive endeavors (*ibid.*). “Conservation must . . . be combined with measures to meet short term economic needs. The vicious circle by which poverty causes ecological degradation which in turn leads to more poverty can be broken only by development. But if it is not to be self-defeating, it must be sustainable—and conservation helps to make it so” (*ibid.*, p. 19).

The WCS's notion of sustainable development—the idea that economic and social development can occur in unison with the conservation of living resources—presented a different perspective on global problems. While the WCS did not fully integrate development and environmental considerations (Clapp and Dauvergne 2005), its formulation of “sustainable development” informed the World Commission of Environment and Development's (WCED's) report *Our Common Future* (see Sect. 2.2.5) that made the concept a defining and integrating theme of the 1992 UN Conference on Environment and Development (see Sect. 2.2.6) (Caldwell and Weiland 1996).

2.2.4 The 1982 Nairobi Meeting

Ten years after Stockholm, the UN convened a meeting in Nairobi to review the progress in implementing the Stockholm Action Plan and make recommendations with respect to prevailing environmental trends for the future actions of the UNEP. The pre-conference reports prepared by UNEP (1982a, c) and the Nairobi Declaration presented a clear message that while nation states had made progress toward environmental protection, their actions were insufficient to reverse the rate of environmental degradation occurring throughout the world. The Nairobi meeting also highlighted the role of economic growth in improving the health and welfare of people and the environment in developing countries (UNEP 1982a, p. 37).

Since the initial concerns for the human environment grew from the negative impacts of industrialization in developed countries, the shift in the international focus toward the environmental problems faced by developing nations is significant. By identifying poverty as a major contributor to environmental degradation, economic growth became more important since it was considered to be the only pragmatic way of alleviating poverty. However, the only way to grow the economy was to follow the path of conventional development. This meant a reliance on technology that was fueled by nonrenewable resources and that generated a significant amount of pollution which would likely damage ecosystems and human health. Thus, developing countries faced a paradox. They needed to develop to not only alleviate poverty but to also protect and improve their environment—upon which their future depended—but in doing so, they would ultimately damage the very environment they wished to safeguard. This contradiction underscored the need for development and environmental protection to advance in unison.

2.2.5 The World Commission on Environment and Development: *Our Common Future*

In light of the evidence that environmental conditions around the world were deteriorating (UNEP 1982a; IUNC et al. 1980; Brandt 1980; CEQ 1980) and population and economic growth—two critical factors affecting the environment—were continuing to increase (Strong 2003), the UN General Assembly established a

special, independent commission on the environment to create “long-term environmental strategies for achieving sustainable development.”³ As part of its terms of reference, the commission was required to consider the interrelationships between developed and developing nations and between people, resources, the environment, and development. In short, the commission was required to articulate a new vision of development.

Under the chairmanship of former Prime Minister Gro Harlem Brundtland of Norway, the World Commission on Environment and Development (WCED, also known as the Brundtland Commission) was subsequently formed and held its first meeting in Geneva, Switzerland, in October 1984.

Between 1984 and 1987, the Brundtland Commission received advice and support from thousands of individuals, institutions, and organizations from all over the world (WCED 1987, p. 359). The commission also visited each world region to obtain a firsthand view of environment and development issues and to hold deliberative meetings and open public hearings. On December 11, 1987, the commission’s “Environmental Perspective to the Year 2000 and Beyond” was adopted by the UN General Assembly.⁴ That same year, the Commission’s full report was published as *Our Common Future*.

Benefiting from more than a decade of debate over the notion of sustainable development, the Brundtland Commission sought to effectively integrate social and economic development with the need for environmental protection. By combining these elements with a consideration of intergenerational equity, the Commission created what has become the most cited definition of sustainable development.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of “needs,” in particular, the essential needs of the world’s poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs.

Thus the goals of economic and social development must be defined in terms of sustainability in all countries—developed or developing, market orientated or centrally planned. Interpretations will vary but must share certain general features and must flow from a consensus on the basic concept of sustainable development and on a broad strategic framework for achieving it (WCED 1987, p. 43).

The latter part of this definition highlights what has since become one of the major issues of contention with sustainable development. The *interpretation* of

³ Source: UN General Assembly, *Resolution 38/161, Process of preparation of the Environmental Perspective to the Year 2000 and Beyond*, 19 December 1983, Section 8 (a), <http://www.un.org/documents/ga/res/38/a38r161.htm> (accessed on April 19, 2015).

⁴ Source: UN General Assembly, *Resolution 42/186, Environmental Perspective to the Year 2000 and Beyond*, 11 December 1987, 2, <http://www.un.org/documents/ga/res/42/a42r186.htm> (accessed on April 19, 2015).

sustainable development by one nation might be seen as leading to “unsustainable” development by another.

Our Common Future defined the major objective of development as the “satisfaction of human needs and aspirations” (WCED 1987, p. 43). Further, it envisioned sustainable development not as an end state but rather as “*a process of change* in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs” (WCED 1987, p. 9, emphasis added). The Brundtland Commission adopted a highly political agenda by viewing “sustainable development as a policy objective, rather than a methodology. It is an overarching concept. . . . Such an approach is unapologetically normative, and places both the responsibility for problems, and the political will to overcome them, in the hands of human actors” (WCED 1987, p. 37).

The Brundtland Commission made a convincing argument that environment and development are “inexorably linked” and cannot be treated as separate challenges (WCED 1987, p. 37). It concluded: “[d]evelopment cannot subsist upon a deteriorating environmental resource base; the environment cannot be protected when growth leaves out of account the costs of environmental destruction” (WCED 1987, p. 37). This statement implies that limits need to be placed on environmentally destructive economic activity, and, as stated above, these “limits” should be determined by the “state of technology and social organization,” implying that the solutions lie in *better* technology and systems of governance.

Our Common Future appeared at a time when the political climate was beginning to become more receptive to the issues raised by the report. Future prospects for economic growth in industrialized nations were beginning to look positive, while global ecosystems were beginning to show signs of distress (Engfeldt 2002). An international audience was eager to learn how to embrace economic growth while reducing pressure on ecosystems. The Commission’s insistence that science and technology could be utilized to meet human needs and solve environmental problems was the answer many were looking for. By promoting the role of technological improvements in supporting economic growth, conserving natural resources, and protecting the environment, the Commission gained the support of both developed and developing nations. If science and technological innovation—two mainstays of economic growth in industrial societies—had not been a central theme of sustainable development, national governments (primarily of the north) would most likely have rejected the concept as another radical and politically unrealistic form of environmentalism.

By explicitly bringing science and technology into the development equation, the technologically optimistic Brundtland Commission sought to articulate a new era of economic growth that is decoupled from increasing environmental degradation.

Having articulated a bold new development agenda, the Brundtland Commission highlighted a major problem with the institutional frameworks that would be responsible for implementing the new era of economic and social development (we treat institutional issues and governance in the context of transportation in

Chap. 5). It argued that most governmental environment agencies, especially those in developing nations, “tend to be independent, fragmented, [and] working to relatively narrow mandates with closed decision processes” (WCED 1987, p. 9). It stated the same was true for many international agencies responsible for areas such as development lending, trade regulation, and agricultural development. The Commission believed the solution to these problems lay in ensuring that national and international institutions consider the ecological dimensions of policy at the same time as economic, social, trade, energy, agricultural, and other dimensions. The idea was to develop a more integrated and proactive approach to environmental protection, rather than the more expensive “react and cure” approach that was typical of many government approaches in the post-Stockholm era (Runnalls 2008). In parallel with this, the Commission called for the strengthening of international law and conventions in support of sustainable development and for better implementation of these mechanisms for change.

Box 2.1 presents the broad set of conclusions from *Our Common Future*, which reiterates the above points and presents several additional requirements for the pursuit of sustainable development.

Box 2.1: Requirements for the Pursuit of Sustainable Development, *Our Common Future* (WCED 1987, p. 65)

In its broadest sense, the strategy for sustainable development aims to promote harmony among human beings and between humanity and nature. In the specific context of the development and environment crises of the 1980s, which current national and international political and economic institutions have not and perhaps cannot overcome, the pursuit of sustainable development requires:

- A political system that secures effective citizen participation in decision making,
- An economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis,
- A social system that provides for solutions for the tensions arising from disharmonious development,
- A production system that respects the obligation to preserve the ecological base for development,
- A technological system that can search continuously for new solutions,
- An international system that fosters sustainable patterns of trade and finance, and
- An administrative system that is flexible and has the capacity for self-correction.

2.2.6 The 1992 United Nations Conference on Environment and Development: The Rio Summit

In response to *Our Common Future*, the UN General Assembly decided to convene the UNCED in Rio de Janeiro, Brazil (also known as the Rio or Earth Summit) in 1992. The UNCED attracted some 178 nation states, including 110 heads of state who attended the final 2-day meeting (UN 1993a–c), an unprecedented global gathering of such leaders.

Two of the official documents from UNCED have since taken a central role in shaping the idea of sustainable development: the Rio Declaration on Environment and Development and Agenda 21. Whereas the Rio Declaration provided a vision of sustainable development, Agenda 21 provided a comprehensive plan of action (a blueprint) that was created to guide and coordinate the work of the UN, governments, and other major groups in their efforts to transition society toward sustainable development. The conference also adopted the Framework Convention on Climate Change, providing the international legal framework for climate policy.

Continuing the Brundtland Commission's conception of sustainable development, the Rio Declaration and Agenda 21 did not supplant previous approaches to development, rather they revised (in fundamental ways) the *conventional development* approach. Prior to the 1990s, the conventional development model (promoted by the international community) incorporated four related concepts: (1) peace and security; (2) economic development; (3) social development; and (4) national governance that secures peace and development (Dernbach 1998, 2004). The Brundtland Commission and UNCED agreements called for environmental concerns to be *integrated* into the conventional development model. Principles 3 and 4 of the Rio Declaration speak directly to this aim.⁵

Principle 3 The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

Principle 4 In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

The recognition of the need to protect the environment—upon which the development process depends—can be considered as the *fifth element* of the international notion of development (Dernbach 1998, p. 21). Therefore, **sustainable development** could be crudely considered as: **conventional development + environmental protection/conservation**.

Principles 15 and 16 of the Rio Declaration also articulated the *precautionary* and *polluter pays* principles, respectively, which have since become guiding principles of sustainable development policy and programs.

⁵ Source: *UNCED Declaration on Environment and Development*, <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm> (accessed on April 19, 2015).

While the UNCED is considered a watershed event in the formation of the concept of sustainable development, it was not without its critics who pointed to several shortcomings of the meeting and its products (The Ecologist 1993; Korten 1991). Grubb et al. (1993) argue that the principles of the Rio Declaration reveal weaknesses in the compromises that were made to make the Declaration politically palatable. A significant turning point in the negotiations of the Declaration was the success of developing nations in placing their “right to development” at the forefront of considerations (Sachs 2001). The recognition that less-developed nations needed to “develop” meant that the Rio Declaration effectively turned into a “declaration on development, rather than on environment” (Sachs 2001, p. 5). Further, since “development” can be defined in multiple ways, it can be argued that the Rio Declaration supports a business-as-usual approach to development where the environment is more of an afterthought.⁶

Redclift (1996) argues that the UNCED neglected to address important questions relating to population, trade, poverty, the debt crisis (faced by many oil-importing developing nations), and distributional inequality more generally. In addition, he raises an important question about whether the “development” of industrialized nations is what the developing world should be aspiring to achieve.

Criticisms such as these point to the need for careful consideration of *who* the development process is really benefiting and what model of development is being promoted. Critics notwithstanding, *Our Common Future*, the Rio Declaration, and Agenda 21 are typically considered as the building blocks of the notion of sustainable development. Two other notable documents that contribute to an understanding of sustainable development are the *Earth Charter* (prepared by the Earth Council) and the *UN Millennium Declaration*—both published in 2000.

2.2.7 The 2002 Johannesburg Summit

In 2002, the Johannesburg Summit was held to review progress since UNCED. During the decade following Rio, the world had experienced a new phase of economic growth that was largely based upon patterns of development, consumption, and lifestyles that had the effect of widening the gap between affluent and poor nations (South Centre 2002).

A new era of economic globalization had changed the approaches necessary to transition the world toward sustainable development. The Johannesburg Declaration stated that “[t]he rapid integration of markets, mobility of capital and significant increases in investment flows around the world have opened new challenges and opportunities for the pursuit of sustainable development.” In addition to reaffirming a commitment to sustainable development, the declaration specifically urged developed nations to provide the internationally agreed-upon levels of

⁶ Ashford and Hall (2011) argue that a similar situation occurs today with employment, which they view as a critical, but often forgotten, element of sustainable development.

official development assistance (ODA)—set at 0.7 % of GNP in 1969 (Pearson 1969)—to developing nations. Furthermore, the private sector was called upon to recognize its role in achieving sustainable development. The declaration stated it had a “duty to contribute to the evolution of equitable and sustainable communities and societies” and that it should “enforce corporate accountability, which should take place within a transparent and stable regulatory environment.” Finally, the declaration stated that the goals of sustainable development would be achieved through “effective, democratic, and accountable international and multilateral institutions,” putting multilateralism at the center of sustainable development efforts.

An important recognition at the Johannesburg Summit was the role of voluntary, multi-stakeholder, international-/national-/local-level partnerships for sustainable development (ECOSOC 2002, p. 7). At the time of the summit, over 220 partnerships had been identified with many new partnerships being announced during and after the Summit. However, some caution that NGOs were worried the partnerships might mitigate government obligations, that governments may “lose control” over their sustainable development agendas to the organizations leading the partnerships, and that since the implementation of sustainable development is not a core activity of many organizations, the impacts of the partnerships may be limited (Hens and Nath 2005, p. 33).

Another outcome of the Johannesburg process was the international community’s commitment to market mechanisms and capacity building (or capacity development) as critical measures to achieving sustainable development. This transition toward a reliance on the market reflected a continuing ideological shift away from the role of the government as a driving force for development. Indeed, multi-lateralism and the inclusion of a strong business and NGO presence in the delivery architecture for sustainable development means that the governance (steering) of actors is increasingly important. This is not to underestimate the importance of governmental actors but to recognize them as part of a broader constellation.

While the Johannesburg Summit focused on a more comprehensive set of environmental issues than those discussed at the UNCED, in the years following the summit, the international community’s attention gravitated toward the challenge of global climate change. The release of Al Gore’s documentary *An Inconvenient Truth*, followed by the award of the 2007 Nobel Peace Prize to him and the Intergovernmental Panel on Climate Change “for their efforts to build up and disseminate greater knowledge about man-made climate change,”⁷ did much to raise global concern about the issue. Equally important was the publication of the *Stern Review on the Economics of Climate Change* (known as the *Stern Review*) by the UK Treasury on October 30, 2006 (Stern 2007). Although the review was not the first economic analysis of climate change (Cline 1992; Mendelsohn et al. 1998;

⁷ Source: Nobel Foundation, The Nobel Peace Prize 2007, http://nobelprize.org/nobel_prizes/peace/laureates/2007/ (accessed on April 19, 2015).

Nordhaus and Boyer 2000), its status as an official government document made it one of the most widely known and debated studies of its kind. The growing dominance of global climate change as *the* environmental concern means that the focus on other important environment and human health concerns is lessened (Ashford and Hall 2011).⁸

2.2.8 The 2012 United Nations Conference on Sustainable Development (Rio+20)

From June 20 to 22, 2012, the UN Conference on Sustainable Development (known as Rio+20) was held in Rio de Janeiro, Brazil, 20 years after the first Rio Conference. The primary purpose of the conference was to reinvigorate the international community's efforts to promote sustainable development. While some 50,000 policymakers, environmentalists, and business leaders attended the conference, the inability of delegates to agree on a comprehensive framework with commitments and targets for long-term action left many organizations considering the conference a failure.⁹

The most significant outcome from the Rio+20 Conference was the endorsement of the “green economy” as a flexible mechanism for advancing sustainability. The Rio+20 conference report, entitled *The Future We Want*, provides the following commentary on the green economy in the context of sustainable development and poverty eradication:

We affirm that there are different approaches, visions, models and tools available to each country, in accordance with its national circumstances and priorities, to achieve sustainable development in its three dimensions which is our overarching goal. In this regard, we consider green economy in the context of sustainable development and poverty eradication as one of the important tools available for achieving sustainable development and that it could provide options for policymaking but should not be a rigid set of rules. We emphasize that it should contribute to eradicating poverty as well as sustain[ing] economic growth, enhancing social inclusion, improving human welfare and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth's ecosystems (UN 2012, p. 9).

⁸ The importance of maintaining a holistic approach to development is discussed in Sect. 2.5.

⁹ For example, see the Friends of the Earth Rio+20 blog that describes the unwillingness of governments to commit to a new set of principles (source: <http://www.foei.org/news/blogs/rio-20/rio20-summit-condemned-as-sell-out-of-people-and-the-planet-2/>, accessed on April 19, 2015), and Greenpeace's press statement on Rio+20 that called the conference a “failure of epic proportions” due to its lack of commitments and targets (source: <http://www.greenpeace.org/international/en/press/releases/Greenpeace-Press-Statement-Rio20-Earth-Summit-a-failure-of-epic-proportions/>, accessed on April 19, 2015).

The emphasis on the green economy continues the modernist development stance established at the 1992 Rio Conference—that is, *green* economic growth (*green growth*) can occur through the deliberate application of science and technology. This stance is reflected in the Rio+20 conference report, which recognizes “the critical role of technology as well as the importance of promoting innovation” to make progress toward sustainable development and reduce poverty (UN 2012, p. 13).

The strategies required to transition to a green *global* economy—such as significantly increasing investment in green technologies combined with more stringent national and international regulations/standards—have revived concerns of emerging economies that such actions may promote green protectionism, conditionality, and subsidies that protect the domestic economies of developed regions (UNCSD and UNCTAD 2011). There is also the concern that only developed nations have the available finance and innovative capacity to create and supply the needed technologies for a green transition—with the possible exception of certain green technology sectors in China (e.g., clean coal technology) and Brazil (e.g., biofuels) (UN 2011). Thus, the technology gap between advanced and emerging economies may increase, placing developing regions at a further disadvantage. Such arguments increase the focus on mechanisms to transfer or share technologies with emerging economies, which raises important questions in areas such as intellectual property.¹⁰

The Rio+20 Conference provided decision-makers with the opportunity to revisit the message from the 1992 Rio Conference—that economic development (i.e., growth) must be decoupled from environmental harm. The green economy is the mechanism the UN system advanced to achieve this objective (UN 2011, 2012).¹¹

Two of the many publications written to inform the preparation of Rio+20¹² were UNEP’s (2011) report *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication* and Smith et al.’s (2010) book *Cents and Sustainability: Securing Our Common Future by Decoupling Economic Growth from Environmental Pressure*. The message from both publications is that a “green economy” and “decoupling” present new growth opportunities that can help protect the environment, create decent jobs, and help address the challenge of poverty. The

¹⁰ Many of the challenges that will accompany a transition to a green economy are clearly articulated in several preparatory reports for Rio+20 (UN 2011; Ocampo et al. 2011; UNCSD and UNCTAD 2011; UNEP 2011).

¹¹ The Organisation for Economic Co-operation and Development (OECD) has also published a series of reports that outline its strategy for promoting “green growth”—see OECD (2011a–c).

¹² See, for example, the extensive list of pre-conference publications listed on the website of the United Nations Conference of Sustainable Development, http://www.uncsd2012.org/resources_publications.html (accessed on April 19, 2015).

publications draw on over a decade of experience with decoupling strategies that *Cents and Sustainability*, in particular, presents in an attempt to renew momentum behind the approach.

The principal argument of *Cents and Sustainability* and *Towards a Green Economy* is that economic growth can coexist with environmental protection—reinforcing the message from the 1992 Rio Conference that economic growth and environmental protection can advance in unison while reducing poverty. The publications are based on a premise that a green economy or decoupling agenda presents the most viable pathway toward sustainable development.¹³

2.2.9 The Post-2015 Agenda

In 2015, the United Nations (UN) will replace the Millennium Development Goals (MDGs) with a new set of goals and indicators for the 2015–2030 timeframe. The post-2015 agenda represents the next evolution in the concept of sustainable development that is explored below by reviewing the emerging sets of sustainable development goals (SDGs).

The challenge of creating the post-2015 agenda falls primarily on the intergovernmental Open Working Group (OWG) on SDGs that was established following Rio +20. The mandate for the OWG was outlined in the Rio+20 outcome document—*The Future We Want*—which charged the 30-member group to deliver the final and “limited” set of SDGs to the UN General Assembly at its 68th session. While no specific SDGs were provided in the outcome document, it did call for the creation of goals that balanced all three dimensions of sustainability in a coherent and integrated way. The process of developing the post-2015 agenda has led to an unprecedented global dialogue that has involved thematic discussions,¹⁴ national consultations in 88 countries,¹⁵ and the submission of reports and input from the High-level Panel on the Post-2015 Development Agenda

¹³ In the aftermath of the 2008 global financial crisis, this position is being challenged by the “new economics” or “degrowth” movement that calls for a fundamental reorganization of social activity, where progress is not measured by economic growth. See, for example, D’Alisa et al. (2014).

¹⁴ These issues cover inequalities, governance, growth and employment, health, education, environmental sustainability, food security and nutrition, conflict and fragility, population dynamics, energy, and water. Source: The World We Want, Thematic Consultations, <http://www.worldwewant2015.org/sitemap#thematic> (accessed on April 19, 2015).

¹⁵ See the World We Want, National Consultations, <http://www.worldwewant2015.org/sitemap#national> (accessed on April 19, 2015).

(UN 2013),¹⁶ the Sustainable Development Solutions Network (SDSN 2014),¹⁷ and many other organizations including over 40 entities within the UN system.¹⁸

With the final SDGs yet to be announced, an analysis of the emerging sets of goals developed by the SDSN, the High-level Panel, and the OWG provides some indication of what factors are being considered. Table 2.1 shows the current MDGs alongside each of the proposed sets of SDGs. The goals have been grouped to enable comparison. The table shows that the original eight MDGs are all covered to a certain extent by each of the proposed sets of SDGs. Beyond the original eight goals, two new goals are present in all three sets of SDGs. These are (1) the need for sustainable economic growth accompanied by the creation of jobs and (2) the need to develop sustainable energy systems that reduce the pressure on the climate.

Two of the sets of SDGs promote the need to establish resilient cities/infrastructure and sustainable/universal access to water and sanitation services, whereas the goal of ensuring sustainable production and consumption is found only in the OWG's set of SDGs.

Interestingly, several of the new SDGs were previously included in the MDGs as targets or indicators. For example, the need for employment for all was a target under first MDG, whereas the need to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation was a target under MDG 8. While MDG 7 included an indicator to measure CO₂ emissions, there were no specific targets related to reducing climate change emissions. The proposed SDGs related to promoting sustainable energy systems, resilient cities/infrastructure, and sustainable production and consumption are new. However, with the exception of "resilient" cities/infrastructure, the need to develop sustainable energy and production and consumption systems can be traced back to the 1992 Rio Declaration and Agenda 21. For example, Principle 8 of the Rio Declaration and Chapter 4 for Agenda 21 focus specifically on sustainable patterns of consumption and production, and Chapter 7 of Agenda 21 discusses the need for sustainable energy. Thus, while the post-2015 agenda is likely to restructure the framing of the

¹⁶ The 27 member High-level Panel on the Post-2015 Development Agenda was created in July 2012, by the UN Secretary-General Ban Ki-moon to advise on the global development framework beyond 2015. Information on the activities of the panel can be found on the UN Secretary-General's website: <http://www.un.org/sg/management/hlppost2015.shtml> (accessed on April 19, 2015).

¹⁷ The Sustainable Development Solutions Network (SDSN) was launched by UN Secretary-General Ban Ki-moon in August 2012, to mobilize "scientific and technical expertise from academia, civil society, and the private sector in support of sustainable development problem solving at local, national, and global scales" (source: SDSN, Vision and Organization, <http://unsdsn.org/about-us/vision-and-organization/>, accessed on April 19, 2015). The group aims to overcome the compartmentalization of technical and policy work by identifying "integrated" solutions to the environmental, economic, and social challenges confronting the world (see Sect. 2.5 for a discussion of the importance of adopting a holistic and integrative approach to sustainable development).

¹⁸ A detailed list of documents, publications, and statements related to the post-2015 agenda development process can be viewed via the OWG's website: <http://sustainabledevelopment.un.org/owg.html> (accessed on April 19, 2015).

Table 2.1 The MDGs and the emerging post-2015 development agenda

Millennium development goals (MDGs)	SDSN's post-2105 development goals (SDSN 2014)	High-level panel's post-2105 development goals (UN 2013)	OWG's post-2015 development goals (UN 2014)
Goal 1: Eradicate extreme poverty and hunger	Goal 1: End extreme poverty including hunger Goal 6: Improve agriculture systems and raise rural prosperity	Goal 1: End poverty Goal 5: Ensure food security and good nutrition	Goal 1: End poverty in all its forms everywhere Goal 2: End hunger, achieve food security, and improved nutrition and promote sustainable agriculture Goal 10: Reduce inequality within and among countries
Goal 2: Achieve universal primary education	Goal 3: Ensure effective learning for all children and youth for life and livelihood	Goal 3: Provide quality education and lifelong learning	Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning
Goal 3: Promote gender equality and empower women	Goal 4: Achieve gender equality, social inclusion, and human rights for all	Goal 2: Empower girls and women and achieve gender equality	Goal 5: Achieve gender equality and empower all women and girls
Goal 4: Reduce child mortality Goal 5: Improve maternal health Goal 6: Combat HIV/AIDS, malaria, and other diseases	Goal 5: Achieve health and wellbeing at all ages	Goal 4: Ensure healthy lives	Goal 3: Ensure healthy lives and promote well-being for all at all ages
Goal 7: Ensure environmental sustainability	Goal 9: Secure biodiversity and ensure good management of water, oceans, forests, and natural resources	Goal 9: Manage natural resource assets sustainably	Goal 14: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development Goal 15: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

(continued)

Table 2.1 (continued)

Millennium development goals (MDGs)	SDSN's post-2105 development goals (SDSN 2014)	High-level panel's post-2105 development goals (UN 2013)	OWG's post-2015 development goals (UN 2014)
Goal 8: Develop a global partnership for development	Goal 10: Transform governance and technologies for sustainable development	Goal 10: Ensure good governance and effective institutions Goal 11: Ensure stable and peaceful societies Goal 12: Create a global enabling environment and catalyse long-term finance	Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development
–	Goal 2: Promote economic growth and decent jobs within planetary boundaries	Goal 8: Create jobs, sustainable livelihoods, and equitable growth	Goal 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all
–	Goal 8: Curb human-induced climate change and ensure sustainable energy	Goal 7: Secure sustainable energy	Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all Goal 13: Take urgent action to combat climate change and its impacts
–	Goal 7: Empower inclusive, productive, and resilient cities	–	Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable
–	–	Goal 6: Achieve universal access to water and sanitation	Goal 6: Ensure availability and sustainable management of water and sanitation for all
–	–	–	Goal 12: Ensure sustainable consumption and production patterns

critical development concerns, if considered in the broader context of the main sustainable development declarations and texts, it could be argued that the agenda is trying to capture concerns that have been previously well articulated. In this regard, the post-2015 agenda could be viewed as a more comprehensive framing of sustainable development.

As should be evident from the above discussion, the framing of sustainable development is likely to continue to evolve in relation to key events (such as the creation of the post-2015 agenda), new knowledge (such as the emerging interest in resilient cities/infrastructure), and from the actions of nations, regions, and the international community in trying to implement the concept. The review of the emerging post-2015 agenda shows that the future SDGs are likely to build on the “Brundtland-UNCED-Johannesburg-Rio+20” agenda, which can be described as technologically optimistic and market oriented. Whether one agrees or not with this approach to sustainable development is a matter of personal conviction; what is important is that if the “Brundtland-UNCED-Johannesburg-Rio+20-Post-2015” view is adopted, the adopter is aware of the development model being promoted. While the Brundtland formulation of sustainable development is the most widely used and accepted approach, other definitions and formulations exist. The following section highlights two useful perspectives on sustainable development by discussing the “weak” and “strong” forms of sustainability.

Discussion Topics

- Given that industrialized nations are primarily responsible for many of the global environmental problems we face today, such as climate change, should these countries be held responsible for remedying these problems—i.e., the *polluter pays* principle is invoked? What actions could be taken? How might these actions impact the development opportunities of emerging economies?
- What kind of development should emerging economies aspire to, and how can it realistically be attained? From an equity standpoint, what right do developed nations have to impose restrictions on developing countries when they have engaged in non-sustainable development for so long? Is there room for compromise?
- What actions can be taken, and by whom, to promote a “green economy”? What challenges and opportunities does the green economy agenda present for developed and developing countries?

2.3 Conceptualizing Sustainable Development

Early critiques on the concept of sustainable development revealed a wide range of interpretations and a lack of a sufficiently robust theoretical and analytic framework against which decisions aimed at achieving a more sustainable form of

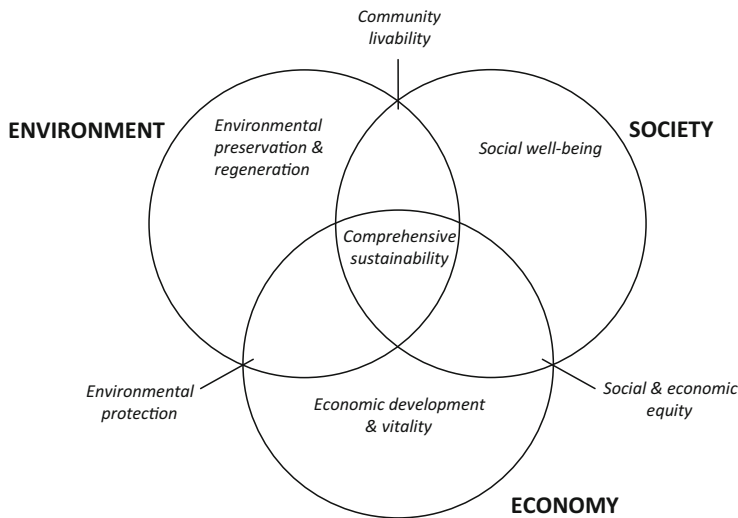


Fig. 2.2 Comprehensive sustainable development. *Sources:* Adapted from CST (1997, p. 2) and Brodmann and Spillmann (2000, p. 8)

development could be assessed (Holdren et al. 1995; Holmberg and Sandbrook 1992; Shiva 1992; Toman 1992; Lele 1991; Redclift 1991; Dixon and Fallon 1989; Norgaard 1988). These reviews indicate that sustainability should be seen as a broad field of inquiry encompassing issues of cultural integrity, justice, and governance, as well as questions of ecological limits to economic activity, the individual right to a safe and secure livelihood, and the national right to economic development.

The different ways in which sustainable development can be formulated raises challenges to its operationalization and measurement. One is quickly faced with questions such as what is to be sustained, for how long, and who bears the costs? As Richard Norgaard (1988, p. 607) aptly pointed out, “[e]nvironmentalists want environmental systems sustained. Consumers want consumption sustained. Workers want jobs sustained.” A further challenge is that the lens or framework (see Chap. 7) through which one views/constructs the problem needing attention can be based on quite different philosophical foundations (Schön and Rein 1994).

Figure 2.2 provides a common visual representation of sustainable development that is often associated with the Brundtland model of development. This comprehensive view implies that progress in all three of the environmental, social, and economic dimensions is necessary for sustainable development. If taken at face value, the diagram indicates that elements of the environmental, social, and economic dimensions can be considered in isolation from each other, which aligns with the “weak” formulation of sustainability discussed below.

A good example of how scientific disciplines can frame the idea of sustainable development quite differently is found in the notions of *substitutability* or *weak sustainability* (Solow 1993) and the *steady-state economy* (SSE) or *strong*

sustainability (Daly 1991b, 1996, 2008; Czech and Daly 2004). Both notions view the environment as a special kind of economic asset—called “natural capital.”

Solow’s (1993) “mainstream” economic lens to sustainability is rooted in the idea that technology can create high degrees of substitutability between one resource and another and, implicitly, that natural and human-made capital are in some sense “fungible.” This is what is described as “weak” sustainability, which essentially argues that natural capital can be substituted by human-made capital (Ayres 2007; Beltratti et al. 1995; Neumayer 2003; Hediger 1999). If resources are fungible, it means that society has no obligation to save a resource for future generations as long as an alternative resource is made available. Therefore, Solow (1993, p. 181) defines sustainable development as “an obligation to conduct ourselves so that we leave to the future the option or the capacity to be as well off as we are.” The basic model is that under certain conditions, maintaining the “aggregate” capital stock (i.e., manufactured + natural capital + human capital + financial capital) intact provides future generations with the same *opportunity* as the present generation and enables them to choose how they use their endowed capital base. Put differently, by focusing on the aggregate stock of capital, a decline in one form of capital is permitted so long as there is an equivalent increase in another form of capital. While conceptually simple, attempting to combine different forms of capital in this way is a highly complex endeavor, and any effort to do so is likely to be thwarted by theoretical challenges.

In neo-classical economics, technological innovation and reproducible human-made capital are viewed as providing “substitutes” for natural capital (Hartwick 1977, 1978a, b; Solow 1974).¹⁹ Under these assumptions of weak sustainability, consumption can be sustained, environmental externalities can be overcome, and resource scarcity problems can be solved. Neo-classical economists argue that as prices increase due to scarcity, investment in technological innovation creates substitutes to replace the scarce resources, further promoting market-led developments.

In contrast, Daly (1991b) holds a “strong” sustainability position—based on an ecological-economic framework—which states that many of the most fundamental services provided by nature cannot be replaced by services produced by humans or

¹⁹ Ayres (1978) presented a convincing case that the laws of thermodynamics place limits on the ability of human-made resources to replace or substitute natural capital. The basic argument is that human-made capital is built and maintained using natural capital. Thus, both forms of capital are complementary and cannot be substituted for one another. It follows that the maintenance of natural capital stock is, therefore, *essential* for the economic process. A reduction in the availability of natural capital will reduce the productivity of human-made capital that depends upon ecosystem goods and services. The same argument is also made by Georgescu-Roegen (1993). Similarly, Ayres (1997) argues that the neo-classical view of externalities as exceptional occurrences in a larger economic context is incorrect. He considers environmental externalities to be *pervasive*, since the real economy depends upon extracting, processing, and converting materials (and energy), which creates waste residuals that can have negative environmental and economic consequences. Since these consequences are not priced in the real economy, the environment is treated as a free good and medium for disposal.

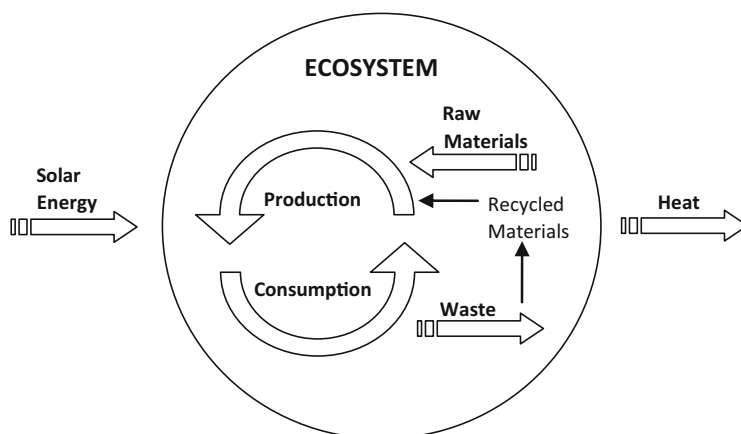


Fig. 2.3 Steady-state economics view of production and consumption cycles in equilibrium with the macroecosystem. *Source:* Adapted from Daly (1991b, p. 181)

man-made capital. Daly (1991b) provides what is probably the most well-developed vision of an economy which functions within macroecological limits—see also Brown et al. (2012) and Burger et al. (2012) for a discussion of the energetic limits to growth and the macroecology of sustainability, respectively.²⁰ Arguing from the first principle of thermodynamics, Daly describes a SSE as one in which births replace deaths and production replaces depreciation. The objective of the SSE is to keep the throughput of raw materials (low entropy) and waste (high entropy) to levels within the regenerative and assimilative capacity of the macroecosystem. Whereas neo-classical economics views the growth economy as a continual expansion of production and consumption, the SSE considers these cycles to be in equilibrium with the macroecosystem (Fig. 2.3).

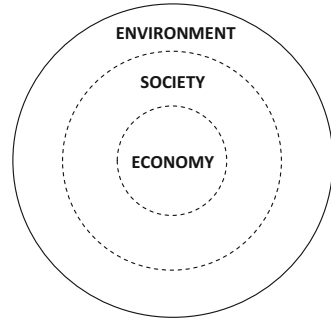
Within the SSE, technology, knowledge, the distribution of income, and the allocation of resources are fluid.²¹ Since a fixed amount of resources will yield constant flows of goods and services (all else being equal), technological progress is one way in which more (or more highly valued) goods and services can be produced

²⁰ The macroecology of sustainability is based on the principles that “1) physical conservation laws govern the flows of energy and materials between human systems and the environment, 2) smaller systems are connected by these flows to larger systems in which they are embedded, and 3) global constraints ultimately limit flows at smaller scales” (Burger et al. 2012, p. 1). Thus, the macroecological perspective requires that all systems and their interrelations must be considered within the context of the global system. Developing a decision-support framework in which such an analysis can occur is perhaps the most important challenge for sustainability science. See Holden et al. (2013) for a commentary on the need to link sustainable passenger transportation to ecological sustainability at a global level.

²¹ In general, ecological economists, especially those focusing on steady-state economics, are concerned with the size of the economy relative to the ecosystem. The efficient allocation of resources is a concern, but it is not the primary focus as in neoclassical economics.

Fig. 2.4 A “strong” model of sustainable development.

Source: IUCN (2004, p. 10)



(Czech and Daly 2004; Czech 2003).²² However, given the laws of thermodynamics there are limits to what is technologically feasible. Thus, there is a theoretical maximum size (an ecological carrying capacity) at which a SSE may exist.

The core principles by which human activities will be kept within the earth’s carrying capacity are most clearly articulated by Herman Daly:

1. The main principle is to limit the human scale (throughput) to a level which, if not optimal, is at least within carrying capacity and therefore sustainable. . . .The following principles aim at translating this general macro level constraint to micro level rules.
2. Technological progress for sustainable development should be efficiency increasing rather than throughput increasing.²³ . . .
3. Renewable resources, in both their source and sink functions, should be exploited on a profit-maximizing sustained yield basis and in general not driven to extinction (regardless of the dictates of present value maximization), since they will become ever more important as nonrenewables run out . . . Specifically this means that: (a) harvesting rates should not exceed regeneration rates; and (b) waste emissions should not exceed the renewable assimilative capacity of the environment.
4. Nonrenewable resources should be exploited, but at a rate equal to the creation of renewable substitutes (Daly 1991a, pp. 44–45).

Costanza and Daly (1992) later added the principle that the use of *replenishable* (i.e., nonliving) forms of natural capital (e.g., groundwater and the ozone layer) should not exceed their rates of replenishment or recharge. While Daly’s (1991a) second principle highlights technological innovation as an important factor in reducing humanity’s ecological impact, social, institutional, and organizational innovation are equally important considerations (Ashford and Hall 2011). Indeed, a more balanced (systems) approach that integrates and co-optimizes technological, social, institutional, and organizational innovation is likely to be more effective at satisfying basic needs while making our resources go further.

Figure 2.4 provides a visual representation of the “strong” form for sustainable development. The figure implies that the economy exists within society (or is a

²² To help describe the SSE, Daly (1991b) compares it to a steady-state library, where the addition of a new book would mean the removal of an old book. Thus, while the quantitative physical scale remains constant, the library would continue to improve in a qualitative sense.

²³ This principle relates to the rebound effect, whereby efficiency gains can result in additional consumption due to lower costs that undermine or eclipse the environmental gains.

product of social interaction) and that both society and the economy depend upon the environment. Therefore, if human activity exceeds the carrying capacity of the environment, this outcome must affect social well-being and the economy. In Fig. 2.2 (shown previously), one could get the impression that the environment only affects certain aspects of society or that the economy can operate separately from the environment.

A useful critique of both “strong” and “weak” sustainability proponents is provided by Ayres (2007). In his view, while the mathematics of Solow’s argument are “impeccable,” the underlying assumptions, or what Ayres calls “the physics,” are not. Ayres (2007) believes that the proponents of “strong” sustainability are right to point out the relevance of entropy law, the second law of thermodynamics, and the impossibility of perpetual motion machines; however, they are wrong to assert that human civilization is totally dependent on a finite stock of high quality (low entropy) resources stored in the earth’s crust. “The fact that much of our industrial base currently utilizes fossil fuels and high-quality metal ores is merely due to the ready availability of these resources at low cost. It does not follow from the entropy law that there are not substitutes” (Ayres 2007, p. 116). Nonetheless, Ayres (2007, p. 126) concludes by saying that: “I have to reiterate that, while there is plenty of room for substitution and some possibility of major breakthroughs (e.g., in manufacturing room temperature super-conductors or carbon nanotubes) the pessimists—those who espouse the notion of “strong sustainability” appear to be closer to the truth than the optimists who believe in more or less unlimited substitution possibilities.”

In summary, the basic distinction between “weak” and “strong” sustainability has important implications as to whether environmental systems and resources should be kept intact by themselves or if the environment can decline as long as the overall value of society’s economic capital is kept intact. The choice of a “weak” or “strong” perspective could have considerable consequences for how environmental sustainability is defined, measured, and verified. From a decision-making perspective, the adoption of a “weak” or “strong” approach will have important implications for the type of tools that can be used to support decisions. For example, tools such as cost-benefit analysis that are compatible with “weak” sustainability may be rejected from a “strong” sustainability perspective on the grounds that the environmental costs being accounted for run against the principle of maintaining the stock of natural capital (Marsden et al. 2010).

While the possible frameworks through which sustainable development can be considered present a range of formulations, the general principles that inform these frameworks remain the same. We identify the following principles—adapted from Zietsman et al. (2011)—that have emerged from the sustainability literature and reflect the international perspective of sustainable development discussed in the previous section.

Sustainability entails meeting human needs for the present and future, while:

- *Preserving environmental and ecological systems*
- *Improving quality of life*

- *Promoting economic development that includes the creation of meaningful and well-paid jobs*
- *Ensuring equity between and among population groups and over generations*

What is not listed in these principles is governance that promotes peace and development, since it is assumed that this is a necessary condition for society to be able to seriously address sustainable development.

Discussion Topics

- Create a list of the main principles of sustainable development discussed in this chapter. Do you think proponents of “weak” sustainability would place more value on certain principles? How might supporters of “strong” sustainability value the principles?
- Think carefully about your own perspective on the purpose of development. Does your perspective align with either the “weak” or “strong” form of sustainability? Why have you adopted this position—e.g., is your position influenced by your education, professional experience, etc.? If so, what are the implications of this for advancing a weak or strong sustainability agenda?

2.4 Measuring Sustainable Development

The term *development* implies a continual process of change. *Sustainable* development, therefore, describes a process of change that promotes the principles of sustainability (described previously). The only way of knowing whether progress is being made toward sustainable development is to measure how we are doing based on existing and prior performance and to use this information to consider what change is likely, under different development scenarios/strategies, in the future. This action requires the use of indicators to quantify the key parameters that define sustainable development. Thus, indicators and performance measures (or targets) are paramount to any attempt to implement a sustainable development agenda.²⁴

We need many indicators because we have many different purposes—but there may be over-arching purposes that transcend nations and cultures, and therefore there may be overarching indicators.

We need many indicators because we have many worldviews—but indicators may help narrow the differences between worldviews (Meadows 1998, p. viii).

At a basic level, the problem of sustainable development can be measured using indicators that capture rates/flows, stocks/conditions, and feedback (Sterman 2000). Such information can inform a society/government of how its actions might be

²⁴ The concepts of an indicator and performance measure are discussed in detail in Chap. 6.

beneficial and/or harmful/unsustainable, enabling adjustments to be made to avoid serious problems and maintain overall societal well-being.

The discourse on indicators of sustainable development is fueled by the fact that different knowledge domains (such as economics, ecology, sociology, and psychology) view sustainable development and its indicators differently (Simon 2003). Similarly, different societies and cultures place different values on what is deemed acceptable in an environmental, social, and economic sense. Further, uncertainty relating to causal chain mechanisms and gaps in information, and differences between how the public and experts perceive information, all combine to make the task of defining, measuring, and responding to perceived problems highly complex (Reiner 2002). It therefore seems unlikely that there will be one golden set of sustainability indicators that are applicable, or acceptable, to all nations and communities. One way to address this problem is to develop overarching frameworks that can guide indicator development using a “fitness-for-purpose” approach—i.e., “using different indicator sets for different purposes. Although, . . . *different* does not mean *unconnected* or *inconsistent*” (Levett 1998, p. 291). This general approach to the selection and application of indicators is adopted in this book and is expanded on in Chap. 6.

The creation of indicators of sustainable development can be placed at the end of a long history of indicator development that emerged during the twentieth century (Innes 1990; Hodge et al. 1999; Hodge 1995, 1997). With the emergence of sustainable development during the 1970s/1980s came the need for more holistic indicators that were capable of measuring progress at a system—rather than a domain/sector—level (Hodge et al. 1999; Hodge 1997). *Our Common Future* laid the foundation for these indicators by arguing that economic measures alone are an inadequate measure of social well-being (WCED 1987). It called for the creation of an overarching framework to integrate economic, environmental, and social concerns relating to human development. This call was later reinforced at the 1992 Rio Conference by “Agenda 21” (Chapter 40), at the 2002 Johannesburg Summit by the “Johannesburg Plan of Implementation” (Chapter X), and at the 2012 Rio+20 Conference where goals, targets, and indicators were seen as essential to “measuring and accelerating progress” (UN 2012, p. 21). The intent of Agenda 21 was to encourage governments, as well as international governmental and non-governmental organizations, to develop a series of indicators for sustainable development that would form the building blocks for decision-making at all levels. Emphasis was placed on *harmonizing* the indicators across geographic levels and on creating a set of indicators at the international level that would be made widely available and kept up to date.

From these initial calls for better ways to measure progress toward sustainable development, a wide variety of indexes/indicator frameworks have emerged. One of the most comprehensive lists of indicator initiatives relating to sustainable development can be found in the International Institute for Sustainable

Development's (IISD's) *Compendium of Sustainable Development Indicator Initiatives*.²⁵ In 2015, the compendium listed some 895 initiatives that range in scale from international to community-focused indicator projects.

At the international level, the MDGs and their supporting indicators provide a framework against which to assess progress toward sustainable development. In 2015, the original set of eight goals is set to be expanded (see Table 2.1 discussed previously) with the launch of the post-2015 development agenda. The final set of goals and indicators selected are likely to “frame” international and national development efforts for the coming decade. Thus, any national, regional, or local effort to measure progress toward sustainable development is likely to be directly or indirectly influenced by the post-2015 development agenda.

In this book, we explore the critical features of indicators (Chap. 6) and indicator frameworks (Chap. 7) and how they can be used to support decision-making for sustainable transportation (Chaps. 8–11). The purpose of Chaps. 6 and 7 is to provide basic/foundational knowledge that can be applied in the development of indicator frameworks. The case study chapters (Chaps. 8–11) then shed some light on how indicators are used in practice. While macro indicator systems such as the post-2015 agenda provide useful national indicators of progress toward sustainable development, at the state and local level, the selection and use of indicators are likely to be driven by agency priorities and the need to cater to organizational, political, and geographic/system realities. Thus, having the knowledge to develop indicator frameworks that can respond to contextual factors while attempting to make connections with theory (e.g., weak vs. strong sustainability) and overarching frameworks (such as the post-2015 agenda) is likely to be more important than having access to lists of indicators. Put differently, the real challenge is to ensure that the indicators selected align with an indicator application area and are representative, practical, and context-specific—i.e., they are *embedded* within an organization culture (see Chap. 6 and the case study in Chap. 10).

2.5 The Importance of a Holistic and Integrative Approach to Sustainable Development

Sustainable development requires a holistic and integrative approach to the design of policies and initiatives for its achievement in order to capture the broad array of environmental, social, and economic development issues that need to be considered. These issues tend to resist easy classification and cut across areas of government and economic activity, promoting the need for an integrative approach to addressing them.

²⁵ See the International Institute for Sustainable Development (IISD), *Compendium of Sustainable Development Indicator Initiatives*, <http://www.iisd.org/measure/compendium/> (accessed on April 19, 2015).

Dernbach (2003, p. 250) goes as far as saying that “integrated decision-making is the foundational principle of sustainable development. . . . Thus, sustainable development requires that fragmentation in decision-making be eliminated.” He identifies four areas where integrated decision-making could occur (Dernbach 2003, pp. 259–282), which include:

1. **Selection of the decision-making process**—e.g., a procedural or substantive mechanism could be used to either consider or achieve desired objectives, respectively;
2. **Scope of the decision-making process**—e.g., decisions could be integrated around a resource, issue, activity, or geographic place;
3. **Time horizon**—e.g., the decision-making process could integrate both short- and long-term objectives; and
4. **Selection of an implementation method**—e.g., legal and policy tools could be integrated to achieve a desired outcome and decision-makers could take action to overcome horizontal/vertical integration barriers to decision-making processes.

An integrative, trans-disciplinary approach is also required to overcome the fragmentation and inadequacy of the knowledge base that leads to the creation of single purpose or narrowly fashioned solutions to complex problems.

Figure 2.5 attempts to provide a visual representation of how existing government structures (or activity areas—the rings) can independently focus on the main sustainable development challenges (the wedges). Thus, a transportation agency could focus on climate change independently from agencies that are, for example, responsible for the environment, energy, or agriculture. The intent of the diagram is to reveal the need for a holistic and integrative approach to sustainable development. The diagram is illustrative of the general activity areas of government and the sustainability challenges facing society and can be adjusted to be more relevant to a specific level of government or geographic region.

Four critical environmental concerns related to sustainable development are highlighted by Fig. 2.5 (Ashford and Hall 2011).²⁶ In addition, it captures important

²⁶ Over the past 40 years, the environmental factors that underlie the concern for sustainable development incorporated—to varying degrees and at different times—what can now be identified as four different environmental concerns (Ashford and Hall 2011). First is the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being. The second concern relates to the world’s finite resources and energy supplies, and asks the question of whether there are sufficient resources to fuel the economy in its current form. A corollary concern is what will the environmental impact be of using a significant proportion of the existing resources? The third concern is that toxic pollution directly affects human health and the health of other species. The final concern is that greenhouse gases from anthropocentric (human-driven) sources are leading to a disruption of the global climate. The first, third, and fourth environmental concerns are connected with the unintended effects of human development/growth, while the second deals with increasing shortages of resources needed to fuel development/growth.

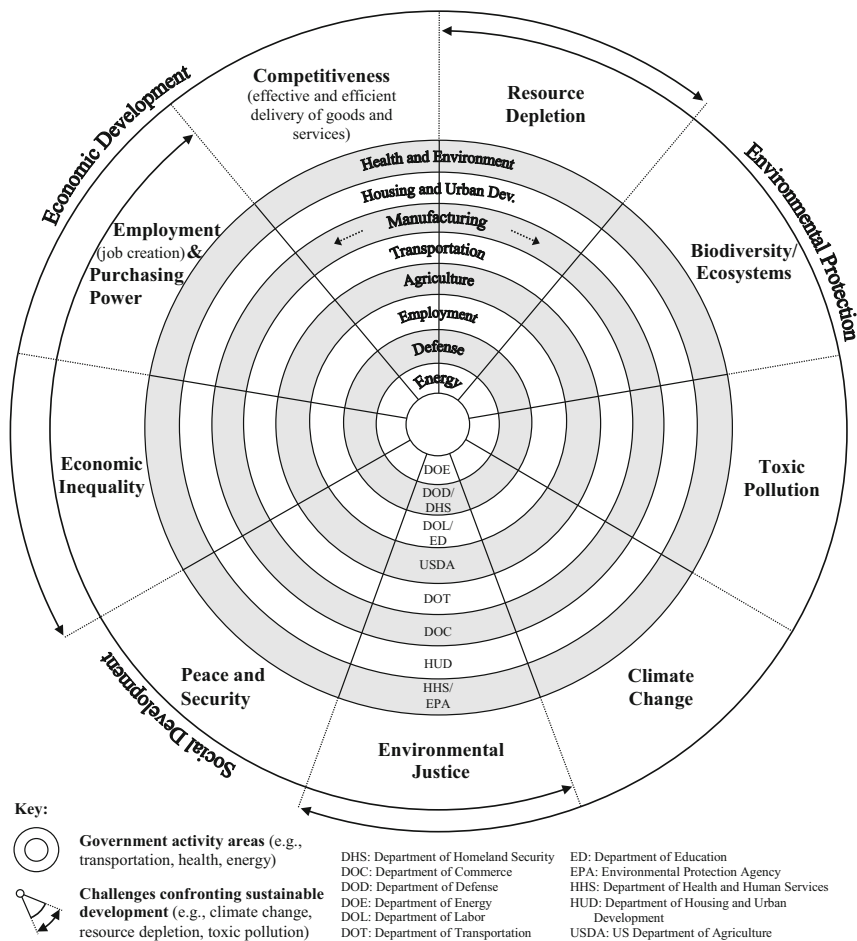


Fig. 2.5 Government activity areas and challenges confronting sustainable development. *Source:* Adapted from Ashford and Hall (2011)

social concerns such as the need for peace, security, and equality, both in terms of environmental justice and income. Employment is also placed alongside these concerns given its critical role in raising purchasing power and providing sufficient income to make essential goods and services accessible to all. A “competitiveness” wedge is included to account for the economic challenge of delivering effective and efficient goods and services. The rationale is that competitiveness is a critical factor of economic growth and one that is closely related to technological innovation. Further, focusing on the competitive delivery of goods and services is also more likely to lead to long-term economic benefits than a focus on short-term economic growth.

The three arrows that follow the circumference of the outer circle in Fig. 2.5 identify which challenges relate to environmental protection, social development, and economic development. The rings in the figure represent several government activity areas—that is, those areas where government provides basic goods and services. There is no hierarchy to the activity areas shown.

Figure 2.5 shows that focusing on, for instance, climate change as *the* major challenge confronting sustainable development ignores the importance of other environmental, social, and economic challenges. In addition, single-purpose policies designed to confront climate change may inadvertently worsen problems in other areas. For example, increasing the percentage of ethanol in gasoline to reduce CO₂ emissions might lead to the production of additional toxic air pollutants and to an increased use of pesticides, worsening the toxics problem, as well as raising the cost of food and actually increasing greenhouse emissions through additional land use (Searchinger et al. 2008). Thus, a major advance in confronting sustainable development would be the integration of government decision-making to address environmental, social, and economic problems that are not constrained by institutional missions or the fragmentation of activities within government agencies (Hall 2006). Such an endeavor is undoubtedly very complex to deliver. One of the key aims of this book is to show how it is possible to achieve more integrated decisions and to demonstrate why information, indicators, and the decision-making frameworks that they are used in are the critical glue which make more integrated decisions possible.

Discussion Topics

- Select one of the sustainability challenges shown in Fig. 2.5. How does each government activity area address, or not, this challenge? What policy connections exist between the government agencies addressing the challenge? If evidence of connections can be found, are the government agencies *coordinating* their independent activities or attempting to *integrate* their activities by working closely together toward a common goal/objective?
- How similar/consistent are the various policy responses to each of the sustainability challenges? For example, are the policy approaches focused on increasing employment and earning capacity consistent with policies for climate change or biodiversity/ecosystem health?

2.6 Conclusions

This chapter provides an overview of the concept of sustainable development from both a historical and conceptual perspective. The historical perspective reveals the compromises that were made when crafting key foundational texts on sustainable development such as *Our Common Future* and the Rio Declaration. It also

highlights what form of development is being endorsed when the Brundtland-UNCED-Johannesburg-Rio+20-Post-2015 formulation of sustainable development is invoked—i.e., one of technological optimism and market liberalization. In contrast, the conceptual perspective removes the historical and political dimensions and presents two different ways in which progress toward sustainability could be achieved. While the “weak” and “strong” forms of sustainability are somewhat academic, they help frame a continuum between an environmentally oriented business-as-usual approach to development and a radical reformulation of economic activity to keep it within macroecological limits. Regardless of where one stands on this continuum, policies and initiatives designed to promote sustainable development need to stem from a holistic and integrative process in an effort to overcome shortfalls that occur in the creation of single-purposed or narrowly fashioned solutions to complex problems.

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