



How to understand and measure environmental sustainability: Indicators and targets

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ABSTRACT

The concept of sustainable development from 1980 to the present has evolved into definitions of the three pillars of sustainability (social, economic and environmental). The recent economic and financial crisis has helped to newly define economic sustainability. It has brought into focus the economic pillar and cast a question mark over the sustainability of development based on economic progress. This means fully addressing the economic issues on their own merits with no apparent connection to the environmental aspects. Environmental sustainability is correctly defined by focusing on its biogeophysical aspects. This means maintaining or improving the integrity of the Earth's life supporting systems. The concept of sustainable development and its three pillars has evolved from a rather vague and mostly qualitative notion to more precise specifications defined many times over in quantitative terms. Hence the need for a wide array of indicators is very clear. The paper analyses the different approaches and types of indicators developed which are used for the assessment of environmental sustainability. One important aspect here is setting targets and then "measuring" the distance to a target to get the appropriate information on the current state or trend.

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1. Sustainable development

The term "sustainable development" was coined by the IUCN's 1980 World Conservation Strategy (IUCN, UNEP and WWF, 1980). It stated that "for development to be sustainable it must take account of social and ecological factors, as well as economic ones". Our Common Future (Brundtland Report) (WCED, 1987) then gave further direction to comprehensive global solutions. It defined sustainable development as development which "meets the needs of the present generation without compromising the ability of future generations to meet their own needs". This has since become an often-quoted definition. The definition was extended by the Earth Summit in 1992 (UN, 1992a). It produced the 40 chapters (150,000+ words) for Agenda 21. The formalization was completed by the World Summit on Sustainable Development in 2002 (UN, 2002) with the notion of the three pillars – social, environmental, economic – as symbolized by the summit motto "People, Planet, Prosperity". At present, the term itself and its tenor have become so widespread and well-known that we may take it as common sense. Moreover, it is inevitably incorporated into any important political, business, or other strategic document (e.g. most of the fundamen-

tal documents of the European Union, including the recent Lisbon Treaty (EU, 2007).

Needless to say, in cited documents as well as in many others (e.g. see Bell and Morse, 1999), the meaning of sustainable development and sustainability is not identical, even though the fundamental sense is basically the same. While sustainability denotes a system property referred to as quality, we believe that the key to the sustainable development concept is provided by the already quoted Brundtland definition and Article 1 of the Rio Declaration (UNCED, 1992): "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature". The message of these two fundamental documents could be summarized in three brief points.

Firstly, the idea of sustainable development is a pragmatic and anthropocentric one. It primarily focuses on people and their well-being. At the base of sustainability are our needs. One approach, known as Maslow's Pyramid, assumes that human beings are motivated by unsatisfied needs. Certain basic needs must be fulfilled before higher needs can be satisfied (Maslow, 1968, 1999). According to Maslow, there are universal needs (physiological, survival, safety, love, and esteem) that must be fulfilled before a person can act unselfishly. This foundation for unselfish behavior could certainly then be seen as one of the conditions for accomplishing sustainable development. We would agree with the essential elements of human well-being stipulated in the Millennium Ecosystem Assessment (2005). These were security,

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the basic material for a good life, health, good social relations, and freedom of choice and action.

Secondly, human life should be “healthy, productive and in harmony with nature”. This principle implies a quest for balance among the three sustainable development pillars. Human life is neither independent nor isolated; it is part of a complex web of natural and social phenomena and depends on a myriad of relationships and interdependencies. In particular, the necessary “harmony with nature”, which addresses the environmental pillar, is stressed.

Thirdly, another essential feature of sustainability is dynamic and long-term nature. The formulation takes into account “present and future generations” and simultaneously points out the changing situation and emphasizes concerns for the future without any explicit time limit or target. The time dimension is tied to the average human life and emphasizes a necessary extension – possibly a very long extension – above and beyond it. These three simple principles apply to all three pillars.

The rather broadly defined notion of sustainability was historically understood as mostly environmental sustainability, as evinced by the already quoted World Conservation Strategy (IUCN, UNEP and WWF, 1980). The strategy believed that humans must recognize the world’s nature resources as finite, with limited capacities to support life. The objective, then, is to conserve natural resources to ensure continued development and to support all life. Even recently, the European Union’s Gothenburg Sustainable Development Strategy approved in 2001 and the renewed version endorsed again in 2006, placed four out of its six main objectives more or less within the environmental realm: climate change and clean energy, sustainable transport, sustainable consumption and production, conservation and management of natural resources, and public health. The other two pertained to social inclusion: demography and migration, and global poverty and sustainable development challenges (EU, 2006).

1.1. Economic sustainability

Gradually, however, the other two pillars have been discussed more thoroughly. The economists focus on various kinds of “capital” (man-made, natural, human, social) that should be sustained (World Bank, 2006). Another approach is based on the Goodland-Ledec specification of sustainable development (Goodland and Ledec, 1987). Sustainable development means the use of renewable natural resources in a manner that does not eliminate or degrade them or otherwise diminish their usefulness for future generations. Furthermore, it implies using non-renewable (exhaustible) mineral resources in a way which does not unnecessarily preclude easy access to them by future generations. Finally, it requires a sufficiently slow-rate of depletion of non-renewable energy resources to ensure the high probability of an orderly societal transition to renewable ones. This definition focuses primarily on the physical aspects of sustainable development. Other approaches focusing on optimal resource management, propose, for example, the definition by Markandya and Pearce (1988). According to this definition, sustainability might be redefined so that the use of resources today should not reduce real incomes in the future because sustainability requires that the conditions necessary for equal access to the resource base be met for each subsequent generation. Or “Natural resources and the environment constitute the ultimate foundation upon which all future economic activity must be construed. From this, it follows that future economic progress will be increasingly dependent on the sustained integrity of the resource and environmental base.” (Hamrin, 1983).

Recently, well-being has been recognized as a pivotal notion in the context of sustainable development. Well-being is understood as any act of consumption which includes the enjoyment of any goods or services. Goods and services can include things freely

provided by nature, such as a beautiful sunset. Sustainable development means increasing “consumption”, following its broadest economic interpretation, over a very long time (OECD, 2008a).

Given the current financial and economic crisis, the economic aspects of development are under close scrutiny. The economic crisis shows that maintaining economic growth is an essential and universally accepted objective for the broad public. It should be noted that growth has been the most important policy goal across the world for the last five decades. It is the reason why it has been difficult to find a balance between sustainability and the economic growth of countries. Hopefully, the economic crisis could be an example of how to change the approach to economic growth and how to conceive of a new economy in terms of sustainable development. An example of such an approach may be the study “Prosperity without growth?” by Tim Jackson (2009) or “Managing Without Growth” by Peter A. Victor (2008).

The importance of economic sustainability is now increasingly recognized even by top political representatives. The U.S. President B. Obama has stated recently: “It is simply not sustainable to have an economy where, in one year, 40 per cent of our corporate profits came from a financial sector that was based on inflated home prices, maxed-out credit cards, over-leveraged banks and overvalued assets.” (Klein, 2009). The current global economic crisis thus brought into focus the economic pillar and questioned the sustainability of development based on economic progress. This means fully addressing the economic issues on their own merits and in no apparent connection with the environmental aspects.

1.2. Social sustainability

The approaches to the social dimension of sustainable development are as diverse as the approaches to the economic pillar. As mentioned by Martin, a specific definition of the social dimension of sustainable development is less clear-cut (Martin, 2001). Understandably, the diversity of economic, social and cultural conditions in individual countries makes development of a uniform definition of social sustainability very difficult. Black defined social sustainability as “the extent to which social values, social identities, social relationships and social institutions can continue into the future” (Black, 2004). Torjman characterizes social sustainability as follows: “From a social perspective in particular, human well-being cannot be sustained without a healthy environment and is equally unlikely in the absence of a vibrant economy” (Torjman, 2000). Gilbert et al. perceive the social pillar of sustainable development as follows: “Social sustainability requires that the cohesion of society and its ability to work towards common goals be maintained. Individual needs, such as those of health and well-being, nutrition, shelter, education and cultural expression should be met” (Gilbert, 1996).

However, these and other definitions are more or less statements of the general goals of social policy rather than serious attempts to define the social dimension of sustainable development, as noted by Colantonio (2007). And yet, it is precisely the social “pillar” of sustainable development that is probably the most important and critical for the long-term survival of human civilizations as shown in Jared Diamond’s insightful study of past (and contemporary) societies (Diamond, 2005). Another somewhat indirect basis for this view is the finding of the authors of *The Wealth of Nations* (World Bank, 2006 – see below) that human and social capital is the most important component of national wealth.

Despite this recognition, it is not yet fully clear what the critical elements of social unsustainability are. Is it growing, or at least not diminishing, inequality among people, regions or nations? Is it good health in a broad sense? What does this imply about the sustainability of health care systems? Is it the malfunctioning of national institutions as documented by the Failed States

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