

Sustainable development as practical intragenerational and intergenerational justice: interpretations, requirements, and indicators¹.

Paul-Marie Boulanger
Institut pour un Développement Durable

1. Introduction

Sustainable development (SD) is not a theoretical or purely philosophical conception of justice. It is a global political objective based on some informal intuitions regarding intra- and intergenerational equity and the strong feeling that owing to the limits of nature and the environment² we can bear in mind only moderate ambitions in both respects. Actually, what is specific to SD, and which probably explains its astonishing success is that it focuses on the relationships between economic growth and the environment at the global level as a concern both of inter- and intergenerational equity.

The importance of the environment for sustaining human existence and welfare and the uncertainties about the limits it sets on the satisfaction of our material needs explain why SD is above all concerned with production and consumption patterns whose ecological efficiency and social equity it attempts to improve. The vital concern of SD stands entirely in the articulation of “development” with “sustainable”. It asks for non self-defeating livelihoods, livelihoods that don’t undermine the resource-base of their own reproduction and likely therefore to be generalized now and forever. The whole SD enterprise is built on the denial of Georgescu-Roegen’s gloomy prediction :“... the destiny of man is to have a short, but fiery, exciting and extravagant life rather than a long, uneventful and vegetative existence. Let other species – the amoebas, for example – which have no spiritual ambitions inherit an earth still bathed in plenty of sunshine” (Georgescu-Roegen 1976, 35). However, it would be meaningless to strive for sustaining “nasty, brutish and short” existences. SD is committed to sustaining “development”, defined as production and consumption patterns fostering real human flourishing.

Admittedly, as many after Jacobs (1999) have argued, SD is still a contestable concept. It allows many different interpretations notably concerning its precise requirements in terms of equity and how the likely trade-offs between the demands of its intragenerational and intergenerational conceptions of justice are to be dealt with. This probably has to do with the fact, firstly that SD doesn’t claim to be a full-fledged theory of justice but only a political agenda to which existing governments could commit themselves and, secondly, that it aims at gluing together concerns with the future and with the present. Knowing that both intragenerational and intergenerational justice taken separately still pose some hard (if not intractable when for example variations in the size of the considered populations are taken into account) philosophical and political problems, it is not surprising if a doctrine that try to “rivets together the major concerns of inter- and intragenerational justice” (Benton 1999:202)

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² Actually WCED(1987:43) doesn’t incriminate the environment as such but “the limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs”. This a strange formulation: it is not with the state currently reached at of technology and social organization that future needs will have to be met but with (hopefully) more productive and effective ones.

lacks the elegance and consistency of a well-formed ethical theory³. However even if, according to Sen (2002, 1), SD, is nothing more than “an starting point for simultaneously considering the future and the present” it is, as he himself acknowledges, nonetheless an “illuminating and powerful” one.

In what follows I discuss this issue in the economic way as a problem of optimal (from an ethical point of view) allocation of aggregate income between consumption and saving or investment. Roughly, consumption points to the intragenerational dimension of the problem while investment (as determining future consumption) points to its intergenerational dimension. The thesis is that SD’s solution of this long-standing issue lies in its insistence on the priority of needs and of needs satisfaction as criterion for allocating today’s income between current and future generations consumption. More exactly, the very distinction between needs and wants or desires is the building block of SD’s way of arbitrating between intra and intergenerational equity requirements. This being said, I try to show how two indicators although frequently opposed one to the other can together help in orienting SD policies. The first, called Genuine Saving, can be mobilized for meeting SD requirements in terms of sustainability (intergenerational equity dimension), while the second (called the Ecological Footprint) could help in orienting global intragenerational equity policies by helping discriminating between satisfaction of legitimate needs and less legitimate wants. Both however, need to be improved in many important ways before they can be used as building blocks of real SD policies.

2. What Brundtland really said...

The various conceptions of (distributive) justice can be roughly classified as egalitarians, prioritarrians or sufficientarians. Egalitarianism is concerned with the distribution of what constitutes the subject matter of justice: initial conditions such as resources, opportunities, circumstances or outcomes such as well-being, need satisfaction, functionings, quality of life or whatever. Briefly, what is bad for an egalitarian is the fact that some fare better than others and the wider the gap between them the more unjust the situation. On the contrary, sufficientarians hold that “What is important from the point of view of morality is not that everyone should have the same but that each have enough” (Frankfurt 1987, 21-22). Finally, what distinguish prioritarrians from sufficientarians is that the former, contrary to the latter attach some importance to additional distributive requirements, namely that moral actions or policies maximize their utility by targeting in priority those who could benefited the more from it, i.e. those for whom the policy makes the biggest difference whatever the consequence in terms of number or proportion of people below the sufficientarian “good enough” threshold. This being said, there is not much difference in practice between sufficientarian and prioritarian requirements, except in rather implausible situations.

Is SD sufficientarian, prioritarian or egalitarian? Gosseries (2005) characterizes “Brundtlandian sustainability” as sufficientarian and blames it for allowing dis-savings (as long as the capacity for the next generations to provide for their needs is ensured) or savings (provided it doesn’t jeopardize the ability of the current generation to satisfy its own needs) that would not be deemed acceptable from a Rawlsian or luck egalitarian perspective. Yet, the Brundtland report (WCED 1987) - in which the idea of SD was exposed at length for the first time - as well as the various declarations and political agreements that followed, mainly at the UN Conference on Environment and Development held in Rio in 1992 (the Rio Declaration

³ Indeed, a complete intragenerational and intergenerational theory of justice would probably add up the difficulties of both intragenerational and intergenerational equity plus the additional intricacies relative to the interactions between the two.

on Environment and Development, the two conventions on Climate Change and on Biodiversity and Agenda 21), are far from clear with respect to the ethical foundations and the exact requirements of sustainable development.

Admittedly, at first glance, the sufficientarian interpretation seems the most plausible given the oft-cited definition of SD as “development that meets the needs of the present without compromising the ability of future generation to meet their own needs” (WCSD, 43). But a more thorough reading of the Brundtland report shows that:

- It is confused about the very definition of needs. At some places, needs are characterized as “basic” or “essential” while at others they refer to more than material needs (going as far as including aesthetical needs) as in the following sentence: “Sustainability requires views of human needs and well-being that incorporate such non-economic variables as education and health enjoyed for their own sake, clean air and water, and the protection of natural beauty”. (WCED, 53).
- It argues for more than just needs satisfaction. At several places, it is also question of “meeting the needs and aspirations” (WCED, pp.40, 43,) or of « meeting the basic needs of all and extending to all the opportunity to fulfill their aspirations for a better life” (WCED, p.8). The following sentence is even more explicit and elaborates somewhat on the distinction between aspirations and basic needs:” The satisfaction of human needs and aspirations is the major objective of development. The essential needs of vast numbers of people in developing countries – for food, clothing, shelter, jobs – are not being met, and beyond their basic needs these people have legitimate aspirations for an improved quality of life”. (WCED, p.8). But it is unclear if aspirations are synonymous of non-basic needs or if one has to do with a three-tiered structure made of basic or essential needs first, then of non-basic needs and finally of aspirations.

Far from clarifying these issues, the political declaration agreed upon at the Rio Conference makes things even more complicated. For example, the fifth and sixth principles of the solemn “Declaration on Environment and Development” state that:

”All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world”. (Principle 5).

“The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority”. (Principle 6)

Clearly, the sixth principle supports a prioritarian interpretation of SD as addressing by priority the situation of the least well-off countries (Principle 6). In that perspective, the Millenium Objectives for Development adopted in 2000 could be considered the first really operational implementation of SD at the global level. However, principle 5 mixes sufficientarian and egalitarian objectives⁴, legitimating an interpretation of SD as a kind of “needs-satisfaction egalitarianism”. Indeed, as Norman (1992, p.144) put it in his discussion of basic income: ”There is an obvious intuitive plausibility in the idea that if all people have enough to eat, are housed and clothed, are healthy, and (perhaps more problematically) have been educated up to the level necessary for them to participate fully in their society, they are in these respects in condition of equality. A society in which this had been achieved would one might think, have made a substantial advance in direction of equality”. All the more so

4 It is also a bit strange to present the fight against poverty as purely instrumental with respect to SD

for the world as a whole....So, from an intra-generational point of view, one could support a needs-satisfaction egalitarian conception of SD according to which all countries should be equally able to satisfy the needs of their population. This could be stated in Roemer's (1998) conception of equal-opportunity policies bearing on the distinction between circumstances and effort as the factors influencing individuals' outcomes. As defined by Roemer, "circumstances" are the attributes of the person's environment for which she should not be held responsible and "effort", the choice variable for which she might be. Building on this distinction, Roemer characterizes an equal-opportunity (EOp) policy as an intervention (e.g., the provision of resources by a state agency) that makes it the case that all those who expend the same degree of effort end up with an equivalent outcome, regardless of their circumstances. Thus, EOp policies are geared at compensating individuals for the disadvantages for which they are not responsible (unfavorable circumstances) by giving them the additional resources necessary for neutralizing the effects of these unfavorable circumstances.

Generalizing Roemer's theory at the international level, SD could be conceived as an equal-opportunity policy aiming at making the case that at equivalent level of effort, opportunities for need satisfaction should be as equal as possible between countries⁵. This would entail compensating countries for the differences in the needs-satisfaction of their population attributable only to the circumstances they face⁶. By the way, it is more or less what already happen when a country is victim of a natural disaster such as a drought, an earthquake or a tsunami. But circumstances should not be restricted to bad luck events like natural hazards, they should include many others more structural factors such as a colonial historical background⁷, unfavorable climate or geographical situation, lack of natural resources, etc. One should not underestimate the difficulties (if not the impossibility) of evaluating circumstances at the country level. It would require normalizing, weighting and aggregating many and deeply incommensurable factors. It is probably easier to go the other way round, notably because efforts can be naturally expressed in the same unit, money. Indeed, it might be possible to build an index of (public) efforts by adding up public expenditures in education, justice, health care, housing, human rights enforcement, environmental protection, water sanitation and other public services, children and family allowances, doles and transfers to disabled, retired and unemployment, etc⁸. The index would then be divided by the population and expressed as a proportion of the GDP per capita. The problem is different with respect to the intergenerational dimension of SD. It is obviously impossible to compensate *ex ante* future generations for facing possible unfavorable circumstances. All can be done here is trying to make the case that the circumstances they will face will be as favorable as possible (within the limits of what is required by intragenerational equity). This is close to what Barry calls the principle of responsibility: "unless people in the future can be held responsible for the situation that they find themselves in, they should not be worse off than we are. And no generation can be held responsible for the state of the planet it inherit" (Barry, 1999, 106).

SD, conceived as an intergenerational equality of opportunity policy would thus be committed to ensure that future generations should not face circumstances such that they would have to make more effort than ourselves to be at least as well-off as we were, once reached the SD objective of intragenerational equity. Practically, it would mean that every generation could benefit from any level of well-being compatible with the following requirements:

⁵ A maximin version of this would be that at an equivalent level of (public) efforts, the least well-off should have a more or less equal level of need satisfaction.

⁶ SD is concerned with equal opportunities between and inside countries. In the name of it, governments are committed to compensate for individual and social disadvantages inside their own borders.

⁷ Independently of any requirement of some compensatory justice.

⁸ And subtracting military expenditures.

1° Everyone has a good enough threshold level of what is necessary for quality of life (or for a life of quality?)⁹;

2° “Circumstances” left to future generations are such that they could reach the same level of quality of life with no more effort than what the preceding one had to expend. What is important here is to make sure that the circumstances will not be the limiting factor hindering the possibility for future generation to reach a good enough threshold of lifetime well-being. It is up to them to expand less effort if they want to insofar as they don’t do it at the expense of the circumstances they leave to their successors.¹⁰

To conclude, SD can be interpreted in prioritarian or egalitarian terms as well as in sufficientarian ones. Whilst it would certainly be interesting to investigate further the differences and similarities between these conceptions of SD, it is not at all evident that they would have very different implications in terms of policy. In my opinion, all of them are compatible with what Van Parijs (1995, 87) called “aggregate sufficiency”, i.e. the “sustainability of generating an aggregate income covering aggregate needs”. This can be considered the minimal requirement of intragenerational and intergenerational justice at the national and international level. As will be showed in the next section, it is precisely this possibility of generating an aggregate income covering aggregate needs that dictates in which conditions savings or dis-savings are to be allowed or prohibited.

3. Sustainable development as “aggregate sufficiency”

In order to understand what it means to sustain an aggregate income sufficient to satisfy aggregate needs, and to uncover the circumstances under which SD allows savings or dis-savings, it is necessary to make use of a few (very elementary) formal expressions.

Let $Y_t = f(K_t, L_t)$. Aggregate income (Y) of any generation t is a function of aggregate capital (K) and labour (L). In what follows we will assume that the only limiting factor to income generation is capital (K).

Let s_t represents the individual level of consumption corresponding to basic needs satisfaction for generation t¹¹ and c_t represents its actual consumption. Let us call “want satisfaction” the surplus of c_t on s_t (if any) and the deficit of c_t with respect to s_t the “needs satisfaction gap”.

Let N_t be the population of generation t. Actual overall consumption is therefore $C_t = c_t N_t$ while the level of income necessary for satisfying needs is $S_t = s_t N_t$.

Let $K_{t+1} = K_t + I_t$. Aggregate capital available for the generation t+1 is the capital available for the preceding generation plus (minus) additions (subtractions) brought about by it, symbolized by I_t . For the sake of simplicity we don’t take into account the depreciation of capital.

⁹ Be they primary goods (Rawls 1971), basic capabilities (Alkire 2001), basic needs (Braybrooke 1987, Doyal & Gough 1991) or what Barry refers to as “vital interests”, that is “objective requirements for human beings to be able to live healthy lives, raises families, work at full capacity and take part in social and political life.” (Barry, 1999, 97).

¹⁰ Adam and Eve, before they were banished from Eden, faced circumstances such that they could enjoy maximum leisure (no effort at all) and sufficient levels of satisfaction of essential needs, except probably for knowing and understanding.

¹¹ This leaves room for an evolution in the definition of basic material needs according to productivity, size of population and level of civilization.

By definition, $I_t = Y_t - C_t$. It can be positive (savings) or negative (dis-savings).

There are three possibilities concerning the relation between generated income and needs satisfaction, keeping in mind that the maximum level (not the real one) of income, by hypothesis, doesn't depend on the level of effort expended by generation t but only on the level of aggregate capital and/or circumstances for which it cannot be help responsible. Generated income can be just sufficient, insufficient or more than sufficient for enabling everyone to satisfy its essentials needs. It is implicitly assumed that governments are committed to redistribute the national revenue so as to ensure that nobody is unable to meet its essential needs insofar as it is sufficient for it. For the sake of simplicity, it is also assumed that $N_{t+1} = N_t$, in other words that generation t just reproduces itself. What matter here are productive assets per capita so if generation t wants to raise more children than the preceding one, it is up to it to save accordingly.

Because N is assumed to be a constant it can be deleted from the formulas. The symbols following "Intra" and "Inter" are easy to understand: '=' means that equity is satisfied at the sufficientarian level, '-' that is unsatisfied and '+' that it is satisfied at a higher level than what sufficientarian justice would require.

1° $Y_t < S_t$ (income is insufficient for needs satisfaction).

1.a. $C_t = S_t \Rightarrow I_t = (S_t - Y_t)^{12} < 0 \Rightarrow K_{t+1} < K_t$ Intra = Inter -
 Generation t dis-saves in order to meet its essential needs. Future generation will be left with reduced assets (and will be also unable to satisfy its own needs).

1.b. $C_t = Y_t \Rightarrow I_t = 0 \Rightarrow K_{t+1} = K_t$ Intra - Inter =/
 Generation t doesn't dis-save and therefore doesn't satisfy its essential needs. It sacrifices itself for the sake of next generation without leaving enough capital for enabling them to be satisfy their own needs.

1.c. $C_t > S_t \Rightarrow I_t = C_t - Y_t < 0 \Rightarrow K_{t+1} < K_t$ Intra + Inter -
 Generation t dis-saves for more than just satisfying its essential needs and do it at the expense of future generation.

1.d. $Y_t < C_t < S_t \Rightarrow I_t = C_t - Y_t < 0 \Rightarrow K_{t+1} < K_t$ Intra- Inter -
 Despite significant dis-savings, generation t is still unable to meet its essential needs.

2° $Y_t = S_t$ (aggregate income is just sufficient for needs satisfaction)

2.a. $C_t > S_t \Rightarrow I_t = C_t - Y_t < 0 \Rightarrow K_{t+1} < K_t$ Intra + Inter -
 Same situation than in 1.c.

2.b. $C_t = Y_t \Rightarrow I_t = 0 \Rightarrow K_{t+1} = K_t$ Intra = Inter =
 Generation t consumes all the income for satisfying its needs but doesn't dis-save.

2.c. $C_t < S_t \Rightarrow I_t = Y_t - C_t > 0 \Rightarrow K_{t+1} > K_t$ Intra - Inter +
 Generation t consumes less required and leave more capital than inherited.

3° $Y_t > S_t$ (Income can provide for more than basic needs satisfaction)

3.a. $C_t = Y_t \Rightarrow I_t = 0 \Rightarrow K_{t+1} = K_t$ Intra + Inter =
 Generation t consumes all the income and doesn't add to the stock of productive assets.

3.b. $C_t = S_t < Y_t \Rightarrow I_t > 0 \Rightarrow K_{t+1} > K_t$ Intra = Inter +

¹² It is supposed that $K_t \geq S_t - Y_t$

Generation t doesn't consume all the income by just satisfying its needs adding to the stock of productive assets and enabling future generation to satisfy more than their needs.

$$3.c. C_t > Y_t \Rightarrow I_t < 0 \Rightarrow K_{t+1} < K_t$$

Intra + Inter -

Generation t consumes more than the generated income at the expense of next generation.

$$3.d. S_t < C_t < Y_t \Rightarrow I_t > 0 \Rightarrow K_{t+1} > K_t$$

Intra+ Inter +

Generation t consumes more than what is necessary for need satisfaction but less than its income.

These different situations can be roughly classified as:

- Developed and sustainable ($C \geq S$ and $I \geq 0$): cases 2.b, 3.a, 3.b;3.d.
- Developed and unsustainable ($C \geq S$ and $I < 0$): cases 1.c,2.a.;3.c.;
- Underdeveloped and sustainable ($C < S$ and $I \geq 0$): cases 1.b,2.c.;
- Underdeveloped and unsustainable ($C < S$ and $I < 0$): cases 1.a.,1.d..

However, all “developed and sustainable” situations are not equally legitimate from a SD point of view. Which cases does SD authorize, which does it prohibit? I think it authorizes 1.a., 1.d. 2.b. and 3.a. and prohibits 1.b., 1.c., 2.a., 2.c and 3.c. The legitimacy of cases 3.b. and 3.d depends on the existence of (countries in) situations 1 or 2. The underlying principles can be summarized as follow: SD prohibits sacrificing needs satisfaction of current generation for the sake of future ones as well as sacrificing needs satisfaction of future generations for the sake of wants satisfaction of current ones. However, if SD prohibits dis-saving for satisfying current generations wants, it also prohibits the accumulation of additional capital by countries wealthy enough to amply satisfy their needs as long as there exist countries whose capital is insufficient (whatever their efforts) to satisfy the needs of their population. Otherwise stated, SD holds that today's needs trump tomorrow's wants, that tomorrow's needs trump today's wants and that today's needs trump tomorrow's needs. It is unclear if tomorrow's wants trump today's one (the reason why situation 3.b. is problematic). However, if one agrees on the proposition that today's needs trump tomorrow's needs then unless being inconsistent, it is rational to discount future wants at the same rate than future needs.

In short, SD principles seems to comply with Brown's (1986, p.167) “revised Pareto Principle”:

“If a social structure systematically denies to some the possibility of enjoying some or all basic goods then it is to be improved upon if possible. An improvement would be a system which provides more people with basic goods even at the cost of denying others inessential goods (inessential, that is, to a basically good life)”. In other words, a situation A is Revised-Pareto-superior to a situation B if at least one person have access to more basic goods in A than B and nobody have access to less (but some may have access to less inessential goods).

Therefore, in order to assess SD it is necessary to know both the sign of the ratio $K_{t+1}-K_t / K_t$ (growth rate of capital) or – what amounts to the same - the sign of the saving rate (I/Y) and the sign of the ratio C/S . Neither alone is sufficient. It follows that SD cannot do without the knowledge of S , the adequate level of (material) need satisfaction. Indeed, what made situation 1.a. acceptable and situation 2.a. unacceptable is that in the former $C = S$ while it is not the case in the latter. So in promoting SD one cannot eschew the difficult problem of the difference between needs and wants.

4. Evaluating intergenerational equity: the genuine saving indicator

An adequate indicator of saving (or investment) is indispensable for assessing the intergenerational equity dimension of SD. This raises a lot of (largely unresolved) issues going from very fundamental ones to more empirical. Fundamentally, it is crucial to get a clear idea of the nature and composition of the capital which, combined with human labor, produces the social income. It is nowadays almost universally acknowledged that the traditional national accounting conventions and practices as summarized in the Gross National Product omit very important productive assets that should be taken into account into a comprehensive and adequate measure of real wealth. In standard national accounting, only the formation of fixed, produced capital is counted as an investment in the future and thus as an increase in the value of the assets available to society. Likewise, standard calculation of net saving rates includes only depreciation in the value of human-made capital as a decrease in the value of a nation's assets. However, the productivity and therefore the well-being of a nation depends also, and sometimes crucially, on other kinds of assets: natural, human and social.

To illustrate this, let us take as example the building of a new house. First of all, it is necessary to have access to a spot of available land on which to erect it. Then, an architect must draw a blueprint that will be used by the different building trades (masons, carpenters, plumbers...). These will consume raw materials such as wood, concrete, bricks, etc. with the help of tools (trucks, trowels, cement mixers, saws, hammers...) and mechanical or electrical energy. Land, raw materials and energy sources are removed from the "natural capital", i.e. the existing stocks of renewable (wood, clay...) and non-renewable (land, oil) resources. The skills and know-how of the various building trades is something that have been handed down by education and enriched from generation to generation. It is called "human capital". The different tools and public infrastructures (roads, energy networks) are man-made productive assets, which by the way incorporate varying parts of past natural and human capital. Finally, all these elements have to be put at work together as harmoniously as possible, which requires social rules, norms and behaviors of cooperation, coordination, trust, etc. also handed down from past generation and forming what can be called "social capital". Should any one of these four productive assets be lacking, the house would be impossible to build. Note also that a house is a durable good if not an asset so that building a new one could be interpreted as the transformation of natural capital into man-made capital. If its value is greater than the value of the natural resources incorporated in it, this new house correspond to an increase in the real wealth of the nation.

The net investment or saving of a country during a period is the sum of the savings and dis-savings in these four kinds of assets during the same period. Since depletion of a non-renewable resource (or over-exploitation of a renewable one) decrease the value of that resource stock as an asset, such activity represents a dis-investment leading – if not properly compensated - to less productivity and well-being in the future. On the other hand, the creation of a better-educated population and a more skilled workforce increases a nation's human capital and is to be considered an investment, not a spending as is standard in national accounting. .

Empirically, the problem is to measure these different kinds of stocks or at least their variations in order to know if a given country is saving, dis-saving or just maintaining its aggregate stock of productive capital. Until recently, only man-made capital (or, more exactly changes in man-made capital) has been more or less adequately evaluated. Attempts to measure natural and human resources are very recent and, to date there is still no reliable or even sensible way to measuring social capital. Furthermore, a common measurement unit is necessary for aggregating changes in the different kind of capitals in order to get an overall

measure of net saving or dis-savings. As there is no natural measurement unit common to natural, human, social and man-made capital, one has to resort to monetary evaluations. This is how the World Bank carries out the computation of its genuine saving (GS) indicator (Hamilton and Clemens 1999, World Bank 2006).

Genuine Saving (GS) consists of aggregating monetary evaluations of annual changes in the man-made, human and natural productive assets. It is computed as follows:

$$\begin{aligned}
 \text{Genuine Saving} &= \text{Gross domestic saving (GDS)} \\
 &- \text{Consumption of man-made capital} \\
 &+ \text{Education expenditure} \\
 &- \text{Energy depletion} \\
 &- \text{Mineral depletion} \\
 &- \text{Net forest depletion} \\
 &- \text{Carbon dioxide and other pollutants damage.}
 \end{aligned}$$

Gross domestic saving (GDS) is the standard measure from national accounts. Subtracting consumption (actually depreciation) of man-made capital from GDS leaves us with the Net domestic savings. Adding public and private expenditures in education and subtracting losses in various kinds of natural assets from NDS gives us finally Genuine saving or investment. All items are first evaluated in dollars than expressed as percentage of Gross National Income.

Table 1 shows the genuine savings rates for a sample of countries.

Country name	Gross national saving	Consumption of fixed capital	Net national saving	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	PM ₁₀ damage(*)	CO ₂ damage	Genuine saving	Change in wealth per capita (\$)
OECD											
Australia	19,5	16,1	3,4	4,9	1,8	1,5	0,0	0,1	0,5	4,3	46
France	22,0	12,6	9,4	5,1	0,0	0,0	0,0	0,0	0,2	14,3	2.951
Japan	28,4	15,9	12,5	3,1	0,0	0,0	0,0	0,4	0,1	15,1	5,643
Norway	36,9	16	20,7	6,1	8,0	0,0	0,0	0,1	0,2	18,5	5.708
Switzerland	32,8	14,5	18,3	4,9	0,0	0,0	0,0	0,2	0,1	22,9	8.020
United States	17,4	11,7	5,7	4,2	1,2	0,0	0,0	0,3	0,3	8,2	2.020
EMERGING											
Brazil	17,8	11,0	29,8	5,6	0,0	0,5	0,0	0,2	0,3	7,2	64
China	38,8	8,9	29,8	2,0	3,6	0,3	0,1	1,0	1,6	25,5	200
India	24,2	9,6	14,6	3,9	2,3	0,4	0,9	0,7	1,4	12,9	16
DEVELOPING											
Bangladesh	25,8	5,9	19,9	1,3	1,3	0,0	0,8	0,3	0,4	18,5	41
Cameroon	14,6	8,9	5,7	2,3	9,4	0,0	0,0	0,7	0,5	-2,5	-152
Ivory Coast	8,4	9,1	-0,7	4,5	4,1	0,0	0,6	0,6	0,6	-2,1	-100
Niger	2,6	6,7	-4,0	2,3	0,0	0,0	4,1	0,4	0,4	-6,7	-83
NATURAL RESOURCES EXPORTING											

Algeria	41,1	11,2	29,9	4,5	39,7	0,1	0,1	0,7	1,0	-7,3	-409
Gabon	16,6	12,6	4,0	2,7	41,8	0,0	0,0	0,1	0,5	-35,7	Nd
Indonesia	21,0	5,6	15,4	1,4	12,5	1,4	0,0	0,5	1,1	1,3	-56
Iran	38,0	9,1	28,8	4,0	41,7	0,2	0,0	0,7	1,8	-11,5	-398
Nigeria	25,7	8,4	17,3	0,9	50,8	0,0	0,0	0,8	0,6	-33,9	-210
Source: World Bank 2006b. (*)PM ₁₀ = population-weighted average of particulate matter less than 10 microns in diameter.											

The GS receives its theoretical justification from the Hartwick-Solow rule of “weak sustainability” which states that welfare can be sustained indefinitely¹³ if saving equals the sum of depreciation of produced assets, depletion of natural resources, and pollution damages. This suppose perfect substitutability between the different kind of assets and notably that a loss in natural capital can always be compensated by a corresponding increase in one or several other kind of capital. For example, a nation that reinvest all of its profits (i.e. the difference between prices and extraction costs) from the exploitation of non-renewable natural resources in the formation of human capital through its educational system would comply with such a rule.

The different countries in table 1 are clustered in 4 categories: OECD, emerging, undeveloped and natural resources exporters. High rates of gross national savings and high levels of consumption of fixed capital with as consequence moderate net national saving rates characterize OECD countries. Norwegian very high gross national saving rate is largely due to its policy of reinvesting an important proportion of its oil rents for future generations which it distinguish it amongst most (if not al other) energy resources exporting countries, including OECD countries like Australia (coal mines) and USA which have rates of genuine savings than lower the OECE mean. The high level of consumption of fixed capital for OECD countries, compared to the other groups, of countries comes from the comparative oldness of their produced capital.

Gross saving rates of emerging countries are similar to those of OECD countries if not higher as is the case for China, Algeria and Iran. However, one should keep in mind that it is very different to save ¼ of the national product when income per capita is about 20-30000\$ than when it doesn’t exceed 850\$ (China) or even 450\$ (India) and when 80% (India) or 48% (China) of the population have to live with less than 2\$ per day. There is another important difference with OECD countries: while a saving rate of 8,2% means that the average American is about 2.000\$ wealthier, an almost equal rate of 7,2 for Brazil translates in an increase of only 64\$ per capita.

If OECD and emerging countries have positive genuine saving rates, meaning that their real wealth is growing, many underdeveloped countries have a negative genuine saving rate and are therefore becoming poorer. Wealth of the average Cameroonian for instance has decreased of 152\$ in 2000 though its income was only 548\$. The situation is, in general, even worst for countries benefiting from important mineral or energy resources. Most of them squander their heritage in disregard of the Hartwick-Solow rule of sustainability. Nigeria, for example, is dis-saving at a rate of nearby 34% of its revenue, losing an average of 210\$ of wealth per capita. Logically, to say that a country is saving too little is equivalent to say that it is consuming too much, because saving is necessarily what is left from total income when consumption has been subtracted. Therefore, speaking of countries like Cameroon, Ivory Coast or Niger (amongst many others), we are driven to the repugnant conclusion that they

¹³ This holds only for a stationary population.

are “consuming too much” even if they fail to satisfy the essential needs of important fractions of their population. But, as Arrows and al. (2002 : 18) rightly observe:

“We would emphasize that insufficient investment by poor countries does not imply excessive consumption in the most important sense. For many of the poorest nations of the world, where productivity and real incomes are low, both consumption and investment are inadequate: current consumption does not yield a decent living standard for the present generation, and current investment does not assure a higher (or even the same) standard for future generations.”

This is certainly true but it makes sense to distinguish between countries endowed with abundant natural resources such as Nigeria or Gabon and others like Cameroon or Niger, which are practically totally deprived of such easily available sources of revenue. Obviously the former have more opportunities than the latter to fulfil their population needs.

One should be aware that these figures are approximate and, what is more important, that the measure itself is far from perfect. First of all, as explained here above, it rests on this questionable assumption of “weak sustainability” according to which it is always possible to substitute (at the margin) man-made capital to natural capital and therefore to compensate future generations for losses of environmental resources with additional human or produced resources provided a sufficient package of aggregate productive resources is passed on. Opponents to the “weak sustainability” position argue that far from being substitutable, the different kinds of assets are basically complementary and that natural resources and functions should be cared for independently of the other forms of resources and revenues. Indeed, one finds both complementarities and substitutions between assets. Complementarities between human capital and man-made capital for instance because the more sophisticated the tools the more apprenticeship is needed to handle them; substitutions between natural and man-made capital insofar as more productive tools make possible to save energy and material. As a matter of fact, development can be seen as an ongoing process of creation of new complementarities and substitutions between the different kinds of productive assets in responses to shortages created by earlier production and consumption patterns¹⁴. What is unknown however and still controversial is how far it will be possible in the future to keep on substituting man-made capital to natural one. As Victor, Hanna and Kubursi (1995, p. 83) put it:

“ the question of sustainability is not really one of short term substitution...based on current available technologies. Rather it is the potential for new, yet to be invented, technologies to substitute for natural capital. No one can reliably predict what new technologies will be developed, and whether the assumed degree of substitution implicit in weak sustainability will become reality”.

Note also that some natural resources are ontologically non-substitutable because their very value lies precisely in their purely “natural nature”, in the fact that man has no part whatsoever in their existence (wilderness, natural scenery, etc.). Furthermore, even assuming that in the long run, it could eventually become possible to substitute man-made capital to every form of natural resources and functions, it will most probably be some time-lag between the moment at which a natural resource would get depleted (or so rare as to become overly costly) and the one at which its substitute would become available at a reasonable cost, a lag during which societies would endure a real impoverishment. These uncertainties justify the adoption of the SD precautionary policy whose maxims are (Daly, 1990):

1. Don't consume more of renewable resources than their maximum sustainable yield;

¹⁴ See for instance, Wilkinson (1973).

2. Exploit non-renewable resources at a rate equal to the rate at which long-run renewable substitutes are made available.

Both are necessary because whatever the rate of depletion of non-renewable resources they will eventually become exhausted (if not physically, at least economically). On the other hand, even if as sources of energy, non-renewable resources are (physically) totally and immediately substitutable, some minerals still have no renewable substitutes as raw materials in industrial processes. This is why SD asks for investing as much as possible in R&D on technologies of substitution and, meanwhile, acting as if renewable substitutes were not to be available before long. SD prudential maxims are therefore close to Wissenburg's (1999:193) extension to the "Rawlsian Saving Principle" for which: "no goods shall be destroyed unless unavoidable and unless they are replaced by perfectly identical goods; if that is physically impossible, they should be replaced by equivalent goods resembling the original as closely as possible; and if that is also impossible, a proper compensation should be provided." The problem is that we still don't know what can be the "proper compensation" for losses of critical natural capital. Take formal education for example. Expenditures in education amounts to some 50% of the genuine saving of several countries such as Canada, Chile, Denmark, Sweden and USA and even more for UK or Indonesia. But it could be argued that more formal education is made necessary now because the most accessible environmental resources ("low hanging fruits") have already been exhausted and that the remaining one are so difficult to exploit that special skills and know-how (and a very complex social organisation) have become indispensable. Indeed, once all the low-hanging fruits have been eaten, you have to learn to climb in the tree if you want to get fed as before. As long as a more formal education means is synonymous of more effort for younger generations, it is disputable if it can be considered a substitute for natural resources. Moreover, in advanced societies, education is for some part a positional good and it is difficult to believe that positional good can compensate for environmental resources. One suspects that we are more or less in a kind of Red Queen situation: "in this place it takes all the running you can do, to keep in the same place." ("Through the Looking Glass")

Second, a lot of most important natural resources like water, soil, fishes, and more generally biodiversity should be included. Water, notably is expected to become scarcer and scarcer in many parts of the world as population and consumption keep on growing. Likewise, as renewable resources will be more and more necessary as substitutes for non-renewable one (especially as sources of energy), competition for land between food production and other uses of the biomass will probably become more and more acute. This obviously should be taken into account in any sensible indicator of sustainability.

There are other disturbing problems with the GS. One of them has to do with the underpricing of natural resources due to insufficient or un-enforced property rights in Third (and Second) World countries, which are their principal producers (Chichilnisky 1994, Dasgupta 2002). As a consequence, they are induced to overexploit them (in order to try to satisfy their essential needs) while the First World countries, on the other hand, can over-consume them (just because they are cheap) and still save an important proportion of their income. Yet, this doesn't show up in the genuine saving figures because only the indigenous natural resources are considered country's natural capital, and rightly so from a national accounting point of view. However, it can hardly be denied that the rich countries have some responsibility in the exhaustion of poor countries natural heritage.

To conclude, it is sensible to assess intergenerational equity as the amount of productive resources left by a generation to its successors. The problem is what resources and how much of them? Weak sustainability holds that what matters is the sum total of natural, social, human

and man-made assets evaluated in monetary units, leaving room for compensations between them. This is the foundation of the genuine saving indicator as a (very approximate) measure of the variation in aggregate productive assets (that is of real comprehensive wealth) occurring during a certain period. It is expressed as percentage of the income generated during that period and must remain non-negative in order to ensure sustainability. Yet, in its current state GS cannot be considered a faithful and reliable indicator of sustainability. First of all, it is too confident in the possibility of always substituting man-made and human capital to natural one. Secondly, it doesn't take into account crucial natural resources such as water, land and biodiversity. It is therefore necessary to improve it seriously before making use of it as guide for sustainable development policies and meanwhile to complement it with other sustainability indicators, such as for instance, the Ecological Footprint. As will be discussed below, this indicator – whilst being usually discussed as an indicator of long-term sustainability and therefore as addressing the intergenerational aspect of SD – might also have interesting properties as an indicator of needs versus want satisfaction.

5. Assessing need satisfaction: the ecological footprint

We have argued that a positive saving rate is legitimate only if it is not at the expense of the satisfaction of current generations' needs. Likewise, wants can only be legitimately satisfied if everyone's essential needs are already met. In order to assess sustainability, it is therefore necessary to distinguish between needs and wants satisfaction. Because SD is concerned with material needs and wants, i.e. those whose satisfaction consumes environmental resources (matter and energy), it would be convenient to express them directly in environmental terms, for instance, in terms of ecological footprint.

The Ecological Footprint (EF) indicator claims to be a measure of the part of earth's carrying capacity spent in the material consumption of a country, a town, a firm or a household. It consists of identifying all of the individual items—goods and services—and amounts thereof, that the given population consumes, of assessing the individual footprint of each component (using life-cycle data that track its energy and resources requirements from extraction to waste disposal, from 'cradle to grave') expressed in standardized units of biologically productive area termed global hectares, aggregating them and dividing the total by the size of the population. The EF is to be interpreted as the amount of “annual regenerative capacity of the biosphere, expressed in mutually exclusive hectares of biologically productive land or sea area, (that) is required to renew the resource throughput of a defined population in a given year—with the prevailing technology and resource management of that year.” (Wackernagel et al., 2005, 4). Each global hectare represents an equal amount of biological productivity i.e. the average productivity of the 11.2 billions bioproductive hectares on Earth.

We are not interested here in the technicalities of the EF computation. It has been abundantly discussed and some of its drawbacks are well known¹⁵. It is clear that it can probably be improved on many aspects. Amongst others, the way carbon dioxide emissions are incorporated is hugely contestable¹⁶ and knowing that it enters for about 50% in the total footprint, it should certainly be more adequately tackled. It can and should certainly be (dramatically) improved before it could be used as suggested hereafter but what matters for now is more the kind of message it can deliver than its scientific correctness. The main message is that we are probably on an unsustainable path at the global level. The EF is sometimes expressed as the number of earths that would be necessary if the world population adopted the consumption pattern of such or such country. For instance, should everyone on

¹⁵ See the discussion *Ecological Economics*, 2000, vol.32, pp341-394.

¹⁶ It translates them in the surface of forests necessary to absorb them.

earth adopt the American way of life, 5,3 planets would be necessary. On the contrary, if everyone lived like an Indian, less than half a planet would suffice. All in all, if the figures are right, we are already consuming 1,2 planets.

Table 2. Ecological footprints (in global hectares/person), Human Development Index and poverty indicator for a sample of countries			
Country name	ECOLOGICAL FOOTPRINT (2001)	Human Development Index (2001)	Population below 2 \$/day (Various dates)
OECD			
Australia	7,7	0,939	
France	5,8	0,925	
Japan	4,3	0,932	
Norway	6,1	0,944	
Switzerland	5,2	0,932	
United States	9,5	0,937	
EMERGING			
Brazil	2,2	0,777	22,4
China	1,5	0,721	53,7
India	0,8	0,590	86,2
DEVELOPING			
Bangladesh	0,6	0,502	82,8
Cameroon	0,9	0,499	19,3
Ivory Coast	0,9	0,396	18,4
Niger	1,1	0,292	85,8
NATURAL RESOURCES EXPORTING			
Algeria	1,5	0,704	15,1
Gabon	1,7	0,653	-
Indonesia	1,2	0,682	52,4
Iran	2,1	0,719	7,3
Nigeria	1,2	0,463	92,4
Sources : Living Planet Report (2003), UNDP (2003) and WB(2005)			

The other message emerging from the EF figures of our sample of countries shown in table 2 is that it is possible to reach more or less the same level of welfare (as measured by the Human Development Index) with quite different EF. The differences between Indonesia and Nigeria for instance, or between United States and Switzerland are illuminating in that respect. That different countries can reach almost equivalent levels of welfare with so different EF, means that some countries use more efficient technologies for needs and want satisfaction than others. The first objective of any SD policy is to ensure that every country uses the best available technologies (BATNEC actually, that is Best Available Technologies Not entailing Excessive Costs), taking account of its specific resources and constraints. However this will not suffice. A variable portion of the total EF of each country must go to the consumption of environmental luxury goods, or mere want satisfaction. It should be possible to identify for every country the number of global hectares (at the household or

individual level) corresponding to what people consider an acceptable level of needs satisfaction, above which no significant increase in well-being is achieved (or with decreasing marginal utility) and such that all additional global hectares consumed could be considered as going to the satisfaction of inessential (and not universalizable) wants. This EF could be set as a cap in the same way than the Kyoto protocol sets caps in GHG emissions.

More precisely, one could imagine an international policy granting to each country a fixed amount of global hectares calculated as the EF it would have if all its inhabitants consumed no more (and no less) than the members of households situated at a specified threshold (just above the poverty line, or occupying the median on the distribution of earnings, or any other threshold on any other relevant distribution function¹⁷) corresponding to what is considered the good enough level of satisfaction¹⁸.

The overall EF of the country (that is, not the EF per capita but the number of global hectares corresponding to the consumption of the entire population) would be reported at fixed intervals and a system of penalties and rewards would be settled down giving the appropriate incentives for reaching the targeted EF. This could be achieved by any policy acting on one or another of the factors influencing the environmental impact of consumption identified in the Ehrlich's equation. According to it, the environmental impact (I) of a country can be expressed as the product of three variables: P (as in Population) which is the number of individuals consuming, A (as in Affluence) which is the level of consumption per capita and T (as in Technology) which is the environmental impact of one unit of consumption.

In short: $I = P * A * T$. A reduction (increase) in I can result from a reduction (increase) in any (or a combination) of the three factors P, A or T. Of course, no reduction of EF at the expense of the consumption of those just at or below the threshold level would be allowed. On the contrary, all households below the threshold level would be entitled to increase their own EF up to that level insofar as those above it reduce theirs in due proportion. An international system of tradable "consumption permits" similar to the CO₂ emission permits introduced with the Kyoto Protocol could also be worked out. The money raised by the different policy instruments used (taxes, fines, funds...) could be partly redistributed towards countries unable - despite their efforts (and proportionally to these) - to adequately satisfy the needs of their population and partly spent in projects and R&D aiming at lowering total EF.

As a comparison between Table 1 and Table 2 shows, there is a wide discrepancy between the Genuine Saving Indicator and the Ecological Footprint. According to the GS, all OECD countries of our sample would be deemed sustainable insofar (or, more precisely, as long as) they invest a positive fraction of their annual income, which ensures future income and therefore consumption. The picture is totally different from an EF perspective. The EF of all OECD countries exceed largely the 1,8 ha per capita proposed as the sustainability threshold by advocates of this indicator. In fact, the assumptions concerning sustainability underlying the two measures are so different that this is hardly surprising. While the GS focus on what each country produces, the EF focuses on what it consumes; while the GS takes into account variations in produced, human and natural capital, the EF consider only the consumption of natural resources (therefore neglecting possible investments in natural capital); while the GS express variations in monetary (economic) units, the EF makes use of an ecological unit, the "global hectare of productive land"... In section 4 we have privileged the GS as indicator of sustainability (and therefore of intergenerational equity) despite its shortcomings and drawbacks because it looks more appealing theoretically (thanks to the Hartwick-Solow rule)

¹⁷ The threshold would vary with the level of prosperity of the country. For example, the acceptable level of needs satisfaction could correspond to the 7th or 8th deciles of income distribution in Niger and to the 3rd or 4th in Switzerland.

¹⁸ Obviously, this level could be set only through a democratic deliberation at the national level.

as well as intuitively (as the family level, what is important is the total value of the portfolio inherited, not its composition). However we have stressed that in its current state it is clearly insufficient, notably in the way it deals with resources as crucial as water, land and biodiversity. This is why, even if the GS and the EF pertain to opposite frameworks, it makes sense to associate them in pragmatic attempts to assess sustainable development.

The information provided by the Human Development Indicator and the proportion of population living with less than 2\$ per day from Table 2, combined with information from Table 1 on the overall saving rates enable us also to sort out (very roughly and tentatively, just for illustration) the countries from our sample with respect to the four possible situations identified in section 3. Briefly, most OECD countries would be considered both developed and sustainable (Australia being borderline for sustainability); Algeria and Iran would be classified as (nearly) developed (i.e. generating an aggregate income sufficient to cover aggregate needs if fairly distributed) but unsustainable, Brazil would be considered (almost) developed and sustainable, China and India insufficiently developed but on a sustainable path and all others both underdeveloped and unsustainable.

6. Conclusions

Despite - or perhaps thanks to – its ambiguities, sustainable development have been hitherto a success story. They aren't many other examples of global political agenda being as widely and quickly adopted, generating as many discussions, efforts and commitments and attracting as much human and financial resources. All this would not have happened were not sustainable development something that speaks deeply and loudly to all of us. Most human beings do believe that there is a moral difference between needs and desires (or wants) and that we bear stronger obligations with respect to the former (if we can) than to the latter (even if we can). Likewise, most human beings do believe that one must find the right balance between our obligations to our contemporaries and our duties toward our successors. Lastly, there is a widespread feeling that no generation is entitled to appropriate more natural resources than what is necessary for living a decent human life.

This said, what makes a decent human life and where is the difference between needs and wants? These questions are crucial for sustainable development and, I believe, for any realistic conception of distributive justice. It is probable that future developments in the sciences of man (mainly neuro-sciences and psychology), for one part, and in ethical theory for another will help us answering these questions, but only rational democratic deliberations will gives us final –albeit probably never definitive – legitimate answers. From science we will learn more about human needs and desires and about the factors that promote or impede human flourishing; ethics will help us clarifying and giving more consistency to our moral intuitions but neither can have the final word in deciding where to draw the dividing line between needs and wants, or stated otherwise between rational and irrational wants as well as between sensible and unrealistic ethical requirements, considering the particular social, environmental and historical circumstances in which these decisions will always have to be taken.

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