Sustainable development indicators: a scientific challenge, a democratic issue

Paul-Marie Boulanger
The picture looks depressing. It should not. But it brings two lessons: first, there is no silver bullet, it is totally impossible to reach the IPCC objective with only one solution, whatever the solution. Only a combination of more energy efficiency, more nuclear, more renewable and more fossil fuels with carbon capture and sequestration can solve the problem. The second lesson is that all these partial solutions carry specific problems which have to be addressed. Energy efficiency is a difficult strategy because it needs a collection of many small scale, small result policies and behaviour changes. Nuclear needs public acceptance, which can be achieved only with impeccable safety and a convincing solution for nuclear waste disposal, renewable and carbon capture and sequestration need strong cost reductions as you cannot base sustainable policies on sustainable subsidies. All those issues call for strong research and development efforts.

Now comes the last challenge, which is a consequence of the two previous ones: energy prices will probably remain high, because demand trends exceed supply capacities, countries, mainly the Middle East and former Soviet Union, have no say in the landlord’s decisions, the taxi driver is far from perfect. The landlord does not pay the energy bill resulting from his investment decisions, his tenant does, but even in liberalized markets, some regulation is needed. The landlord relies more than 95% on oil products, simply because filling a vehicle tank is so easier with a liquid! That is the reason why biofuels are interesting: they provide the only credible alternative—or at least complement—to oil, but they are acceptable only under three conditions: to be cost-effective, to significantly reduce CO2 emissions and to avoid destroying the environment. With these criteria, and with current technologies, only ethanol made from sugar cane in tropical areas is acceptable. All other biofuels can be justified only by farm policy needs. Here again, research and development is urgently needed, with the aim of bringing new kinds of biofuels to the market (cellulose, new crops, GMO). Hydrogen and fuel cells may provide another solution in the longer term, if and when the challenges of producing, storing and delivering hydrogen without CO2 emissions at acceptable costs can be solved.

Is the global picture a cause for pessimism or optimism? Probably both! In the dark side, we have to recognize that the overall challenge is huge. Frankly, I doubt that the +2°C scenario of the IPCC is still achievable. We are probably going to cope with a temperature increase in the range of 3 to 4°C, which means that adaptation policies should be considered together with mitigation policies. On the bright side, there are some no regret policies which can be implemented immediately and which are badly needed. Energy efficiency is an obvious one. Nuclear may be another one, at least in some countries. All that is needed is strong and sustained political will.

The good news is that some policies—not all, think of coal—are effective in addressing the three challenges together. Nuclear is certainly one of them. But the best example is energy efficiency, which provides better energy security of supply, reduces greenhouse gas emissions, and is very often cost-effective: the additional capital costs, if any, are generally more than offset by reductions in the energy bills during the lifetime of the facility or of the appliance. Energy efficiency is not only a win-win strategy, it is a win-win-win one.

Some may raise the question: if so why market mechanisms do not deliver? The short answer is that this kind of market is far from perfect. The landlord does not pay the energy bill resulting from his investment decisions, his tenant does, but has no say in the landlord’s decisions, the taxi driver sometimes does not pay his gasoline consumption, etc. Even in liberalized markets, some regulation is needed. One of the most concerning sectors is certainly transport, as it relies more than 95% on oil products, simply because filling a vehicle tank is so easier with a liquid! That is the reason why biofuels are interesting: they provide the only credible alternative—or at least complement—to oil, but
In the opinion of the authors of Agenda 21, current indicators call for certain simplifications to be used, at the risk of losing space available, it will not be possible to provide sufficiently relevant indicators to guide the sustainable development process, i.e. adequate indicators for decision-making, should the information be appropriately converted for use in decision-making and must be converted and then redirected at the level of the various user groups. Therefore:

1. INTRODUCTION

The need for reliable and pertinent indicators to guide the sustainable development process was recognised early, at the time of the Rio Conference. It was reaffirmed in many subsequent reports on the sustainable development process was recognised early, at the time of the Rio Conference. It was reaffirmed in many subsequent reports, such as the World Commission on Environment and Development (1987). The need for reliable and pertinent indicators to guide the sustainable development process was recognised early, at the time of the Rio Conference. It was reaffirmed in many subsequent reports, such as the World Commission on Environment and Development (1987).

The concept of indicators was originally used in a purely scientific context: sociology and social research. It designated the translation of theoretical (abstract) concepts into observable variables, the scientific hypotheses involving these concepts could be submitted to empirical verification. We come across the word “index” in a seminal text by Lazarsfeld on the operationalisation of sociological theories (Lazarsfeld, 1958) where the various stages in the translation of concepts into indices were clearly identified and analysed for the first time.

An indicator is therefore an observable variable used to represent a non-observable reality. As regards the word “index”, it designates a synthetic indicator constructed by aggregating other so-called “basic” indicators. Most of the indicators used in public policy-making are in fact indices: this is true for GDP, the index of consumer prices, stock exchange indices such as the Dow-Jones and the Human Development Index (HDI) of the United Nations Development Programme (UNDP).

Shortly after Lazarsfeld’s article was published, the word “indicator”, to which the word “index” was added as a qualifier, became popular in the public domain, or at least in the scientific community. It designated the translation of theoretical (abstract) concepts into observable variables, the scientific hypotheses involving these concepts could be submitted to empirical verification. We come across the word “index” in a seminal text by Lazarsfeld on the operationalisation of sociological theories (Lazarsfeld, 1958) where the various stages in the translation of concepts into indices were clearly identified and analysed for the first time.

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And yet the only difference between a management chart and a synthetic index lies in the ultimate phase of the construction and measuring process of the indicators: that is the production, using basic indicators, of a single synthetic value for the purpose of condensing the information contained in the management chart. In other words, a synthetic index is no more or less than a scoreboard to which is added an extra indicator made up of the aggregation of the data contained in it. But it would seem that for some people, this ultimate phase is all the difference between a rigorously serious and scientific effort and a subjective, ideological and fanciful exercise.

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3. THE CONSTRUCTION OF INDICATORS

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The exception represented by the Human Development Index is rather enlightening: without the backing of the Nobel Prize for Economic Science laureate Amartya Sen, it probably would have also failed to pass muster. On closer examination, it is not so much indicators that come up against a degree of opposition (in particular from the scientific community) but rather indices or synthetic indicators. There is no opposition, quite the contrary, to the proliferation of scorecards of every variety, i.e. batteries of indicators, be it in the environmental or the “social” sectors. However, the construction of indices, in particular the Human Development Index, sets off reactions such as the one by Baneth, for example, who goes so far as to say: “It was a vain, pretentious and slightly ridiculous endeavour to try to sum up development in all its complexity and multiple dimensions with a single figure...” (Baneth, 1998, p22).

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1. INTRODUCTION

The need for reliable and pertinent indicators to guide the sustainable development process was recognised early, at the time of the Rio Conference. It was reaffirmed in many sections of Agenda 21 the programme document which was agreed at the summit, and was the central theme of Chapter 40, the last one, which deals with information required for decision-making. The most explicit reference to the limitations of existing indicators and to the need for new ones to evaluate sustainability is in paragraph 40.4:

“40.4. Commonly used indicators such as the gross national product (GNP) and measurements of individual resource or pollution flows do not provide adequate indicators of sustainability. Methods for assessing interactions between different sectoral environmental, demographic, social and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems.”

Therefore:

“40.22. Countries and international organizations should review and strengthen information systems and services related to sustainable development, at the local, provincial, national and international levels. Special emphasis should be placed on the transformation of existing information into forms more useful for decision-making and on targeting information at different user groups. Mechanisms should be strengthened or established for transforming scientific and socio-economic assessments into information suitable for both planning and public information. Electronic and non-electronic formats should be used.”

In the opinion of the authors of Agenda 21, current indicators (including GDP) are incapable of evaluating the “sustainability of systems”—1. Furthermore, existing information cannot be used in this format for decision-making and must be converted and then redirected at the various user groups. Several questions are left unanswered, to which the authors of Agenda 21 would have us reply: Who are these groups of users? Into what forms, more appropriate for decision-making, should the information be converted? How should it be converted for use in decision-making? What sectors are involved in sustainable development? In the following paper, we will be suggesting a few pointers to respond to these questions and some indications on the construction of appropriate information systems for sustainable development, i.e. adequate, pertinent and acceptable to all development actors. In the space available, it will not be possible to provide sufficiently detailed and qualitative definitions of these issues, so that certain simplifications will have to be used, at the risk of painting with a broad brush at times. For example, the subject of the various user groups will be dealt with in a voluntarily reductive fashion, based on the following question: “Indicators for whom or for what?”. The question on the more or less usable forms will be limited to asking “scoreboard or synthetic indices?” And the question of sectors involved in sustainable development will be reduced to a comparison between four major approaches to the actual object of sustainable development. Contrary to what a strictly logical sequence would require, we will begin with a discussion of the issue “scoreboard or Synthetic Index” because the latter more properly examines the empirical examination of certain definitions which are essential for an understanding of what follows.

2. INDICATORS: SCOREBOARD OR SYNTHEThIC INDEX?

The concept of indicators was originally engaged in a purely scientific context: sociological research. It designated the translation of theoretical (abstract) concepts into observable variables so that the scientific hypotheses involving these concepts could be submitted to empirical verification. We come across the word in a seminal text by Lazarsfeld on the operationalisation of sociological theories (Lazarsfeld, 1958) where the various stages in the translation of concepts into indices were clearly identified and analysed for the first time.

An indicator is therefore an observable variable used to report a non-observable reality. As regards the word “index”, it designates a synthetic indicator constructed by aggregating other so-called “basic” indicators. Most of the indicators used in public policy-making are in fact indices: this is true for GDP, the index of consumer prices, stock exchange indices such as the Dow-Jones and the Human Development Index (HDI) of the United Nations Development Programme (UNDP). Shortly after Lazarsfeld’s article was published, the word “indicator”, to which the word “index” was added as a qualifier, became popular in the public domain, or at least in the domain of public policy. A “social indicator movement” emerged in the United States, then in Europe, following the publication by Bauer, Biderman and Gross (1946) of a report called “Social Indicators”. Whereas for Lazarsfeld and later, the scientific community, the role of indicators was purely methodological, it became normative and axiological with the movement for social indicators. The reference to norms and values is given at the outset in the definition Bauer gives for social indicators: “statistics, statistical series, and all other forms of evidence that enable us to assess where we stand and are going with respect to our values and goals.” (Bauer et al., 1946, p.11).

While the term “indicator” was new, the reality described was much older, not to say immemorial. The same term in fact covered two traditions, one, age-old and the other going back much more recent. The first is the concept of statistics in the original meaning of the word, i.e. the methodological study of social facts by numerical processes [classifications, counting, quantified inventories and censuses], for the purpose of information and assisting governments. The other more recent source is to be found in the numerous movements for social reform and hygiene at the time of the industrial revolution. At the start of the 19th century, philanthropists (often physicians or clergymen) were using statistical data on housing, living and working conditions, income, alcoholism, prisons, etc. with the aim of reforming society and improving the lot of the underprivileged. In the United States, the first known use of social indicators for the purpose of social reform goes back to around 1810, with the production of statistical data for five consecutive years on the number of inmates awaiting trial in Philadelphia prisons (Cohen, 1962). Other surveys are well-known, such as those on poverty by Villemot (1782-1863) in France, Ducpéliau (1804-1868) in Belgium and Booth (1840-1916) in the U.K.

After the decline of the social indicators movement of the sixties, the concept of social indicator suffered a lapse of several decades before re-emerging quite recently, first with reference to the measurement of human welfare and development and later with reference to the notion of sustainability and development. Observers, among them Gadrey and Jany-Catrice (2003), Perret (2003) and Sharpe (2004) were numerous in remarking on the recent proliferation of attempts—if not at replacing GDP—at least supplementing it with a more adequate synthetic measurement of well-being. Box 1 gives a brief presentation of these various indices.

Among these attempts, only one achieved a real measure of success: this was the UNDP Human Development Index. All the others—be it the ISEW (Index of Sustainable Economic Welfare) created by Daly and Cobb (1991), the GPI (Genuine Progress Indicator, see Talberth et al, 2006) the MDP (Measure of Domestic Progress, Jackson, 2004) the Index of Economic Well-being created by Sharpe and Osberg (2002), the HWI (Human Wellbeing Index Prescott-Allen, 2001), etc.—failed to gain much favour—sufficient legitimacy to become institutionalised. For an exhaustive census of welfare and quality of life indices or macro-indicators, see Gadrey and Jany-Catrice’s (2003) and Sharpe (2004).

The exception represented by the Human Development Index is rather enlightening: without the backing of the Nobel Prize for Economic Science laureate Amartya Sen, it probably would have also failed to pass muster. On closer examination, it is not so much indicators that come up against a degree of opposition (in particular from the scientific community) but rather indices or synthetic indicators. There is no opposition, quite to the contrary, to the proliferation of scoreboards of every variety, i.e. batteries of indicators, be it in the environmental or the “social” sectors. However, the construction of indices, in particular the Human Development Index, sets off reactions such as the one by Baneth, for example, who goes so far as to say: “It was a vain, pretentious and slightly ridiculous endeavour to try to sum up human development in all its complexity and multiple dimensions with a single figure...” (Baneth, 1998, p.225).

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This figure shows the successive phases of the construction of indicators identified by Lazarfeld:

1 This formulation would suggest that sustainable development is primarily concerned with systems and limited to their sustainability. We will come back to the implications of this view 2 Sometimes called a “macro-indicator”.

3 Which we are told he was at first reluctant to do (see Gadrey, 1993, pp.20-21).

4 The Social Inclusion Indicators developed for the E.U. Commission are the most widely accepted of the “social”scoreboards, see Allison et al. (2002).
unemployment, illness and single-parent families). Economic and social dimensions play a very important role, in particular as regards environmental issues.

- HDI, the Human Development Index, was created by the United Nations Development Programme (UNDP), on the basis in particular of Sen’s work. It combines three basic indicators: life expectancy at birth, income; level of education. The latter is itself measured by the extent of adult literacy combined with the school attendance rate of children.

- ISEW, the Index of Sustainable Economic Welfare, is a monetary index correcting GDP on a certain number of points, in particular taking into account the social and environmental costs ensuing from income inequalities, mobility, pollution, accidents, air and water pollution, the loss of natural ecosystems, the depletion in reserves of non-renewable resources, the fight against global warming and the erosion of the ozone layer. On the other hand, unpaid household work and public health and education expenditure are integrated as positive contributions to welfare.

- GPI, the Genuine Progress Indicator, has been calculated since 1995 by the Californian institute “Redefining Progress”, for the United States. It is directly derived from the ISEW which it slightly modifies, particularly by introducing the positive contribution of voluntary work, consumer durables and transport infrastructures, but subtracting some supplementary expenditures, such as the cost of family breakdown, unemployment, loss of leisure time, loss of natural areas, etc.

- MDI, the Measure of Domestic Progress, is derived from the ISEW and close to the GPI, of which it is a kind of British relative. To be more precise, we should put empirical standardisation before a great many statistical modelling exercises but is unfortunately inapplicable in the context of social indicators because each new observation involves a new calculation of the mean followed by a new standardisation.

1.2 From indicators to measurements.

Once indicators are defined, they must be measured. Then must be decided how to apply them—accuracy, spatial and temporal scale as well as which units are to be used. More often than not, indicators do not have the same degree of precision and are not measured with similar units, which of course complicate the process of aggregation of measurements into a synthetic indicator. For example, the concept of social status, operated by indicators such as length of schooling, level of education, income and type of job, is a mix of purely quantitative (income), semi-quantitative (level of education) and purely qualitative data (job). As a result, it is often necessary to bring down units and measurement scales to the most elementary and least demanding levels, with all that this implies in terms of loss of information.

1.2.1 From indicators to measurements.

When testing a scientific hypothesis (the situation being different in the case of social indicators) only the synthetic indicator is considered significant; basic indicators being meaningless individually: they are just pieces of a puzzle of which only the whole is significant. But, as we have already mentioned, to become aggregated, indicators must be capable of expression in a common unit. This is obviously the case for monetary indicators such as GDP, the price index, etc. But if there is no natural common unit such as currency, the different indicators have to be standardised.

1.2.2 Empirical standardisation.

To be more precise, we should put empirical standardisation in the plural since various techniques can be used. One of the more common ones consists in using as a base for calculation a base-year (for example the year when the statistical survey began) and expressing all the subsequent values as a percentage of variation from the initial value. This approach is useful for an analysis in terms of progress or regression from an initial situation. Another method consists in attributing a 0 value [min] to the observation considered as the worst case and a 1 (or 10, 100, etc.) and expressing all the subsequent values as standard deviations, after having transformed the elements. For example, again on poverty, there is a point in time when the poverty threshold will be arrived at by calculating the amounts necessary to cover the needs considered to be essential, which will have to be previously defined. In the second case, measuring the phenomenon will require to set a reference level (distribution mean or median), a spread compared to it (40%, 50%, 60%?) and the appropriate scale (household or individual?).

3.1.3 Axiological standardisation.

The various dimensions are then broken down into variables, some of which will be retained as indicators, either because they seem to be particularly pertinent or because they are easier to measure. While the selection of indicators is often based on an assessment of observation and measurement constraints, it does nevertheless always include theoretical elements. For example, again on poverty, there is a theoretical opposition between the nature of the income indicator, i.e. is poverty an absolute or relative reality? In other words, should people be considered poor if they do not have the minimum income to cover needs considered to be essential, or if they have considerably less income than other people? In the first case, the poverty threshold will be determined by calculating the amounts necessary to cover the needs considered to be essential, which will have to be previously defined. In the second case, measuring the phenomenon will require to set a reference level (distribution mean or median), a spread compared to it (40%, 50%, 60%?) and the appropriate scale (household or individual?).

3.1.2 From dimensions to indicators.

The process is identical to empirical standardisation with the min and max boundaries, except that the boundaries are not dictated by the data base (observed values) but are chosen with reference to the context of action or evaluation. The situation from which there needs to be differentiation is given the value 0, and the situation which is viewed as ideal (which may or may not correspond to a strategic objective) is given the value 1.

3.2 Mathematical standardisation.

3.2.1 Statistical standardisation.

Statistical standardisation consists in applying a mathematical transform (function) to data so that they remain between a lower and a higher boundary (e.g. -1 and +1 or 0 and 1). The logistical and hyperbolic tangent functions are those most frequently used. However, such manipulations are not recommended for social indicators, firstly because they distort to a certain extent the original distribution, but mainly because they lack transparency for a non-professional user. Clearly, the choice of a method and the maximum and minimum boundaries used for standardisation are not without consequence as regards the interpretation and the use of indicators. Bouyoussi et al. (2001) give several examples of distortion as a result of minimum differences in the choice of one or the other baseline values. Take for example the Human Development Index: one of the three components is life expectancy at birth, the observed values of which are standardised with a lower boundary set at 25 years and an upper limit at 85. What would be the result if instead of using 85 years as the upper limit we were to choose 80? The interval between the maximum and the minimum value would change from 60 to 55, i.e. a 9% reduction. A 55-year life expectancy, instead of being worth 0.50, would be worth 0.545, i.e. 9% more. If the other components of the index did not change, the result would be an increase of 9% in the weight of life expectancy in the calculation of the total… As a consequence, the more or less arbitrary nature of the choice of min and max values, even in the case of empirical standardisation, pleads in favour of the adoption of a normative approach and therefore for maximum values to be chosen so that they effectively correspond to the goals to be arrived at.

3.3 AGGREGATION

Aggregation is the operation consisting in condensing the information contained in each criterion into one single item of information. This supposes that the following questions receive an answer. Should the same weight be given to all the criteria constituting the index? Or should they be given different weights? And if so, how? What is the relationship between the index and the indicators? Is it a sum, a product, or something more complicated?
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Once indicators are defined, they must be measured. Then must be decided the method of measurement—accuracy, spatial and temporal scale as well as which units are to be used. More often than not, indicators do not have the same degree of precision and are not measured with similar units, which of course complicates the process of aggregation of measurements into a synthetic indicator. For example, the concept of social status, operated by indicators such as level of schooling, level of education, income and type of job, is a mix of purely quantitative (income), semi-quantitative (level of education) and purely qualitative data (job). As a result, it is often necessary to bring down units and measurement scales to the most elementary and least demanding levels, with all that implies in terms of loss of information.

3.1.4 FROM MEASUREMENTS TO INDEX.

The last operation—an essential one in the context of putting a scientific concept to the empirical test—is to aggregate the various indicators into a synthetic indicator. When testing a scientific hypothesis (the situation being different in the case of social indicators) only the synthetic indicator is considered significant; basic indicators being meaningless individually; they are just pieces of a puzzle of which only one is significant. But, as we have already mentioned, to become aggregated, indicators must be capable of expression in a common unit. This obviously in the case for monetary indicators such as GDP, the price index, etc. But if there is no natural common unit such as currency, the different indicators have to be standardised.

3.2 STANDARDISATION.

There are several possibilities for standardising, none of them entirely satisfactory.

3.2.1 Statistical standardisation.

Statistical standardisation consists in expressing all the values as statistical deviations, after having transformed the variables so that their mean is equal to zero. This type of standardisation is done before a great many statistical modelling exercises but unfortunately inapplicable in the context of social indicators because each new observation involves a new calculation of the mean followed by a new standardisation.

3.2.2 Empirical standardisation.

To be more precise, we should put empirical standardisation in the plural since various techniques can be used. One of the more common ones consists in using as a base for calculation a base-year (for example the year when the statistical survey began) and expressing all the subsequent values as a percentage of variation from the initial value. This approach is useful for an analysis in terms of progress or regression from an initial year to a final one. This method consists in attributing a 0 value [min] to the observation considered as the worst case and 1 (or 10 or 100) to the one corresponding to the best score (max). All the intermediate values are then calculated according to the following formula: Y = X - Min / (Max - Min) so as to remain within the limits of a scale ranging from 0 to 1 (or 10, 100, etc.). The main problem with this type of standardisation is the variability of the minimum and maximum boundaries. If a new observation spills over, either at the top or the bottom of the scale of observations up to that time, all the variables need to be re-standardised, failing which any new observation will be outside the range.
In practice, both questions usually come down to a dilemma between a simple and a weighted average. The question of whether to weight is a crucial and distinctly difficult concept. It consists in attributing a weight, and therefore a specific value to the various dimensions of the concept. For instance, in the case of a poverty index, it could consist in giving more weight to the income dimension than to the social (isolation, exclusion) or cultural dimensions.

Dimensions and indicators making up an index can be represented in the form of a tree diagram, the concept being the trunk of the tree and each branch representing one of the dimensions, with each branch breaking down into sub-branches ending up with the leaves representing the actual indicators. At each branching out, a weighting can be attributed to the branches arising there, with at the end the leaves to which is attached a weight equal to the product of the coefficients of the sub-branches and the branches from which they arise.

3.4 CONSTRUCTION OF INDICATORS AND MULTI-CRITERIA DECISION-MAKING

The hierarchical tree analysis described above is reminiscent of certain methods of multi attribute decision making which use the same kind of decision-tree. As Bouyssou et al (2000) rightly reminded, the construction process of indicators is, in fact, a multi criteria or multi attribute decision problem. In essence, it is composed of: C = C1... Cn, a set of objectives to arrive at or of criteria to be taken into consideration (e.g. for purchasing a car: price, safety, fuel consumption, etc.); A = A1... An, a finite set of alternative means to arrive at these objectives or meet these criteria (the different car models); Wi = W1... Wn, a set (which may be empty) of weightings of criteria C, such as:

\[ \sum W_i = 1 \]

The decision consists in ordering the m alternatives on the basis, either of a single criterion made up of the aggregation of the n objectives (or criteria), or of the different criteria plurality acquired (the multi-criteria approach), all of which serves to evidence the alternative which is the closest to the desired goal.

The approach consists in filling in an alternatives/criteria matrix made up of the values given by the decision-maker to each alternative with regard to each criterion. The matrix is then interpreted so as to obtain a classification of the various alternatives and identifying the one which is the closest to satisfying the requirements. In the case of a monocriterion (or aggregative) approach, the entire matrix will be synthesised into a vector comprising only one value per alternative. In a multicriteria approach, although the entire matrix may not be considered, there will at least be consideration of a number of criteria greater than 1.

Let us now take the case of an NGO wishing to set up its headquarters in the best-performing country as regards sustainable development. It will start by selecting a series of economic, social and environmental indicators, collect the relevant data over a certain number of years and examine the performances of the various countries in terms of sustainable development. Depending on such performances, it will be able to determine the ideal location for its headquarters. This is in fact a decision-making problem where the criteria to consider are indicators which may be weighted and aggregated or, at the very least, synthesised so as to be able to classify the alternatives (the countries).

Two consequences arise out of the similarity of situations: on the one hand, the methods and tools developed as part of the aid to decision-making can equally apply to both the weighting and the aggregation of criteria for sustainable development and therefore to the indicators which account for it; on the other hand, were no aggregated indicator to be produced, this being incompatible to deciding not to classify the various alternatives. Clearly, in the case of sustainable development indicators, this is a matter for collective decision, therefore of social choice, and it is in these terms that it must be considered.

3.5 WEIGHTING

While standardisation and aggregation methods raise serious theoretical and practical difficulties, it is mostly as regards weighting that the main scientific challenges and democratic issues arise. As B. Perret (2002, p27) rightly remarked, “The intrinsic theoretical weakness of synthetic indicators is obvious (a rational justification of the weightings used is difficult)”. On what basis and using what procedure should the decision be made, for example, to give the economic pillar a 45% weighting, 35% to the social pillar and 20% to the environmental one? Does this not suppose that the crucial question of possible substitutions between various kinds of assets has been solved? The temptation is strong to take such weightings for substitution rates (a loss of one point in the environmental pillar can be offset by a gain of 20/45 (0.44) point in the economic pillar, for example). It is understood that certain aggregation conventions (called “non compensatory”) can limit the risk of erroneous interpretation (see for example Bouyssou and Vansnick, 1986), but nevertheless current scientific knowledge cannot in itself justify any weighting structure applied to such different sectors.

Is such an exercise actually meaningful? Are we not confronted with an insurmountable obstacle because of the intrinsic incomensurability of the sectors we are trying to compare? On this subject, Martinez-Alier et al. (1998), in the context of multicriteria and multi-actor decision-making methods, speak of the incomensurability when there is no common basis for comparison with which to rank the various alternatives without leading to a conflict in values. The criteria considered would therefore be incomensurable, for technical reasons, because the real systems are too complex, and/or social reasons, because of the multiplicity of legitimate value systems within society. Why not then abandon the idea of weighting altogether? This is exactly what certain multicriteria and multi-decision analysis techniques do, e.g. the Electre IV method. And yet, every decision, be it individual or collective, contains some arbitrary options, more often than not subconscious and implicit, such as choosing between today or tomorrow, us or them, economic growth or protecting the environment, employment or quality of life, etc. In the realm of public policy weighting, in the last analysis, the reflection or the echo of the relative power of the various social groups. But the requirements of sustainable development in fact imply an evaluation of these arbitrary choices, in the context of democratic debate and in the light of ethical and scientific criteria. And it is precisely because it forces us to put on the agenda the evaluation of any pressure group, that abides by proven procedures in mechanisms such as citizen juries, planning units and hybrid forums (Callon, Lascoumes et Barteil, 2001), that real collective intent can be expressed. Existing political and social bodies are, from this point of view, the worst of all solutions, as J.-J. Rousseau had long ago stated.

“If, when the people, being furnished with adequate information, held its deliberations, the citizens had no communication one with another, the grand total of the small differences would always give the general will, and the decision would always be good. But when factions arise, and partial associations are formed at the expense of the great association, the will of each of these associations becomes general in relation to its members, while it remains particular in relation to the State: it may then be said that there are no longer as many votes as there are men, but only as many as there are associations.” Rousseau, (1762) The Social Contract. Book II, Chap III.

4 INDICATORS FOR WHOM?

The reasons which disqualify the synthetic index option and argue in favour of the scoreboard are: the impossibility to understand if the user for which the information is provided is not specified. For example, the argument given by Baneth (1998), in opposition to synthetic indices, which reads: “A pilot flies an aircraft using data supplied by a large number of instruments and that data cannot be summed up in a single indicator”, is only acceptable if you consider that only pilots, not passengers, need indicators. The aircraft metaphor is irrelevant because the difference between it and a human group or society, is that the passengers of an aircraft are all going to the same destination and all want to get there as safely and comfortably as possible. As a result, once aboard, their only concern is how far they are from their point of arrival and how much time will be needed to get there. This information is in fact displayed on video screens where flight is symbolised by the picture of an airplane moving across a map. In a human society, things are very different. All its citizens do not have, a priori, the same destination and perhaps most of them do not even know where they are going. Before even thinking about steering the social aircraft, its pilots must try to get everyone to agree on where they are headed. This is exactly where indicators for sustainable development come into play.

On closer inspection, indicators can be used for as many social appropriations and purposes as there are policy concepts and, in a democratic society, as there are concepts A critical word is being referred to in the text: “The Analytical Hierarchy Process (AHP) method is not specified. For example, the argument given by Baneth (1998), in opposition to synthetic indices, which reads: “A pilot flies an aircraft using data supplied by a large number of instruments and that data cannot be summed up in a single indicator”. It is possible to use various methods, such as the Electre IV method. And yet, every decision, be it individual or collective, contains some arbitrary options, more often than not subconscious and implicit, such as choosing between today or tomorrow, us or them, economic growth or protecting the environment, employment or quality of life, etc. In the realm of public policy weighting, in the last analysis, the reflection or the echo of the relative power of the various social groups. But the requirements of sustainable development in fact imply an evaluation of these arbitrary choices, in the context of democratic debate and in the light of ethical and scientific criteria. And it is precisely because it forces us to put on the agenda the evaluation of any pressure group, that abides by proven procedures in mechanisms such as citizen juries, planning units and hybrid forums (Callon, Lascoumes et Barteil, 2001), that real collective intent can be expressed. Existing political and social bodies are, from this point of view, the worst of all solutions, as J.-J. Rousseau had long ago stated. “If, when the people, being furnished with adequate information, held its deliberations, the citizens had no communication one with another, the grand total of the small differences would always give the general will, and the decision would always be good. But when factions arise, and partial associations are formed at the expense of the great association, the will of each of these associations becomes general in relation to its members, while it remains particular in relation to the State: it may then be said that there are no longer as many votes as there are men, but only as many as there are associations.” Rousseau, (1762) The Social Contract. Book II, Chap III. The reasons which disqualify the synthetic index option and argue in favour of the scoreboard are, the impossibility to understand if the user for which the information is provided is not specified. For example, the argument given by Baneth (1998), in opposition to synthetic indices, which reads: “A pilot flies an aircraft using data supplied by a large number of instruments and that data cannot be summed up in a single indicator”, is only acceptable if you consider that only pilots, not passengers, need indicators. The aircraft metaphor is irrelevant because the difference between it and a human group or society, is that the passengers of an aircraft are all going to the same destination and all want to get there as safely and comfortably as possible. As a result, once aboard, their only concern is how far they are from their point of arrival and how much time will be needed to get there. This information is in fact displayed on video screens where flight is symbolised by the picture of an airplane moving across a map. In a human society, things are very different. All its citizens do not have, a priori, the same destination and perhaps most of them do not even know where they are going. Before even thinking about steering the social aircraft, its pilots must try to get everyone to agree on where they are headed. This is exactly where indicators for sustainable development come into play. On closer inspection, indicators can be used for as many social appropriations and purposes as there are policy concepts and, in a democratic society, as there are concepts with.
In practice, both questions usually come down to a dilemma between a simple and a weighted average. The question of weighting is a crucial and distinctly difficult concept. It consists in attributing a weight, and therefore a specific value to the various dimensions of the concept. For instance, in the case of a poverty index, it could consist in giving more weight to the social dimension than to the social isolation, exclusion or cultural dimensions.

Dimensions and indicators making up an index can be represented in the form of a tree diagram, the concept being the trunk of the tree and each branch representing one of the dimensions, with each branch breaking down into sub-branches ending up with the leaves representing the actual indicators. At each branching out, a weighing can be attributed to the branches arising there, with at the end the leaves to which is attached a weight equal to the product of the coefficients of the sub-branches and the branches from which they arise.

3.4 CONSTRUCTION OF INDICATORS AND MULTI-CRITERIA DECISION-MAKING

The hierarchical tree analysis described above is reminiscent of certain methods of multi attribute decision making which use the same kind of decision-tree. As Boussoy et al (2000) rightly remarked, the construction process of indicators is, in fact, a multi-criteria or multi-attribute decision problem. In essence, it is composed of: C = C1... Cn, a set of objectives to arrive at or of criteria to be taken into consideration (or components for purchasing a car: price, safety, fuel consumption, etc.); A = A1... An, a finite set of alternative means to arrive at these objectives or meet these criteria (the different car models); W = W1... Wn, a set (which may be empty) of weights of criterions C, such as:

\[ \sum_{i=1}^{n} W_i = 1 \]

The decision consists in ordering the alternatives on the basis, either of a single criterion made up of the aggregation of the n objectives (or criteria), or of the different criteria mutually acquired (the multi-criteria approach), all of which serves to evidence the alternative which is the closest to the desired goal.

The approach consists in filling in an alternatives/criteria matrix made up of the values given by the decision-maker to each alternative as it relates to each criterion. The matrix is then interpreted so as to obtain a classification of the various alternatives and identifying the one which is the closest to satisfying the requirements. In the case of a monocriterion (or aggregative) approach, the entire matrix will be synthesised into a vector comprising only one value per alternative. In a multicriterion approach, although the entire matrix may not be considered, there will at least be consideration of a number of criteria greater than 1.

Let us now take the case of an NGO wishing to set up its international headquarters in the best-performing country as regards sustainable development. It will start by selecting a series of economic, social and environmental indicators, collect the relevant data over a certain number of years and examine the performances of the various countries in terms of sustainable development. Depending on such performances, it will be able to determine the ideal location for its headquarters. This is in fact a decision-making problem where the criteria to consider are indicators which may be weighted and aggregated or, at the very least, synthesised so as to be able to classify the alternatives (the countries).

Two consequences arise out of the similarity of situations: on the one hand, the methods and tools developed as part of the aid to decision-making can equally apply to both the weighting and the aggregation of criteria for sustainable development and therefore to the indicators which account for it; on the other hand, were no aggregated indicator to be produced, this would be comparable to deciding not to classify the various alternatives. Clearly, in the case of sustainable development indicators, this is a matter for collective decision, therefore of social choice, and it is in these terms that it must be considered.

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On closer inspection, indicators can be used for as many social appropriations and purposes as there are policy concepts and, in a democratic society, as there are concepts
of democracy. The “aggregative” model in liberal democracies sees the political process as a simple choice, by voting, between the programs of political parties which were generated before the electoral process. The model is the market (Easter, 1999), not the forum. Following this view, there is no common good except if it relates to the least conflictual of the possible specific interests. In this context, social indicators would have but a small role to play in a situation where the members of a political system do not need them to verify that decisions taken by the people in charge are in their interests. They have personal indicators they can use for that purpose: their income, their employment, their pension schemes, their environment, etc.

But there is another model for democracies, the “deliberative” model, in which the political process exists precisely for the purpose of creating a common vision of what is good or just. The vote itself is less important than the deliberative process which is the source of decisional legitimacy, more so than voting or negotiation between parties each seeking to defend their private interests. It is deliberation which makes it possible to transform “pre-reflected” preferences, established or ante, into post reflective preferences, capable of transcending personal opinions and taking the common good into consideration. While in aggregate democracies (the market), preferences are a given and intangible, in deliberative democracies (the forum), they are discussed and constructed through rational argumentation during the process of developing a general will. Social indicators then have a much more important role to play, in so far as they can contribute to the constitution of a common definition of the situation and to prior agreement on the facts.

The type of addressee for whom the information is mainly intended is what differentiates the two historical traditions from which current social indicators stem. This is the essential difference between administrative statistics and social indicators. The former are a governmental discipline, implemented by the administration in the service and at the behest of central government. Their primary objective is to inform the authorities (and only them) of the state of society. It is not, for that matter, by pure chance that the emergence of social indicators is associated with the name of Machiaveli (Wol, 1986).

Social indicators, however, developed along very different lines. Their purpose is not so much to inform government—even though officially reports are addressed to the government—as to allow civil society to evaluate public policies (and, in the last resort, government action) and beyond that, to evaluate society’s entire development. Unlike official statistics, social indicators are meant to be an instrument of democratic evaluation just as much as a tool of democratic evaluation. According to Dewey, the role of social indicators is to serve the public interest and not that person’s private interests. Of course, remarks Dewey, “He may fail, [...] in effort to represent the interest entrusted to him. But in this respect he can differ from those who have been designated public officials who have also been known to betray the interest committed to them instead of faithfully representing it” (Dewey, 1927, p.37).

Social indicators then have a much more important role to play, in so far as they can contribute to the constitution of a common definition of the situation and to prior agreement on the facts. The role of deliberative democracies is to inform the public about the results of its own activities, the public creates its own political organisation (1946), Dewey considered that relations between nations are not mentioned, but only their needs, whereas throughout the report there are innumerable references to needs AND aspirations jointly.  The aspirations are even omitted in the French translation of the passage where sustainable development is initially defined. As we have seen, seeking out indicators must involve a definition of the essential dimensions of the concept to be made operational. What are the dimensions of sustainable development? To answer that question, we need to begin by agreeing on the reference frame for the development concept, i.e. the type of object to which it refers. However, there is no consensus on this point. The inaugural definition in the Brundtland report refers to the “needs and aspirations” of present and future generations. It therefore clearly refers to human beings and their well-being. And yet, as regards indicators, Agenda 21—as we saw in our introduction—only refers to systems. In fact, if we examine the various lists of sustainable development indicators, we are confronted with a bewildering diversity of approaches. Simplifying a little, we can whittle them down to four major reference classes: socio-natural sectors (or systems), resources, people, standards.
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But there is another model for democracies, the “deliberative” model, in which the political process exists precisely for the purpose of creating a common vision of what is good or just. The vote itself is less important than the deliberative process which is the source of decisional legitimacy, more so than voting or negotiation between parties each seeking to defend their private interests. It is deliberation which makes it possible to transform “pre-reflected” preferences, established or not, into ex post reflective preferences, capable of transcending personal opinions and taking the common good into consideration. While in aggregative democracies (the market), preferences are a given and intangible, in deliberative democracies (the forum), they are defined and constructed through rational argumentation during the process of developing a general will. Social indicators then have a much more important role to play, in so far as they can contribute to the construction of a common definition of the situation and to prior agreement on the facts.

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Social indicators, however, developed along very different lines. Their purpose is not so much to inform government—even though officially reports are addressed to the government—as to allow civil society to evaluate public policies (and, in the last resort, government action) and beyond that, evaluate society’s entire development. Unlike official statistics, social indicators are meant to be an instrument of democratic evaluation just as much as a source of decisional legitimacy, more so than voting or negotiation between parties each seeking to defend their private interests. However, as soon as they are no longer considered to be generating indirect consequences, certain activities which were once part of the public sector can return to the private sector. For example, religious and political beliefs passed from the public to the private domain when the members of a social community ceased to believe that the consequences of individual piety or piety could have an effect on the community.

The existence of externalities is not sufficient in itself for a public to be constituted; they must also be perceived and understood. According to Dewey, one of the major political problems of the age of technology is that the consequences of certain individual or group behaviours are so diffuse and remote in time that it is no longer possible to perceive them without recourse to what he calls social enquiry, i.e. scientific investigation of a social nature. We are of the opinion that indicators may acquire their full democratic legitimacy in the context of this social enquiry which is essential for the constitution of an appropriate public.

There may, however, be some mismatch between political and public organisation. While a public state always give rise to some kind of political organisation, it may become inadequate because of the emergence of new publics who may then find themselves deprived of any suitable political organisation. In the addition of his book (1946), Dewey considered that relations between nations were in the process of acquiring the properties which constitute a public and that, for that very reason, they needed some kind of specific political organisation which they were lacking at the time.

To counteract and control the undesirable consequences of certain activities, the political organisation made up of officials and civil servants designed for that purpose. In a democratic organisation based on the right to vote, every person becomes—because he is a member of the electorate—a potential public official, purporting to serve the public interest and not that person’s private interests. Of course, remarks Dewey, “He may fail, [...] in effort to represent the interest entrusted to him. But in this respect he does not differ from those he designs as public officials, who have also been known to betray the interest committed to them instead of faithfully representing it!” (Dewey, 1927, p26).

This language shows clearly that Dewey rejects an aggregative vision of democracy and is so much in favour of the deliberative perspective that he considers that using voting rights to serve personal interests is a perversion of democracy.

Publics are born, assimilate themselves and disappear as a result of external conditions such that activities which were once charged with consequence lose that quality while other activities emerge, the effects of which turn out to be “stable, uniform, recurrent and irreparable”. Alterations in material

8 Even Rawls, although he does not abhor the idea of common good, recognises that he is defending the idea of a minimal (thin) common good.

9 The term “social reporting” was first used by men who acknowledged the project started in the 1960s by promoting Social Statistics, which they hoped that by gathering up and disseminating great masses of information about all the regions of France, they could promote national unity and an informed citizenry.” (Porter, 1995, p52)

10 “Social reporting belongs to the democratic infrastructure and has special functions. To put it simply, social reporting places welfare issues on the political agenda. It supplies material to the public debates, influencing the media and, indirectly, the administration.” (Métge, 1999, p71)

11 “Social reporting belongs to the democratic infrastructure and has special functions. To put it simply, social reporting places welfare issues on the political agenda. It supplies material to the public debates, influencing the media and, indirectly, the administration.” (Vogel, 1990, p91)

12 “Osgood’s “Social Trends”, which also influenced the social indicator movement to a great degree, had exactly that purpose.

13 In this connection, it is a remarkable fact that posteriorly every member, in the entire Brundtland report, the single definition where the aspirations of present and future generations are not mentioned, but only their needs, whereas throughout the report there are considerable references to needs AND aspirations jointly. The aspirations are even omitted in the definition in the Brundtland report refers to the “needs and aspirations of present and future generations”. It therefore clearly refers to human beings and their well-being. And yet, as regards indicators, Agenda 21— as we saw in our introduction— only refers to systems. In fact, if we examine the various lists of sustainable development indicators, we are confronted with a bewildering diversity of approaches.

Simplifying a little, we can whittle them down to four major reference classes: socio-natural sectors (or systems); socio-cultural systems; socio-political systems; socio-economic systems (or systems).

As we have seen, seeking out indicators must involve a definition of the essential dimensions of the concept to be made operational. What are the dimensions of sustainable development? To answer that question, we need to begin by agreeing on the reference class: a sustainable development concept, i.e. the type of objects to which it refers. However, there is no consensus on this point. The inaugural definition in the Brundtland report refers to the “needs and aspirations of present and future generations”. It therefore clearly refers to human beings and their well-being. And yet, as regards indicators, Agenda 21—as we saw in our introduction— only refers to systems. In fact, if we examine the various lists of sustainable development indicators, we are confronted with a bewildering diversity of approaches.
Furthermore, in the pair formed by the noun "development" and the adjective "sustainable", emphasis can be put on one or the other of the two words. For instance, Agenda 21 insists on sustainability. Table 1 shows the area of sustainable development dimensions as a function of the four identified objects and the development-sustainability pair. The last line of the table indicates the institution level for which the approach described seems the most appropriate. Before examining briefly, each in turn, these various approaches, it must be specified that most of the indicator systems constructed within international, institutional or countries or inspired by multiple paradigms. To the best of our knowledge, no list is entirely restricted to one perspective. This is easily explained for both practical and theoretical reasons, as we shall see below.

5.1 THE SECTORAL APPROACH

The sectoral approach is certainly the one which inspired the greatest number of attempts at defining sustainable development indicators. In its most rustic form, it is limited to the famous pillars of sustainable development, with economic, social and environmental "domains" considered separately. This approach centres on sustainability understood as a form of equilibrium in the development of each of these famous pillars. However, there is almost no analysis of the development dimension. It is possibly considered to be a given and therefore included in economic growth together with certain social conditions (not too much unemployment, some degree of social security, etc.), certain growth together with certain social conditions (not too much environmental pressures).

The construction of the corresponding indicator systems is also greatly facilitated: it is the result of negotiation between these three social forces with the assistance of experts and scientists, whose mission, more often than not, is to reinforce to some degree the environmental pillar which is rather weak compared to employer and union "heavyweights". The resulting management chart of economic, social and environmental indicators is generally well balanced and there will be no question, quite obviously, of aggregating them into one synthetic index, of whatever variety, since by definition it is precisely the equilibrium between pillars that matters. Although this outlook does not encourage the construction of synthetic cross-indices, it is not incompatible with the calculation of decoupling indicators nor with the use of sectoral synthetic indices, such as GDP in the economic domain. Decoupling indicators address the relationship between economic and environmental domains. They are inspired by the economic concept of elasticity and express the relation between two growth rates, for example those of household waste and household consumption. They are then the expression of an objective which consists in lessening the possible substitution from gross national saving as defined in the SNA the depreciation of man-made capital, deadown on natural resources, the cost of damage to the environment, as well as the external debt, but also healthcare and education which are considered as an investment in human capital. Positive saving is supposed to mean that current generations are not consuming an excessive share of the national product and are transmitting a sufficient productive transmission of an aggregate stock of productive capital per capita sufficient for future generations to produce the goods and services required for their well-being. Almost all the environmental synthetic indicators can be put into this category: the ecological footprint (Chambers et al., 2000), the ESI (Environmental Sustainability Index of the World Economic Forum, 2002) the EWI (Ecosystem Wellbeing Index, Prescott-Allen, 2001). Most of these indices adopt a so-called "strong sustainability" outlook, i.e. low substitution between natural capital and man-made capital. Attempting to reduce the issue of sustainability to the sole use of natural resources necessarily entails supposing that there is no possible substitute for these natural resources, or only within very narrow limits.

An indicator such as the genuine saving rate (Hamilton and Clemens, 1999; Dasgupta, 2001) is based on a radically opposite hypothesis. This monetary index is based partly on the national accounts and seeks to measure the degree of true enrichment or genuine saving, that is, the fraction of economic growth that is not the result of a subtraction from gross national saving as defined in the SNA the depreciation of man-made capital, deadown on natural resources, the cost of damage to the environment, as well as the external debt, but also healthcare and education which are considered as an investment in human capital. Positive saving is supposed to mean that current generations are not consuming an excessive share of the national product and are transmitting a sufficient productive heritage for future generations. Genuine saving is therefore exclusively an indicator of intergenerational equity. They are not an indication of the degree to which the demand for intergenerational equity is satisfied. Furthermore, there is an assumption of perfect substitution between the three forms of capital under consideration: natural, produced (or manufactured) and human.

The pillar or sectoral approach does have the drawbacks which are inherent to its advantages, plus a few more extraneous ones. The major drawback is the result of its principal advantage, i.e. the risk of being insignificant. There is a real danger that, precisely because it is too consensual, it ends up ignoring the real demands of sustainable development and does not all prepare us, despite appearances to the contrary, to taking on its challenges. It could almost be said that it smacks of climbing onto the sustainable development bandwagon, particularly when we consider some of the business or political uses made of it, for example.

5.2 THE RESOURCE-BASED APPROACH

The resource-based approach is also silent on the problems of development. It is firmly focused on sustainability, to be understood either in the restricted meaning of a sustainable use of natural resources, or in the wider acceptance, the transmission of an aggregate stock of productive capital per capita sufficient for future generations to produce the goods and services required for their well-being. Almost all the environmental synthetic indicators can be put into this category: the ecological footprint (Chambers et al., 2000), the ESI (Environmental Sustainability Index of the World Economic Forum, 2002) the EWI (Ecosystem Wellbeing Index, Prescott-Allen, 2001). Most of these indices adopt a so-called "strong sustainability" outlook, i.e. low substitution between natural capital and man-made capital. Attempting to reduce the issue of sustainability to the sole use of natural resources necessarily entails supposing that there is no possible substitute for these natural resources, or only within very narrow limits.

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Furthermore, in the pair formed by the noun "development" and the adjective "sustainable", emphasis can be put on one or the other of the two words. For instance, Agenda 21 insists on sustainability. Table 1 shows the area of sustainable development dimensions as a function of the four identified objects and the development-sustainability pair. The last line of the table indicates the institution level for which the approach described seems the most appropriate. Before examining briefly, each in turn, these various approaches, it must be specified that most of the indicator systems constructed within international institutions or countries are inspired by multiple paradigms. To the best of our knowledge, no list is entirely restricted to one perspective. This is easily explained for both practical and theoretical reasons, as we shall see below.

5.1 THE SECTORAL APPROACH

The sectoral approach is certainly the one which inspired the greatest number of attempts at defining sustainable development indicators. In its most rustic form, it is limited to the famous pillars of sustainable development, with economic, social and environmental "domains" considered separately. This approach centres on sustainability understood as a form of equilibrium in the development of each of these famous pillars. However, there is almost no attempt at defining sustainable development dimensions as a function of the four identified objects and the development-sustainability pair. The last line of the table indicates the institution level for which the approach described seems the most appropriate. Before examining briefly, each in turn, these various approaches, it must be specified that most of the indicator systems constructed within international institutions or countries are inspired by multiple paradigms. To the best of our knowledge, no list is entirely restricted to one perspective. This is easily explained for both practical and theoretical reasons, as we shall see below.

### TABLE 1: Space of sustainable development dimensions

| Development | Sustainability |
|-------------|----------------|
| Resources   | Equilibrium    |
| Systems     | Disconnection  |
| People      | Co-evolution   |
| Norms       | Etc.           |

The pillar or sectoral approach does have the drawbacks which are inherent to its advantages, plus a few more extraneous ones. The major drawback is the result of its principal advantage, i.e., the risk of being insignificant. There is a real danger that, precisely because it is too consensual, it ends up ignoring the real demands of sustainable development and does not at all prepare us, despite appearances to the contrary, for taking on its challenges. It could almost be said that it smacks of climbing onto the sustainable development bandwagon, particularly when we consider some of the business or political uses made of it, for example.

5.2 THE RESOURCE-BASED APPROACH

The resource-based approach is also silent on the problems of development. It is firmly focused on sustainability, to be understood either in the restricted meaning of a sustainable use of natural resources, or in the wider acceptance, the transmission of an aggregate stock of productive capital per capita sufficient for future generations to produce the goods and services required for their well-being. Almost all the environmental synthetic indicators can be put into this category: the ecological footprint (Chambers et al., 2000), the ESI (Environmental Sustainability Index of the World Economic Forum, 2002) the EWI (Ecosystem Wellbeing Index) (Prescott-Allen, 2001). Most of these indices adopt a so-called "strong sustainability" outlook, i.e. a low substitution between natural capital and man-made capital. Attempting to reduce the issue of sustainability to the sole use of natural resources necessarily entails supposing that there is no possible substitute for these natural resources, or only within very narrow limits. An indicator such as the genuine saving rate (Hamlin and Clemens, 1999; Dasgupta, 2001) is based on a radically opposite hypothesis. This monetary index is based partly on the national accounts and seeks to measure the degree of true enrichment, i.e., the proportion of the national product that is not a subtraction from gross national saving as defined in the SNA the depreciation of man-made capital, drawdown on natural resources, the cost of damage to the environment, as well as the external debt, etc. Although healthcare and education which are considered as an investment in human capital. Positive saving is supposed to mean that current generation is not consuming an excessive share of the national product and are transmitting a sufficient productive heritage for future generations. Genuine saving is therefore exclusively an indicator of intergenerational equity. They are not an indicator of the degree to which the demand for intergenerational equity is satisfied. Furthermore, there is an assumption of perfect substitution between the three forms of capital under consideration: natural, produced (or manufactured) and human.

5.3 THE APPROACH IN TERMS OF WELL-BEING

While the resource-based approach dispenses with defining development, this is not the case for the approach focused on human beings, their needs and their well-being. In this case development is understood as the increase in well-being for the greatest possible number of humans, now and in the future. Contrary to what this formulation might lead one to suppose, an approach based on well-being does not necessarily mean accepting the utilitarian programme which pervades welfare economics. A. Sen’s theory bases well-being on the capacity to act (agency) and the satisfaction experienced (well-being), and distinguishes between capabilities and functionings; its philosophical context is very far from utilitarianism. For that matter, Sen was the first recognized economist to propose a multidimensional vision of development focused, not on economic growth or an increase in monetary income but rather on an extension of the real freedom for people to achieve their goals. The concept of well-being defended by Sen follows a tradition that goes back to Aristotle and is related to Adam Smith in his Theory of Moral Sentiments and Marx (1844 Manuscript) who saw in Commodities: "the realm of freedom taking the place of the realm of necessity".

Sen refuses utilitarianism by the following. In utilitarianism’s classical form (...) utility is defined as pleasure, or happiness, or satisfaction, and everything thus turns on these mental achievements. Such potentially momentous matters as individual freedom, the violation of recognized rights, aspects of quality of life not adequately reflected in the statistics of pleasure, cannot directly swing a normative evaluation in this utilitarian structure... (Sen, 1999, p56-57).

According to Sen, what contributes to people’s well-being is not the basket of consumer goods which they have access to, but what they can do with it considering the characteristics of the goods themselves, their personal characteristics—both physical and mental—as well as social characteristics and external circumstances. The three together define what is commonly called: “Functionings are what a person succeeds in doing with commodities (and their characteristics), in his possession, given his personal characteristics as well as the existing external circumstances (including factors like physical environment, cultural factors, public goods provision and others that may impact the conversion of the commodity to the functioning)” (Saith, 2001, p7). As to capabilities, they refer to the possibility for individuals to be and act according to their own objectives and values (“people’s capabilities to lead the lives they value”). From this perspective, development, in fine, consists in broadening the capability set available to individuals and therefore the range of desirable life choices accessible to human beings. As he constructs his theory of capabilities, Sen seeks to make...
possible an evaluation of “social arrangements”. As a result, he extract the theory of social choice out of the quagmire in which Arrow demonstrated that there was no mechanism for social choice satisfying simultaneously the requirements for rationality and democracy on which everyone could agree. In fact, Sen argued, Arrow’s impossibility theorem was misunderstood.

"(...) it establishes in effect, not the impossibility of rational social choice, but the impossibility that arises when we try to base social choice on a limited class of information" (Saith, 2001, p.250). The solution to the problem raised by Arrow consists therefore in broadening the information base on which to establish social choice. This broadening must take into account capabilities and functionings20.

While the resource-based approach has given rise to a number of works mostly concerned with environmental indicators, the well-being approach has also been fertile in attempts to construct synthetic indices. Think for example of the IDH, the ISEW, the GFI, the MDP, and Sharpe and Osbirn’s Index of Economic Welfare, etc (see box 1). It is worth noting that, except for the ISEW, none of these indices attempt to include the sustainability dimension.

6. THE NORMATIVE APPROACH

The first three approaches to sustainable development, in terms of pillars, resources and well-being, adopt a substantial definition. It is however possible to choose a procedural approach and consider sustainable development in normative terms. From this angle, any form of social action satisfying these norms and/or procedures would be seen as sustainable development. In table 1, as an example and subject to reformulation, we have characterised the “development dimension” as respect for efficacy, participation and freedom standards. In the “sustainability box”, we have put equity (both inter- and intragenerational), efficiency, resilience and precaution (prevention and precaution). These choices are certainly debatable and would require in-depth examination. They are inspired partly by the logical framework to which development projects submit to in order to be included in the “development box”, we have put equity (both inter- and intragenerational), efficiency, resilience and precaution (prevention and precaution). These choices are certainly debatable and would require in-depth examination. They are inspired partly by the logical framework to which development projects submit to in order to be included in the

We have included in the sustainability norms the two forms of equity constituting sustainable development, which signifies that development which contradicts intragenerational equity can no more be considered sustainable than development which exhausts the resources that future generations will be needing. Therefore, the kind of efficiency that we are dealing with here is not simply economic efficiency as it is defined by cost/benefit or cost/effectiveness analysis procedures. It is overall efficiency, mindful of all scarce resources, i.e. natural, human, social and cultural resources. In fact, once the requirement of double equity posited, other norms become rather superfluous. It is for the sake of equity that it is important to make the various approaches intermingling. And from that point of view, the combination of well-being and resources seems to be the best compromise to guide the construction process of a sustainable development information system. On this basis, a hierarchy (a tree-diagram) could be surmised with, on the one side, a synthetic well-being indicator and all its components and, on the other, an environmental synthetic indicator, also broken down into its basic indicators. It is very probable however that the two indices would develop in opposite directions, if the correlation analyses performed by Cherchye and Kuussmanen (2006), of which table 2 gives a preview, are to be relied on. These rank correlation (Spearman's rho = 1.00) between various human development indices and environmental sustainability. HDI stands for UNDP’s Human Development Index, HDI for Prescott-Allen’s (2001) Human Welfare Index, HAL for WHO’s Healthy-Adjusted Life Expectancy index, EF for the Ecological Footprint (Chambers et al., 2000), ESI and ES12 are the Ecological Sustainability Indices 1 and 2 and are the World Economic Forum’s two environmental indices, the former being a status indicator and the latter indicating pressure.

There is a strong negative correlation between the EF and the three human development indices. This is also true of ESI and ES12, at a lower intensity however than for the EF. But the various socio-economic indices are positively correlated as well as the various environmental indices, except the EWI and the EF which develop in opposite directions. These indications point to the possibility of tension, or even of contradiction, between the pursuance of socio-economic objectives and certain intergenerational justice requirements. We are convinced that this tension would be much less perceptible in a scoreboard or a list of several dozen indicators. There is nothing to prevent us, however, from an in-depth exploration of the contradiction that the synthetic indicators reveal, and to seek its causes and expression in the various basic indicators that were used to calculate them.

6. CONCLUSIONS

After over twenty years spent on research in the field of social indicators, Judith Innes (1996, p46), arrived at the following conclusion: “The most influential, valid, and reliable social indicators are constructed not just through the efforts of technicians, but also through the vision and understanding of the other participants in the policy process. Influential indicators reflect socially shared meanings and policy purposes as well as respected technical methodology.” It is because it did not recognise the dual nature of indicators, i.e. both scientific and political, that the social indicators movement, in spite of promising beginnings, gradually stalled until it died out completely. The sustainable development indicators “movement” is in danger of suffering a similar fate if it loses contact with the

**TABLE 2: Correlations between socio-economic and environmental indices**

|   | HDI | HWI | HAL | EWI | EF | ESI | ES12 |
|---|-----|-----|-----|-----|----|-----|------|
| HDI | 100.00 |   |    |     |    |     |      |
| HWI | 95.38 | 100.00 |    |     |    |     |      |
| HAL | 94.67 | 90.10 | 100.00 |    |    |     |      |
| EWI | -24.21 | -23.62 | -27.75 | 100.00 |    |     |      |
| EF  | -90.58 | -87.89 | -83.88 | 27.46 | 100.00 |     |      |
| ESI | 7.00  | 9.69  | -2.01  | 14.28 | -12.44 | 100.00 |      |
| ES12| -26.54 | -18.73 | -25.21 | 9.28  | 30.22 | 24.31 | 100.00 |
It establishes in effect, not the impossibility of rational social choice, but the impossibility that arises when we try to base social choice on a limited class of information" (Sartth, 2001, p250). The solution to the problem raised by Arrow consists therefore in broadening the information base on which to establish social choice. This broadening must take into account capabilities and functionings.

While the resource-based approach has given rise to a number of works mostly concerned with environmental indicators, the well-being approach has also been fertile in attempts to construct synthetic indices. Think for example of the IDH, the ISEW, the GPI, the MDP, and Sharpe and Osberg's Index of Economic Welfare, etc (see box 1). It is worth noting that, except for the ISEW, none of these indices attempt to include the sustainability dimension.

5.4 THE NORMATIVE APPROACH

The first three approaches to sustainable development, in terms of pillars, resources and well-being, adopt a substantial definition. It is however possible to choose a procedural approach and consider sustainable development in normative terms. From this angle, any form of social action satisfying these norms and/or procedures would be seen as sustainable development. In table 1, as an example and subject to confirmation, we have characterised the "development dimension" as respect for equity, participation and freedom standards. This is probably why it is rarely easy to translate such an outlook into measurable indicators. This is certainly the case for social development that should be viewed as an end in itself and as a means to a more rapid economic growth (Stiglitz, 2002, p175).

The outcome is that participation cannot be limited to having the right to vote. It implies that citizens are able to make their voice heard for any decision likely to affect them, at all levels and in all fields, including economic matters.

Efficacy as an evaluation norm raises the question of goals and objectives of any social action and also of institutions and systems. While the object of evaluation is a production or consumption pattern, which is at the core of sustainable development, the efficacy norm brings us back to questions of well-being, needs, etc. In the final analysis, a socio-economic system can only be judged by reference to the well-being (in the acceptance that Sen gives to the term) of the individuals who are its constituent parts and/or whose well-being depends on it, directly or indirectly.

However, There is no "well-being" theory that can dispense with value judgments necessarily focused on the more or less desirable nature of one or the other state of society. (Perrot, 2002, p29).

We have included in the sustainability norms the two forms of equity constituting sustainable development, which signifies that development which contradicts intragenerational equity can no more be considered sustainable than development which exhausts the resources that future generations will be needing. Therefore, the kind of efficacy that we are dealing with here is not simply economic efficacy as it is defined by cost/benefit or cost/effectiveness analysis procedures. It is overall efficacy, mindful of all scarce resources, i.e. natural, human, social and cultural resources. In fact, once the requirement of double equity posed, other norms become rather superfluous. It is for the sake of equity that it is important to make the various approaches intermingled. And from that point of view, the combination of well-being and resources seems to be the best compromise to guide the construction process of a sustainable development information system. On this basis, a hierarchy (a tree-diagram) could be surmised with, on the one side, a synthetic well-being indicator and all its components and, on the other, an environmental synthetic indicator, also broken down into its basic indicators. It is very probable however that the two indicators would develop in opposite directions, if the correlation analyses performed by Cherchye and Kuosmanen (2006), of which table 2 gives a preview, are to be relied on. These are rank correlation coefficients between Sen's indices 1 and 2 and are the World Economic Forum's two environmental indices, the former being a status indicator and the latter indicating pressure.

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6. CONCLUSIONS

After over twenty years spent on research in the field of social indicators, Judith Innes (1998, p4), arrived at the following conclusion: The most influential, valid, and reliable social indicators are constructed not just through the efforts of technicians, but also through the vision and understanding of the other participants in the policy process. Influential indicators reflect socially shared meanings and policy purposes as well as respected technical methodology. It is because it did not recognise the dual nature of indicators, i.e. both scientific and political, that the social indicators movement, in spite of promising beginnings, gradually stalled until it died out completely. The sustainable development indicators “movement” is in danger of suffering a similar fate if it loses contact with the.

| HDI | HWI | HALE | EW1 | EF | ESI1 | ESI2 |
|-----|-----|------|-----|----|------|------|
| 100.00 | 95.38 | 100.00 | 94.67 | 90.10 | 100.00 | 90.58 |
| -24.21 | -23.62 | -27.75 | 100.00 | 27.46 | 100.00 | 14.28 |
| 7.00 | 9.69 | -2.01 | 100.00 | 14.28 | -12.44 | 100.00 |
| -26.54 | -18.73 | -25.21 | 9.28 | 30.22 | 24.31 | 100.00 |
public in the meaning that Dewey gave to the word. There are two ways of turning your back on this public: withdrawing in a scientific ivory tower, as did the social indicators movement scientists; or deciding to address only the powers that be. Back in 1927, Dewey already saw how democracy could be endangered by globalisation and technological development. He thought that the Great Society of the machine age needed to be converted into a Great Community, in other words a great democracy. The Society of the machine age needed to be converted into a Great Community, in other words a great democracy. The problem is that a scattered, mobile and multiform public has difficulty in recognising, defining and expressing itself. For Dewey, it was first and foremost an intellectual problem, indicating the nature of the only possible solution:

“What is needed today is the perfecting of the means and ways of communication of meanings so that genuinely shared interest in the consequences of interdependent activities may inform desire and effort and thereby direct action.” (Dewey, 1927, p332).

In this respect science, social science in particular, has a task, more than ever, actions, in a world confronted with the new challenges of globalisation and technology. This task, more than ever, requires immediate attention.

Acknowledgement. This paper is a revised version of an article originally published by Id'd (Boulanger, 2004). We wish to thank Olivier Godard and Claudio Henry for their insightful comments and remarks, Evelyn Aparin van Gelder and Antoinette Bourdelet for their invaluable translating skills and James Downhour from the Dewey Center for his assistance with John Dewey’s quotes.

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"What is needed today is the perfecting of the means and ways of communication of meanings so that genuinely shared interest in the consequences of interdependent activities may inform desire and effort and thereby direct action." (Dewey, 1927, p.332).

In this respect science, social science in particular, has a major role to play and important responsibilities to shoulder. It was science’s mission to explore and analyse these consequences and disseminate results as widely as possible, so as to conjure up this public, this community capable of resuming control over the consequences of its actions, as Dewey did in the face of the new challenges of globalisation and technology. This task, more than ever, requires immediate attention.

Acknowledgements. This paper is a revised version of an article originally published by Iddri (Boulanger, 2004). We wish to thank Olivier Godard and Claude Henry for their insightful comments and remarks, Evelyn Apaire van Gelder and Antoinein Bourdelet for their invaluable translating skills and James Downhour from the Dewey Center for his assistance with John Dewey’s quotes.

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