especially when the indicators can be presented visually. Yet these have their disadvantages, not least of which is the truism that having an indicator does not automatically mean that the public have been engaged in any real sense. Neither does it mean that supplying information in such a condensed form will automatically ensure that managers and policy-makers will act on it. Without these, indicators will not help bring about SD. They will remain technically elegant images in journals and reports of what a few individuals want as SD. In the next chapter, the development and use of indicators in SD will be discussed in more depth.

Chapter 2

Sustainability Indicators: A Brief Review

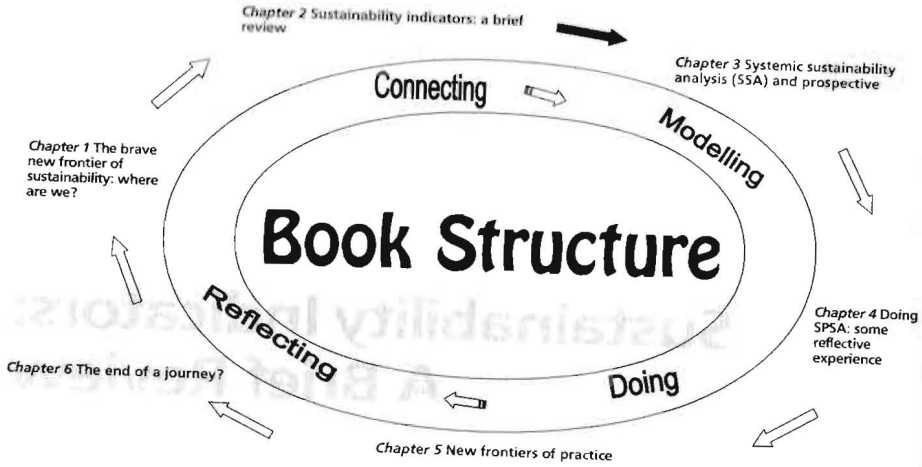
Introduction

Although the use of indicators as a device for 'doing' sustainable development (SD) is logical given the context set out in Chapter 1, it does present some immediate difficulties. We can summarize these as:

- What indicators do we use to measure sustainability?
- How do we measure them?
- How do we use them?

The irony is that these appear to be very simple questions. After all, with a blank sheet of paper we can rapidly list the main elements important in SD. It is also possible to ask small groups of people to negotiate a list of indicators amongst themselves, and within 30 minutes or so a basic list usually emerges. Both of us have carried out this exercise with undergraduate and postgraduate students as well as professional planners, and can readily assure the reader that it is not difficult. Topics such as pollution, density of cars, noise, the environment, litter, the countryside, quality of food, etc will rapidly emerge. Indicators bubble up out of this cauldron with ease, and with feeling. Even a methodology can be discerned. For example, car density can be 'measured' by the time it takes to get to work in the morning.

Given that indicators have perhaps been the most commonly applied tool to help gauge progress towards attaining SD, in this chapter the theory and practice behind their use will be discussed. We feel it is vital to cover the literature of the creation and use of indicators in SD in order to demonstrate the complexity and variety of approaches to this subject. However, it has to be said that in reading this chapter the reader may in places be perplexed by the detail of the description. While this may be bewildering, the description is important as it provides a summary of the background to the choices facing us in developing systemic sustainability analysis (SSA) within the Malta project.



We have set out to provide the reader with a taste of the diversity and complexity of the sustainability indicator (SI) literature, but not necessarily to analyse the underlying patterns (points of agreement or disagreement). The two of us did discuss this, but we wanted to present our Malta example against a backdrop of the complex and highly contested terrain of SIs without worrying too much at the moment about mapping out the terrain in depth. We felt it was more important to highlight the main steps in the SI process so as to allow a comparison with the steps in Malta described in Chapters 3 and 4.

The chapter will begin with a discussion of the theory behind the use of indicators in SD and criteria commonly applied in their selection. This will be followed by a summary of the debate surrounding the ways in which indicators of SD should be presented. Of central import here is the decision to aggregate indicators into a single index or keep them separate. There are many options between these extremes, and all manner of indicator diagrams have been suggested as ways of presenting the information to users. The third section of the chapter will explore the setting of reference conditions in SD. Just what value of the indicator would suggest that sustainability has been obtained? Indeed, is it even possible to do this, or should a user be content with knowing the direction in which the indicator is moving over time? Who makes these decisions? The final section of the chapter will discuss the various uses of indicators in SD, and in particular what have been the problems with these.

INDICATORS OF SUSTAINABLE DEVELOPMENT

The first point to make is that people use indicators all of the time without actually realizing it.

> *Indicators are used by people on a day-to-day basis for making decisions. A blue sky in the morning indicates that we should wear a T-shirt because the weather will be good. All around us there are indicators that tell us something about the state of the world. The media and television are littered with indicators.* (Acton, 2000)

Indicators really are a vital part of people's lives, yet at the same time the term 'indicator' has a technical and cold feel to it. It conjures up assumptions of numbers and statistics that mean nothing to the lay person and can only be used by specialist technocrats. It is certainly true that for SD there has been an emphasis on selecting indicators deemed to be 'relevant', largely by applying a set of indicator rules, by technicians. Such checklists are common in the SD literature. For example, one could stress that an indicator should be:

- specific (must clearly relate to outcomes);
- measurable (implies that it must be a quantitative indicator);
- usable (practical);
- sensitive (must readily change as circumstances change);
- available (it must be relatively straightforward to collect the necessary data for the indicator); and
- cost-effective (it should not be a very expensive task to access the necessary data).

There are other lists of criteria besides this, and another example is presented in Table 2.1 (Guy and Kibert, 1998). Mitchell (1996) echoes these concerns and summarizes them into a five-point set of criteria that those attempting to obtain indicators of SD should follow. These include the need for a clear definition of the objective that the indicators are meant to achieve, who is going to use the indicators and how. Although the criteria of Guy and Kibert (1998) or Mitchell (1996) do not rule out the possibility of qualitative indicators, a general assumption has been that indicators of SD should be quantitative.

Table 2.1 *Guy and Kibert's suggestion for criteria to help select indicators for sustainable development*

Criteria	*Questions*
community involvement	were they developed and acceptable by the stakeholders?
linkage	do they link social, economic and environmental issues?
valid	do they measure something that is relevant?
available and timely	are the data available on a regular basis?
stable and reliable	are they compiled using a systematic method?
understandable	are they simple enough to be understood by lay persons?
responsive	do they respond quickly and measurably to change?
policy relevance	are they relevant to policy?
representative	do they cover the important dimensions of the area?
flexible	will data be available in the future?
proactive	do they act as a warning rather than measure an existing state?

Source: Guy and Kibert, 1998

Yet the irony, as Acton (2000) says in the earlier quotation, is that we use indicators all of the time, but these are qualitative in nature (eg a blue sky) and seemingly far removed from the 'hard' indicators of Guy and Kibert (1998) and Mitchell (1996). Some do suggest conditions under which qualitative indicators would be preferable to quantitative (Gallopin, 1997), including considerations of cost and ease of data collection. Yet in terms of SD there is much contradiction in this balance. After all, if one examines the theoretical assumptions that lie behind more qualitative approaches to research then there is much that resonates with the very essence of SD summarized in Chapter 1 (Paulesich and Reiger, 1997). For example, reality in qualitative research is understood to be a social construct. Hence much depends upon perspective, and this will be multiple as in SD. An understanding (analytical) approach (as distinct from descriptive) is indispensable in such research, and case studies are central. Similarly, much of the reported SD work is very site- and time-specific. Also, the researcher is not separate from the researched (ie an objective and neutral observer) but has an integral relationship with the system being analysed. This is sometimes not appreciated in SD, and some even talk of a sustainability science (Kates et al, 2000) that can imply an empirical objectivity that may be an illusion at best. The resonance between the nature of qualitative research and SD as set out in Chapter 1 is indeed marked.

Nevertheless, whatever the individual rights and wrongs behind such indicator criteria, they do provide some limits to the indicators that may be 'allowed' in any one context. Even so, different authors tend to stress different characteristics. Crabtree and Bayfield (1998), for example, suggest that operational feasibility, an issue that encompasses much of the above discussion, is important. This consideration may be at the expense of technical soundness, a thought echoed by de Kruijf and van Vuuren (1998), who quote an Indonesian minister as saying, 'If a theoretically sound indicator is not possible, then find me one that is rather less theoretically sound.' As a result Crabtree and Bayfield (1998) suggest that a more cost-effective strategy would be to influence bodies that already collect indicator data rather than put new bodies in place. Yet at the same time there may be a clear concern that data availability should not be a constraint in selecting relevant indicators (Meter, 1999). If it is, then the result could be a maintenance of the status quo with people using what is available rather than taking a more imaginative stance (Crilly et al, 1999; Meter, 1999).

Some workers also suggest a structure that can be applied to selecting SD indicators. At a basic level this could comprise the standard pressure–state–response (PSR) indicator framework.[1] Various forms of the basic PSR model have been suggested. Two examples, linear and cyclical, are presented in Figure 2.1. Some suggest the inclusion of a further category of impact indicators in this model: the pressure–state–impact–response model (PSIR; Figure 2.2). The United Nations applies this framework in the selection of its indicators of SD, although it uses the term 'driving force' instead of pressure (driving force–state–response; DSR). Others see the inclusion of 'driving force' in the PSR model as adding a new dimension rather than as a synonym; ie driving forces generate pressure (Figure 2.2). Driving forces would be factors such as demand for food, water, revenue, etc. In turn these generate specific pressures within the system. Whatever the terminology and detail, this family of approaches usually seeks to categorize indicators in terms of cause and effect. The result is typically (but not always – see, for example, Mortensen, 1997) a framework with the categories of indicators in columns and an assumption of horizontal links between columns.

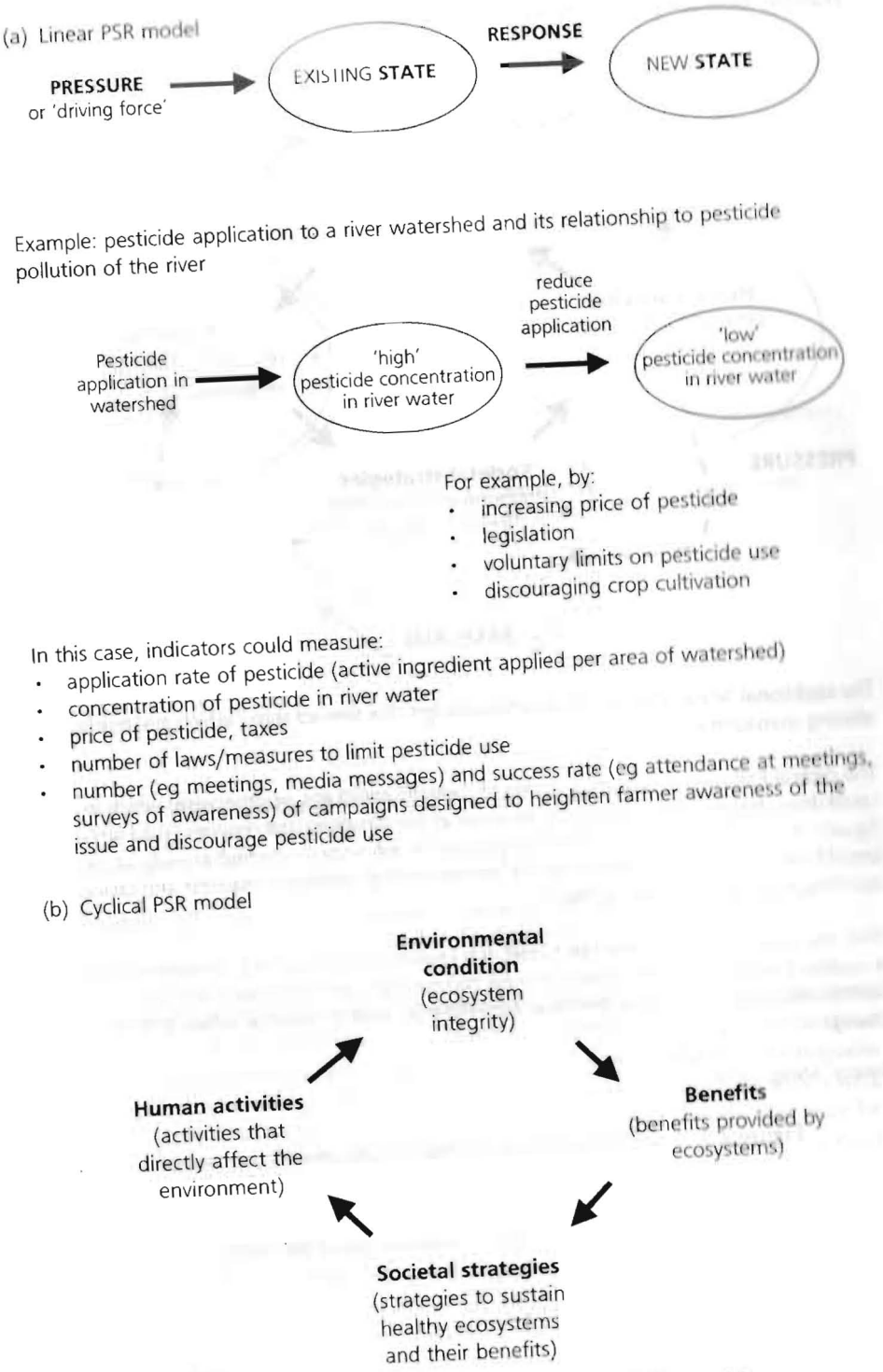
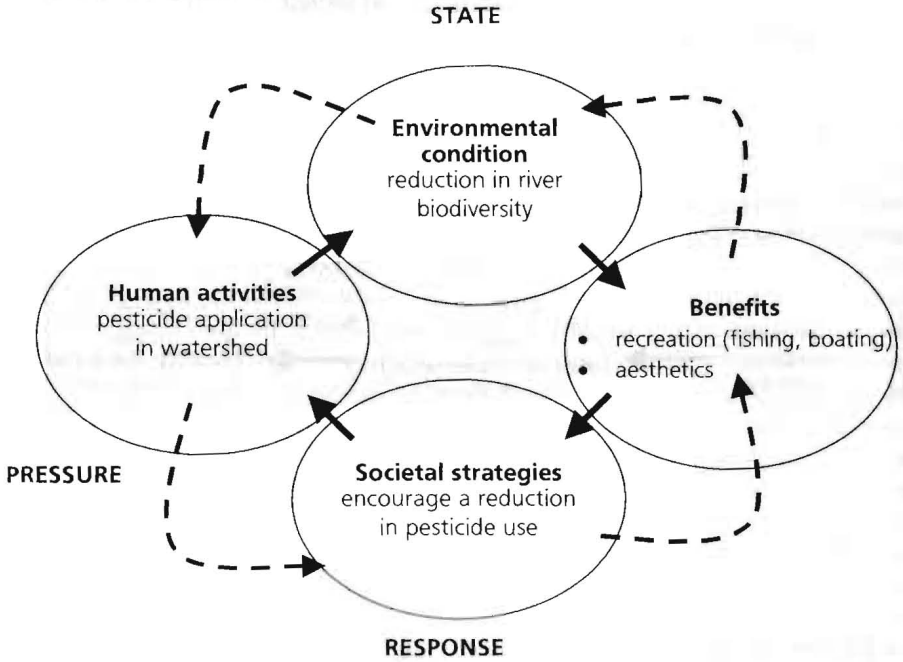


Figure 2.1 *Some pressure–state–response (PSR) models*

Example: pesticide pollution of a river



The traditional 'linear' PSR model assumes a target (the desired state) which one reaches by altering management.

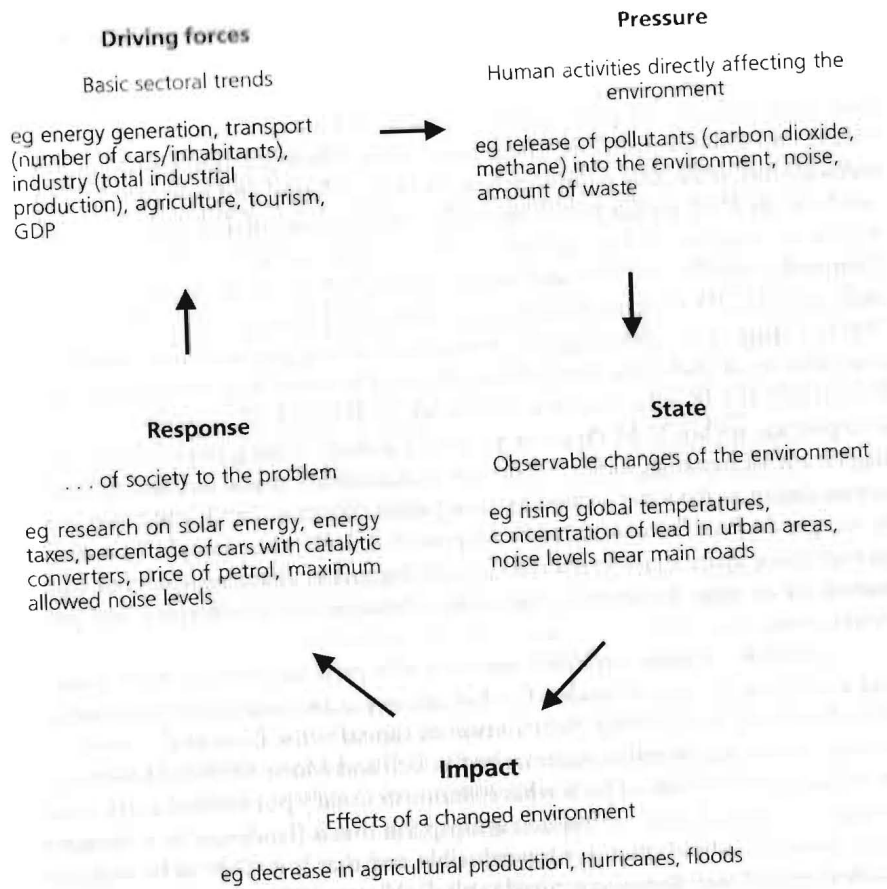
The cyclical PSR model includes a notion of 'benefit' (aesthetic or otherwise) which in turn could drive strategy and activity so as to arrive at the condition one requires (solid arrows in figure). It is also possible to see the relationship in the reverse (dashed arrows). A desired benefit will allow a prediction as to the environmental condition required and change in activities necessary to arrive at this.

With the cyclical version of the PSR model, it is implied that change will always be present in a society. For example, the advent of new technologies and strategies will open up new threats and possibilities, and desirable benefits may alter as societal values and structure change.

Source: Meter, 1999

Figure 2.1 *Some pressure–state–response (PSR) models (continued)*

While conceptually convenient, and indeed popular, the PSR family of models does have some serious problems. Spangenberg and Bonniot (1998) describe some of these, including a tendency for the 'R' of PSR to encourage short-term curative policies rather than the 'development of cause-orientated approaches'. They suggest that the PSR models reflect a sort of 'political end-of-the-pipe thinking' that militates against more proactive responses. An additional problem is that PSR models may not capture



Source: Jesinghaus, 1999

Figure 2.2 *Pressure–state–impact–response (PSIR) model for indicators of sustainable development*

the richness of multiple causality and interaction, which inevitably exists between most indicators of SD (Gallopin, 1997; Hardi et al, 1997). The danger is that those developing indicators with this model in mind may shoe-horn them into categories and think one-dimensionally about which pressure indicator influences which state indicator, and what we can do about it. In practice, a single indicator may be categorized either as pressure or state, and a single state indicator could be influenced by a number of pressure indicators (Hardi et al, 1997). One can impose further conditions on indicator selection to avoid this, but the danger is that the essentially organic nature of SD will be reduced to a highly simplistic and mechanical model (Gallopin, 1997) that encourages quick-fix solutions. As a result, some have rejected the PSR model in favour of more context-relevant approaches. For example, Meter (1999) refers to the use of 'linkage analysis' in the community development of indicators, where the major concern was whether the indicators were linked to issues that are important to a community rather than worry about cause–effect relationships.

In other situations, SD indicators could be created within a broad analytical framework. An example is the use of the 'multiple capital' framework (Howlett et al, 2000; Woodhouse et al, 2000) where sustainability is seen in terms of available capital (natural, human, social, physical and financial) and the vulnerability context (trends, shocks and stresses) in which these assets exist. There are numerous examples of sustainability indicators within each of these asset bases, and one could, of course, combine the PSR approach with multiple capital by identifying a suite of indicators within the asset bases. For example, in the natural capital base, Syers et al (1995), Dumanski and Pieri (2000) and Lefroy et al (2000) have developed land quality indicators (LQI) to be applied in sustainable land management (SLM; Herrick, 2000). Lefroy et al (2000) suggest using a decision support system to help generate a suitable set of such indicators, although they also stress that validation is not easy. Part of this is a familiar, to those who work in SD, lack of a consensus over what is important within SLM (Syers et al, 1995). Indeed, arising out of this has been a suggestion by some (eg Jodha, 1991) that sustainability is best assessed through un-sustainability, as the latter is often more apparent (Fuentes, 1993) and easier to gauge by using indicators (Newman, 1998). Mageau et al (1995), for example, have described an ecosystem distress syndrome (EDS), and the sort of characteristics that could be looked for in order to detect it, including a reduction in biodiversity and primary productivity.

'Capital' is a widely employed notion in SD, particularly in terms of describing and analysing the sort of trade-offs that can occur between these different assets (Goodland and Daly, 1996). Substitution of capital is the basis of the 'weak' verses 'strong' sustainability debate summarized in Bell and Morse (1999). However, some do see land as quite distinct from what economists usually put forward as the meaning of the term 'capital' with 'an implicit assumption that it [land] can be substituted by other forms of capital, that it is reproducible and that it is there to be managed in much the same way as manufactured capital' (Victor, 1991).

Another approach to formulating indicators, claimed to rest on a basic analysis of what is deemed necessary for SD, is described by Bossel (1997, 1999). Here, indicators are selected on the basis of their ability to address a set of questions concerning 'basic oriental satisfaction'. This is meant to contrast with other indicator sets that Bossel regards as being 'developed by various ad hoc methods'. In his approach, indicators of 'system sustainability' are determined in response to a 'very specific set of questions covering all essential aspects of viability and sustainable development'. The result is a set of basic orientors that can be applied to systems as a means of representing 'basic system interests'. Bossel (1999) lists these as in Table 2.2. They can act as a sort of checklist for what is 'important in and for systems, ie the basic system needs'.

In all of the above examples, one is applying a set of criteria to generate indicators deemed important within the development context. For the most part, and as the reader may have gleaned from the above, such lists have been derived in a largely top-down and technical mode, with technical excellence (what people would like to know) rather than practical use (what people need to know) as the prime concern (Rigby et al, 2000). They may be in line with a social-economic environment, PSR or asset base perspective, but it is clear that one indicator to cover all these will not be adequate. Instead, a common approach is to present the indicators within tables

Table 2.2 *The basic orientors of system sustainability as described by Bossel*

Basic orientor	*Key questions*	*Worldwatch examples*
Existence	Is the system compatible with and able to exist in its particular environment? Is the speed of escape from an existing danger greater than the speed of its approach?	Grain surplus factor Debt as share of GDP in developing countries World fish catch
Effectiveness	Is it effective and efficient? Is the rate of increase in resource use efficiency greater than the rate of erosion of resource availability?	Unemployment in the EU Gross world product per person Grain yield efficiency
Freedom of action	Does it have the necessary freedom to respond and react as needed? Is the rate of increase in the spectrum of possible responses greater than the rate of appearance of new challenges?	Share of population age 60 and over Energy productivity in industrial nations Water use as share of total runoff
Security	Is it secure, safe and stable? Does the rate of installation of protective measures keep up with the rate of increase of threats?	Share of population in cities World grain carryover stock Economic losses from weather disasters
Adaptability	Can it adapt to new challenges? Does the rate of structural change in the system keep up with the rate of irreversible changes in the environment?	Persons per television set Capital flow (public funds) to developing countries Carbon emissions
Coexistence	Is it compatible with interacting sub-systems? Can the rate of change in interaction and communication keep up with the rate of appearance of new actors?	Income share of richest 20% of population Number of armed conflicts Recycled content of US steel
Psychological needs	Is it compatible with psychological needs and culture? Does the rate of appearance of psychological stresses and strains remain below the rate at which they can be absorbed?	Refugees per 1000 people Immunization of infants Chesapeake oyster catch

Source: Bossel, 1999

(indicator frameworks). Numerous examples of such indicator frameworks exist,[2] and while there may be many differences there may also be commonalities. For example, a Local Government Management Board report (LGMB, 1995) identified a set of commonly suggested indicators of SD within UK local initiatives, and the following common denominators can be extracted:

- Resources and waste
- Pollution
- Biodiversity
- Local needs
- Basic needs

- Satisfying work
- Health
- Access
- Living without fear
- Empowerment
- Culture and aesthetics

Much of this is not surprising, and indeed as mentioned at the start of the chapter, when prompted to do so these are the sort of issues that emerge out of discussions with students and professionals. Naturally there is substantial diversity in terms of the precise indicators for these categories and how they are to be measured (LGMB, 1995).

The number of indicators to be included within a framework also provides some constraint on choice. Suggested numbers of indicators vary a great deal. Guy and Kibert (1998), describing the Florida Local Assessment Guide (FLAG) in the US, suggest that an initial list of 100 indicators will need to be 'distilled down to more manageable sets of 15–20', although manageable to whom is not described. Indeed, although there is variation, the figure of 20 indicators as a compromise between manageability and depth of information appears a great deal in the literature, although with little if any rationale as to why this ballpark figure in particular should be so magical. Crilly et al (1999), for example, suggest the use of 21 indicators of SD in order to resonate with Local Agenda 21, and the Local Government Management Board (LGMB) in the UK, having reviewed a number of pilot indicator projects, noted that the average number selected was 23 (range from 13 to 27; LGMB, 1995). A comment from Bossel (1999) probably best sums up the prevailing feelings of SD practitioners: 'the number of indicators should be as small as possible, but not smaller than necessary'. This leaves plenty of room for manouevre, but still doesn't explain the magic of 20.

Although much effort and thought has gone into the creation of numerous indicator frameworks, there is something of a conundrum here. As discussed in Chapter 1, everyone has their own opinion as to what is good or bad in SD, and the fact that there are so many SD indicator frameworks and projects is testament to this. This is the very essence of what makes SD so popular and yet so difficult to do in practice. The devil really is in the detail! On the one hand, given the site-specific (case study) nature of what SD entails, this would seem to be inevitable, and some even call for more of the same as a way of making progress (Syers et al, 1995; Gardner et al, 1995). Indeed, there may be few, if any, key indicators that could be applied across even quite similar systems (Gardner et al, 1995). However, the result of such a rapid and diverse process of SD indicator creation, often starting anew each time, can be a bewildering choice of approaches, matrices, classifications and types (Mitchell, 1996). Nevertheless, there have been attempts to create guidelines that could be applied to similar systems worldwide. The UN list of indicators arising out of the Rio conference is an example of this, as are the United Nations Food and Agriculture Organization (FAO) guidelines for fisheries (Garcia et al, 2000). Even here, though, there is still great emphasis on local flexibility and an avoidance of being too prescriptive.

Integration of sustainable development indicators

Indicator integration is basically a means by which individual and quite different indicators in a framework can somehow be viewed together to provide an holistic view of SD. It attempts to get around two problems often attributed to indicator frameworks (OECD, 1998):

1 Complexity. Many indicators may be sensible from a technical perspective, but one can lose sight of the bigger picture and become enmeshed in detail.
2 Compromise. An indicator framework may not allow an immediately apparent analysis of trade-offs between some indicators and others.

Aggregating them into a single index can help address both points. It is particularly seen as important in terms of presenting the information to the public and decision-makers who, it is assumed, do not need to be aware of the detail but only the broad message as to what is happening.

There are two main approaches here. One could keep the indicators entirely separate, but listed or presented together within a single table or diagram (visual integration), or one could combine the indicators to yield a single index of SD (numerical integration). Many examples exist for both, involving all sorts of mathematics from the simple to the complex. Mitchell (1996) summarizes some of the approaches taken to integrate (or aggregate) indicators into a single index of sustainability, many of them founded on monetary valuation of resources – money can be a powerful medium for aggregation! Tyteca (1996) provides a review of examples for the narrower field of environmental performance of industry.

One non-monetary example of integration is described by Manyong and Degand (1997). They describe an approach to measuring the sustainability of agriculture using a technique called weighted goal programming (WGP). The technique is based on a measurement of deviation of the actual value of a set of indicators from some nominal target or goal. The aggregate deviation from the target, after weighting the relative importance of the individual indicators in the wider scheme, is given the symbol 'Z'. Clearly, if the target is deemed to be the sustainable condition then the nearer Z is to zero (ie the lower the deviation), the more sustainable the system. In Manyong and Degand's example, Z is an attempt to integrate human nutrition, soil fertility and income, although most of the indicators are for human nutrition and all indicators have the same weight. However, this issue of weighting during integration is highly contentious and driven in the most part by value judgement (Dahl, 1997).

A further approach described by Cornelissen et al (2001) is based on the use of fuzzy set theory. For example, assuming that there are three indicators of SD, these can be measured and checked against an 'acceptable' level (Table 2.3). What is deemed to be acceptable is, of course, a matter of some value judgement. The pattern of response to all three indicators can then be aggregated to provide an overall condition for SD (a numerical value symbolized by μ_{SD} rather than Z). Therefore, although the attitude towards SD is highly subjective, the use of fuzzy set theory can allow a link between human expectation and the numerical nature of indicators. It could be one way of combining quantitative and qualitative information in SD (Rotmans, 1998).

Table 2.3 *The use of fuzzy logic in determining an overall assessment of sustainable development*

Rule	SI_1 *acceptable*		SI_2 *acceptable*		SI_3 *acceptable*	***RESULT*** *sustainable development*
1	yes	**AND**	yes	**AND**	yes	very good
ELSE						
2	yes	**AND**	yes	**AND**	no	good
ELSE						
3	yes	**AND**	no	**AND**	no	poor
ELSE						
4	no	**AND**	no	**AND**	no	very poor

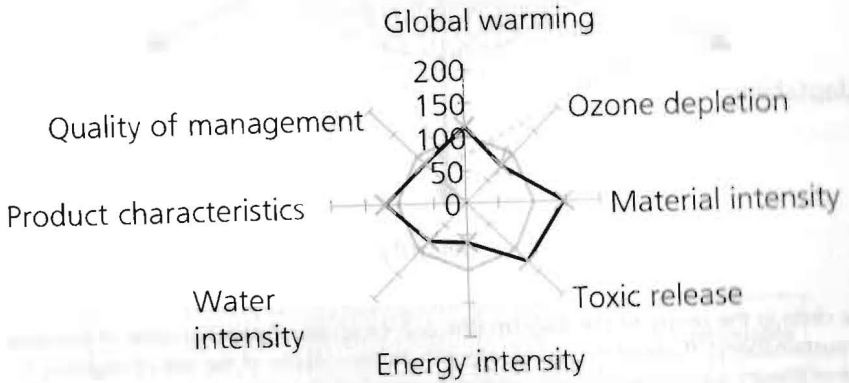
Note:
* At the end of each rule there is an 'ELSE' that forces the reader to consider the next line in the table.
* Answers to the lines can be either completely 'true' or not, or 'true' to varying degrees.
* The result is a numerical assessment of SD (called μ_{SD})

Source: Cornelissen et al, 2001

A more economic example of such integration is sustainability calculated on the basis of national savings, national income and depreciation to man-made capital, natural resources and the environment (Pearce and Atkinson, 1993; Rennings and Wiggering, 1997). The idea is that an economy should be able to save more than the combined depreciation of all forms of capital. The result is a single value, again symbolized by Z, which represents the sustainability of the economy (sustainability in its 'weak' sense; Bell and Morse, 1999). This is an example of what some term 'green accounting', and can include entries in the standard systems of national accounting.[3] As long as the depreciation of natural resources is made up for by replacement with other assets of equal value, then Z will indicate sustainability: 'the cardinal sin is not mining; it is consuming the rents from mining' (Solow, 1993). The calculation of a single value for sustainability on a country basis opens up the possibility of league tables; a sort of 'name and shame' policy.

The use of money as a common unit to integrate indicators of SD certainly has a logic that appeals to those charged with raising (eg as taxes) and spending it. Some would even go so far as to claim that monetization is the only practical solution to combining different types of indicator.[4] Bio-physical indicators are far more difficult to integrate because of their different units of measurement (Bartelmus, 1999). Despite the advantages, the problem with the use of money as a common denominator is that it implies that all assets and processes involved in SD can be valued. While this has been attempted, it may not be easy or even possible (Dahl, 1997).

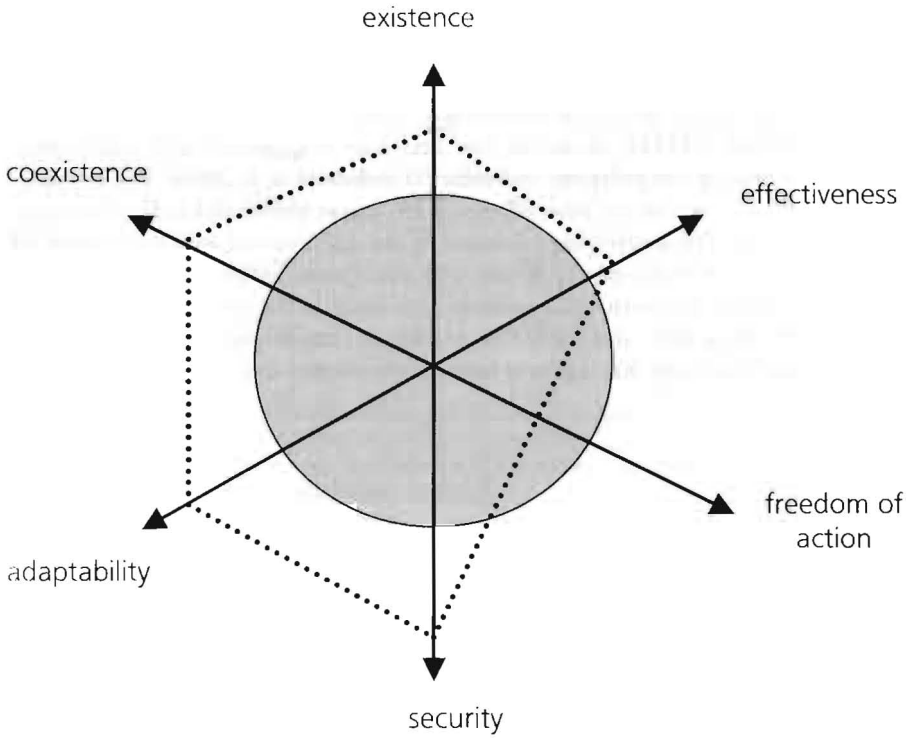
All three above examples are examples of numerical integration – the generation of a single value for sustainability. Other integrative approaches are based on the use of diagrams. The AMOEBA (or RADAR), where indicators are arrayed as arms, is one example.[5] As originally designed, it essentially comprises a bar graph of indicator values turned into a circular presentation. Figure 2.3 is an example of a RADAR diagram for 'company sustainability' (in this case, eco-efficiency indicators for the pharmaceutical industry; adapted from Joly, 2001). The arms of the RADAR represent actual performance by the industry in terms of eco-efficiency. Other variants on the AMOEBA/RADAR theme are 'star' and 'kite' diagrams (Garcia and Staples, 2000) and sustainability polygons and webs (Woodhouse et al, 2000). For example, Bossel (1999) presents his six 'basic orientors' for system sustainability as an 'orientor star' (Figure 2.4). The underlying mechanic of the orientors is based on the ratio of the rate of response to the rate of threat, with the former having to be greater than the latter in order to ensure sustainability. The circle in the centre of the diagram represents the minimum value for SD (ie, a ratio of 1; rate of response to threat = rate of threat), with each arm having to at least match this for SD.



Indicator	*Value*
Global warming	113
Ozone depletion	78
Material intensity	145
Toxic release	128
Energy intensity	61
Water intensity	80
Product characteristics	118
Quality of management	85

Note: This particular example comprises eight eco-efficiency indicators for the pharmaceutical industry (adapted from Joly, 2001).

Figure 2.3 *Example of a RADAR diagram for company sustainability*



The circle in the centre of the diagram (the unit circle) represents the zone of non-viability (unsustainability). If any of the six 'orientor satisfactions' (ratio of the rate of response to the rate of threat) is less than one (eg freedom of action in the above diagram) it will fall inside the circle and indicate unsustainability.

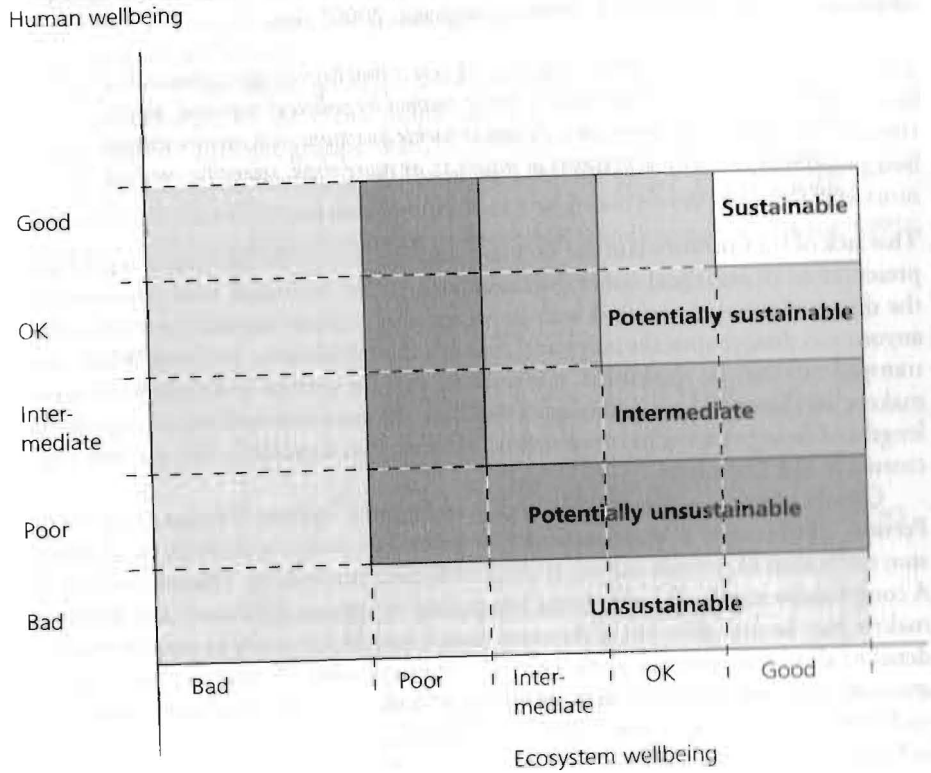
The six orientor satisfactions are:

	Orientor	*Numerator*	*Denominator*
1	Existence	Speed of escape from a danger	Speed of approach of danger
2	Effectiveness	Rate of increase in resource efficiency	Rate of erosion of resource availability
3	Freedom of action	Rate of increase in spectrum of possible responses	Rate of appearance of new challenges
4	Security	Rate of installation of protective measures	Rate of increase of threats
5	Adaptability	Rate of structural change	Rate of irreversible changes
6	Coexistence	Rate of change of interaction and communication	Rate of appearance of new actors

Source: Bossel, 1999

Figure 2.4 *The orientor star of sustainable development*

Although in such AMOEBA-type diagrams the visual 'whole' provides some basis for integration, the individual indicators are still presented separately. This can be an advantage, as it allows the reader to disaggregate the whole. The appeal of such a compromise was one reason behind our selection of the AMOEBA as a presentation device in the systemic sustainability analysis (SSA) described in Bell and Morse (1999). There are alternatives, and the 'sustainability dashboard' (Hardi, 2001) is gaining in popularity. Here the approach is to draw an analogy between a vehicle dashboard, and all its dials and lights, and SD. Separate dials and warning lights are included for various dimensions of SD, so there is some disaggregation. By way of contrast, a diagrammatic approach that doesn't allow any disaggregation is the 'sustainability barometer' (Prescott-Allen, 1997; Figure 2.5). This involves mapping the particular state of a system on to a two-dimensional structure of human and ecosystem wellbeing. Sustainability equates to a defined area of the structure (top right of Figure 2.5). The reader, from the diagram itself, cannot discern why a system happens to occupy the location it does in the barometer.



Source: adapted from Prescott Allen, 1997

Figure 2.5 *The IUCN barometer of sustainability*

Numerous writers and practitioners have discussed the desirability of integrating a suite of indicators into a single index for SD.[6] Experts are divided into those who see this is a good thing, and those who stress the dangers. The following quotation sets out the basic difficulty:

> *[I]t would be counterproductive if new indicators were to become weighted and averaged together – leading to more fetishing of one single index, which tries to add up all the apples and oranges into a single number coefficient. This can turn out to lead to the same kind of nonsense as the GNP indicators. It is better on scientific grounds, as well as those of public education and efficient, democratic government to have a group of indicators covering different dimensions. [O]nly transparent and tangible indicators that people can readily understand and visualize and relate to their own lives will provide the desired political constituency for needed governmental policy. This has been an endemic problem with economics, and its arcane formulae which have left people mystified, alienated and demotivated.* (Henderson, 1991, p176)

The lack of transparency afforded by highly aggregated indicators is a serious problem (Moffatt, 1994; Allenby et al, 1998; Jesinghaus, 2000). Yet:

> *The challenge for the scientific community is that highly aggregated indices of sustainable development are being pushed by political demand, despite the hesitancy of experts and scholars to tackle questions that involve human values and political processes as much as, or more than, scientific methodologies.* (Dahl, 1997)

This lack of transparency is at the 'communication' level (ie in the form it is generally presented to an audience) rather than necessarily at the 'technical' level. For example, the documentation associated with an index may include the full data set so that anyone can disaggregate the index and monitor the calculations involved. While such transparency may be applauded, it is unlikely that the groups (politicians, decision-makers, etc) intended to use the index will have the time and inclination to go to the lengths of disaggregating its components. After all, that is precisely why the index was created in the first place!

Clearly, there is a demand for highly aggregated indices (Hodge et al, 1999; Persson, 2001), even if 'their purpose may indeed be more to provoke by shocking sum totals than to provide statistical support to decision-making' (Bartelmus, 1999). A compromise may be in order. Some integration to appease politicians and decision-makers may be desirable, but at the same time it may be necessary to provide enough detail to allow transparency at the level of communication. There have been various attempts to do this, many of them revolving around the use of compromise diagrams such as the AMOEBA, although these have also had their critics, and some see them as biased more towards addressing a need for aggregation.

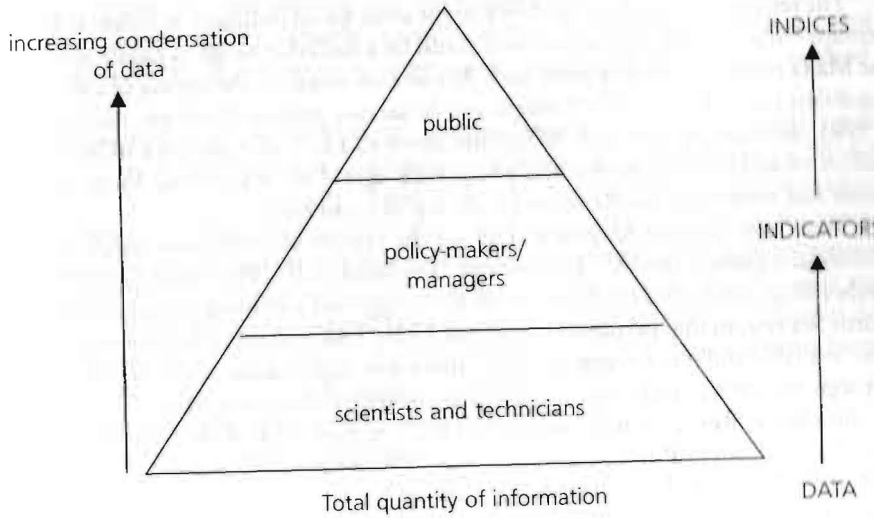
> *From a methodological point of view, it [the AMOEBA] can be criticized for the aggregation process, simple addition of indicators and the reference to historical situations; it is a very crude, preliminary solution for measuring sustainability.* (Rennings and Wiggering, 1997)

However, while this fear does resonate with many,[7] a workshop held at the OECD in 1998 made the point that:

> *Many participants had found that it was easier to gain attention for an issue with a simple graphical presentation or a limited numerical index than with a more complex concept. This comes back to the essential problem of whether the priority is to guide policy in the 'right' direction as opposed to getting the indicators strictly comprehensive and correct.* (OECD, 1998)

Sustainability diagrams, and indeed indices, have received a high level of prominence in the literature. The basis upon which these devices are founded – clarity for users – is bound up with the uses to which they will be put. As Wefering et al (2000) suggest, there are very different views about clarity with regard to SD. Scientists and technicians are interested primarily in data presented as tables, graphs, etc, and possibly even raw uncondensed data, while decision-makers and managers typically require some condensation of the data, particularly in terms of how it relates to goals and targets. With this group, visual devices such as those described above may be useful, but should also be capable of being unwrapped to reveal underlying data. On the other hand, individual users (the public) prefer highly aggregated data (perhaps as an index) and visual devices.

A pragmatic approach, given the contested views of the SD indicator technicians and those wanting to use them, points towards a hybrid approach with layers of aggregation for different groups. OECD (1998) referred to a 'pyramid of indicators sets' (Figure 2.6). At the top level would be a few (or even one) highly aggregated indicators for the public and decision-makers, and as one moves towards the bottom of the pyramid the indicators would become increasingly disaggregated (Braat, 1991).



Source: Braat, 1991

Figure 2.6 *Relationships between indicators, data and information: the OECD 'pyramid of indicator sets'*

THE REFERENCE CONDITION

Assuming that we are able to develop a set of indicators, or perhaps just one index, that can be used to gauge progress towards the goal of SD, we are still left with the question: What is the goal? Just what are we aiming for? There are two broad approaches:

1 A defined target for an indicator/index. The aim is to get some/all of the indicators to this target.
2 A defined direction for an indicator/index. The aim is to get some/all of the indicators to move in the desired direction.

The notion of a defined target or threshold, equating to a sort of best practice for indicators of SD, is perhaps the most common approach.[8] It allows decision-makers to judge the gap or distance between what is and what should be (Gilbert, 1996; Crabtree and Bayfield, 1998). It is also a familiar approach in a number of fields where indicators have been applied. In environmental management, for example, there are legal targets for levels of pollutant emission ('critical loads') and 'critical concentrations' in air and water (Kellogg and Goss, 1997; Rennings and Wiggering, 1997). This is what some call a 'target frontier', with the 'ideal frontier' being zero (Tyteca, 1996). The difference here may well be based on a recognition that the 'ideal frontier' may be difficult to achieve in practice (Tyteca, 1996). In SLM, 'the threshold value may be regarded as the level of that indicator beyond which the particular system is no longer sustainable' (Syers et al, 1995). Naturally, each indicator would have its own threshold, but knowing what these are is not by any means an exact science. Even with the more bio-physically based environmental indicators (Syers et al, 1995), there is much subjectivity.[9]

The reference condition could be a single value for an indicator or index, although perhaps backed up by legislation, or it could be a desirable range (a band) as used in the Malta project, to be discussed later. As one may imagine, the setting of a reference condition for indicators of SD might not be an easy process. Crabtree and Bayfield (1998), for example, put such difficulties down to a lack of experience of individual indicators and their interpretation, a nationally agreed set of standards for most indicators and consensus mechanisms for setting SD standards.

Some have used an historical state for the system as a reference condition (an 'historical reference system'). For example, Ten Brink et al (1991), in their AMOEBA methodology for indicators of sustainability, suggested a reference condition for the North Sea system that pertained to the year 1930. This year was selected because data were available and it corresponds with a time when exploitation of the North Sea was not seen as excessive and hence could loosely be regarded as sustainable. In a variation on this theme, Rotmans and van Asselt (1999), in their AMOEBA of future projections arising from multiple perspectives, use 1990 as the baseline, and the arms of the AMOEBA represent future trends up to the end of the 21st century. The year 1990 was not selected because it represents sustainability (unlike 1930 in the Ten Brink et al example), but was simply a convenient baseline against which to plot the future. An alternative to the use of a reference year is to compare the system to one currently in existence and assumed to be sustainable, or at least to have better 'system health' (a 'geographical reference system'; de Soyza et al, 1997; Wefering et al, 2000). We could also try and reconstruct what the reference condition should be from first principles rather from anything we have seen (a 'theoretical reference condition').

Historical, geographical and theoretical reference systems are attempts to base decisions on some notion of a quasi-objective condition rationalized to represent sustainability. We can take a different approach and ask the stakeholders what they think the reference condition should be (ie the 'worst' and 'best' cases for each indicator, providing a 'stakeholder reference system'). Woodhouse et al (2000) provide an example of such an approach, and – as we will discuss in Chapters 3 and 4 – this was essentially the basis of our work in Malta. Naturally, there may be much inherent subjectivity and value judgment in such stakeholder reference systems, and opinions may be diverse. Also, it should be borne in mind that nothing prevents us from combining all of these approaches, using different ones for each indicator in the framework.

Once a reference condition has been established, it is a simple matter to calculate the deviations of indicators from the reference condition, taking into account the 'polarity' of SD in each case. The value of an indicator may be well outside the reference condition, but that may not be a problem for SD provided they are the right side. In essence this is over-achievement! An example here is the incidence of pollution. One may set a maximum target level for a pollutant in a river, and one could back this up with legislation, but values lower than this would be highly desirable. With a number of indicators one could sum 'bad' deviations from the reference condition (a sort of sustainability gap index; SGI). An example of an index of this sort is the Ecological Dow Jones Index, calculated as the sum of the deviations of indicators from the reference condition (Ten Brink et al, 1991; Wefering et al, 2000). With 32 indicators, this would vary from zero (32 × 0 per cent difference) to 3200 (32 × 100 per cent difference), with 0 representing sustainability and 3200 representing unsustainability. A further example is provided by Ekins and Simon (2001), who describe the gap in terms of time taken to address the standard required for SD.

What level of deviation from the reference point is acceptable could vary from zero to all sorts of compromises arising out of an essentially political process (Wefering et al, 2000). We could, of course, build such concerns into the setting of the reference condition in the first place, as with the stakeholder reference system, for example. After all, if decision-makers help set the targets then they also have some responsibility to ensure attainment; they are as much stakeholders as anyone else. To some extent this may be included even when the indicators are of an apparently technical derivation. For example, the AMOEBA of Ten Brink et al (1991) has indicators based to some extent on the level of acceptability to decision-makers rather than just scientists.

One danger with such a focus on SD 'gaps' is that only indicators on the 'bad' side of the target may be prioritized for consideration. This may result in some complacency with regard to indicators on the 'right' side of the reference condition at the time the measurement was taken. It could also cause some shifting of resources away from indicators deemed to be OK to those with 'bad' gaps. Much also depends upon which indicators have been included. In practice, the aim is typically to limit the number of indicators for logistical and/or presentational purposes, and decisions

have to be made as to which indicators to include and how they are to be measured. As already discussed, this is a highly subjective and value-ridden process, but it will influence the magnitude of any deviation from the reference condition. A danger here, of course, is what Crabtree and Bayfield (1998) refer to as 'institutional capture'. Powerful individuals or groups may set the agenda in terms of what indicators of SD to include and, in essence, what gaps to address.

It is possible to do away with a reference condition per se, and instead present the value of indicators (eg across countries) in the form of league tables. In this case, the aim is to present status in relative terms rather than use an absolute standard. Hence the motivation for change is not to do better relative to a standard, but to do better relative to other countries. Great care needs to be taken with such an approach, given that developed countries tend to take the lead in developing such tables, and 'institutional capture' can occur. The debate surrounding the calculation of the Environmental Sustainability Index (ESI) is but one example of what can happen.[10] The importance of including Southern voices in the process has been reiterated by many (eg de Kruijf and van Vuuren, 1998).

There are other examples that are much less overtly reference condition or league table orientated, and instead look to present indicator trends over time. A good example here is the list of indicators provided by *Vital Signs*, a publication of the Worldwatch Institute. First published in 1992, the series attempts, in the words of Worldwatch, to 'broaden the base of information available to decision-makers around the world by assembling a unique and eclectic set of global indicators'. In the mode of all indicator sets, the Worldwatch publication attempts to address a common problem: 'there is a widening sea of data but, in comparison, a desert of information' (Mitchell, 1996). As an example, the 2000–2001 offering (Brown et al, 2000) lists 32 key indicators, ranging from the usual environmental suspects (carbon emissions, global temperature, use of fertilizer) through to the not so usual (bicycle production, internet use) to the unexpected (cigarette death toll, peacekeeping expenditure). Although some indicators do have graphs that break trends down into regions and/or countries, for the most part this is avoided. The commentaries do bring out regional and/or country comparisons, but one does not detect a strong 'name and shame' style. The result is perhaps more of a feeling that we are all in this together. Bossel (1999) uses examples of the Worldwatch indicators to illustrate his basic orientors of system sustainability (Table 2.2).

Using indicators of sustainable development

Once a set of indicators has been established, measured and compared with a reference system, the results have to be communicated to those intended to use them. After all, indicators of SD are means to an end, and are not ends in themselves (Stirling, 1999).

> *There seems little point in developing an approach to monitoring the things that are meaningful to local people if they never find out about it.* (Acton, 2000)

Of course, this quotation could equally apply to all those who are meant to 'do' something with the indicators, and not just the public! Although this may sound blindingly obvious, the danger with indicators is that people sometimes lose sight of the ultimate goal ('what we want to be') and instead become wrapped up with 'what we want to measure and how'.

The form in which this communication occurs has significant consequences in terms of how the indicators are to be applied (Corvalán et al, 1997). Communication to end-users may take a number of forms: internet (Garcia et al, 2000), printed mass media, television/radio, leaflets, technical reports (for example, see Global Reporting Initiative, 2000), and conferences and workshops. Just who should be told will have an influence on both the form of indicator presentation and the means of communication (Crilly et al, 1999). It may be that indicators have to be translated into other forms (such as financial cost–benefit analysis), or aggregated, before they are communicated. Given the centrality of communication in all of this, it is perhaps surprising that this has received remarkably little attention (Acton, 2000), a point that will be returned to in Chapter 4 when we discuss the Malta project.

Two key questions at this stage are who will use the indicators; and how (Mitchell, 1996)? It certainly appears as if some SD indicator projects have been, to say the least, a little 'fuzzy' over the answers to these (Acton, 2000). However, one answer has been summatized by Moldan et al (1997):

> *The potential uses of ISDs (indicators of sustainable development) include alerting decision-makers to priority issues, guiding policy formulation, simplifying and improving communication and fostering a common understanding of key trends with a view to initiating necessary national action.*

This is a commonly stated position, if perhaps rather unmet in practice, and unsurprisingly is no different to the use of indicators in a wide variety of fields (Tyteca, 1996). De Kruijf and van Vuuren (1998) suggest that SD indicators have two related purposes, as:

1 tools in the policy planning process; and
2 communication tools.

But the second use should not be a passive process of technocrats telling others, such as the public and decision-makers, what they have found, ie seeing the public as nothing more than passive consumers of someone else's indicators (MacGillivray and Zadek, 1995). Indicator exercises should be founded on a participatory process that helps provide new goals for politicians and decision-makers (Pinfield, 1996; Meter, 1999). However, there have been mixed experiences with all of this. For example, in the more specific context of SLM, the land quality indicators (LQIs) summarized by Dumanski and Pieri (2000) are intended to act as foci for research policy. These have generally been developed by experts with the aim of providing indicators upon which decision-makers can act. Yet Herrick (2000) fears that adoption of LQIs, particularly those centred on soil quality, has not been good. Rigby et al (2000), also working in the broad sphere of natural resource management (NRM) and livelihood, make the candid claim that:

Much of the measurement of indicators has, at the end of the day, largely resulted just in the measurement of indicators. The actual operationalization of indicators to influence or change, for instance, policy is still in its infancy.

And this after more than 20 years of effort into the development of indicators within a field (NRM) where much experience of the process exists, and indeed helped to generate the broader vision of SD seen today! But it gets worse: in the broader field of SD there also seem to be problems with this assumption of an indicator–policy change link, with some suggesting that 'there is little evidence of indicators leading directly to the formulation of policies for sustainable development' (Pinfield, 1996). Is this suggestive of a problem with the indicator approach or is there something bigger involved? Reid (1995), for example, is critical of progress towards the attainment of SD and suggests a number of reasons for this, including:

- lack of awareness of the issues;
- political unacceptability of most action;
- opposition from entrenched interests; and
- inadequacy of institutional mechanisms for bringing together development and environment

These are substantial issues, particularly the second and third points, but the use of indicators as a tool was supposed to help with some of them. Are there other issues involved? For example, we could question factors such as a lack of involvement from decision-makers in the setting of indicators in the first place. This may be due, at least in part, to unwillingness from more technical-orientated SD researchers to fully engage with the socio-political environment (including laws and regulations) within which decision-makers operate (Moran, 1994). It may also be that decision-makers are not so familiar with many of the basic concepts in SD, for example the notion of carrying capacity (Pinfield, 1996).

To date, there are severe difficulties in translating the outputs of environmental science into appropriate inputs for policy formulation. This does not come as a surprise, as the two worlds, of scientific inquiry and political decision-making, are dissimilar in both their cognitive and social aspects. (Kasemir et al, 1999)

Yet as Reid (1995) points out, politicians may well place conflicting demands upon the institutional structures meant to help facilitate SD, including the setting and use of indicators. For example, in the UK the national government has established a set of headline indicators of SD that it expects local governments to adopt and amend as they see fit. The result has not only been some confusion over the importance of 'local' issues, with perhaps an emphasis on the 'environmental' flavour of SD, but conflict with the national government's stated priority of encouraging economic growth.[11] Yet some are adamant that SD is certainly not sustained growth and neither is it related to an 'environmental movement' (Hart Environmental Dara, 1998).

Perhaps understandably given the above morass, it seems at times as if the emphasis in setting indicators has been technical excellence rather than helping managers to manage (Rigby et al, 2000; Pannell and Glenn, 2000). Indeed, while the literature has much to say about methods of selecting indicators and participation, the advantages of specific suites of indicators, methods of presentation, etc, there is little on the practical use of these tools, for example to explore policy and investment options (Stirling, 1999; Pannell and Glenn, 2000). If included, the latter is often dealt with as a once-off application rather than as a sustained activity. Some suggest that this could even be deliberate so as to delay action (Pinfield, 1996). At the very least, given that SD indicators have been around for some 20 years, and much time and effort has gone into indicator-based research, this lack of use may be surprising.

For those involved in SD there may be some uncomfortable truths in all of this. It's not that people don't want indicators. We use qualitative indicators all of the time, and even some quantitative and technical indicators are widely used and familiar to much of the public (eg gross domestic product (GDP), unemployment rates). Yet with indicators of SD there has perhaps been a failure to convince decision-makers and politicians about the costs, financial or otherwise, of not implementing SD (O'Neill et al, 1996). Wiggering and Rennings (1997) suggest that the financial (bottom-line) costs of environmental damage be made far more explicit. After all, there is evidence to suggest that publicly reporting indicators of company environmental performance is enough to drive firms to improve this performance (Ditz and Ranganathan, 1998). There may be various mechanisms at play, including ethical investment, but there does seem to be a correlation between transparency and performance (Tyteca, 1996). The World Business Council for Sustainable Development (WBCSD) is a group that monitors such environmental performance indicators, and its philosophy with such indicators is that it is better to be 'approximately right rather than precisely wrong' (Allenby et al, 1998).

Yet to be useful in a 'management' sense, indicators have to be set and measured on a regular basis. Monitoring, unfortunately, may be regarded by some as an inferior grade of inquiry relegated to managers rather than scientists, and perhaps even worse, could become so routine that it becomes an end in itself with little application in management (Kessler et al, 1992). Hence, from the point of view of researchers, there may well be a greater incentive to keep generating new sets of indicators, or indeed other tools and methods to gauge SD, rather than getting involved in or even considering too deeply the less glamorous side of the business. This would include issues such as how will these tools feed into what could be the fairly routine and repetitive yet critical decision-making required in part for SD? The danger must be that the routine measurement of indicators ends up being relegated to a data collection branch of an agency that generates tables of numbers that no one ends up either looking at or using. The key here may well be convincing those who are intended to use the indicators that the process of routine monitoring is cost-effective, ie that it is worth doing (Pannell and Glenn, 2000). There have been surprisingly few cost–benefit analyses of the use of indicators in SD. The theory has been clearly set out by Pannell and Glenn (2000) with reference to indicators of agricultural sustainability:

The fundamental criterion for choosing to monitor an indicator is that the benefits from doing so must exceed the costs. A decision-maker (either

farmer or policy-maker) should choose to monitor the set of indicators for which the total benefits exceed the total costs by the greatest absolute amount.

However, while the costs of monitoring are relatively easily determined, as always with SD the crux comes down to how the benefits are assessed. If one takes a financially pragmatic view of 'benefits' in the sense of saving expenditure on agricultural inputs, unemployment benefit, health care etc, then this may be possible, as illustrated by Pannell and Glenn (2000). But what about the 'value' of biodiversity, a good view, clean air, less noise, etc? Having a close relationship between the use of an indicator and a pay-off will no doubt make the 'use' of that indicator more likely, but what are the pay-offs, and who receives them?

By way of contrast, others are sceptical about the use of indicators as tools for stakeholders to influence policy:

> *In more than 20 years of grassroots organizing experience I have neither personally used nor come across a grassroots group that has used indicators as a primary tool to encourage a party or government to change its political objectives.* (Brugmann, 1997b)

> *A 'The Tail Wags the Dog' strategy, ie 'let's produce an index that tells people what should be really important for them', is bound to fail – there is no shortage of attempts to tell people what they have to do, and it becomes boring after a while.* (Jesinghaus, 2000)

However, there is another direction that employs indicators more as devices to help people understand themselves and what they want in SD. The focus here is not so much at the level of influencing macro-policy, but at the level of inspiring a community to take control of change. Kline (2000) suggests that 'indicators can be an effective mechanism for understanding people's values, needs, concerns and expectations', a point echoed by Besleme and Mullin (1997) in their summary of community indicator projects, including those focused on SD, in the US. While early (1960s–1970s) attempts at using indicators in social accounting within the US died out due to funding cuts and a 'perception that indicators had no direct and useful application', a rebirth in the 1980s has seen a host of examples of community indicator projects in the US (Besleme and Mullin, 1997), including the famous 'Sustainable Seattle' project. In a more bullish statement of the advantages of indicators as part of community development that stands in some contrast to the point made by Brugmann (1997b) above, there is the following quotation:

> *Indicators are an excellent tool for communities working toward a common goal. When properly designed, they can forewarn a community about a potential problem or negative trend before its effects become irreversible. They can demonstrate the linkages among large social, economic and environmental systems and help to identify the causes of complex problems. They can measure the effectiveness of policies and projects. Most of all, they can simplify, yet comprehensively track a community's progress towards its goals.* (Besleme and Mullin, 1997)

As a result some distinguish another type of indicator, community sustainable development indicators (CSDIs, or neighbourhood sustainability indicators), quite distinct from the sort of SD indicator discussed so far (Acton, 2000; Table 2.4). The difference between these two is largely in terms of who has set them and what for. CSDIs may have a more indirect effect on policy, while the traditional SD indicators may be intended to directly influence policy rather than facilitate change at local level (the 'attempts to replace GDP' of Jesinghaus, 2000). Some have subdivided the CSDI category. The result may be a set of 'nested indicators' (Meter, 1999; Table 2.5) that operate at different spatial and time scales, and may have varying relevance to external groups (researchers, decision-makers etc).

Table 2.4 *Two different types of sustainable development indicators*

Characteristic	*Sustainable development indicators (SDIs)*	*Community sustainable development indicators (CSDIs)*
Public participation	Limited	Extensive
Who collects data/statistics?	Experts	Community
Communication of indicators	Extensive within the policy-maker/manager group	Via media and other means
	More limited with other groups	
Use	Directly to drive policy	Encourage individuals to make changes in their day-to-day lives
		Affects policy indirectly
Resonance	Policy-makers/managers	Public

While indicators are often seen in terms of their use as tools to help understand linkages and processes in complex systems, some do put limits on the depth of this understanding:

> *To me, indicators are a very poor tool for deepening our understanding of the system(s). They should be primarily used to track whether or not we are imposing our newly redefined, ie sustainable development, values on the system . . . [W]e want to use indicators to establish that essential link of accountability to the sustainable development agenda.* (Brugmann, 1997b)

The problem may simply be that decision-makers and managers have other agenda, and indicators of SD frankly have little influence. They may even be a useful (to some) device for diverting attention into avenues that make for pleasant rhetoric but don't mean much in practice. As Brugmann (1997b) puts it, 'in one aspect of such planning

Table 2.5 *Four types of community sustainable development indicators (CSDIs)*

Type of CSDI	*Purpose*	*Linkages*	*Main use*	*Potential limitations*
Data poetry (community)	Highly linked indicators that are most useful for stakeholders (internal groups) Designed to help transform the discussion of the community towards a more long-term view	high	internal	do not allow for comparisons across neighbourhoods focus more on action steps than complete picture of local sustainability concerns
Core (community and experts)	Linked indicators useful for local residents as well as external groups (researchers, funders, policy-makers) Designed to allow comparisons among diverse communities	high	internal and external	difficult to define one set of indicators that apply to diverse neighbourhoods
Background (experts)	Offer interesting background information that helps define the context in which SD takes place Useful for both internal and external groups	few	external	less integrating than data poetry and core indicators
Deep sustainability (community and experts)	Help local stakeholders to define a long-term vision for their community Highly linked and look far into the future Evoke long-term visioning	high	internal and external	may be impractical to implement in the short term

Notes: 'Linkages' refer to relationship with local concerns and goals. 'Main use' (internal and external) refers to the groups that would primarily use the indicators. 'Internal' refers to the neighbourhood community while 'external' refers to those outside of the neighbourhood (such as researchers).

Source: Meter, 1999

[for sustainable development] – the use of "sustainability indicators" – we have failed to be methodical and articulate'. This author goes on to illustrate why he believes indicators have failed to have an impact in planning. One reason is their tendency to be applied to meet a variety of needs (planning, public education, accountability), and he suggests that a better approach may be to focus instead on a defined set of performance indicators to which decision-makers and managers can be held responsible (see also Jimenez-Beltran, 2001).

This potential confusion between indicators of sustainability and indicators of 'quality provision' (including access and demand) has arisen within various contexts besides the local government context described by Brugmann (1997a and b). The United States Agency for International Development (USAID), for example, has tried to separate these out within a context of health and family planning provision in Africa. The results can be subtle and somewhat confusing. For example, USAID distinguishes between indicators of the 'sustainability of demand' and indicators of 'demand', yet at the same time acknowledges 'there is a great deal of potential overlap between indicators of access, quality and demand and indicators of sustainability' (USAID, undated)!

Given the ambiguities that can arise, it is perhaps not unsurprising that the ability of local stakeholders ('dedicated generalists') to both set and apply indicators to meet the complex issues surrounding sustainability are, to use Brugmann's word, problematic. Even if it were possible to set indicators of SD, Brugmann argues that their usefulness in influencing behaviour would be limited given the other more pressing influences, including legal requirements, that managers and decision-makers face on a regular basis. The result can be inconsistency between SD indicators and other performance indicators, with the former losing out in the struggle (Table 2.6).

Table 2.6 *A comparison of sustainability indicators for Seattle with some of the city's performance indicators*

Parameter used in both 'sustainability' and 'performance'	*Consistent in terms of:* vision	*indicator measurement*
Air quality	✓	✓
Water consumption	✓	
'Open space'	✓	
Volunteering	✓	
Neighbourhood perception (eg safety)	✓	
Unemployment	✓	
Crime	✓	✓
Recycling	✓	
Household income	✓	
Biodiversity		
Equity and justice		

Note: ✓ indicates that the indicator is compatible in its use to gauge both 'sustainability' and 'performance'.

Source: after Brugmann, 1997a

Instead, Brugmann (1997a) suggests that it would better if 'stakeholders would ideally focus on preparing the goals and targets of a strategic plan that has legal standing' rather than taking part in an exercise to get indicators that 'measure sustainability – which in the face of effecting real change takes on a more academic or pedagogical appeal'.

Of course, one could go on to think of indicators in more organic terms than the 'end product' (a 'deliverable' in project parlance) of a public consultation exercise to be applied by managers. We could see the whole process of participation, consensus building and debate as a desirable process in itself, resulting in 'reflective insight and the genuine sharing of ideas', without necessarily arriving at an end point of 'positive and normative definition' (Meppem and Gill, 1998). The role of decision-makers here is to 'facilitate learning and seek leverage points with which to direct progress towards integrated economic, ecological and socio-cultural approaches for all humanity' (Meppem and Gill, 1998).

Indicators of SD could certainly play a role here as useful tools to play out such debates and learning (Acton, 2000), although they cannot by themselves empower people (LGMB, 1995).

> *In the process of their development, indicators do serve to stimulate community visioning and unite different interests, but they cannot single-handedly bring about change.* (Besleme and Mullin, 1997)
>
> *Even if we never use a single indicator the process [of their development] has given us so much.* (Meter, 1999)

This is quite distinct from the use of indicators, such as newspaper readership, to passively measure public participation, for example in the political process or in social programmes (MacGillivray, 1997; Kline, 2000) or indeed participation as a means of getting the indicators. Instead the indicators are in part a product of a vision of SD but at the same time help to define as well as implement it! This logic implies a constant circularity with a starting vision of SD and indicators that in turn generate greater participation and interest in SD, which in turn leads to a new definition of SD and a new set of indicators, etc ad infinitum. Indicators are no longer a neutral end product to aid implementation of a positive and normative definition of SD but exist explicitly as a catalyst for further change. As Kline (2000) puts it, 'they can be a critical element in helping people gain more control over their lives and in ensuring a healthier future for the next generations'.

Seeing sustainability within a learning context rather than a defined target has much to commend it, and it is one emergent fearure of our work in Malta that will be expanded upon in Chapters 4 and 5. Crilly et al (1999), for example, describe how the Sustainable Northern Ireland Project (SNIP) acted as a catalyst to encourage local government officers to think beyond their statutory remit as well as allowing community and pressure groups to expand upon their understanding of SD. The problem is that such increased awareness can lead to frustration if the individuals or groups concerned are unable to do anything about it. It can become learning for learning's sake rather than resulting in desired change. While this has a logic, we have to be careful not to get carried away with despair. Heightening awareness of problems and perspective can be liberating at the level of an individual's life, and may increase the questioning as to how larger-scale change can be brought about.

Summary

This chapter has covered a number of key issues that arise out of the creation and use of indicators as tools to help achieve SD. Criteria for their selection, the number to be selected, the degree (if any) of aggregation, presentation and use are all important and indeed central considerations. However, the last point, use, is perhaps the one that has received the least attention. Projects geared to generating SD indicators tend to become myopically focused on technical issues (what indicators, how many, how to aggregate, etc) rather than really consider usage to bring about change. The result is a substantial literature that deals with methodological issues, but with little to say on how, or even if, the indicators were applied to help improve the quality of people's lives. The assumption is that they do, but where is the proof? Various negative comments to the contrary (eg Brugmann, 1997a and b; Kasemir et al, 1999; Jesinghaus, 2000; Rigby et al, 2000) must engender some cynicism about the whole process of generating indicators in order to bring about SD. Their use in a community learning sense may have an appeal (Meppem and Gill, 1998), but could ultimately result in frustration if these groups cannot actually bring about change at larger scales; nothing prevents them making changes to their own lives. Having said that, making someone aware of their problems may be a good first step to initiating change. It's not a bad place to begin!

In the following two chapters, the development and use of indicators of SD will be explored in the context of a project that both authors have worked on over a period of two years. The project was based in Malta and drew, in part, upon much of the foregoing discussion. The reader will be able to see numerous points in the Malta project where we took a particular direction when alternatives were available. We have explained our rationale behind such choices, but as we hope the reader would have seen from Chapters 1 and 2, there is no universally defined set of rules and methods in SD; much is left to personal opinion, and that is framed by a host of factors including culture, experience and livelihood.

MEASURING SUSTAINABILITY
LEARNING by DOING

Simon Bell and Stephen Morse

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