4. A REVIEW OF EXISTING SUSTAINABILITY ASSESSMENT SYSTEMS AND INDICATORS

Behind the formulation of any system of indicators lies some implicit or explicit model of (1) what matters, and (2) the way the world works[127]

4.1.   Sub Problem Three and Hypothesis Three

Sub problem: What are the key features of existing sustainable development, sustainability and development assessment systems and frameworks?

Hypothesis: Existing sustainable development, sustainability and development assessment systems and frameworks can inform the development of a specification for an assessment tool that aims to integrate sustainable development into building briefing and design processes.

4.1.1. Introduction

As there is still no precise definition for sustainable development it is difficult to develop a comprehensive and complete assessment system. There is however general agreement on the broad path (sustainable development) that leads towards sustainability and a wide range of indicators have been developed to assess progress down this path.

This chapter will critically review a range of different assessment systems and indicators that have been developed to measure sustainable development progress. This critical review will be undertaken in three parts. An initial section will review international initiatives to develop sustainable development indicator systems. This will be followed by a review of national, local and project indicators systems. This will review initiatives by the United Kingdom and South Africa to develop national sustainable development indicator systems. It will also describe systems developed by non-governmental organisations to assess progress within particular areas, such as the contribution of community to sustainable development. In addition it will review a widely used procedure called the Log frame for development projects. This will be followed by a review of a number of established building environmental impact assessment systems.

The review of assessment systems is carried out to provide an understanding of how these work and inform how an assessment tool should be developed. This will provide a useful input for developing a specification for an assessment tool in the Chapter five. It is also important to review existing building assessment systems in the light of the understanding about the sustainability and sustainable development developed by the study.

4.1.2. International Indicator Systems

There has been a shift in emphasis internationally in the way development is measured. In the past this has had a strong emphasis on economics and used measures such as gross national income, gross national income per capita and gross domestic product.[128] Increasingly, this is moving to systems that include a wider range of measurements and include social and environmental indicators. The UN and a number of non-governmental organisations have identified this type of reporting as crucial to implementing sustainable development effectively.

Agenda 21 Working Indicators[129]

An early initiative on sustainable development reporting is the Agenda 21 set of working indicators. These include three sets of indicators (driving force, state and response) that describe different aspects of the theme described in each of the Agenda 21 chapters. The driving force indicator describes factors that make an impact on sustainable development; the state indicators reflects the current status of aspects within the theme and the response indicators provides a description of the level of response being developed by the country to address this.[130] A table showing these indicators is included in Appendix six.

These indicators have been developed, and their implementation supported, through the Commission on Sustainable Development (CSD), a body set up by the UN to support monitoring of progress on Agenda 21 issues.[131] One of the objectives of this body is to assist countries develop their own 'country reports' which report on progress towards achieving the objectives listed in Agenda 21.[132] These country reports are provided at five yearly intervals, with the last one due in time for the World Summit on Sustainable Development held in 2002.

CSD Theme Indicator Framework[133]

In addition to the working list of indicators the CSD has also developed an indicator framework organised by theme. The organization of these indicators is similar to the system used for in the UK's Strategy for Sustainable Development.[134] The CSD framework is included in Appendix seven of the study.

Both the UK and South Africa have developed 'country reports' in the format required by the UN. However neither country are using this to develop and implement programmes to support sustainable development and have instead produced their own systems.

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[127] World Bank. 1996
[128] http://www.worldbank.org/data/wdi2002/tables/table1-1.pdf 02/01/03 09:37
[129] http://www.un.org/esa/sustdev/indisd/english/worklist.htm 02/01/03 10:36
[130] The structure of the indicator framework is explained in full at http://www.un.org/esa/sustdeve/indi6.htm 02/01/03 10:36
[131] http://www.un.org/esa/sustdev/csdgen.htm 02/01/03 10:40
[132] http://www.un.org/esa/agenda21/natlinfo/ 02/01/03 10:45
[133] http://www.un.org/esa/sustdev/indisd/isdms2001/table_4.htm 08:47 02/01/03 08:47
[134] http://www.sustainable-development.gov.uk/uk_strategy/quality/lifehtm 18/11/02 09:45

This suggests that the structure and indicators required for Agenda 21 are not considered appropriate for implementing national programmes. This may be because the framework is too complex (there are two many chapters) and that the structure and indicators do not reflect local priorities. For instance, South Africa reported that the indicators used in the UN country report were biased towards developed countries:

…Generally one could argue that the list of indicators reflect a developed world perspective and that it does not yet sufficiently incorporate appropriate indicators for less developed countries and countries in transition.[135]

The evolution of indicator types and formats developed by the CSD as well as their use by countries suggest that simpler, clearly linked sets of indicators tend to work better. It also suggests that while the base set of indicators and format provided are useful for international comparability it is important to ensure that enough flexibility in indicators systems and assessment should be designed in to enable local priorities to be expressed. This is an important concept that will be explored further in the development of the specification of the assessment system in Chapter five.

The International Institute for Sustainable Development (IISD)[136]

The IISD is a Canadian based non-governmental organisation that has, as a strategic aim, the development of indicators that measure progress towards sustainable development.[137] The IISD have been influential in guiding the design of sustainable development indicators systems through the Bellagio Principles for Assessment.[138] These were conceived in 1996 by the IISD in collaboration with a range of measurement practitioners and researchers. These principles guide the assessment of sustainable development progress and are listed below:

1. **Guiding vision and goals:** Assessment towards sustainable development should:
- be guided by a clear vision of sustainable development and goals that define that vision.

2. **Holistic perspective:** Assessment of progress towards sustainable development should:
- Include review of the whole system as well as its parts
- Consider the well being of social, ecological, and economic sub-systems, their state as well as the direction and rate of change of that state, of their component parts, and the interaction between parts.

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[135] http://www.un.org/esa/sustdev/indi4za.htm 02/01/03 10:35
[136] http://www.iisd.ca/measure/faqcriteria.htm 02/01/03 10:35
[137] www.iisd.org/about 02/01/03 10:36
[138] http://www.iisd.org/measure/2.htm 02/01/03 10:36

- Consider both positive and negative consequences of human activities, in a way that reflects the costs and benefits for human and ecological systems in monetary and non-monetary terms.

3. **Essential elements:** Assessment of progress towards sustainable development should:

- Consider equity and disparity within current population and between present and future generations, dealing with such concerns as resource use, over-consumption and poverty, human rights, and access to services, as appropriate.
- Consider the ecological conditions on which life depends'
- Consider economic development and other, non-market activities that contribute to human/social well-being,

4. **Adequate scope:** Assessment of progress towards sustainable development should:

- Adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short term decision-making.
- Define space of study large enough to include not only local but also long distance impacts on people and ecosystems
- Building on historic and current conditions to anticipate future conditions- where we want to go, where we could go

5. **Practical focus:** Assessment of progress towards sustainable development should be abased on:

- An explicit set of categories or an organising framework that links vision and goals to indicators and assessment criteria.
- A limited number of key issues for analysis
- A limited number of indicators or indicator combinations to provide a clearer signal of progress.
- Standardisation measurement wherever possible to permit comparison
- Comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate

6. **Openness:** Assessment of progress towards sustainable development should:

- Make methods and data that are used accessible to all
- Make explicit all judgement, assumptions and uncertainties in data and interpretations

7. **Effective communication:** Assessment of progress towards sustainable development should:

- Be designed to address the needs of the audience and set of users

- Draw from indicators and other tools that are stimulating and serve to engage decision-makers
- Aim, from the outset for simplicity in structure and use of clear and plain language.

8. **Broad participation:** Assessment of progress towards sustainable development should:

- Obtain broad representation of key grass-roots, professional, technical and social groups, including youth, women, and indigenous people- to ensure recognition diverse and changing values.
- Ensure the participation of decision makers to secure a firm linked to adopted policies and resulting action

9. **Ongoing assessment:** Assessment of progress towards sustainable development should:

- Develop a capacity for repeated measurement to determine trends
- Be iterative, adaptive, and responsive to change and uncertainty because systems are complex and change frequently
- Adjust goals, frameworks, and indicators as new insights are gained
- Promote development of collective learning and feedback to decision-making

10. **Institutional capacity:** Assessment of progress towards sustainable development should be assured by:

- Clearly assigning responsibility and providing ongoing support in decision making process
- Providing institutional capacity for data collection, maintenance, and documentation
- Supporting development of local assessment capacity.

The IISD argues that developing a conceptual framework for guiding the assessment process is important as this enables indicators to emerge and be adapted to suit local circumstances by decision-makers.[139] They suggest that this framework should be hierarchical and extend from broad sets of data to detailed measures.

The IISD also make a range of suggestions for the selection of indicators and have developed a compendium of sustainable development indicators.[140] The selection of indicators, they suggest, depends on perspective and usefulness in planning for sustainable development:

What is a good or bad measure tends to vary with one's Weltanschauung or worldview, including such factors as level of education, cultural background, economic status, political

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[139] Hardi and Zardi. 1997. p. 10
[140] http://www.iisd.org/measure/compinfo.htm

affiliation, gender, and so on. Selection criteria are guidelines that one creatively applies to establish a preference for the "best" indicators that fit the needs and circumstances of a given region, institution, and at the same time enhance adaptive planning capacity for sustainable development. At a time of increasing globalisation they should help create a minimum level of comparability, coherence and consistency between measures, and, perhaps more importantly, between ways these measures are applied in real-life situations.[141]

The criteria for the selection of sustainability indicators developed by the IISD are as follows:

- **Policy relevance:** Can the indicator be associated with one or several issues around which key policies are formulated? Sustainability indicators are intended for audiences to improve the outcome of decision-making on levels ranging from individuals to the entire biosphere. Unless the indicator can be linked by readers to critical decisions and policies, it is unlikely to motivate action.

- **Simplicity:** Can the information be presented in an easily understandable, appealing way to the target audience? Even complex issues and calculations should eventually yield clearly presentable information that the public understands.

- **Validity:** Is the indicator a true reflection of the facts? Was the data collected using scientifically defensible measurement techniques? Is the indicator verifiable and reproducible? Methodological rigor is needed to make the data credible for both experts and laypeople.

- **Time-series data:** Is time-series data available, reflecting the trend of the indicator over time? If based on only one or two data points, it is not possible to visualize the direction the community may be going in the near future.

- **Availability of affordable data:** Is good quality data available at a reasonable cost or is it feasible to initiate a monitoring process that will make it available in the future? Information tends to cost money, or at least time and effort from many volunteers.

- **Ability to aggregate information:** Is the indicator about a very narrow or broader sustainability issue? The list of potential sustainability indicators is endless. For practical reasons, indicators that aggregate information on broader issues should be preferred. For example, forest canopy temperature is a useful indicator of forest health and is preferable to measuring many other potential indicators to come to the same conclusion.

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[141] http://iisd.ca/measure/faqcriteria.htm 19/12/02 09:20,

- **Sensitivity:** Can the indicator detect a small change in the system? We need to determine beforehand if small or large changes are relevant for monitoring.

- **Reliability:** Will you arrive at the same result if you make two or more measurements of the same indicator? Would two different researchers arrive at the same conclusions?

The IISD also provide a range of ways that measures of sustainability can be displayed. They suggest that it is important, particularly, for aggregated indicators, that these can be read quickly and accurately by decision makers. Examples of visual reports provided include the four-sided pyramid, the elliptical cluster, the compass of sustainability and the dashboard of sustainability.[142] The idea that performance should be able to read quickly and in a highly visual way is important and particularly relevant to tools that may be used by lay people and in developing countries. The specification developed in Chapter five for the tool will develop this into a set of specific requirements.

The Global Reporting Initiative

The Global Reporting Initiative (GRI) has developed the Sustainability Reporting Guidelines.[143] The GRI was initiated by the US non-governmental organisational Coalition for the Environmentally Responsible Economies (CERES) and the United Nation's Environment programme (UNEP) with the goal of improving sustainability reporting. The GRI suggest there are strong benefits from reporting on sustainability. These have a particular emphasis on improvements in management and communications and include the following:[144]

Management: Measuring and reporting on past and anticipated performance helps improve management processes. It also helps support the longevity of business by creating a more complete picture of long-term prospects and supporting, in the eyes of customers, its "license to operate". Sustainability reporting also can also support stronger cooperation and communication between sometimes insular and discrete components of an organisation such as finance, marketing, research and development. Reporting may also enable emerging or potential problems and unanticipated opportunities to be discovered early allowing these to be addressed more effectively.

Communication: Reporting is a key aspect of building, sustaining, and continually refining stakeholder engagement. Transparency and open dialogue about sustainability performance and future plans can, it is suggested, bring about trust, and support partnership with a diverse set of groups including investors, community groups and consumers.

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[142] http://iisd.ca/cgsdi/visuals.htm 03/01/03 10:35
[143] http://www.globalreporting.org 03/01/03 10:35
[144] Global Reporting Initiative. 2002 p. 4

The reporting process suggested by GRI places an heavy emphasis on participation and using the reporting process as a way of introducing discussion that leads to actions and changes in behaviour:

The primary goal of reporting is to contribute to ongoing stakeholder dialogue. Reports alone provide very little value if they fail to inform stakeholders or support a dialogue that influences the decisions and behaviour of both the reporting organisation and its stakeholders.[145]

The design of the GRI guidelines aims to be flexible. An example of this is the inclusion of two sets of indicators: a core set and an additional set.[146] Core indicators are those that are relevant to most reporting organisations and of interest to most stakeholders, while additional indicators may include areas only reported on by a few organisations but may be deemed to be worthy of further testing in order to be included as future core indicators. The guidelines aim to support growth and change within the field of sustainability reporting. They are designed to be used by both experienced organisations and those new to sustainability reporting. The reporting format allows organisations to progress from developing informal reports to rigorous 'in accordance' reports which comply with GRI standards.[147] This is a useful concept that should, if possible, be incorporated in the specification of the tool in Chapter five. In a developing country it is likely that there will be a wide range of potential users for a tool. Versatility and flexibility would therefore be useful attributes in a building assessment tool.

The GRI guidelines provide a description of the principles that should be applied to developing sustainability reports. These principles are as follows:

Transparency: Full disclosure of the processes, procedures, and assumptions in report preparation are essential to its credibility

Inclusiveness: The reporting organisation should systematically engage its stakeholders to help focus and continually enhance the quality of its reports.

Auditability: Reported data and information should be recorded, compiled, analysed, and disclosed in a way that would enable internal auditors or external assurance agent's providers to attest to its reliability.

Completeness: All information that is material to user for assessing the reporting organisation's economic, environmental, and social performance should appear in the report in a manner consistent with the declared boundaries, scope, and time period.

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[145] Global Reporting Initiative. 2002. p. 9
[146] Global Reporting Initiative. 2002. p. 12
[147] Global Reporting Initiative. 2002. p. 13

Relevance: relevant is the degree of importance assigned to a particular aspect, indicator, or piece of information and represents the threshold at which information becomes significant enough to be reported.

Sustainability context: The reporting organisation should seek to place its performance in the larger context of ecological, social and economic or other limits or constraints, where such contexts add significant meaning to the reported information.

Accuracy: The accuracy principle refers to achieving the degree of exactness and low margin of error in reported information necessary for users to make decisions with a high degree of confidence

Neutrality: Reports should avoid bias in selection and presentation of information and should strive to provide a balanced account of the reporting organisation's performance

Comparability: The reporting organisation should maintain consistency in the boundary and scope of its reports, disclose any changes and re-state previously reported information

Clarity: The reporting organisation should remain cognisant of the diverse needs and backgrounds of its stakeholder groups and should make information available in a manner that is responsive to the maximum number of users while still maintaining a suitable level of detail.

Timeliness: Reports should provide information on a regular schedule that meets user needs and comports with the nation of the information itself.

4.1.3. Human Development Report

The Human Development Report is developed by the United Nations Development Programme (UNDP) and produced annually. The report includes reports on progress in terms of the Human Development Index (HDI), a composite measure of human development. The HDI is designed to capture three basic dimensions of human development – longevity, knowledge, and a decent standard of living. It is measured by life expectancy, educational attainment (adult literacy and combined primary, secondary and tertiary enrolment) and adjusted income per capita in purchasing power parity (PPP) in US dollars. The reason for developing the HDI is explained in the following way:

To capture the attention of policy makers, media and NGOs and to draw their attention away from the more usual economic statistics to focus instead on human outcomes, not economic

data. The HDI was created to re-emphasize that people and their lives should be the ultimate criteria for assessing the development of a country, not economic growth.[148]

Since the development of this index a number of variations of this have been developed to address perceived shortcomings in the HDI. These include HPI -1, which aims to measure poverty in developing countries and includes measures for adult literacy and people not using improved water source, HPI-2 which includes an assessment of social exclusion, GDI which aims to capture inequalities in gender and GEM which assesses the extent to which women take an active role in economic and political life.[149]

These indicators are important to acknowledge in the study as they provide widely accepted measures of human development. There is a clear overlap between these measures and indicators of social sustainable development. Of interest to the study are the specific criteria assessed (such as education attainment, income and gender equity) and the way these are agglomerated into indexes. The implication for the specification developed in Chapter five are that it may be important to investigate how buildings and construction can support human development (as defined in the Human Development Index) and that the agglomeration methodology used to develop the HDI may inform the assessment criteria and reporting approach applied.

4.1.4. The Genuine Progress Report[150]

Redefining Progress, a US based non-governmental organisation, developed the Genuine Progress Report. This is based on an indicator called the Genuine Progress Indicator (GPI), which aims to reflect the national health of a country in economic terms. The Genuine Progress Indicator starts with the personal consumption component of Gross Domestic Product (GDP) and adds and subtracts a range of benefits and costs ignored by the GDP.

Costs subtracted include:

Economic costs

- Adjustment for unequal income distribution
- Net foreign borrowing
- Cost of consumer durables
- Social costs
- Cost of crime
- Costs of automobile accidents
- Costs of commuting

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[148] http://www.undp.org/hdr2002/faq.html#2 03/01/03 10:35
[149] http://www.undp.org/hdr2002/faq.html#1 03/01/03 10:35
[150] http://www.rprogress.org/project/gpi1999.pdf 19/12/02 09:45

- Cost of family breakdown
- Loss of leisure time
- Cost of underemployment

Environmental costs:

- Cost of household pollution abatement
- Cost of water pollution
- Cost of air pollution
- Cost of noise pollution
- Loss of wetlands
- Loss of farmlands
- Depletion of non-renewable resources
- Cost of long-term environmental damage
- Cost of ozone depletion
- Loss of old-growth forests

Benefits added include:

- Value of housework and parenting
- Value of volunteer work
- Services of consumer durables
- Services of highways and streets
- Net capital investment

Redefining Progress argue that conventional economic indicators do not reflect actual progress as this ignores environmental costs and actually counts the depletion and degradation of resources as income rather than asset depreciation. Another indicator supported by Redefining Progress is the ecological footprint.

Ecological footprint[151]
Ecological footprints are an indicator of the amount of the world's biological productive capacity that an individual or a country uses per year. It is calculated by measuring the amount of biologically productive land and water areas required to produce resources consumed, and to assimilate waste generated, using prevailing technology.

In a report titled 'The Ecological Footprint of Nations' Redefining Progress publishes ecological footprint and ecological capacity information of countries.[152] This report shows that

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[151] http://www.earthday.net/footprint/index.asp# 19/12/02 09:45
[152] Wackernagel, Mofreda and Deumling. 2002

already man's consumption and waste production (the ecological footprint) exceeds the Earth's capacity to create new resources and absorb waste (the carrying capacity). It also shows which countries exist within their carrying capacity, by calculating the country's ecological footprint and subtracting this from its bio capacity in order to get a domestic ecological deficit or remainder. The report shows that South Africa is living beyond its bio capacity by 1.6 ha per person whereas many other developing countries such as Zambia, Sudan, Senegal exist within their bio capacity.

This is relevant to the study as it provides insight into the development of progress indicators. The Genuine Progress Report indicates that it is important to describe what is constituted as progress and then ensure that all factors affecting this are strictly defined in terms of whether they contribute to, or detract from, this. Adding and subtracting these factors then provides an accurate picture of progress.

It also draws attention to the fact that sustainability is often defined in terms of balance, in this case, a balance between ecological footprint and carrying capacity. This is an important concept to address in the development of the specification. The assessment tool must be able to assess the contribution of buildings and construction to both sides of the sustainability equation. Using the concepts referred to by Redefining Progress, the assessment tool must measure the contributions to both the ecological footprint as well as to carrying capacity.

4.1.5. National, Community and Project Indicator Systems

4.1.6. Quality of Life Counts (UK)[153]

The United Kingdom's indicator system was developed in order to measure progress towards sustainable development. It includes broad sustainable development objectives such as maintenance of economic growth, social progress, effective protection of the environment and prudent use of resources. Each of these broad strategies is broken down into specific objectives linked to policies and specific actions by particular groups. These objectives have associated indicators and are designed to encourage action from individuals, business and local government. The aims of the national set of indicators are described as follows:

- To describe, overall, whether we are achieving sustainable development.[154]
- To highlight key national–scale policy initiatives relevant to sustainable development and to monitor whether we are meeting key targets and commitments in those areas.
- To educate the public about what sustainable development means.
- To raise public and business awareness of particular actions that needs to be taken in order to achieve more sustainable development.
- To report progress to international audiences.

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[153] http://www.sustainable-development.gov.uk/uk_strategy/quality/life/09.htm 18/11/02 09:45

- To help make transparent trade-offs and synergies between sustainable development objectives.

In developing indicators a number of criteria were used to inform the selection of indicators. Each indicator had to comply with following requirements:

- It is an overarching "state of the nation" indicator
- It reflects a key international or national commitment or target
- It supports a key message for individuals or business especially in relation to key actions needed, for example on energy efficiency, health and safety at work, ethical trading etc.
- It is recommended for use in international reporting, for example as proposed by UNSCD.

And the following scientific and technical criteria; indicators should:

- Be representative
- Be scientifically valid
- Be simple and easy to interpret
- Show trends over time
- Give early warning about irreversible trends where possible
- Be sensitive to the changes it is meant to indicate
- Be based on readily available data or be available at reasonable cost
- Be based on date adequately documented and of known quality
- Have a target level or guideline against which to compare it.

There are a number of concepts from this approach that are useful for the study to note. The system is linked to policy and measures progress in achieving policy objectives and ultimately the policy goal. It therefore measures progress along a path that has been *clearly delineated*. The UK government consider the goals of the policy to be too ambitious to be achieved solely by government. This is acknowledged in the formulation of policy and the indicator system, which aims to ensure active involvement of and support by communities and business. An explicit aim of the approach is to ensure that the goal, objectives and indicators are stated very clearly in order to ensure that there is shared understanding and therefore a coherent and integrated move towards sustainable development across many sectors.

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[154] http://www.sustainable-development.gov.uk/uk_strategy/quality/life/09.htm 18/11/02 09:45

National Environment Indicators Programme (South Africa)[155]

The National Environmental Indicator programme is being undertaken by the Department of the Environment and Tourism in South Africa. In order to establish the priority environmental issues for reporting in the State of the Environment report the following was set up:

- A review of policies laws, international agreements and other relevant documentation for possible issues pertaining to environmental sustainability in South Africa
- Setting up a forum (Imbizo workshop) on emerging environmental issues in the global business and industry environment
- Consulting with representatives from key stakeholders through a workshop
- Eliciting public opinion on key national and local environmental issues in South Africa through the Human Sciences Research Council (HSRC) ' Evaluation of the Population ' Study.

This lead to the following criteria being established for indicators:

- The indicator must be based on good quality data that are available at a reasonable cost.
- The indicator should provide information that measures something that is important to decision makers.
- The information can be presented in a way that is easily understood and appealing to the target audience.
- The indicator must relate to goals, targets or objectives.
- The indicator must provide timely information (to allow for response).
- The indicator must be able to detect small changes in the system.
- The indicator must be relevant to policy and management needs within the South African context. The indicator must therefore be associated with one or several environmental policy issues.
- The indicator must be based on data that are accurate, reliable, statistically sound and scientifically valid. Metadata should define the quality of the data in the data set and include information on sensitivity, uncertainty, variability, precision, accuracy and error.
- The data must be available and accessible, particularly in the long term.
- The indicator must be based on data of the correct spatial and temporal extent. Sufficient historical data must be available to identify trends over time.
- The data collection process should have minimal environmental impact.

These criteria are similar in many ways to the criteria used in the UK policy. It is however unclear whether these criteria have been strictly applied. For instance in Chapter two it was

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[155] http://www.environment.gov.za/soer/indicator/neip_pr.htm 19/12/02 11:35

noted that the indicators used in the South Africa's State of the Environment report did not appear to be linked with specific policies. A criticism made in Chapter two was that the State of the Environment report had a limited number of social and economic indicators. The report and indicators, it is therefore suggested, are of limited value to the study.

Sustainable Measures

Sustainable Measures is a private consulting firm that have been working in the evaluation and monitoring of sustainability in the USA. They describe characteristics of effective indicators as follows:

An indicator is something that points to an issue or condition. Its purpose is to show you how well a system is working. If there is a problem, an indicator can help you determine what direction to take to address the issue. Indicators are as varied as the types of systems they monitor. However, there are certain characteristics that effective indicators have in common:

- *Effective indicators are **relevant**; they show you something about the system that you need to know.*
- *Effective indicators are **easy to understand**, even by people who are not experts.*
- *Effective indicators are **reliable**; you can trust the information that the indicator is providing.*
- *Lastly, effective indicators are based on **accessible data**; the information is available or can be gathered while there is still time to act.* [156]

In particular Sustainable Measures works with communities and have developed a large database of indicators for sustainability in communities.[157] These indicators are rated by being reviewed against a set of criteria. These criteria are posed as questions and are as follows:

1. Does the indicator address the carrying capacity of the natural resources - renewable and non-renewable, local and non-local - that the community relies on? [158]
2. Does the indicator address the carrying capacity of the ecosystem services upon which the community relies, whether local, global, or from distant sources?
3. Does the indicator address the carrying capacity of aesthetic qualities - the beauty and life-affirming qualities of nature - that are important to the community?
4. Does the indicator address the carrying capacity of the community's human capital - the skills, abilities, health and education of people in the community?
5. Does the indicator address the carrying capacity of a community's social capital - the connections between people in a community: the relationships of friends, families,

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[156] http://www.sustainablemeasures.com/Database/index.html 19/12/02 11:35
[157] http://www.sustainablemeasures.com/Database/index.html 19/12/02 11:35
[158] http://www.sustainablemeasures.com/Database/index.html 19/12/02 11:35

neighbourhoods, social groups, businesses, governments and their ability to cooperate, work together and interact in positive, meaningful ways?

6. Does the indicator address the carrying capacity of a community's built capital - the human-made materials (buildings, parks, playgrounds, infrastructure, and information) that are needed for quality of life and the community's ability to maintain and enhance those materials with existing resources?

7. Does the indicator provide a long-term view of the community?

8. Does the indicator address the issue of economic, social or biological diversity in the community?

9. Does the question address the issue of equity or fairness - either between current community residents (intra-generational equity) or between current and future residents (inter-generational equity)?

10. Is the indicator understandable to and useable by its intended audience?

11. Does the indicator measure a link between economy and environment?

12. Does the indicator measure a link between environment and society?

13. Does the indicator measure a link between society and economy?

14. Does the indicator measure sustainability that is at the expense of another community or at the expense of global sustainability?

The approach developed by Sustainable Measures is useful to the study for the following reasons. The approach attempts to measure difficult-to-assess aspects of sustainability such as human and social capital. These are new measurement domains and it is important to understand this area as buildings and construction may be expected in the future to contribute to social and human capital in order to support sustainable development. This will be explored further in Chapter five.

4.1.7. Log frame[159]

The log frame is a project design and monitoring methodology used widely by development agencies such as the World Bank and donor organisations such as the Department for International Development (DFID) for development projects. In the planning stages project designers and stakeholders can use this tool to:

- Set proper objectives[160]
- Define indicators of success
- Identify key activity clusters (project components)
- Define critical assumptions on which the project is based
- Identify means of verifying project accomplishments
- Defined resources required for implementation

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[159] http://www.worldbank.org/html/opr/pmi/urban/urban002.html 8/11/02 13:43
[160] http://www.worldbank.org/html/opr/pmi/urban/urban002.html 8/11/02 13:43

It does this through the use of a 4x4 matrix, with a hierarchy of objectives, indicators of performance, means of verifying performance and list of assumptions and risks. An example of a log frame is provided below.

Table Four: A Log Frame[161]

Project Structure	Indicators of Achievement	Means of Verification	Important Risks and Assumptions
Goal What are the wider objectives which the activity will help achieve? Longer term programme impact	What are the quantitative measures or qualitative judgements, whether these broad objectives have been achieved?	What sources of information exist or can be provided to allow the goal to be measured?	What external factors are necessary to sustain the objectives in the long run?
Purpose What are the intended immediate effects of the programme or project, what are the benefits, to whom? What improvements or changes will the programme or project bring about? The essential motivation for undertaking the programme or project.	What are the quantitative measures or qualitative judgements, by which achievement of the purpose can be judged?	What sources of information exist or can be provided to allow the achievement of the purpose to be measured?	What external factors are necessary if the purpose is to contribute to achievement of the goal?
Outputs What outputs (deliverables) are to be produced in order to achieve the purpose?	What kind and quality of outputs and by when will they be produced? (QQT: Quantity, Quality, Time)	What are the sources of information to verify the achievement of the outputs?	What are the factors not in control of the project which are liable to restrict the outputs achieving the purpose?
Activities What activities must be achieved to accomplish the outputs?	What kind and quality of activities and by when will they be produced?	What are the sources of information to verify the achievement of the activities?	What factors will restrict the activities from creating the outputs?

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[161] http://62.189.42.51/DFIDstage/FOI/tools/chapter_05.htm 9/12/02 11:35

It is suggested that the log frame should be developed and agreed by all stakeholders involved in the development, ideally in a workshop situation.[162] This process, it is argued, enables the following to be achieved:

- Stakeholder consensus[163]
- Organised thinking
- Activities and investment linked to expected result
- Performance indicators to be set
- Responsibilities to be allocated
- Communication to be developed that is concise and unambiguously to all key stakeholders

Indicators

The use of indicators is an important part of the log frame approach and these are important as they:

- Specify realistic targets (minimum or otherwise) for measuring or judging if the objectives at each level have been achieved[164]
- Provide the basis for monitoring; review and evaluation so feeding back into the management of programme/project implement and into less learning planning for other subsequent projects
- Contribute to transparency and develop consensus on the overall objectives, log frame and plan

Log frame indicators are divided into product and process indicators. Product indicators measure what is produced, while process indicators assess the means used to deliver the product. Process indicators are increasingly used as these are seen as more appropriate for development projects as they generally lead to better targeting of real problem, better implementation and improved sustainability.[165] It is suggested however that while product indicators generally can be quantified, it may be difficult to carry this out for process indicators, which may need to include qualitative aspects. DFID suggests that ideally a mix of quantitative and qualitative indicators should be used to develop an accurate picture of the impact of a development project. Examples of indicators they provide include:

Quantitative indicators

- The frequency of meetings, the number of people involved

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[162] Box 5.5, http://62.189.42.51/DFIDstage/FOI/tools/chapter_05.htm 9/12/02 11:35
[163] Box 5.2, http://62.189.42.51/DFIDstage/FOI/tools/chapter_05.htm 9/12/02 11:35
[164] http://www.worldbank.org/html/opr/pmi/urban/urban002.html 8/11/02 13:43
[165] http://62.189.42.51/DFIDstage/FOI/tools/chapter_05.htm 9/12/02 11:35

- Growth rates
- Climate data
- Yields, prices
- The uptake of activity inputs e.g. loans, school enrolment, seeds, visits to the clinic

Qualitative indicators

- The level of participation of a stakeholder group[166]
- Stakeholder / consumer opinions; satisfaction
- Aesthetic judgements; e.g. taste, texture, colour, size, shape, marketability
- Decision-making ability
- Attitudinal change
- The emergence of leadership
- The ability to self-monitor
- The development of groups and of solidarity
- Behavioural changes
- Evidence of consensus

An example of a completed log frame including indicators can be found in Appendix nine. The approach taken to indicators by the World Bank has a stronger emphasis on performance indicators. They suggest these can be used in a range of ways to improve performance. Example of uses of performance indicators given include:[167]

Strategic planning: It is suggested that performance indicators forces greater consideration of critical assumption that underlie a program's relationships and causal paths. They also help clarify the objectives and logic of the program.

Performance accounting: Performance indicators can help inform resources allocations if they are used to direct allocations to the most successful activities and thereby promote the most efficient use of resources

Forecasting and early warning: Performance indicators can help point toward future performances, enabling areas needing improvement to be addressed.

Measuring programme results: Performance indicators can measure what has been achieved relative to objectives rather than just what has been completed, improving accountability.

[166] http://62.189.42.51/DFIDstage/FOI/tools/chapter_05.htm 9/12/02 11:35
[167] http://www.worldbank.org/html/opr/pmi/urban/urban002.html 8/11/02 13:43

Program marketing and public relations: Performance indicators can be used to demonstrate program results and thus the value to an external audience.

Benchmarking: Performance indicators can generate data against which to measure other programs and projects enabling learning and good practice to be shared.

Quality Management: Performance indicators can be used to measure customer (beneficiary) satisfaction and thereby assess whether and how a program is improving their lives.

For the purposes of the World Bank performance indicators are most useful at specific project stages. These they define as project design (strategic planning), project supervision (forecasting results) and project evaluation (measuring results and quality management) stages. Indicators are seen as a means of measuring the flow of change and are used as part of process that includes a baseline assessment (the values of performance indicators at the beginning of the project) and targets, which are the values at the end.[168] To tie in with the log frame format the World Bank identify a range of different types of indicators designed to measure different variables within a project such as objective, impact, outcome, output and input. These are described below:

Results indicators: These measure project results relative to project objectives.

Inputs indicators: These measure the resources provided for a project's activities and could include: funding, human resources, training, equipment, materials and supplies or recurrent costs of these items.

Outputs indicators measure the goods and services created or provided through the use of inputs and could include: clients vaccinated, farmers visited, miles of road built, pollution control measures installed or incentives or regulations enforce.

Outcome and Impact Indicators: These measure the quantity and quality of the results achieved through the provision of good and services and could include: reduced incidence of disease, improved farming practices, increased vehicle use, increased rural supple and consumption of electricity and reduced mortality or lower health costs.

Relevance Indicators: These aim to capture the impact on higher order objectives such as national or sectoral objectives. These could include: improved national health as measured by health indicators, increased farm profits and reduced food costs, reduced transportation costs

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[168] http://www.worldbank.org/html/opr/pmi/urban/urban002.html 8/11/02 13:43

and expanded economic development and improved economic growth and consumer well-being.

Risk indicators: These measure the status of external factors identified as critical risks and enabling factors. Thus these indicators should indicate whether the right conditions are in place for the project to be a success if embarked on.

Efficacy indicators: These show how well result from one level of project implementation have been translated into results at the next level, thus these indicators would measure the efficiency of inputs, effectiveness of project outputs and sustainability of project impact.

Efficiency Indicators: These usually represent the ratio of outputs per unit of project outcome or impact, these could include: number of vaccination administered per unit decline in morbidity rate, or number of farmers visited per measured change in farm practices or, miles of road built per unit increase in vehicle use

Sustainability Indicators: these represent the persistence of project benefits over time, particularly after project funding ends. These could include:

- Disease incidence trends after external funding for a vaccination project ends.
- Persistence of changed farming practices after extension visits are completed
- Maintenance and use of roads after highway construction ends
- Persistence of institutions (programs, organisations, relations and so on) created to deliver project benefits

Criteria are also provided for the selection and development of indicators. These criteria include the following aspects:

Relevance: the indicators selected must be relevant to the basic sectoral development objectives and, if possible to overall country objectives.

Selectivity: There should be no more than a dozen indicators, with at least half of these designed to measure project impact against each of the major development objective

Practicality of indicators, ownership: stakeholders should develop indicators jointly during a participatory project planning process. Thought should also be given to the design and capture of indicators and this should be addressed in the design of programs.

Intermediate and leading indicators: It may be necessary to have early pointers of development impact in order to indicate progress towards achieving program objectives.

Advantages of the log frame approach

The World Banks lists the following advantages of the logframe approach:

- Ensures fundamental questions are asked and weaknesses are analyses in order to provide decision makers with better and more relevant information[169]
- Guides systematic and logical analysis of the interrelated elements that constitute a well-designed project
- Improves planning by highlighting linkages technology, and effects on the environment
- Facilitates common understanding and better communication between decision makers managers and other parties involved in the project

The approach developed through the log frame is relevant to the study in a number of ways. The log frame has been specifically designed to support development projects. This is relevant to the study because if buildings and construction projects are expected to support sustainable development they may be expected to support beneficial development within an area. There are two particular aspects from the log frame approach that, it is suggested, should inform the development of the specification of the tool in Chapter five.

The first is the assertion that development projects require a participatory approach and full buy-in of the communities that they affect. The second is the acknowledgement, and measurement of, a wide set of impacts and implications that may be associated with development projects. These include the use of qualitative indicators and the development of a life cycle approach, which, for instance, recognizes maintenance implications early on in the development of projects.

4.1.8. Building Environmental Performance Assessment Tools

This section reviews building assessment systems. The assessment systems reviewed assess the environmental impact of buildings. Systems reviewed include BREEAM, LEED, and the GBtool.

Each assessment system will be described under the following headings.

- **Introduction:** this will provide a background to the tool.
- **Aims of the tool:** this will describe the objectives set for the tool by its authors.
- **Aspects assessed:** this will include a list and description of the aspects assessed in buildings by the tool will be given.
- **Assessment process:** this will describe, as far as can be ascertained from the literature, the suggested method(s) for assessing buildings.

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[169] http://www.worldbank.org/html/opr/pmi/contents.html 18/11/02 09:45

- **Discussion:** this will review the tool in order to understand limitations and potential to contribute to the study.

The tools are compared and discussed later in chapter in section 4.2.

4.1.9. BREEAM

Introduction

The Building Research Establishment (BRE) in the UK developed BREEAM (Building Research Establishment Environmental Rating Method) in 1990. The system has had a significant impact on commercial buildings in the UK and it is estimated that 25% of new office buildings are assessed using the system. Since 1990 the Building Research Establishment have gone on to develop a range of different systems and guidelines aiming to minimise the environmental impact of buildings. They have also updated the original BREEAM system and increased the range of building types that this covers. There is a BREEAM for offices and housing and versions of BREEAM are being developed for Hong Kong and Canada.

The BREEAM assessed here is 'BREEAM 98 for Offices', published in 1998. In updating BREEAM the authors suggest that the tool reflects a change in environmental related policy. The main shift, they suggest is that environmental issues have become a component of a much broader sustainable development movement.[170] The key aims of sustainable development described by the tool are the same as those provided by the Department of the Environment in the UK and are:

- Social progress which meets the needs of everyone
- Effective protection of the environment
- Prudent use of resources
- Maintenance of high and stable levels of growth and employment (DoE1996)

To reflect the shift to sustainability the authors state that BREEAM 98 addresses environmental impacts of buildings, prudent use of natural resources, and quality of life.

Aims of the Tool

BREEAM aims to provide guidance on how to minimise the negative environmental impacts of buildings while ensuring that these provide comfortable and healthy indoor environments.[171] It specifically sets itself the following objectives:

- To distinguish buildings of reduced environmental impact in the market place[172]
- To encourage best environmental practice in building design, operation, management and maintenance.

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[170] Baldwin, Yates, Howard and Rao. 1998. p.4
[171] Baldwin, Yates, Howard and Rao. 19981998. p.1

- To set criteria and standards going beyond those required by laws and regulations
- To raise the awareness of owners, occupants, designers and operators of buildings with reduced impact on the environment

Aspects Assessed

The tool awards points for meeting or surpassing a set of performance criteria. The set of criteria are listed under the following headings:

- Management
- Health & Comfort
- Energy
- Transport
- Water
- Materials
- Land use
- Site ecology
- Pollution

Each of these headings contains specific criteria, such as, under 'Health and Comfort';

"…at least 30% of windows to office are openable. This should have an even distribution around the office area".[173]

Each of these criteria that are weighted differentially through a point system with some criteria allocated a large number of points, for instance thirty, and others a far lower number, for instance six. These weighting were achieved through what BRE call 'consensus based weighting', which reflects a consensus in the weighting of the importance of the different criteria amongst a range of interest groups including government policymakers, construction professionals, local authorities, material producers and academics. [174]

Assessment process

BREEAM provides two ways that assessment can take place. The first is by working through the assessment prediction checklist provided with the BREEAM documentation. This provides an approximate estimation of the performance. This however is a simplification of the full process, which is undertaken by trained assessors licensed by the BRE.[175]

The assessment system is designed to be able to assess three broad aspects in buildings. These are design and procurement issues, core building issues, and management and

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[172] Baldwin, Yates, Howard and Rao. 1998. 1998. p.1
[173] Baldwin, Yates, Howard and Rao. 1998. 1998. loose A3 sheet
[174] Baldwin, Yates, Howard and Rao. 1998. 1998. p. 8
[175] Baldwin, Yates, Howard and Rao. 1998. 1998. p. 6

operation issues.[176] In this way the system attempts to provide a tool that is able to provide guidance and assessments for buildings through the lifecycle of the building.

Formal certification of buildings requires detailed assessments by trained BRE-licensed assessors. In the appendix of the document are a list of suggested services that assessor can provide. These services include:

- Design consultancy[177]
- Outline design stage guidance meeting
- Detailed design stage guidance meeting
- Formal assessment review
- Final certification
- Review after construction

On completion of an assessment the assessor provides a certificate of environmental performance of the building. These rate the buildings as: 'Excellent', 'Very Good', 'Good' and 'Pass'.

The document however suggests that a formal assessment is only a part of a more comprehensive approach that is required to address environmental impact in buildings. Guidelines for other activities required are given in checklists contained in the appendix of the document.[178]

4.1.10.   LEED

Introduction

The LEED (Leadership in Energy and Environmental Design), Green Building Rating System was developed by the US Green Building Council. The system is being continuously developed. The LEED system can be downloaded at http://www.usgbc.org/. In this study, Version 2, issued in March 2000, is reviewed.

Aims of the System

The aims of LEED are:

- To provide a standard that improves the environmental and economic performance of commercial buildings using established or advanced industry principles, practices, materials and standards

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[176] Baldwin, Yates, Howard and Rao. 1998. 1998. p. 9
[177] Baldwin, Yates, Howard and Rao. 1998. 1998. p. 27
[178] Baldwin, Yates, Howard and Rao. 1998. 1998. p. 33

- To be used by commercial building project stakeholders and project teams as a guide for green and sustainable design

Aspects Assessed

The system makes as assessment under five broad headings. These are:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality

Each of these criteria is described in terms of **Intent**, **Requirement** and **Technologies / Strategies. Intent** describes the reasoning behind the criteria and what this aims to achieve, for instance, 'reduce erosion' on a site. **Requirement** describes what the building must achieve in order to gain a point or points under the rating system. **Technologies/Strategies** provide suggestions as to how compliance with the requirement can be achieved.

The document is unclear as to how the 'Intent' descriptions where developed. The objectives of the tool appear to be very similar to those of BREEAM, namely to minimise the negative impact of buildings on the environment while achieving comfortable and healthy accommodation.

The requirements specify minimal performance requirements that must be achieved. These often refer to other documents and standards. For instance, for standards of indoor air quality the document refers to documentation developed by the Sheet Metal and Air Conditioning National Contractors Association.[179] Similarly, it suggests that a range of Environmental Protection Agency (EPA) documents be consulted in the site selection process, including 'Storm Water Management for Construction', the 'Brownfield Redevelopment Programme' and the 'OSWER Directive'.[180]

Assessment Process

The document does not specify how, when, or by whom, the assessment should be carried out. However it appears likely that the document is used in two ways. The first would be that a client wishing to achieve an environmentally building issues the document as part of a brief to a professional team. The second way is likely to be the use of LEED by a building design team to assess and shape their own designs and to influence clients on environmental issues.

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[179] US Green Building Council. 2000. p.20
[180] US Green Building Council. 2000. p.4-5

The assessment process is carried out by an assessment of whether the requirements set in LEED are achieved. Where these requirements are achieved points are awarded. These points are then added up in a final page and, depending on the total, a level awarded.[181] The levels listed are:

- LEED Certified
- LEED Certified Silver
- LEED Certified Gold
- LEED Certified Platinum

4.1.11. The GBTool

Introduction

The GBTool has been developed to assess the environmental performance of buildings. The tool is part of the Green Buildings Challenge Assessment Framework, which is being developed by an international committee called the International Framework Committee.

The GBTool can be downloaded from the Internet at http://greenbuilding.ca/. The tool consists of templates in the Excel spreadsheet programme and accompanying by two volumes of manuals. The tool reviewed in this study is the GBC 2000 Assessment Manual Volume 1 and Volume 2: Office Buildings and GBTool, issued in April 2000.[182]

Aims of the GBTool and the Green Buildings Process

A number of goals are given for the Green Buildings process.[183] These are:

- To advance the state of the art in building environmental performance assessment methodologies
- To maintain a watching brief on sustainability issues to ascertain their relevance to "green" building in general, and to the content and structuring of building environmental assessment methods in particular.
- Sponsor conferences that promote exchange between the building environmental research communities and building practitioners and showcase the performance assessment of environmentally progressive buildings.
- To develop an internationally accepted generic framework that can be used to compare existing building environmental assessment methods and used by others to produce regionally based industry systems

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[181] US Green Building Council. 2000. p. 25
[182] Cole and Larsson. 2000.
[183] Cole and Larsson. 2000. Volume one. p. 5

- To expand the scope of the GBC Assessment Framework from green buildings to include environmental sustainability issues and to facilitate international comparisons of the environmental performance of buildings.

Aspects Assessed

The assessment tool has a large number of performance criteria. These are organised under the following headings:

- Environmental Sustainability Indicators
- Resource Consumption
- Loadings
- Indoor Environmental Quality
- Quality of Service
- Economics
- Pre-Operations Management

The performance criteria are described in the manual in a similar way to the LEED document. The broad headings used to describe environmental sustainability indicators are: **Intention, Background, Scope**, **Performance Indicator, Units, Data and Source** and **Performance Scale**

The **Intention** provides a description of what aspects the criteria aim to assess. The **Background** provides a context and explains why the specified criteria is important to address. Under **Scope** a description is provided which delineates the extent of the assessment. **Performance Indicator** provides a description of what will be measured, for instance, the 'normalised measure of potable water consumed'. **Units** provide the units of measurement that will be used. In many instances the units provided are normalised. For instance, under 'Net Use of Water' the units provided are m3/kaph, where m3 is the annual consumption of potable water and kaph is the number of thousand annual person hours of occupancy.[184]

Data and Source indicates sources of information required to make an assessment. Finally the **Performance Scale** provides a short table which lists performance measures. The performance measures are generally provided as a performance above a benchmark (such as 120%) or below benchmark. The performance scale allocates points to each of these measures, with performance below benchmark scoring negative points and performance above this, scoring positive points.

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[184] Cole and Larsson. 2000. Volume two. p. 7

Assessment Process

GBTool assessment involves inputting information into the supplied spreadsheets. This information includes occupancy (in terms of numbers of people and hours occupied) and area (in metres square) to enable performance assessments to be normalised. The tool also requires benchmarks to be included for each criterion. Benchmarks included are entered by the user and should reflect the performance within the specified criteria of an average building. Once this information has been entered, a design can be assessed.

Assessments require detailed information about the design and site and often require calculations. In some cases the calculations required are complex and require specialist knowledge or software. For instance the 'Emissions of Gases Leading to Acidification' criteria requires data from software such as Athena or Eco-Quantum or the calculation of an estimate using information such as the total embodied energy of the building and the national or regional emissions for the building industry.[185]

Once this information has been entered the GBTool generates summary graphs for each of performance areas. These indicate building performance relative to a benchmark. The assessment method is complex and it is likely at this stage to be used mainly by technical personnel such as engineers.

There is no formal training or status for the Tool currently. The main users of the tool currently are national teams who form part of the International Framework Committee of the Green Buildings Challenge. These teams use the GBTool to assess building in their country and present the results of these assessments at conferences. These discussions then guide the development of the next stage of the tool.

4.2.   Addressing Hypothesis Three

The hypothesis that existing sustainable development, sustainability and development assessment systems and frameworks can inform the development of a specification for an assessment tool is shown to be true. A review of systems and frameworks provides useful material for the development of the tool. This material can be divided into a set of generic principles that should be applied to sustainability assessment systems and more detailed recommendations that come from a critique of existing building assessment systems. This is described below.

Generic Sustainability Assessment Principles

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[185] Cole and Larsson. 2000. Volume two. p. 37

Indicator Systems Structure: Effective indicator systems need to be developed and used within a structure. This structure includes a number of elements. These are:

- **A context:** The indicator system should be developed with a clear understanding of the context within in which it is located. This includes developing an understanding of institutional frameworks as well as the social, economic and environmental context.

- **A vision or overarching goal:** The indicator system should have a clearly defined goal or aim in terms of changing this context.

- **Plan of action / objectives:** The indicator system should have a plan of action or route with clearly defined characteristics, which will be embarked on in order to achieve the goal stated above.

- **Indicators:** The selection or development of indicators should be designed to measure the speed of change that occurs in the direction of, or progress towards achieving, the stated objectives.

Development project outputs: Development projects aiming to support sustainable development are likely to have a range of different types of outputs. These outputs are mutually supportive and designed to achieve a particular state of sustainability. For instance, with a building project, as well as a building, maintenance and management capacity and systems may also be included as a required output to ensure that the building is maintained and operated at high levels of performance.

Development project stages: Development projects designed to support sustainable development are generally designed to have more stages, and more complex stages, than conventional projects. Early stages may involve actions to ensure support and buy–in from stakeholders as well as steps to ensure long-term sustainability (such as capacity development for maintenance). Later stages are likely to include an evaluation stage to assess impact and capture learning for future projects.

Stakeholder buy in: There is a strong emphasis on encouraging the people involved, or affected, to support development programmes and strategies, and related indicator systems. There is the suggestion that all stakeholders should be involved in the development, and selection of indicators, in order to ensure that these are fully supported.

Dialogue: The development of indicators can encourage useful dialogue and shared understanding between stakeholders, thus promoting the development of shared goals and plans of action.

Simplicity: There is a strong suggestion that indicators used should be few and simple. This can be achieved by careful selection and development of indicators. This should aim to identify the key indicators and develop aggregated indicators that are able to capture a range of aspects in one measure.

Types of indicators: There are a wide variety of different types of indicators, and it appears care should be taken to ensure the right selection and balance of these. In particular, indicators should be developed or selected to, as far as possible, report on progress towards achieving particular objectives.

Development models: There is a strong suggestion in many of the indicator systems that there is a causal link between different levels of development, and that through achieving a number of objectives at one level, higher order development goals can be supported.

Hierarchical objective and indicator systems: Hierarchical systems of objectives and indicators appear to be a common way of overcoming the problem of implementing seemingly abstract high-level goals and addressing concepts such as sustainable development.

Building Assessment Systems Critique

BREAM

It is likely that the long history of development has contributed to BREEAM becoming an effective tool for assessing the environmental impact of buildings. This is probably a result of two main factors. The first is that simplicity of the methodology and instructions that have been developed for the tool which allow 'lay-user' assessments to be carried out easily. The second is the strong and continued support that the tool has had from the BRE, the British government and business. The BRE have rapidly developed environmental impact assessment in buildings into a key area of their business and have invested in the ongoing development of BREEAM as well as related products. The consultation process taken as part of the development and the technical approach in assessments seems to have encouraged government and business to be strongly supportive of the tool. The legitimacy of the tool may also be assisted by the fact that it has been developed by the leading building research institute in the UK, and that formal assessments are carried out by licensed assessors.

The tool is more flexible than the other tools in that it can be used to assess different aspects of buildings such as building performance, design and procurement and management and operation. This reflects an approach, which takes into account the lifecycle of the building and the need to have a tool that can be used to assess environmental impact at the different stages in the lifecycle. This is an advantage over LEED and the GBTool, which concentrate

purely on the design stage of buildings and cannot be used to assess the design of existing buildings, or guide the management and operation of these.

BREEAM provides detailed explanation on many aspects of the tool including providing a short history of the development and the process behind the weighting of criteria. This explanation is likely to appeal to users as it allows users to ascertain the level of scientific rigour that has been applied in the development of the tool. This indicates that while a rigorous approach has been used to develop many aspects of the tool, the consensus method used to develop the assessment weighting of criteria is not scientific and likely to be highly influenced by perception and social trends.[186]

The tool clearly displays its close links with business through its efforts to demonstrate business benefits from using the tool. These include suggesting that value can be gained from developing and presenting a better company image internally, and externally, through undertaking a BREEAM assessment. This image would be supported through prominently displayed certification. The commercial aspects of the tool are also reflected in rating scales, which range from 'Excellent' to 'Pass'.[187] These suggest that even buildings which perform extremely poorly, 'Pass' merely as a result of having had an assessment taken. An approach more concerned with making significant environmental improvements, it could be argued, would have a 'Fail' category and highly challenging targets that would have to be met to achieve an 'Excellent' rating.

The tool has been developed and tested through use. For instance, different BREEAM related services are listed alongside their relevant RIBA stages of work making it easy for building professionals to understand when these could be used.[188] The simple format, pull out A3 'rapid assessment' sheet and the checklist also demonstrate an understanding of the time pressures that many building professionals work under.

The authors of the tool acknowledge the changes that are occurring in the environmental arena and suggest that they have addressed this in the tool. They assert that the tool, by including issues such as environmental impact, prudent use of materials and quality of life remains up-to-date and reflects the shift in emphasis that has occurred in the environmental arena from an emphasis on environmental issues to sustainable development.[189] However, it is suggested that this shift is not sufficiently reflected in BREEAM and that this leads, to some extent, to BREAM appearing old fashioned compared to LEED and the GBTool. It is odd that the tool does not reflect a greater emphasis on sustainable development as this concept has become firmly established in government and business in the UK. For instance, the 'Quality of Life Counts, Indicators for a Strategy for Sustainable Development for the UK' developed by

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[186] Baldwin, Yates, Howard, and Rao. 1998. p 6
[187] Baldwin, Yates, Howard, and Rao. 1998. loose A3 sheet
[188] Baldwin, Yates, Howard, and Rao. 1998. p.27

the Department of Environment, Transport and the Regions demonstrates this approach by having a strong emphasis on society, equitable economics as well as the environment indicators.

LEED

It is clear that LEED has been designed for buildings in the USA. It contains an odd mix of units. For instance, distances are measured in feet [190], and lighting in footcandles [191]; measurements used in few other countries. In other sections of the document however SI units are used such as kW/ton.[192] This mix of units and the absence of conversion tables limit the ease with which people in other countries can use LEED.

In many instances the document refers to American standards and guidelines. These have been developed by a range of different bodies, including non-government organisations such as the Farmland Trust, government bodies such as the Environmental Protection Agency and professional bodies, such as ASHRAE.[193] This obviously helps to keep the document concise as detail is provided elsewhere. It also reduces the effort required to maintain and update criteria as this work is done by the association responsible for the referenced materials. There are however a number of problems with this approach. The first is that unless one has to hand all of the referenced material it is difficult to carry out an assessment quickly as one continually has to find and read through the additional material. In addition, the reference material may not be readily available to non-US users.

LEED is a very short document. This makes it easy to use. There may however be doubts about the legitimacy of the criteria used as there is no explanation of how these arose. These doubts are reinforced by the lack of detail on the organisation (the Green Building Council) that developed the tool and the motives behind why the tool was developed.

The document has a number of characteristics, which make it difficult for lay-users to use easily. It often uses acronyms such as ASTM, CFR, EPA, FEMA, which are not explained. It also refers to building terminology such as 'development footprint', which is also not explained.[194] The lack of a glossary may result in errors, as there is the possibility that acronyms and building terminology have different meaning in other countries.

The GB Tool

The GBTool is large and complex. This makes it difficult to use and it is unlikely that busy building professionals will make time to undertake a full building assessment on a voluntary

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[189] Baldwin, Yates, Howard, and Rao. 1998. p. 27
[190] US Green Building Council. 2000. p. 4
[191] US Green Building Council. 2000. p. 7
[192] US Green Building Council. 2000. p. 13
[193] US Green Building Council. 2000. p. 4
[194] US Green Building Council. 2000. p. 6

basis. However it is possible, that they may use aspects of the tool to investigate particular concerns, such as ventilation, or material specification. The tool therefore is likely to be more successful as a compendium of technical information and assessment systems for reference use rather than as a widely used assessment system. This aspect may change as the system is developed and becomes simpler.

The tool, like LEED, provides little explanation as the sources of criteria. Considering the number of criteria included one could question whether these were all necessary. Generally, however, criteria are well explained and glossary at the back of the manual provides definitions.

The GBTool attempts to move away from being a national, or context related tool. It does this through avoiding reference to national standards and using internationally accepted methods and units. There are however criteria and assumptions built into the assessment system that indicate that the tool was developed in Canada. For instance, the tool often refers to HVAC systems. Increasingly, conventional air conditioning systems are not being specified in new buildings in Europe as passive systems gain in popularity. Similarly, lower cost office buildings in developing countries often do not have air-conditioning because of the capital and operating costs.

The tool has a very simple summary report for the building enabling the key performance indicators to be read easily. The report displays key indicators and graphs of performance at category level. While the key indicators measure performance in actual units – for instance in MJ of energy consumed per annum, this information is not displayed on reports. These show positive or negative performance in relation to a benchmark. The problem with this is ensuring that the benchmark is appropriate. If the benchmark selected is too low, the building assessed may show high performance reducing the tool's impact as a catalyst for improved performance. Another difficulty is that users are required to enter benchmark information, leading to the possibility that a mixture of benchmarks are used for very similar building types. This aspect limits the ability of the tool to be used for comparison purposes – this can only be done if the same benchmark is used. This aspect would appear to be somewhat in conflict with the 'international comparison' aim (see aims above) set for the tool.

The summary performance report shows performance 'by area' and 'by area and occupation'. These are normalised quantities, the first indicates a figure, for instance MJ of energy consumed per annum, divided by the area of the building measured in square metres. The second shows the same figure normalised for both area of the building and for occupancy measured in million annual person hours occupancy. This is useful as enables performance to be increased in relatively low cost ways, for instance, reducing the size of the building, or increasing the occupancy rates can improve performance. This is an important point to make

to professional teams and building owners who may think that environmentally friendly buildings are expensive and require large amounts of capital to be spent on advanced technology.

In reviewing the building environmental impact assessment tools there are a number of aspects that are relevant to the study and worth discussing.

Environmental emphasis: All of the tools appear to have an emphasis on environmental impact rather than sustainability. This suggests that the development of these tools now lags behind international developments within this area which now has an increasing emphasis on the broader and more holistic concept of sustainability. It is suggested that the specification for the tool developed by this study must reflect this change in emphasis and be based on concepts from sustainable development rather than environmental impact.

Awareness: It is interesting to note the emphasis in BREEAM on ensuring that the tool develops awareness in stakeholders that are part of the building process. This reflects the emphasis found in many of the non-building assessment tools reviewed by the study. This aspect is important; it is suggested because it is likely to be very difficult to develop and operate a building to support sustainability without the support of the developer or owner of the building and the users of the building.

Indicator selection and weighting: None of the tools were highly explicit in the methodology, or principles used in the selection of indicators. BREEAM however provided information on the process for weighting indicators. This was done through consensus and discussion with a range of interested parties. This, although better than having no method at all, seems somewhat arbitrary.

Stages and assessments: There is the realisation in BREEAM that greater impact can be achieved through linking assessment to building development stages. This enables assessments to be tied into the conventional building process, making this more likely to be adopted. Another useful aspect is that it supports continued awareness of environmental objectives, reinforcing the likelihood that these will continue to inform the implementation of the project through to completion.

Commercial building: All of the assessment systems have an emphasis on commercial buildings. This is not in line with sustainable development priorities, which include addressing the needs of the poorest. It is unlikely that reducing the environmental impact of a commercial building will have any impact on poor or marginalized people. The emphasis on addressing the needs of poor and marginalized people has not been addressed in any of the tools and, it

is suggested, this should be considered and addressed in the specification for the tool developed by the study in Chapter five.

Scope: All the tools have a limited scope. This generally focuses on ensuring that buildings become more environmentally friendly. It is suggested that this may be a missed opportunity as buildings, can be used to encourage change in the wider environment. For instance, buildings can support the development of a more diversified economy through specification of innovative and new components, produced by small emerging enterprises.

Technological emphasis: It is interesting to note the emphasis, particularly in LEED, on technology. This suggests that there is the perception that using different and better technology will result in reduced environmental impact. While this may be the case in certain circumstances it is not necessarily true and ignores the opportunities offered by changing consumption and production patterns.

Overall goal: All of the systems provide clear aims and objectives for the tool. Only one tool however, BREEAM ties this to wider policy by making reference to UK's Strategy for Sustainable Development. While linking into this context is useful for users in the UK it leads to the questioning of the relevance of the tool in countries where national policy has different priorities to the UK.

Objectives: The assessment tools have a set of simple objectives. These include supporting the development of comfortable and healthy internal environments at minimum expense to the environment. If one compares this to the complexity of sustainable development and the goals that have to be achieved these objectives appear to be too simple and not challenging enough. It is suggested that they do not fully grasp opportunities to use buildings and construction as a vehicle for change and for initiating and supporting sustainable development. Objectives for a building that supports sustainable develop should, it is argued, have a more ambitious goal in terms of supporting sustainable development and include a much larger range of lower order objectives, which support this goal.

4.3.   Concluding Hypotheses Three

The hypotheses that existing sustainable development, sustainability and development assessment systems and frameworks can inform the development of a specification for an assessment tool is demonstrated.

This chapter concludes that existing building assessment tools are inappropriate in respect of the objective set for the tool by this study, namely 'the integration of sustainable development into the briefing and design processes of buildings and construction in developing countries'. It shows that these systems are only partly relevant to developing country contexts. This is

because they do not take into account the particular social, economic and environmental priorities that exist in developing countries. It is also suggested that these building assessment systems are to a certain extent out of date, as they do not fully reflect the shift in emphasis from environmental impact to sustainable development that has occurred. However existing systems have gone a long way in developing assessment systems that enable the contribution of building to sustainable development to be measured and there is much that can be learnt from existing approaches for the study.

The review enables a clear picture of best practice in sustainable development assessment to be developed. It also enables this practice to be defined in terms of a structure, components and methodology that can be used to inform the development of the specification. Effective indicator and assessment systems that are able to capture information on, and guide, sustainable development generally have particular structures and characteristics. Key aspects of these are described below.

A context: The indicator system should be developed with a clear understanding of the context within which it is located. This includes developing an understanding of institutional frameworks as well as the social, economic and environmental context. Where possible the indicators should be developed to link, and work with, existing appropriate policy and initiatives. It is also important to understand, and develop, a description of the context in terms of a number of perspectives. The perspectives that appear important from a sustainable development view are those of poor or marginalized people (to ensure their needs are met), the future (to ensure that future generation's needs are addressed) and the earth (to ensure that the carrying capacity of the earth is maintained).

Sustainable development: Indicators used for sustainable development need to be developed with a very clear understanding of sustainable development and sustainability. This needs to be understood in terms of an ultimate goal that is to be achieved, such as a 'state of sustainability', and a clear route or direction defined as to how to get there, such as 'sustainable development'. Knowledge in the field now enables approximate definitions of both of these. For instance, sustainability from a human perspective can be said to have been achieved when man is able to live within the carrying capacity of the earth (when man's ecological footprint does not exceed the earth's carrying capacity). Similarly, from within the 'sciences of sustainability' a range of tools and approaches are being developed to guide moves towards more sustainable practices. These include concepts such as " Do more with less" (methodologies and process for achieving greater resource efficiencies) and "Needs not Wants" (changing consumption patterns to make sure that everyone's basic needs are addressed).

Model of the system: Indicator systems should ideally relate to an explicit model of the system they are designed to assess. This is useful because it can assist with the design of interventions that are aim to make systems more sustainable. They can also improve performance by testing and evaluating scenarios before selecting the most favourable option. The model as far as possible should make the workings of the system explicit and show it's links to, and impact on, related social, environmental and economic systems.

A vision or overarching goal: Indicators should be linked to objectives. These should be generated and cascade down from a clearly defined goal.

Plan of action: The indicator system should have a plan of action with clearly defined characteristics that will be embarked on in order to achieve the goal state above. These characteristics should include the following. Objectives, and actions should be developed, and organised, in a hierarchical structure in order to support the achievement of an overarching goal. As far as possible all stakeholders should be involved in the development of objectives, and progress indicators. This should occur in a shared process such as a workshop in order that this is transparent and fully supported.

Indicators: The selection or development of indicators should be designed to measure the speed of change that occurs in the direction of, or progress towards achieving, stated aims and objectives. An effective indicator system that enables progress towards objectives to be ascertained can improve effectiveness as accurate information can be used to develop, and adapt strategies in order to achieve maximum performance.