

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/306177756>

Assessing sustainable buildings in developing countries – The sustainable building assessment tool (SBAT) and the sustainable building lifecycle (SBL)

Article · January 2005

CITATIONS

29

READS

341

1 author:



Jt Gibberd

CSIR/UP/GAUGE

35 PUBLICATIONS 117 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



SASBE2015 Conference [View project](#)



Journal article [View project](#)

ASSESSING SUSTAINABLE BUILDINGS IN DEVELOPING COUNTRIES – THE SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT) AND THE SUSTAINABLE BUILDING LIFECYCLE (SBL)

Jeremy GIBBERD MSc Dip Arch (Bartlett, UCL), PrArch, MIArch (PIA) PhD.¹

¹ CSIR, Building and Construction Technology, PO Box 395 Pretoria 0001, jgibberd@csir.co.za

Keywords: sustainable, building, assessment, tool, lifecycle, developing countries

Summary

Work on building environmental assessment tools tend to focus on the negative environmental impacts of buildings and a developed country context, and require considerable time and expertise to undertake. The Sustainable Building Assessment Tool (SBAT) and Sustainable Building Lifecycle (SBL) have been developed to respond to the need for a more holistic approach that takes into account developing country contexts. As a result the SBAT and SBL have taken a significantly different approach to other tools. Aspects of the approach include:

- Aiming to assess the extent to which buildings and construction support sustainable development. The approach therefore assesses *positive* social and economic impact as well as *negative* environmental impacts.
- Being aligned with sustainable development policy. For instance, assessment criteria relate to actions set out in the World Summit on Sustainable Development Plan of Implementation.
- Encouraging key building stakeholders to become involved in improving building performance. For instance, clients, users and local communities are involved in setting and monitoring sustainable development performance targets.
- Drawing on sustainability theory to explore the relation between buildings and concepts such as social and human capital and the development of local economies.
- Ensuring that buildings and construction processes are responsive to local needs and opportunities.
- Enabling the tool to be used in a range of ways, from simple, quick indicative assessments, to more sophisticated performance measurements.

This paper discusses sustainable development, sustainability and developing country contexts in order to provide background to the approach developed in the SBAT and the SBL. It provides a description of the SBAT and SBL, and provides examples of how these tools can be used to integrate sustainable development into building and construction. The paper reviews the approach taken and provides recommendations for further study.

1. Introduction

There has been much discussion about what actions are required for sustainable development. Unfortunately this has often led to inaction. There is however an agreed international action plan in the form of the World Summit on Sustainable Development (WSSD) Plan of Implementation (United Nations 2002), which provides a clear set of actions that governments are required to take to implement sustainable development.

The WSSD Plan of Implementation provides a useful starting point for actions required within the building and construction industry. In order to align with these actions, the Plan was analyzed and a set of objectives relevant for construction and buildings developed (Gibberd 2003). These are listed below.

Sustainable Development Objectives

Environmental Sustainable Development Objectives

- Size, productivity and biodiversity: Ensure that development conserves or increases the size, biodiversity and productivity of the biophysical environment.
- Resource management: Ensure that development supports the management of the biophysical environment.

- Resource extraction and processing: Ensure that development minimises the use or support of environmentally damaging resource extraction and processing practices.
- Waste & pollution: Ensure that development manages the production of waste so that it does not cause environmental damage.
- Water: Ensure that development manages the extraction, consumption and disposal of water in order not to adversely affect the biophysical environment.
- Energy: Ensure that development manages the production and consumption of energy in order not to adversely affect the biophysical environment.
- Resource use: Ensure that development manages the extraction and consumption of resources so as not to adversely affect natural systems

Economic Sustainable Development Objectives

- Employment and self-employment: Ensure that development supports increased access to employment and supports self-employment and the development of small enterprises.
- Efficiency and effectiveness: Ensure that development (including technology specified) is designed and managed to be highly efficient and effective, achieving high productivity levels with few resources and limited waste and pollution.
- Indigenous knowledge and technology: Ensure that development draws on indigenous knowledge and technology, where appropriate.
- Sustainable accounting: Ensure that development is based on a scientific approach that takes into account, and is informed by, social, environmental and economic impacts.
- An enabling environment: Develop an enabling environment for sustainable development including transparent, equitable and supportive policies, processes and forward planning.
- Small-scale, local and diverse economies: Ensure that development supports small-scale, local and diverse economies.

Social Sustainable Development Objectives

- Access: Ensure that development supports increased access to land, adequate shelter, finance, information, public services, technology and communications, where this is needed.
- Education: Ensure that development improves levels of education and awareness, including awareness of sustainable development.
- Inclusive: Ensure that development processes, and benefits, are inclusive.
- Health, Safety and Security: Ensure that development considers human rights and supports improved health, safety and security.
- Participation: Ensure that development supports interaction and partnerships, and involves, and is influenced by, the people it affects.

This provides a broad set of objectives that have been agreed on an international level. It therefore makes sense to ensure that assessment tools and guidelines aiming to support sustainable development are aligned with these objectives. The criteria in the Sustainable Building Assessment Tool have therefore been developed to help ensure that buildings and construction play their role in achieving these objectives.

The ultimate goal of sustainable development is sustainability. This goal, it is argued, also provides useful guidance for the development of assessment tools.

Sustainability

With the complex interactions between environment, society and economy, it is difficult to develop a comprehensive description of sustainable states. There are, however, a broad set of characteristics within each area that are generally accepted as being important contributors to sustainability. These characteristics are briefly described below:

- **Environmental Sustainability State:** Robust, vibrant, productive and diverse biophysical systems that are able to provide resources and conditions necessary for existing and future populations on an ongoing and steady basis.
- **Economic Sustainability State:** Responsive structure, systems and technology, able to accommodate change and ensure that limited resources are used and maintained as efficiently and effectively as possible to provide for the needs of existing and future populations, without damaging the biophysical environment.

- **Social Sustainability State:** Safe, happy, healthy, cohesive, fulfilled and educated societies with organizational structures and innovative capacity that enable limited resources to be shared equitably and in ways that ensure the needs of existing and future populations are met.

These characteristics begin to describe systems that sustainable development will ultimately develop. They also suggest that there are a number of more intangible qualities within these systems that are important to sustainability, such as social cohesion. These aspects are being explored through research within the areas of natural, social and human capital and are increasingly considered important components of sustainability (Loh, 2000) (Putnam, 1993) (Elkington, 1997)

In the design of assessment frameworks it is therefore important to begin to understand how buildings and construction contribute to the development of these characteristics. While much research is still required in this area, the concepts of natural, social and human capital have been considered in the design of the SBAT.

A Developing Country Context

Having described sustainability and sustainable development, it is important to understand how this relates to developing and developed countries. Developed countries may have achieved certain aspects of 'a state of social sustainability', such as reasonable health and safety within their populations. It therefore could be argued that social sustainable development objectives could have a lower priority to economic and environmental sustainable development objectives in these developed countries.

Developing countries on the other hand are unlikely to have achieved many aspects described for a state of social sustainability. Addressing social sustainable development objectives is therefore likely to be a priority in developing countries.

These differences in states mean that there are often differing priorities in developing and developed countries. In sustainable development it is therefore important to understand the local context and priorities. The assessment framework must acknowledge and respond to the context in which it is used. The key aspects of a developing country context relevant for the assessment framework are listed below.

- **Infrastructure:** In developing countries there are generally lower levels of infrastructure development than in developed countries. This means that infrastructure development is required in order for key sustainable development objectives, such as increased access to productive resources to be achieved.
- **Capacity:** There are generally low levels of capacity and education within developing countries. Sustainable development interventions are therefore likely to require the inclusion of education and capacity-building programmes to ensure that development has the appropriate impact and is sustained.
- **Participation:** In developing countries, populations may have had little say in how development has occurred. In order to ensure that development reflects the needs and priorities of the people it will affect, and will be supported by them, it is important to ensure that they are appropriately involved.
- **Social exclusion:** In developing countries there may be groups such as old people, poor people, disabled people, uneducated people or people from a particular tribe whose needs have not been adequately addressed by existing development approaches. It is therefore important to understand these needs and make sure they are addressed.
- **Social priorities:** In many developing countries there are urgent social priorities such as health and education that need addressing.
- **Economic priorities:** Developing countries often have urgent economic priorities that need to be addressed, such as unemployment and inequity.
- **Development limitations:** Developing countries may have particular limitations and parameters that must be acknowledged. These may be physical, for instance developing countries may experience serious water shortages. They may also be financial, with development options limited by lack of financial resources or access to foreign exchange.
- **Indigenous systems:** Developing countries may have highly evolved indigenous systems that are sustainable. These include technological, organisational, cultural and knowledge systems. These can provide highly valuable models for sustainable development as they provide working models that can be drawn on.

The description of a developing country context above suggests that interventions to support sustainable development in developing countries should address social and economic issues as a priority. It is not suggested that environmental issues should be neglected, as this would not enable a state of sustainability to be achieved. Rather, it is suggested, that environmental sustainable development objectives are acknowledged and addressed in interventions designed to address urgent social and economic priorities.

Within a developing country context there are valuable opportunities to develop infrastructure that is aligned with sustainable development objectives. It is suggested that new infrastructure, if developed correctly, may be able to avoid many of the problems associated with existing infrastructure in developed countries, which now has to be managed and adapted to try and make it more sustainable.

This however will require significant changes to be made throughout the building and construction industry, and will require an effective and easily adoptable approach. A conscious decision must be made to make sustainable development an explicit goal. Once this decision is taken it must be driven systematically through all aspects of buildings and construction. This approach requires two components: an assessment framework and a set of processes that ensures that the framework is used to guide action in buildings and construction.

An Assessment Framework

The assessment framework should consist of an overarching goal, objectives and indicators. The overarching goal should ensure that buildings and construction processes support sustainable development. The objectives describe a range of actions that should be taken to support this goal. These objectives should be defined through a structured approach (described below) and refer to local sustainable development priorities and opportunities. Indicators are used to measure progress towards achieving the objectives. The assessment framework aims to ensure that the right sustainable development objectives are set in terms of the state of knowledge and technology, the context, project, and stakeholders. It aims to make sustainable development directly relevant to buildings and construction by breaking this down into easily implementable steps, which can be integrated into buildings and construction processes.

A Structured Approach

A structured approach should aim to make sure that the assessment framework is used to its maximum effect. It does this in the following ways. It ensures that the framework is based on accurate up-to-date and relevant information. It aims to ensure that key project stakeholders gain some understanding of sustainable development and are able, through the assessment framework, to discuss and agree on building and construction objectives that will support sustainable development. Finally, It ensures that once an assessment framework has been populated and agreed, this is used to influence the development of buildings and construction processes.

It is suggested that an assessment framework and structured approach is an effective way of beginning to integrate sustainable development into buildings and construction processes. This has been reflected in the development of an assessment framework, the Sustainable Building Assessment Tool (SBAT), and a structured framework, the Sustainable Building Lifecycle (SBL).

2. The Sustainable Building Tool (SBAT)

The SBAT describes 15 sets of objectives that should be aimed for in buildings. It suggests that the extent to which these objectives are achieved in buildings provide a simple, yet reasonably effective, measure of the level of support for sustainable development. Objectives are arranged under the headings of Social, Economic and Environmental, and are as follows:

SOCIAL

- Occupant Comfort
- Inclusive Environments
- Access to Facilities
- Participation & Control
- Education, Health & Safety

ECONOMIC

- Local Economy
- Efficiency of Use
- Adaptability & Flexibility
- Ongoing Costs
- Capital Costs

ENVIRONMENTAL

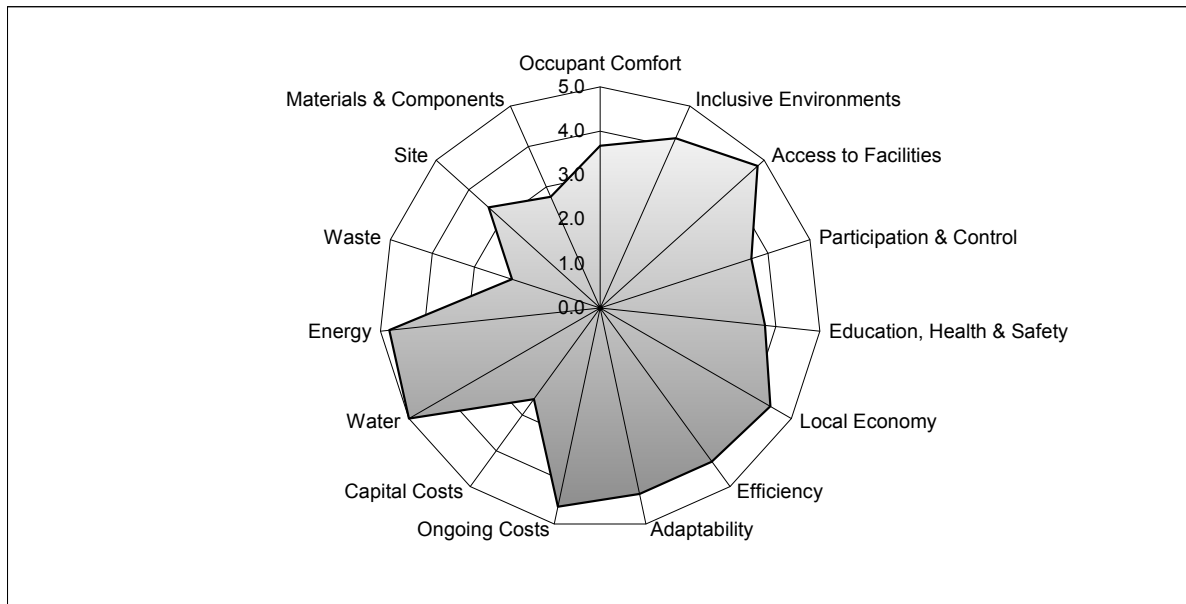
- Water
- Energy
- Waste
- Site

- Materials & Components

These objectives were established through a process of describing, and understanding, buildings in terms of their relationship to social, economic and environmental systems (Gibberd 2001). Different environmental, economic and social systems have different levels of sustainability and the approach used to develop the SBAT aimed not only to assess the 'internal' performance of buildings but also to assess the extent of the building's 'external' contribution to supporting, and developing, a wider set of more sustainable systems around it. The figure below shows the SBAT report.

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT)

PROJECT	ASSESSMENT
Project title:	Date:
Location:	Undertaken by:
Building type (specify):	Company / organisation:
Internal area (m2):	Telephone:
Number of users:	Fax:
Completion date:	Email:



Social	4.0	Economic	4.0	Environmental	3.6
Overall		3.9			

Figure 2. The SBAT-P report

An important part of developing the SBAT was consideration of how this could become part of, and influence, normal design, construction and building management processes. This led to the development of a 9-stage structured approach based on the typical lifecycle of a building.

3. The Sustainable Building Lifecycle

The Sustainable Building Lifecycle has been developed to ensure that an assessment framework, like the SBAT, can be used to maximum effect. It is designed to ensure that at particular stages, targets are set and agreed by key stakeholders (during the briefing, site analysis and target setting stages) and that these are then used to guide design decisions and the selection of procurement and construction options. There are a number of key principles within the concept of a Sustainable Building Lifecycle. These are:

- Shared understanding of sustainability and agreement on the setting of strategic sustainable development objectives for the project.

- Detailed, challenging and responsive performance targets should be set and their achievement monitored.
- Multidisciplinary interactive processes should be used to generate imaginative and innovative solutions capable of achieving the performance required.
- The strategic sustainable development objectives set at the onset should inform all stages of the building lifecycle. The specific body of knowledge on how these are achieved in the building should be transferred from one stage to the next.

These principles can be integrated into conventional building and processes by introducing actions, and supporting decision-making, at specific stages within a development. These can be described in terms of a sustainable building lifecycle with the following stages: Briefing, Analysis, Target Setting, Concept Design, Detailed Design and Construction, Handover, Operation and Demolition/Reuse/Recycle. These stages with their respective activities and outputs are illustrated below.

	Stage	Activities / Outputs
1	Briefing	Briefing workshops, Briefing document with strategic sustainability priorities.
2	Site Analysis	Site Analysis
3	Target Setting	Target Setting Document
4	Design	Design Review, Design for Sustainability Methodologies, modeling tools
5	Design development	Detailed Design Review Report
6	Construction	Construction Monitoring Indicators and Guidelines
7	Handover	Building User Manual, Facilities Management Training
8	Operation	Facilities Management Systems, User Awareness
9	Reuse/refurbish/recycle	As stages 1-6

Figure 3: Sustainable Building Lifecycle

Each of these stages has specific activities required to ensure sustainable development is effectively integrated into the project. These activities are summarized below.

Briefing: During this stage, the strategic sustainable development objectives should be set out and agreed by all of the key people involved in the project. Developing high-performance solutions will not be achieved if the client, future building users and the full design team are not fully on board.

As part of the discussion it may be useful to include short presentations on sustainability and sustainable development, future users, organizational strategic objectives and existing and potential sites. This will help to achieve a shared understanding and should promote discussion and agreement on the following questions:

- How serious is the client about supporting sustainable development? Would they continue to support this if it meant a longer delivery period, an unconventional building and additional costs? What are their particular concerns and priorities?
- What are the strategic objectives of the organisation, and how can these be integrated into the strategic sustainable development objectives for the brief? For instance, can the development and change process involved in the development of new accommodation be used to support corresponding beneficial changes within the organisation, its stakeholders and the surrounding community?
- Is new accommodation necessary? Can existing accommodation be used or improved?

Analysis: This stage has two components which ensure that development is highly responsive to the organisation and the functions it is designed to house, as well as to the site within which it will be situated. These are the type of questions the analysis should answer:

- Site analysis: What is the most appropriate site? What are the social, economic and environmental needs on, and around, the site that the development should respond to? What are the social, economic and environmental opportunities that the development could work with?
- Organisational analysis: How does the organisation work? What does its structure look like? Who does it work with? How will this work in the future? Are there building and space management

models that will support the organisation and make the building more efficient? Are there new technologies that may enable the organisation and the building to work more efficiently?

Target setting: This stage draws on the strategic brief, the organisational and site analysis findings and sustainable building best practice to develop detailed and challenging performance targets for the building. This requires an understanding of performance benchmarks in similar buildings in order to ensure these are achieved or surpassed. This stage ensures that the following questions are answered:

- What specific targets will be aimed for to ensure the building supports social, environmental and economic sustainability?
- How will these targets be defined and measured to ensure that they achieve the strategic sustainable development objectives set? How will the achievement of these targets be monitored? What happens if they are not being achieved?

Concept design: This stage aims to ensure that solutions are generated which will achieve the performance targets. If appropriately challenging and diverse targets are set it is likely that only innovative and integrated solutions will be able to achieve this. This stage attempts to answer the following questions:

- Design: Does the design work with the local context and user organisation (as understood in the analysis stage)? Is the right mix or breadth of expertise present on the team to achieve the required performance? Are there design and modeling processes that could help generate the right solutions?
- Construction: How well do the proposed structure and systems perform in terms of sustainability? Has sufficient investigation been made into different technologies in order to understand their implications and performance?
- Procurement: What would be the most appropriate procurement and construction method in order to achieve the required performance? What are the implications of this for the design and specification?

Detailed design: This stage should only be embarked on once there is a strong level of confidence that major design decisions are right and will lead to the required performance. During this stage the detailed mechanics of sustainable systems and high-performance buildings are designed. It aims to answer the following questions:

- What is the detailed performance of the proposed building in terms of each of the specific targets set? Can this be better? Are trade-offs required between the different performance areas?
- Is the client fully aware of the proposed solutions and their implications? For instance, does he understand the performance of the proposed environmental control systems for the building? Will he, for instance, ensure that proposed water, energy, waste and procurement systems are implemented in the facilities management of the building?

Construction: Whichever procurement process is followed, it is important that it is informed by the performance targets. It is important that potential contractors and component manufacturers on the project understand the sustainable development objectives of the project and the seriousness with which they will be pursued. To reinforce this message, sustainable development should be explicitly written into tender documents and contracts, and discussed at progress meetings. The key questions that should be answered at this stage are:

- Have effective structures been set up to ensure that construction supports the achievement of targets?
- Is progress towards the achievement of these targets being monitored in a regular and detailed enough manner? What actions will be taken if targets are not being met?

Hand over: On completion of the building it is important that new owners and users understand how the building should be used and managed, otherwise the effort involved in developing a sustainable building will be wasted. This requires the detailed knowledge of the systems developed in the building to be transferred to facility managers. It also requires mechanisms to ensure that users, as well as building managers and subcontractors, play their role in ensuring there are ongoing improvements in the operational performance of the building. This stage aims to ensure the following questions are answered:

- Has there been effective transfer of knowledge to, and capacity development of, the new building manager(s) to ensure the new building is operated and maintained at the required levels of performance?
- Is there sufficient knowledge, motivation and ongoing awareness amongst facility managers, users and outsource and subcontracting firms to ensure that the building and users work in an integrated way to achieve the required performance?

Operation: Most buildings have a life of over 50 years. Over this period it is important to ensure that performance of the building improves in terms of sustainability, which requires monitoring systems and mechanisms. An often ignored component of this is a periodic analysis of the 'fit' between the building and the inhabitants. This is important because it helps ensure that minor management or building modifications are carried out, which help increase overall performance. The questions this stage aims to answer are:

- What is the performance of the building? Is this good enough? What needs to be done about this?
- What is the 'fit' between the building and the inhabitant organisation? Are there modifications that can be made to improve this, and thus improve performance?

Reuse/Demolish/Recycle: Ideally, because of the environmental cost of new buildings, existing buildings should be used as long as possible and only require minor modifications to improve performance over time. However, where the demolition of a building is inevitable, it should be done in a way that supports sustainability. This includes ensuring that the maximum amount of material is recycled and components, where possible, are reused. This stage asks the following questions:

- Does the building have to be demolished? If so, how can this be done in the most sustainable way?
- Do the information and knowledge captured and transferred to the client at handover provide detailed instructions that ensure minimal waste and environmental damage in the demolition of the building?

The questions raised through a discussion of a 'sustainable building lifecycle' highlight the range and complexity of processes required to integrate sustainable development into construction and buildings. It is argued that this complexity must be addressed holistically. Therefore the SBAT / SBL aims to provide an overall framework that aims to ensure that all key aspects of sustainable development are considered and can be integrated into construction processes and buildings.

4. Conclusion

Developing and implementing sustainable development objectives in buildings and construction is particularly important in developing countries where there may be considerable social and economic problems, such as low or poor levels of health, education and employment and limited economic resources. It is suggested that the approach developed should ensure maximum beneficial social and economic impact for the investment, rather than merely concentrating on the more conventional approach of minimising environmental impact. Buildings and construction therefore cannot be seen in isolation from users and local communities and should be responsive to local needs and opportunities. They should be seen as systems that require both physical aspects (such as the buildings and site) and non-physical aspects (such as use of the building and management systems) to work together in an efficient and integrated way to achieve sustainable development objectives.

The paper suggests that new knowledge needs to be developed on how buildings contribute to positive and beneficial change in economic and social systems (such as through support for increased social and human capital). This is especially important in supporting sustainable development in developing countries where social and economic problems are a priority.

References

- Elkington, J. 1997. *Cannibals with Forks*. Capstone. Oxford.
- Gibberd J. 2001. *Building Sustainability: How Buildings can support Sustainability in Developing Countries*. Continental Shift 2001 - IFI International Conference, 11 – 14 September 2001, Johannesburg.
- Gibberd J. 2003. *Integrating Sustainable Development into Briefing and Design Processes of Buildings in Developing Countries: An Assessment Tool*. Unpublished thesis.
- Loh J (ed) 2000. *The Living Planet Report 2000*. WWF, Gland, Switzerland, pp1.
- Putnam, R. 1993. *The Prosperous Community, Social Capital and Public Life*. The American Prospect. Volume 4. Issue 13.
- United Nations. 2002. *World Summit on Sustainable Development, Plan of Implementation*, advance unedited text. <http://www.johannesburgsummit.org/index.html>