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Does the Sustainable Building Assessment Tool address resilience sufficiently?

Jeremy GIBBERD [2]

[1] Council for Scientific and Industrial Research,

Email JGibberd@csir.co.za

Abstract

Climate change is already having significant impacts globally. These impacts are experienced most acutely in developing countries where infrastructure and population are often more vulnerable and resources and capacity for adaptation are limited. It is therefore particularly important to understand vulnerabilities to climate change in developing countries and address these in the most effective and efficient ways possible. The Sustainable Building Assessment Tool (SBAT) was developed to support the integration of sustainability in buildings in developing countries. Through analysis of current climatic change projections for South Africa, key implications for built environments are ascertained. These will reviewed against the SBAT to investigate whether existing criteria adequately address projected climate changes. Findings from the study indicate that while the SBAT provides a robust framework for addressing sustainability, it does not address climate change resilience comprehensively. Recommendations are therefore made for how the SBAT, and other similar tools, could be improved to support climate change better.

Keywords: *Sustainability, resilience, SBAT, Sustainable Building Assessment Tool.*

1. Introduction

Climate change is having a substantial impact in South Africa. For instance, a number of cities, such as City of Cape Town have experienced severe droughts and water shortages (City of Cape Town, 2017). These impacts identify the need to prepare better and it is becoming increasingly apparent that resilience must be integrated into the planning, design and operation of buildings. Green building rating tools such as the BREEAM, LEED and Greenstar have an emphasis on achieving more environmental friendly buildings. Other tools, such as the Sustainable Building Assessment Tool (SBAT) aim to assess sustainability in built environment (Gibberd, 2008). The current and worsening impact of climate change has meant that developers of these tools now need to consider how climate change adaptation and resilience can be addressed in addition to environmental impacts and sustainability.

This study therefore reviews climate change projections for South Africa and the concept of resilience in order to develop a framework that can be used to assess building design guidelines and tools. This framework is applied to the Sustainable Building Assessment Tool in order to evaluate the extent to which it addresses climate change and resilience. Through this analysis, opportunities for integrating climate change and resilience into the SBAT are identified. These are developed into recommendations for the development of the tool. The study therefore focusses on the following research questions:

- What are the climate change projections for South Africa?
- How can climate change projections and the concept of resilience be developed into a framework that can be used to evaluate building design guidelines and tools?
- What does the application of this framework to the SBAT indicate?
- Can findings from this applications be developed into recommendations for the further development of the SBAT?

2. Climate change

Climate change is one of the significant issues facing mankind (Hamin and Gurran, 2009). While climate change modelling is subject to uncertainty, levels of accuracy and detail are rapidly advancing (Guan, 2009). Recent climate change modelling of South Africa has been carried out an 8 x 8km resolution (Engelbrecht, 2017). This indicates that significant climate change impacts are projected. It also indicates that the nature and extent of climate change impacts will vary across South Africa. For instance, it indicates that some areas are projected to receive increased rainfall while in other areas this will be significantly reduced and drought conditions are regularly expected. The modelling developed a range of projections based on different mitigation scenario. For this study the lowest mitigation scenario has been selected (RCP 8.5). Representative Concentration Pathways (RPCs) are defined according to their contribution to atmospheric radiative forcing in the year 2100 relative to pre-industrial values. An RCP 8.5 therefore represents the addition to the earth's radiation budget as a result of an increase in GHGs of +8.5 W/m^2. A review of the projections for this scenario for the period 2021 – 2050 relative to 1961-1990 indicate a number of broad trends which are outlined below.

Higher temperatures: Temperature increases of 1 to 2.5 °C in the southern coastal areas and 3°C in the northern areas of South Africa are projected for the period 2021 to 2050, relative to temperatures in the period 1961 – 1990.

Minimum temperatures: Minimum temperatures are projected to increase by 2 to 3 °C for the period 2021 – 2050, relative to the period 1961 -1990.

Very hot days (days above 35 °C): An increase in very hot days is projected for the period 2021 – 2050, relative to 1961 – 1990.

***Changes in rainfall*:** Increases in annual rainfall are projected in the central interior and east coast of South Africa, while reductions are expected in the western interior and the north-eastern parts in the period 2021-2050, relative to the period 1971 – 2000.

***Extreme rainfall events*:** Extreme rainfall events are projected to increase in frequency in the central interior and east coast for the period 2021-2050, relative to the period 1961 – 2000. For the period 2070-2099, relative to the period 1961 – 2000, reductions in these events are projected for Lesotho and Kwa-Zulu Natal Midlands areas.

Increased wind speeds: Wind speeds are projected to increase in the northern interior regions of South Africa and decrease in other regions for the period 2021-2050, relative to the period 1961 – 2000 (Engelbrecht, 2017).

These changes have significant implications which are being addressed in national plans, such as the National Development Plan (National Planning Commission, 2012). The level of detail provided in these projections also enable their implications for the built environment to be ascertained and addressed (Gibberd, 2018). The science of how climate change can be accommodated is being developed in a rapidly evolving field, broadly referred to as Resilience.

3. Resilience

Resilience has its origins in ecosystem theory and can be defined as 'the persistence of relationships within a system and the ability of this system to absorb changes, and still persist' (Holling, 1973). Since its origins in ecology, many different definitions of resilience have been developed for different fields (Adger, 2000; Perrings *et al.,* 1995; López-Ridaura *et al.,* 2005; Zhou *et al*., 2009; Holling, 1973; Pimm, 1984; Lele, 1998).

Understanding and defining resilience becomes increasingly complex in large multifaceted entities such as buildings and cities which have both natural and artificial systems (World Health Organisation, 2009; Piketh *et al.,* 2014). It is therefore useful to review resilience at a sub component level; at the level of natural systems such as ecosystems, as well as at the level of artificial systems, such as social resilience, and understand how this relate to built environments.

3.1 Natural Systems Resilience

Resilience within the ecology field refers to the ability of an ecosystem to accommodate disturbance without a fundamental change to its structure or function (Holling, 1973). Adger (2000) attributes resilience in ecological systems to a range of factors related to ecological diversity such as:

Diversity (Schulze and Mooney 1993; Mooney and Ehrlich, 1997; Tilman,1997)

Diverse and resilient resources (Adger, 2000)

Rapid self-regulating and regenerating functions (Costanza,1995)

A characteristic of ecological resilience can be illustrated through the concept of ecological redundancy. Ecological redundancy is created when more than one species performs a given role. This redundancy within the system reduces vulnerability by avoiding reliance on single part of the system and therefore supports overall stability of the system.

The concept of ecosystem services and ecological resilience is being applied through an urban planning approach that that includes ecological land-use complementation (ELC). This aims to support biodiversity and ecosystem health through clustering synergistic function and land uses (Colding, 2007).

Similarly, the concept of a buffer, or buffer capacity as developed in ecosystem science, as a capacity to absorb disturbance, is being applied in cities in a range of ways. A simple example is the way swales and retention ponds can be built into storm water systems to absorb the disturbance generated by urban runoff surges resulting from a downpour.

There is a strong relationship between natural system resilience and social system resilience, particularly for communities that rely directly on the environment for survival (Adger, 2000). However this relationship exists for all communities through the provision of ecosystems services. Ecosystem services describe the range of services provided by ecosystems to man and include provisioning, regulating, cultural and supporting services (Colding, 2007).

It is argued that man, by disturbing natural cycles, through for instance, fire suppression, or urban development, cause environments to move from one type of ecosystem state to another less desirable one (Gunderson and Pritchard, 2002). This less desirable state not only provides reduced ecosystem services for man, it is also more vulnerable and less able to absorb shocks. Built environments must therefore not only ensure the natural systems thrive and are enhanced, they must also ensure that these are resilient and are not negatively affected by climate change.

3.2 Artificial Systems Resilience

Artificial systems refer systems developed to provide particular services to communities such as water supply, communication and transport systems. They also include systems which govern or structure the functioning of communities such as social and economic systems. In this review, the focus is on understanding social and economic resilience and how this can be supported by built environments.

Resilience in social systems has been defined as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change. (Adger, 2000). Folke (2006) refers to social – ecological resilience as:

> *"The amount of disturbance a system can absorb and still remain within the same state..,*
>
> *The degree to which the system is capable of self-organization..*
>
> *The degree to which the system can..increase the capacity for learning..."*

The understanding or resilience within social systems is still exploratory and there are still many uncertainties (Folke, 2006). Extensive work however has been carried out to identify and understand the key factors that contribute to social resilience. These are:

Learning, flexibility, self-organization (Folke, 2006)

Organizational and institutional flexibility (Grumbine, 1994; Danter et al., 2000; Armitage, 2005; Ostrom, 2005)

Social capital (including trust and social networks) (Enemark, 2006)

Social memory (including experience for dealing with change) (Olick and Robbins, 1998; McIntosh, 2000)

A modern productive infrastructure (transport, broadband provision, etc.). (Christopherson et al., 2010).

A skilled, innovative and entrepreneurial workforce (Christopherson et al., 2010).

A supportive financial system providing patient capital (Christopherson et al., 2010).

A diversified economic base, not over-reliance on a single industry (Christopherson et al., 2010).

Economic growth and the stability and distribution of income (Adger, 2000).

Inclusivity and degree of trust (Harriss and de Renzio, 1997)

Rules which govern the social system (Aldger, 2000)

The concept of social resilience is complex and can be studied at many levels. This includes understanding the role and impact of economics and institutions (Aldger, 2000). There are a clearly a wide range of implications of social resilience for city design and management. Examples include economic planning to creates a diverse economic base and the avoidance of an over reliance on a single employer or business. It also includes the creation of accessible social infrastructure that supports learning, innovation, inclusion and trust.

Built environments must therefore ensure that characteristics of artificial systems such as social cohesion and learning are enhanced as they provide a valuable way of increasing resilience and reducing vulnerability to climate change.

The review of climate change projections and natural system and artificial system resilience can be used to develop a simple framework which can be used to evaluate the design guidelines to ascertain the extent to which they address resilience.

4. A Resilience Assessment Framework

The resilience assessment framework outlined below is based on a review of climate change projections, natural and artificial systems resilience. The framework aims to provide a useful way of assessing whether design tools and guidelines such as the SBAT addresses climate change directly, through measures that address projected change, or indirectly through enhancing the resilience of natural and artificial systems.

Table 1: Resilience Assessment Framework (by the author)

Aspect	Key questions
Higher temperatures	Does the tool or guideline include built environment measure that address projected increased temperatures? Measures could include site planning, building form, building envelope, mechanical and passive cooling measures that reduce ambient temperatures on site and within buildings.
Very hot days (days above 35°C)	Does the tool or guideline include built environment measures that address very hot days? Measures could include measures indicated for Higher Temperatures (above) as well as specific measures such as well as support for personal adaptation measures. These measures enable people to adapt their behavior to cope with increased temperature, by for instance, drinking more water and being less active during the hottest periods of the day.
Changes in rainfall	Does the tool or guideline include built environment measures that address increased or reduced rainfall? Measures for increased rainfall could be improved waterproofing, drainage provision and flood prevention. Measures for decreased rainfall include more efficient water fittings, the adoption of rainwater harvesting and greywater systems, the avoidance of water-based sanitation and xeriscape landscaping strategies.
Extreme rainfall events	Does the tool or guideline include built environment measures that address extreme rainfall events? Measures for extreme rainfall events include strengthened roof and building structure, enhancing the capacity of rainwater goods, improved onsite drainage systems.
Increased wind speeds	Does the tool or guideline include built environment measures that address extreme rainfall events?

	Measures for flooding avoidance measures such as avoiding flood zones, building on stilts and increased floor levels.
Natural systems resilience	Does the tool or guideline include built environment measures that enhance the resilience of natural systems? Measures to enhance resilience of natural systems include retaining and enhancing existing natural systems and environments and creating and supporting new ones, through for instance the creation of indigenous ecosystems and landscaping, roof gardens and biological waste water treatment plans.
Artificial systems resilience	Does the tool or guideline include built environment measures that enhance the resilience of artificial systems? Measures to enhance resilience of artificial systems include support for social cohesion, the local economy, economic diversity, communication and education.

5. Sustainable Building Assessment Tool

The Sustainable Building Assessment Tool (SBAT) aims to assess the sustainability performance of buildings. It does this by measuring the extent to which built environment characteristics deemed to support sustainability exist in a building or a design of a building (Gibberd, 2008).

Built environment characteristics measured in the SBAT are based on a definition of sustainability that includes both minimum quality of life (defined using the Human Development Index developed by the United Nations) and environmental limitations (defined with reference to the Ecological Footprints and the earth's carrying capacity) (World Wildlife Fund, 2006; Gibberd, 2017). This basis is markedly different to green building rating tools LEED, BREEAM and Greenstar which have an emphasis on incremental environmental performance improvement of buildings. The SBAT therefore has a broader remit and indicators are derived from environmental, economic and social sustainability objectives as shown in table 2.

Table 2: Sustainable Building Assessment Tool Categories, Areas, Objectives and Indicators (Gibberd, 2008).

Category	Area	Objective	Indicator
Environmental	Energy	Built environment is energy efficient and uses renewable energy	EN1 Orientation, EN2 Building Depth, EN3 Roof Construction, EN4 Wall Construction, EN5 Floor Construction, EN6 Window to Wall Ratio, EN7 Ventilation openings, EN8 Daylight, EN9 Internal Lighting, EN10 External Lighting, EN11 Installed Equipment Power Density, EN12 Food Cooking, EN13 Water Heating, EN14 Renewable Energy Generation
	Water	Built environment minimises the consumption of mains potable water	WA1 Toilets, WA2 Wash Hand Basins, WA4 Showers, WA5 Hot Water, WA6 Landscape, WA7 Rainwater harvesting
	Waste	The building minimises emissions and waste directed to landfill.	WE1 Recycling Area, WE2 Recycling Collection, WE3 Organic Waste, WE4 Sewage, WE5 Construction Waste
	Materials	Construction impacts of building materials are minimised.	MA1 Building Reuse, MA2 Timber Doors and Windows, MA3 Timber Structure, MA4 Refrigerants, MA5 Volatile Organic Compounds, MA6 Formaldehyde, MA7 Locally Sourced Materials

	Biodiversity	Built environment supports biodiversity	BI1 Brownfield Site, B14 Municipal Boundary, BI3 Vegetation B14 Ecosystems
Economic	Transport	The building supports energy efficient transportation.	TR1 Pedestrian Routes, TR3 Cycling, TR3 Public Transport
	Resources	The building makes efficient use of resources.	RE1 Site Density, RE2 Area per occupant RE3, Renewable Energy Generation, RE4 Food Production
	Management	The building is managed to support sustainability.	MN1 Manual, MN2 Energy Metering, MN3 Water Metering, MN4 Recording, MN5 Residents Association
	Local Economy	The building supports the local economy.	LE1 Locally Sourced Materials and Products, LE2 Small Enterprise, LE3 Construction Workers Support
	Services and Products	The building supports use sustainable products and services.	SP1 Fruit and Vegetables, SP2 Bakery Products, SP3 Beans and pulses, SP4 Milk and Eggs, SP5 Clothing, SP6 Furniture, SP7 Equipment Hire, SP8 Notice Board
Social	Access	The building supports access to facilities.	AC1 Internet Access, AC2 Banking, AC3 Groceries, AC4 Post Office, AC5 Creche, AC6 Primary Schools
	Health	Built environment supports a healthy	HE1 Exercise, HE2 Health facility, HE3 Fruit and Vegetables, HE4 Bean and

		and productive environment	Pulses, HE5 Milk and Eggs, HE6 Water, HE7 External Views, HE8 Daylight, HE9 Openings, HE10 Roof Construction, HE11 Wall Construction, HE12 Volatile Organic Compounds, HE13 Formaldehyde, HE15 Construction Worker Health
	Education	The building supports education.	ED1 Primary Schools, ED2 Secondary Schools, ED3 Ongoing education, ED4 Internet, ED5 Noticeboards, ED6 Space for Learning, ED7 Building User Manual, ED8 Construction Worker Education
	Inclusion	The building is inclusive of diversity in the population.	IN1 Public Transport, IN2 Groceries, IN3 External Routes, IN4 Entrances and Exits, IN5 Lobby, IN6 Window, door and lighting controls, IN7 Doors, IN8 Bathroom, IN9 Kitchen, IN10 Inclusive Employment, IN11 Affordability
	Social Cohesion	The building supports social cohesion.	SC1 Occupants, SC2 Community space, SC3 External Facilities, SC4 Residents Association

The SBAT consists of a locked preformatted Excel spreadsheet (the tool) and manual. The tool generates a rating and graph based on data entered into the tool, as shown in figure 1. The report shown is for the SBAT residential which measures performance of housing. In the SBAT the overall rating is shown under 'Achieved' in the report. The graph in figure 1 shows actual performance against targeted performance. Performance in the different sectors, such as environmental, economic and social performance are provided in the table below this. The EF and HDI factors refer to Ecological Footprint and Human Development Index and reflect performance of indicators that are related to these areas. Finally, details of the Assessor and validation process are provided.

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1.04

		Achieved
SB	**SBAT REPORT**	**1.6**

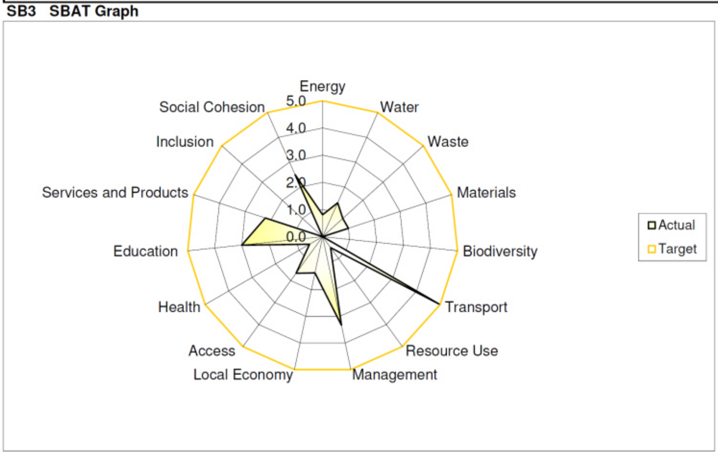
SB1 Project

0

SB2 Address

0

SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	0.8
Economic	2.4
Social	1.7
SBAT Rating	1.6

SB5 EF and HDI Factors	Score
EF Factor	1.5
HDI Factor	1.2

SB6 Targets	Percentage
Environmental	17
Economic	47
Social	33

SB7 Self Assessment: Information supplied and and confirmed by
Name — Date
Signature

SB8 Validation: Documentation validated by
Name — Date
Signature

SB9 Validation Report Version

IVR

Figure 9: Sustainable Building Assessment Tool Report (Gibberd, 2008)

6. SBAT Evaluation

In order to evaluate the SBAT the resilience assessment framework developed earlier is applied. The findings are outlined below, under the headings provided in the framework.

Higher temperatures

Criteria in the SBAT that address temperature in buildings fall under Energy and Health categories and include Orientation, Building Depth, Roof Construction, Wall Construction, Floor Construction, Window to Wall Ratio, Ventilation Openings and Daylight. Criteria define building characteristics such as a northerly orientation of the building (Orientation), roof colour and thermal performance (Roof Construction), thermal performance of walls (Wall Construction), exposed thermal mass of flooring material (Floor Construction), glazing (Window to Wall Ratio), the location and size of ventilation openings (Ventilation Openings) and location and sizing of windows relative to interior space (Daylight).

While these criteria help measure key characteristics of buildings that support low energy use and occupant comfort and health in warmer climates, they do not specifically address the higher temperatures projected under climate change. It is therefore recommended that the criteria within the Energy and Health categories be reevaluated in light of increased temperature projections. This evaluation should review whether, and how, existing criteria, such as thermal performance, should be updated to reflect climate change projections. In addition, it is recommended that criteria that include additional measures should be considered. These include:

Site layout and landscaping strategies which support cooling such as ensuring access to ventilation, increasing shading and trees around buildings and reducing the extent of hard paving (such as car parking) around buildings (Zuo et al, 2014; Santamouris, 2015; Wong & Chen, 2009)

Integration of specific passive cooling strategies such as cross ventilation, evaporative cooling and night-time cooling (Karimpour et al, 2015; Peacock et al, 2010). As these strategies tend to be site and climate specific, care should be taken to avoid developing overly prescriptive criteria and instead should advocate a responsive approach instead.

The application of low energy mechanical cooling such as ceiling fans and evaporative cooling systems that are powered by renewable energy systems (such as photovoltaic systems).

Very hot days

Criteria in the SBAT that are relevant to very hot days have already been listed above under Higher Temperatures. These criteria do not address the extreme nature of hot days projected under climate change and their potential detrimental impacts on health. Therefore, it is recommended that the existing temperature related criteria in the SBAT are reviewed and that criteria for additional measures are considered. Additional measures could include support for the following personal adaptation measures:

Provision of drinking points that encourage occupants to drink more water means of keeping cooler and health under very hot conditions

Working practices that accommodated clothing suitable for hot weather and encouraged occupants to be less active and indoors during the hottest part of the day **(**Krecar et al, 2014; Hatvani-Kovacs et al, 2016; Saman et al, 2013).

Changes in rainfall

As climate change projections indicate increased rainfall in some areas and reduced rainfall in other areas, different criteria for different areas are required. The SBAT only addresses rainfall through the Water criteria. These include water efficient sanitation (Toilets), water efficient taps (Wash Hand Basins), water efficient showers (Showers), reduced wastage (Hot Water), reduced irrigation (Landscape) and water harvesting and storage (Rainwater harvesting). These criteria will help address water shortages that occur as a result of reduced rainfall but should be re-evaluated to ascertain whether the measures are sufficient for projected shortages under climate change. The SBAT however does not address projected increases in rainfall. Therefore this should be considered through criteria in the SBAT that measure the extent to increases in rainfall can be accommodated. Examples of measures include:

Water proofing details which avoid potential dampness and moisture-related problems in buildings.

Sustainable urban drainage systems which ensure that additional precipitation and resulting runoff is addressed adequately on site.

Extreme rainfall events

The SBAT does not address extreme rainfall events. This therefore should be addressed in the tool through criteria that included:

Strengthening structural elements of the building, and in particular, the roof to withstand projected rainfall events.

Enhancing the capacity of rainwater goods such as gutters and downpipes to accommodate projected flows.

Increased wind speeds

The SBAT does not address increased wind speeds. This therefore should be addressed in the tool through criteria that included:

Strengthening structural elements of the building, and in particular, the roof to withstand projected wind speeds.

Strengthening elements exposed to wind, such as walls and facades, to ensure they can withstand projected wind speeds.

Natural systems resilience

SBAT criteria that address natural environments are found primarily under the Biodiversity category and include, avoiding green field sites (Brownfield Site), reducing urban sprawl (Municipal Boundary), enhancing onsite planting (Vegetation), supporting ecosystem (Ecosystems). These criteria appear to support the objective of natural systems resilience well. However, it is recommended that these criteria are reviewed and enhanced where possible.

Artificial systems resilience

The SBAT criteria that address social and economic system resilience are distributed across a number of categories including Local Economy, Education, Health, Inclusion and Social Cohesion. Criteria include, local sourcing of materials and products (Locally Sourced Materials and Products), using small enterprises (Small Enterprises), locating the building near local primary, secondary and going education (Primary Schools, Secondary School and Ongoing Education), including facilities that support education and awareness (Internet, Notice boards, and Space for Learning), specific support for construction worker education (Construction Worker Education) and understanding of the building’s systems by users (Building User

Manual). Specific criteria in the SBAT aim to promote social cohesion and include spaces where occupants can interact socially (Occupants), spaces, facilities and organizations that support social interaction and organization within the local community (Community Space, External Facilities, Residents Association).

The SBAT appears to have numerous criteria supportive of artificial systems resilience and it is difficult to readily identify additional measures. Therefore, it is recommended that the existing criteria are reviewed in light of artificial systems resilience literature in order to ascertain whether they can be improved and whether additional measures can be developed.

7. Discussion

The review indicates that the SBAT does not comprehensively address the additional risk to built environments represented by climate change. In some cases, the nature of climate change risks, such as flooding and the urban heat island effect, requires that these are addressed at a larger scale than the building level. Here urban planning tools and policies that govern land use and development are likely to be more effective than building-scale tools. It is therefore important that tools and policies that address the larger-scale are also reviewed and updated to ensure that a comprehensive and linked up approach is developed.

At a building level, the SBAT provides general support for improved sustainability performance, however, it does not provide specific measures that address the risks generated by climate change. The review indicates that additional measures may be available that could be incorporated in buildings to improve their resilience to climate change. These include additional shading, heat island mitigation measures, provision of drinking water, enhanced water proofing, increased rainwater and storm water system capacity and reinforcing roof and façade structures. These measures, in most cases, could be easily integrated in existing buildings and new designs and would contribute significantly to achieving more client resilient buildings. It is therefore recommended that these are include as criteria in an updated version of the SBAT.

The SBAT includes a large number of criteria that are supportive of natural and artificial systems resilience. A review of these criteria suggests that they are well suited for the purpose of enhancing natural and social resilience. This, however, is achieved implicitly, and it may be valuable to define natural and artificial systems resilience in the tool and design criteria to explicitly address this. Through this process relevant existing criteria could be enhanced and new criteria added, where necessary.

8. Conclusions and Recommendations

Climate change must be addressed both in existing and new built environments. By understanding the risks presented by climate change, measures can be identified which enhance the resilience of built environments. Local natural and artificial systems also make important contributions to local resilience. Built environments can address climate change by incorporating physical measures which enable buildings and their occupants to adapt to projected change. They can also foster local resilience by supporting increased local and natural system resilience.

A review of the Sustainable Building Assessment Tool indicates that it does not comprehensively address climate change resilience or enhance the resilience of local natural and artificial systems. Valuable additional assessment criteria supportive of resilience are identified that can be integrated into the SBAT. It is recommended that these are integrated into the tool when it is next updated.

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