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A Government Sustainable Building Rating Tool?

J T Gibberd ^{1,2*}

¹ CSIR, Pretoria, South Africa

² University of the Witwatersrand, Johannesburg, South Africa

*Corresponding author: jgibberd@csir.co.za, jeremy.gibberd@wits.ac.za

Abstract. Some countries have significant public building backlogs. Schools, colleges, clinics, and hospitals still need to be built and existing infrastructure needs to be updated and refurbished. In addressing backlogs, there is the prospect of developing more sustainable buildings and infrastructure. However, often this opportunity is not taken, and the design and construction of public buildings continue to follow conventional unsustainable approaches. Reasons for this include the lack of a suitable sustainable building rating tool that aligns with government priorities. To address this gap, this study explores development a Government Sustainable Building Rating Tool (GSBRT). It investigates this for South Africa, a country with large public building backlogs. Government policy is analysed to establish the key development priorities and translate these into building performance criteria. These criteria are compared with criteria from an existing green building rating tool, to determine alignment. The study finds that while there is some overlap, there are also significant differences and that the conventional green building rating tool does not cater for some government sustainable development priorities. Recommendations are made for further research and development of a GSBRT as a means of addressing sustainability in government buildings.

1. Introduction

To achieve the Sustainable Development Goals and climate change targets, there must be rapid and widespread change in the way built environments are planned, designed, constructed, and operated [1, 2, 3, 4, 5]. This requires government and the private sector to play their roles and undertake actions required for more sustainable built environments. Many governments are developing built environment policies and regulations that aim to improve the sustainability performance of buildings. Green building councils also have rating systems which encourage the adoption of more sustainable designs and practices [6, 7]. The construction industry has responded by complying with more stringent environmental requirements and in some cases, has adopted green building rating tools. However, green building rating tools have not been widely applied. Their implementation, to date, has tended to be restricted to large developers and corporations, with few smaller developers and government departments pursuing green ratings [8, 9].

The rate of transformation to more sustainable built environments is inadequate, and the International Panel on Climate Change (IPCC) confirm the urgent need for more rapid change [10]. It is therefore important that role-players, like government, do more to enable climate change targets and the



Sustainable Development Goals to be achieved. To contribute to addressing this need, this study explores how governments can develop more sustainable public buildings.

Many countries have very significant public sector building portfolios which include schools, technical colleges, clinics, hospitals, government offices and police stations. Where there has been rapid development and migration there may be considerable backlogs and many new public buildings are required. There may also be maintenance backlogs and a requirement to upgrade and refurbish older buildings. In addressing these backlogs, there is the opportunity to develop public buildings which address government sustainable development priorities. This can be achieved by requiring government buildings to comply with defined sustainability criteria. However, this does not happen in many government projects, or occurs in an ad-hoc way. Reasons for this may be a lack of technical capacity within the government, the perception that green building rating tools and their criteria do not align well with government priorities, or both [7, 8, 11]. It may also be that government see their development objectives as the priority, and this leaves little scope to consider, and include additional green issues [12].

This study explores how these factors could be addressed and government could promote more sustainable buildings through a Government Sustainable Building Rating tool (GSBRT). It aims to understand the government's key development priorities and their implications for buildings. Government development priorities are reviewed to develop government building objectives and criteria. These are compared with criteria in green building rating tools to understand the alignment and overlap. The lack of alignment confirms the need for a GSBRT and outline specifications for criteria that could be included in a GSBRT are developed. The study is structured around the following research questions:

- a) What are government development priorities?
- b) What are the implications of these for government buildings?
- c) Can public building performance criteria be developed that reflect government priorities?
- d) Do government building performance criteria align with green building rating tool criteria?
- e) What do findings from a-d, indicate about the development of a Government Sustainable Building Rating Tool (GSBRT)?

2. Materials and Methods

The following materials and methods are used to address the research questions developed for the study.

- a) What are government development priorities?

To answer this question, the strategic development frameworks used by the government are reviewed and analysed. Strategic development frameworks selected for the study are restricted to key documents that guide development and are widely referenced in legislation, policies, and guidelines.

- b) What are the implications of these for government buildings?

To ascertain the implications of the strategic development priorities these are translated into government building objectives. These are objectives that should be achieved in government buildings to support strategic development priorities.

- c) Can building performance criteria be developed that reflect government priorities?

To develop building performance criteria, government building objectives identified in b) are translated into government building performance criteria. These criteria aim to measure the extent to which buildings support government development priorities.

- d) Do government building performance criteria align with green building rating tool criteria?

To understand whether the government building performance criteria align with green building rating tools, GSBRT and green building rating tool criteria are compared. This is used to identify overlaps and gaps between the frameworks.

e) What do findings from a-d, indicate about the development of Government Sustainable Building Rating Tool?

An analysis of the findings from a-d is used to evaluate the need for a government-sustainable building rating tool. This aims to establish whether government building priorities and performance criteria identified in b) and c) are sufficiently different from criteria in green building rating tools to warrant the development of a new tool.

3. Results

The strategic development frameworks selected for the study are restricted to key documents that guide development and are widely referenced in South African built environment legislation, policies, and guidelines. These are the South African Constitution and the Sustainable Development Goals [13,14]. These frameworks are reviewed to identify key objectives that should be met in government buildings to support goals listed in the Constitution and the SDGs. These objectives are then translated into government building performance criteria, as shown in Table 1. As an example, the South African Constitution has a ‘Right to Equality’. This is translated into the government building objective of ‘Buildings must be designed and operated to be inclusive and support equal access’ and the criterion of ‘Inclusion: Design and operation to promote inclusion, equality and freedom’.

The South African Constitution provides key objectives and principles that government legislation and policy must align and fulfil in South Africa [13]. A review of the Constitution identified sections which had clear implications for built environments. These include sections on Equality, Freedom, Housing, Education, Health, and Children. These sections and their implications in terms of government building objectives and criteria are set out in Table 1.

The Sustainable Development Goals (SDGs) are also drawn on in South Africa in development strategy and plans [14]. The SDGs list 17 goals including ending poverty, improving health and education, reducing inequality, spurring economic growth, tackling climate change, and working to preserve our oceans and forests [14]. UN member states, including South Africa, have committed to achieving these goals. In this study, a review of the SDGs was carried out to identify building objectives that support the goals. These objectives are also developed as government building performance criteria as shown in Table 1.

Table 1. Strategic development framework, building objectives and criteria.

Strategic development framework	Section	Government building objective	Government building performance criteria
The Constitution	Section 9	Equality: Buildings must be designed and operated to be inclusive and support equal access.	Inclusion: Design and operation to promote inclusion, equality, and freedom.
	Section 15	Freedom: Buildings must be designed and operated to ensure there is freedom of religion belief and opinion.	Inclusion: Design and operation to promote inclusion, equality, and freedom.
	Section 24	Environment: Buildings must be designed and operated to minimise negative environmental impacts.	Environment: Design and operation to minimise negative environmental impact.
	Section 26	Housing: Buildings must be designed and operated to ensure access to adequate housing.	Housing: Design and operation to promote access to housing.
	Section 27	Health: Buildings must be designed and operated to ensure access to healthcare facilities, sufficient food and water, social security, and medical care.	Health: Design and operation to promote health and well-being and access to healthcare facilities, sufficient food and water, social security, and medical care.

	Section 28	Children: Buildings must be designed and operated to ensure the rights of children.	Children: Design and operation to promote the rights of children.
	Section 29	Education: Buildings must be designed and operated to promote access to education.	Education: Design and operation to promote access to education.
	Section 31	Cultural, religious, and linguistic communities: Buildings must be designed and operated to support cultural, religious, and linguistic communities.	Inclusion: Design and operation to promote inclusive, equality and freedom.
	Section 32	Access to information: Buildings must be designed and operated to ensure there is access to information.	Information: Design and operation to promote access to information.
Sustainable Development Goals	Goal 1	Poverty: Built environments must include facilities and characteristics that provide access to productive resources and work opportunities to enable people to avoid poverty.	Poverty: Design and operation to promote access to productive resources and work opportunities to enable people to avoid poverty.
	Goal 2	Food security: built environments must include facilities and characteristics that provide access to affordable healthy food from reliable and sustainable sources and promote sustainable agriculture.	Food: Design and operation to promote access to affordable healthy food from reliable and sustainable sources and promote sustainable agriculture.
	Goal 3	Health: Buildings must include facilities and characteristics that provide access to environments that are conducive to health and well-being including access to clean water, healthy food, exercise, and health care and which do not have hazards harmful to health such as pollution and crime.	Health: Design and operation to promote health and well-being and access to healthcare facilities, sufficient food and water, social security, and medical care.
	Goal 4	Education: Buildings must include facilities and characteristics that provide access to education facilities such as schools, colleges, universities, training facilities and libraries that enable inclusive, equitable, quality education and promote lifelong learning for all.	Education: Design and operation to promote access to education.
	Goal 5	Equality: Buildings must include facilities and characteristics that promote gender equality and empower women and girls.	Inclusion: Design and operation to promote inclusive, equality and freedom.
	Goal 6	Water: Buildings must include facilities and characteristics that ensure there are affordable water and sanitation systems that can be accessed by all and are sustainable.	Water: Design and operation to promote access to affordable and sustainable water and sanitation systems.
	Goal 7	Energy: Buildings must include facilities and characteristics that enable access to affordable reliable, sustainable, modern energy systems.	Energy: Design and operation to promote access to affordable reliable, sustainable, modern energy systems.
	Goal 8	Inclusive economic growth: Buildings must include facilities and characteristics that promote inclusive and sustainable economic	Inclusive and economic growth: Design and operation to promote inclusive and sustainable economic

	growth including local employment and self-employment opportunities.	growth including local employment and self-employment opportunities.
Goal 9	Inclusive industrial growth: Buildings must include facilities and characteristics that promote inclusive and sustainable industrialization and innovation.	Economic growth: Design and operation to promote inclusive and sustainable economic growth including local employment and self-employment opportunities.
Goal 10	Buildings must include facilities and characteristics that reduce inequality such as access to affordable education, health, services and products, accommodation, and local employment opportunities.	Inclusion: Design and operation to promote inclusive, equality and freedom.
Goal 11	Inclusive, sustainable settlements: Buildings must include facilities and characteristics that promote inclusion, safety, resilience, and sustainability.	Resilience and sustainability: Design and operation to promote inclusion, safety, resilience, and sustainability.
Goal 12	Sustainable consumption and production: Buildings must include facilities and characteristics that support sustainable consumption and production patterns such as local access to sustainable products and low ecological footprint food.	Sustainable consumption and production: Design and operation that support sustainable consumption and production patterns such as local access to sustainable products and low ecological footprint food.
Goal 13	Climate Change: Buildings must include facilities and characteristics that combat climate change and its impacts such as passive design, energy-efficient fittings, and renewable energy systems.	Climate Change: Design and operation that combat climate change and its impacts such as passive design, energy-efficient fittings, and renewable energy systems.
Goal 14	Sustainable oceans: Buildings must include facilities and characteristics that conserve and sustainably use the oceans, seas, and marine resources for sustainable development.	Climate Change: Design and operation that combat climate change and its impacts such as passive design, energy-efficient fittings, and renewable energy systems.
Goal 15	Sustainable ecosystems: Buildings must include facilities and characteristics that promote such as sustainable use of terrestrial ecosystems including the use of sustainably grown materials and the inclusion of planting and the protection of biodiversity on sites.	Sustainable ecosystems: Design and operation that promote such as sustainable use of terrestrial ecosystems
Goal 16	Peace and inclusion: Buildings must include facilities and characteristics that promote peaceful and inclusive societies for sustainable development including local democratic governance institutions.	Peace and inclusion: Design and operation that promote peaceful and inclusive societies for sustainable development including local democratic governance institutions.

To ascertain alignment between the government building performance criteria and green building rating tool criteria, the Greenstar rating tool was selected. The Greenstar rating tool has been developed by the Green Building Council of South Africa (GBCSA) for South Africa and has versions for office, residential and commercial buildings [15]. Greenstar was chosen as it is the tool that is most widely applied in South Africa. Greenstar measures building performance using the following criteria:

- **Management:** The credits within the management category promote the adoption of environmental principles from project inception, design, and construction phases, to commissioning and operation of the building and its systems.
- **Indoor Environment Quality (IEQ):** Each of the credits in the IEQ category targets the well-being of the occupants. The credits address how the heating, cooling, lighting, and indoor air pollutants contribute to a healthier indoor environmental quality.
- **Energy:** The credits within the energy category target an overall reduction in energy consumption and a reduction of greenhouse gas emissions associated with energy generation.
- **Transport:** The credits within the transport category reward the reduction in automotive commuting while encouraging the use of alternative transport.
- **Water:** All the water credits aim to reduce the use of potable water through the design of efficient systems, rainwater collection and water reuse.
- **Materials:** All the credits in the materials category target the consumption of resources through the selection and reuse of materials. The concept is to reduce the amount of natural resources used and reuse materials that can be reused or recycled.
- **Land Use & Ecology:** All the credits in the land use & ecology section promote initiatives that improve or reduce the building's impact on ecological systems and biodiversity.
- **Emissions:** emissions credits target the environmental impacts of a development's emissions or substances emitted from the site.
- **Innovation:** The innovation category encourages, recognises, and rewards the spread of innovative technologies, designs and processes that impact the overall environmental performance of the building [15].

Table 2 shows an analysis of the government building performance criteria in relation to the Greenstar criteria listed above. The first column lists government building performance criteria and the second column, the green building rating tool criteria that are relevant. The final column confirms if there is an alignment between the government building performance criteria and green building rating tool criteria. Alignment is indicated as 'No', meaning no alignment, 'Partial', indicating some alignment and 'Yes' indicating full, or strong, alignment.

Table 2. The alignment between government building performance criteria and green building rating tool criteria.

Government building performance criteria	Relevant green building rating tool criteria	Alignment
Inclusion: Design and operation to promote inclusive, equality and freedom.	None	No
Housing: Design and operation to promote access to housing.	None	No
Health: Design and operation to promote health and well-being and access to healthcare facilities, sufficient food and water, social security, and medical care.	Indoor environment quality, Water, Material	Partial
Children: Design and operation to promote the rights of children.	None	No
Education: Design and operation to promote access to education.	None	No
Poverty: Design and operation to promote access to productive resources and work opportunities to enable people to avoid poverty.	None	No
Food: Design and operation to promote access to affordable healthy food from reliable and sustainable sources and promote sustainable agriculture.	None	No
Information: Design and operation to promote access to information.	Management	Partial

Peace and governance: Design and operation that promote peaceful and inclusive societies for sustainable development including local democratic governance institutions.	None	No
Environment: Design and operation to minimise negative environmental impact.	Management, Indoor environment quality, Energy, Transport, Water, Material, Land use and ecology, Emissions	Yes
Resilience and sustainability: Design and operation to promote inclusion, safety, resilience and sustainability.	Management, Indoor environment quality, Energy, Transport, Water, Material, Land use and ecology, Emissions	Partial
Sustainable consumption and production: Design and operation that support sustainable consumption and production patterns such as local access to sustainable products and low ecological footprint food.	Management, Indoor environment quality, Energy, Transport, Water, Material, Land use and ecology, Emissions	Partial
Climate Change: Design and operation that combat climate change and its impacts such as passive design, energy-efficient fittings and renewable energy systems.	Management, Energy, Transport, Water, Material, Land use and ecology, Emissions	Yes
Sustainable ecosystems: Design and operation that promote such as sustainable use of terrestrial ecosystems	Material, Land use and ecology Material	Yes Partial
Inclusive economic growth: Design and operation to promote inclusive and sustainable economic growth including local employment and self-employment opportunities.		
Inclusive industrial growth: Buildings must include facilities and characteristics that promote inclusive and sustainable industrialization and innovation.	Material	Partial

Table 2 shows that there are different levels of alignment between government building performance criteria and green building rating tool criteria. This is analysed further and presented in Table 3.

Table 3. Extent of alignment between government building performance criteria and green building rating tool criteria.

Extent of alignment	Relevant green building rating tool criteria	Number
Alignment	Environment, Climate Change, Sustainable Ecosystem	3
Partial	Health, Information, Resilience and Sustainability, Sustainable Consumption and Production, Inclusive Economic Growth, Inclusive Industrial Growth	6
None	Inclusion, Housing, Children, Education, Poverty, Food, Peace, and Inclusion,	7

Table 3 shows the extent of alignment between the sixteen government building performance criteria and green building rating tool criteria. Three government building performance criteria have green building rating tool criteria that are well aligned, six have criteria that are partially aligned and seven have no alignment. This indicates that the alignment between the government building performance criteria and green building rating tool criteria is poor and is only aligned fully in three criteria (19%). For seven criteria (44%), there is no alignment.

The findings for a-d indicate that it is possible to develop government building objectives and criteria from strategic development documents. When government building criteria are compared to the criteria

found in the green building rating tool and government building rating the alignment is found to be poor, with only about 19% of the criteria overlapping. The analysis shows that 44% of the government building criteria derived from government development priorities are not catered for.

3. Discussion

The results indicate that if the government wish to address development objectives and sustainability it cannot rely on existing green building rating tools and that a new framework or tools are necessary [16]. The study confirms that the adoption of sustainability assessment strategies in lower-income countries should be preceded by the determination of local urban challenges as these are different to those of high-income countries. It shows that a simple process can be followed to derive government sustainable building objectives and criteria from strategic development frameworks. This provides a framework that can be used to guide the development of government buildings. A comparison of this framework with a green building rating tool framework confirms that there is limited overlap. Environmental aspects are an exception, where alignment is strong.

The difference in emphasis between green and sustainable buildings may partly explain the lack of overlap. Green buildings tend to focus on environmental improvements while sustainable buildings have had a broader focus which includes addressing social, economic, and environmental issues [17]. The mandate of government is wider than the environment and therefore a focus on sustainable buildings rather than green buildings is appropriate.

The findings from the study confirm research by Ameen and Mourshed, who state that sustainability assessment tools in lower-income countries should be preceded by an assessment of local issues and respond to these, instead of ‘importing’ criteria from elsewhere [16]. Results also confirm that green building rating systems from other countries may make assumptions that are not necessarily true for local conditions. For example, there may be assumptions that levels of education, health, housing and energy, water and sewage services are adequate (and therefore do not need to be addressed), when this is not the case [16, 18].

Ameen and Mourshed show that culture, housing, jobs, and economic growth are important for lower-income countries but are not reflected in green building tools [19]. This study confirms this finding and indicates that important local considerations should not be discounted or disregarded. To support further investigation into the development of a Government Sustainable Building Rating Tool, further research into criteria determined by this study is recommended [20].

Outlined below are recommendations for the development of criteria that could be included in Government Sustainable Building Rating Tools. This input could be drawn on in a tool used to set targets and measure the performance of buildings in terms of government sustainable development priorities.

- Inclusion: Research should be carried out on best practice inclusion processes and criteria for planning, design, construction, and operation of government buildings that promote inclusive, equality and freedom.
- Housing: Research should be carried out on best practice approaches and criteria for planning, design, construction, and operation of government buildings to ensure this promotes affordable sustainable housing in areas with access to job opportunities and services such as schools. This may include exploring mixed-use developments.
- Health: Research should be carried out on best practice approaches for planning, design, construction, and operation of government buildings to promote improved well-being and health. This should include a focus on the occupants of the building as well as communities around the building. Thus, where there was a lack of local health services, government buildings such as offices and schools may include provisions to support health services.
- Children: Research should be carried out on best practice approaches that ensure that the planning, design, construction, and operation of government buildings promote the rights of children and ensure these are given priority.
- Education: Research should be carried out to develop best practice approaches and criteria for the planning, design, construction, and operation of government buildings that promote education and learning. This should include a focus on the occupants of the building as well as

communities around the building. Thus, where there was a lack of local education services, government buildings such as offices and clinics may include provisions to support education.

- **Poverty:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings to ensure poverty is addressed. This should include prioritising this in planning, by for instance providing better services, in construction, by for instance providing local employment, and in building operation, by for instance providing for the development of local enterprises and employment.
- **Food:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that address food. This should include a focus on ensuring that addressing food security was prioritised in planning, by for instance ensuring that there was local access to affordable healthy food.
- **Information:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that promote access to information.
- **Peace and governance:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that promote more inclusive societies including local democratic governance institutions.
- **Environment:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that promote environmental aspects of government policy and international commitments.
- **Resilience and sustainability:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that promote the integration of resilience and sustainability.
- **Consumption and production:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that promote more sustainable consumption and production.
- **Climate Change:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that ensure that climate change commitments are achieved.
- **Sustainable ecosystems:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that promote sustainable ecosystems.
- **Inclusive economic growth:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that ensure that promote inclusive economic growth including jobs and small enterprise development.
- **Inclusive industrial growth:** Research should be carried out to develop practical best practice approaches for the planning, design, construction, and operation of government buildings that ensure that promote inclusive local economic growth and resilience.

Recommendations to develop a broader set of building performance criteria, like those listed above, that include social economic and institutional factors have been made by a range of researchers, particularly those working in lower-income country contexts [7, 9, 17, 19].

7. Conclusions and Recommendations

The study explores the possible development of a Government Sustainable Building Rating Tool (GSBRT) in the case of South Africa. It analyses government policy to establish the key development priorities and translates these into building objectives and criteria. A comparison of these criteria with existing green building rating tools indicates little overlap. This suggests that conventional green building rating tools do not cater well for government sustainable development priorities. The study findings suggest that if the government wishes to target and measure performance in terms of its sustainable development priorities, a Government Sustainable Building Rating Tool (GSBRT) could be

used. Outline specifications for the development of criteria for a GSBRT are developed and recommendations on how these could be developed in a new tool are made.

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