# 570: FROM GREEN BUILDING TO SUSTAINABLE URBAN SETTLEMENTS: A NEW ASSESSMENT METHOD

**Fazia Ali-Toudert**

*TU Dortmund University . Faculty of Architecture and Civil Engineering*
*Chair for Environmental Architecture . Dortmund . Germany*
*fazia.alitoudert@tu-dortmund.de*

**Abstract**

Assessment methods of environmental performance with focus on the building scale have rapidly grown since the early 1990's. Yet, methods dedicated to the urban scale are few and still in an experimental stage. Indeed, although the sustainability of cities has focused the interest of several research fields for decades, the lack of a common framework which coordinates all findings in readily understandable performance criteria or indicators prevents their effective implementation.

The critical and current issue is to know how to manage the increased complexity related to urban sustainability assessment induced by i) the enlarged scope: the city, ii) more environmental issues to be considered, and iii) the manifold human-being related topics: social, cultural and economic.

The present paper seeks to signpost a new assessment method for urban scale. The project of a comprehensive assessment method for high environmental quality and sustainable settlements (neighbourhoods) is presented. This is partly inspired from building assessment methods BEAM and to this purpose, a number of popular methods are exemplarily analysed and compared (BREEAM, LEED®, CASBEE, HQE®, GBC/SBC). The new method is structured in a number of prescriptive and quantitative indicators covering the governance, the environmental (urban climate & pollution, resources depletion), and the socio-cultural & economic dimensions. A special attention is given to the necessary simplicity and practical form of the tool.

Keywords: Building Assessment Method, Sustainable Urban Design, Sustainability Indicator. Rating System, CAMESUD.

## 1. Introduction

This topic was first addressed in [1] which focused on a comparative analysis of a number of building assessment systems. Exemplarily, BREEAM [2], LEED® [3], CASBEE [4], NF-HQE® [5], GBC/SBC [6] have been chosen for the comparison. The outcome was to show their convergences and divergences and their ability to evolve towards more extensive systems. The present paper examines again these rating systems with focus on their technical content, and formulates a first draft for a new assessment system to be used at urban level. The reader is, therefore, advised to report to this first reference as introductory material.

## 2. Convergences & Divergences of BEAM

In [1] the author compared the main features of building environmental assessment methods: Applicability Area (scope and scale, type of projects), Development Approach, Technical Content, Measurability, Maturity, Communicability, Usability, Verification Means and Certification Process, Cost, etc.

Basically all these systems handle the major environmental issues of Energy, Water, Materials & Waste and Indoor Environmental Quality, with some elements of convergence from which: i) the building being the main object of interest, yet with a trend for scale change from building to urban scale, ii) all but GBC are commercial tools with strong market motivation and diversified offer of products covering various building projects and life cycles, iii) context-specific benchmarks and weightings are set for local use and iv) the consensus of a presentation in form of a ranking system. On the other hand, evidence for divergence is observable at the scope of required compliance documentation, level of accuracy of assessment, content thoroughness, criteria weighting scale used, legibility and user-friendliness, user's support with calculation aid means, verification process and cost.

Once, this general picture is understood, it is critical to look in more detail at the technical content, i.e. at the individual indicators of performance in order to catch the specificities of each system and their potential for extension to new issues. However, the task is challenging to place side by side these methods because of their different development history, strategic choices, structure (linear vs. arborescent) and local benchmarks, which lead to an evident heterogeneity. Nevertheless, such an effort is useful and an attempt for a systematic comparison is shown in Table 1. The main topics building the structure of this table is a synthesis from all methods as explained in [1]. The individual items under each topic have been defined according to their frequency between all systems under investigation. They are expressed by their original [ID] codes. A number of observations can be drawn as follow:

Table 1: Comparison of the technical content of a number of environmental Building rating systems: BREEAM, LEED®, CASBEE, HQE®, GBTool

| BREEAM | LEED® | CASBEE | HQE® | GBC.Tool (*) | Environmental Indicators (Performance Criteria) |
|---|---|---|---|---|---|
| | | | | 1 | **Management** |
| M21 | | | SME | A2.3 | Environmental Management System |
| M7, M17 | | | SME | | Committment & Environmental policy |
| M6 | SS1 | | 1.1, 1.3 | A1 (1~9), A2.1 | Site Selection & Site Investigation |
| M4 | | | 3.1.1, 3.1.2, 3.1.3 | | Considerate Construction |
| M5 | SSpr1, MR2 | | 3.2.1, 3.2.2, 3.2.3 | C3.1, C5.2 | Construction Site Impacts (resources use, waste & pollution) |
| | EQ3.1, 3.2 | | | D1.1, 1.2 | Construction IAQ Management Plan |
| M12 | | | | F 3.5 | Building User Education |
| M11-M22 | | | | | Building User Guide and Technical Documentation |
| M13, M14, M16 | | | | | Communication & Publication of Building information |
| M8, LE7 | | | | | Consultation of Stakeholders |
| M15 | ID3 | | | | Building as Eco-education Teaching Tool |
| | | | | 2 | **Quality of Services** |
| M1 | EApr1 - EA3 | | | B4 | Commissioning (Building & Systems) |
| E2 | | | 4.1.1 | F1 | Maintenance of Building Envelope Performance |
| M19 | EQ11 | Q2.3.3 | 2.2, 7 (1~4) | E3 (1~4), E2 | Ease of Maintenance & Controllability of Systems |
| | | Q2.2.2 | 7.1 | F3.1, F3.2 | Service Life of Operating Performance |
| E6 | | | 7 | F3.3 | Operating Plan and Maintenance Schedules |
| | | Q2.1.1, 2.3.1, 2.3.2 | 2.1 (1~3) | F2.2, F2.3, F2.4 | Adaptability of the Building |
| | | Q2.2.3 | 7.1, 7.2, 7.3 | F2.1, 2.4, 2.5 | Adaptability of the Technical Systems |
| | | Q2.1.1 | | E1 | Efficient Use of the Spaces |
| | | Q2.1.2 | | | Amenity and Perception of Indoor Spaces |
| MW10 | | | | | Robustess, Durability and Reliability facing Risks |
| | | | | 3 | **Urban Design** |
| | SS2 | Q3.3.1 | | A3.1, A3.3 | Development Density & Community Connectivity |
| | SS5.1 | | | A3.5 | Preservation of heritage and restoration |
| | | Q3.3.1 | | A3.4 | Respect of Local Cultural Values |
| M9 | SS10 | | | A3.2 | Joint Use of facilities |
| | SS5.2 | Q3.1, Q3.3.2 | | A3.8, A3.9, A3.10 | Maximized Public and Green Spaces |
| | | Q3.3.2 | | A3.11 | Natural Flora Corridors |
| T3, T4 | | | | A1.8 | Proximity to Commerce and Activities |
| | | | | A1.7 | Mix of Employment & Residential |
| | | Q3.1 | | A1.9 | Proximity to Public and Green Spaces |
| | | LR3.3 | 1.3.1, 1.3.2 | A2.9, C6.1 | Solar Acces to Building and Surrounding Environment |
| | | LR3.3 | | C5.3 | Aerodynamic Effects of Wind |
| MW2 | SS7.1 | Q3.3.2, LR3.5 | | C6.3 | Heat Island Mitigation - Outdoor Spaces |
| | SS7.2 | LR3.5 | | C6.4 | Heat Island mitigation - Roofs |
| | | Q3.3.1, Q3.3.2 | 1.2(1~4) | G2.4, G2.5 | Outdoor Living Spaces (Quality & Comfort) |
| | | Q3.2 | | | Building Geometry and Urban Integration |
| P12 | SS8 | LR3.4 | | C6.5 | Lighting Nocturnal Pollution |
| P13 | | LR3.2.1 | | | Noise Attenuation |
| | | | | 4 | **Sustainable Sites** |
| LE2 | SSpr 2 | | | | Salubrity and Contamination-Free Site |
| LE3 | SS1 | | | A1.1, A1.2 | Ecological Value and Sensitivity of Site |
| LE1 | SS3 | | 1.1.4 | A1.5 | Brownfield Redevelopment |
| LE4 | | | | C5.1, C5.2 | Reduction of Ecological Impact |
| LE5 | | Q3.1 | 1.1.3 | | Amelioration of Site Ecology |
| LE6 | SS5.1 | Q3.1 | | | Preservation of Biodiversity |
| P7 | SS6.1,SS6.2 | Q2.2.1 | 1.1.4 | A1.3 | Protection from Natural Hazards (earthquake, flooding...) |
| | | | | A.1.4 | Water Proximity |
| | | | | 5 | **Transport** |
| | | LR3.6 | 1.1.2 | A3.7 | Alternatives to Motor Traffic |
| T1 | SS 4.1 | | | A1.6 | Public Transportation Access |
| T 5 | SS 4.2 | LR3.6 | | A3.6 | Bicycle Use |
| T 2 | SS 4.3 | | | | Clean or Low-Emission Vehicles |
| T9 | SS 4.4 | LR3.6 | | | Surface Parking |
| T8 | | | | | Travel Plan |
| | | | | 6 | **Energy** |
| E1 | | | | | CO2-Emissions Reduction |
| E1, E2 | EApr2-EA1 | LR1.1, LR1.2 | 4.1, 4.2 | | Energy Performance |
| | | | 4.2.3 | B1.1, B1.2 | Non-Renewable Energy |
| P11 | EA2 | LR1.2 | | B3.2 | On-Site Renewable Energy |
| | EA6 | | | B3.1 | Off-Site Renewable Energy (Green power) |
| E5 | | | 1.2.3 | | External Lighting |
| E3-E4 | EA5 | | | | Energy Monitoring & Measuring |

*Continue on next page*

| | | | | | |
|---|---|---|---|---|---|
| | | | | 7 | **Water** |
| W6 | WE1.1,WE1.2 | | | B6.2 | Water Efficiency for Irrigation |
| W1 | WE3.1, 3.2, WE4 | LR2.1.1 | 5.1(1~3) | B6.3 | Optimized Use of Water for Occupancy Needs |
| W4 | WE2 | | 7.4 | | Innovative Wastewater Technologies |
| W5 | SS6.1, 6.2 | LR2.1.2 | 5.2 (1~3) | C4.3 | Retention and re-Use of Rainwater |
| W5, W7 | | LR2.1.2 | | C4.2 | Greywater Recycling |
| | | | | A2.4 | Management of Surface Water |
| | | | | A2.5 | Treatment of Potable Water |
| | | | 14.2 | A2.6 | Separation between Potable and Grey Water |
| W3, W4 | | | | | Leakage Detection |
| | | | 14.1, 14.3, 14.4 | | Water quality |
| W2, W9 | WE3.1, WE 3.2 | | | | Water Meter |
| | | | | 8 | **Materials and Waste** |
| MW1 | | | | B5.4, B5.5 | Materials Specification |
| | | | 2.3 | | Eco-Materials ( with low energy content) |
| | MR5 | | | B5.6 | Regional or Local Materials |
| MW8 | MR7 | LR2.2.2 | | | Responsible Sourcing of Timber |
| MW6 | MR1.1, MR1.2 | LR2.2.4 | | B5.1 | Re-Use of Existing Structures |
| MW5 | MR1.3 | | | | Re-Use of Non-Structural Building Elements |
| MW7 | MR3, MR4 | LR2.2.5 | | B5.2, B5.3 | Re-Use of Salvaged Materials |
| | MR2 | | 3.1 (1~3) | C3.1 | Reduction of Construction and Demolition Waste |
| | | | 6.1, 6.2 | C3.2 | Reduction of Waste from Building Operation |
| MW12 ~ 15, MW17 | MRpr1 | | 6.1 | A2.7, A2.8 | Storage of Operation Waste and Composting |
| MW9 | | LR2.2.6 | | C5.4 | Hazardous Materials & Waste |
| | | | | 9 | **Indoor Environmetal Quality (Comfort & Health)** |
| HW9, 10, 12, HW16 | EQpr1, EQ5 | Q1.4.1 | 12.2, 13.1, 13.2 | D1.4 ~ D1.7 | Indoor Air Quality IAQ: Pollution Control |
| | EQpr1, EQ1 | Q1.4.3 | | D1.8 | IAQ Monitoring |
| MW3, MW4, HW13 | EQ4.1 ~ EQ4.4 | LR2.2.3 | 2.4.1, 2.4.2 | D1.3 | Low Emitting Materials - VOC |
| HW1 | EQ8.1, EQ8.2 | Q1.3.1, LR1.2.1 | 10.1 | D4.1 | Daylighting |
| HW2 | EQ8.1, EQ8.2 | Q2.1.2 | | G2.7 | View Out |
| HW3 | | Q1.3.2 | 10.1 | D4.2 | Glare control |
| HW4, HW5 | | Q1.3.3 | 10.2 | D4.3 | Lighting: Quality and Systems |
| HW6, HW7 | EQ6.1 | Q1.3.4 | | E3.3 | Lighting Zones and Controllability |
| HW17 | EQpr3-EQ9 | Q1.1.(1~3) | 9.1, 9.2 | D5.1~ D5.4 | Noise and Acoustics |
| HW8 | EQ2 | Q1.4.2, LR1.2.1 | 11.1 | D2.1 | Natural ventilation |
| HW11 | EQ1 | Q1.4.2, LR1.3.1, LR1.3.2 | | D2.2, D2.3, D2.4 | Mechanical Ventilation & Ventilation Rates |
| | | LR3.2.2 | 11.1, 11.2 | | Odours |
| HW14 | EQ 7.1, EQ7.2 | Q1.2.1, Q1.2.2 | 8.1 ~ 8.4 | D 3.1, D3.2 | Thermal Comfort |
| | | | 12.1 | N.A | Electro-magnetic hazards |
| HW15 | EQ6.2 | Q1.2.3 | | | Zoning and Thermal Comfort Controllability |
| | | | | 10 | **Pollution & Environmental Loadings** |
| E1, T2 | | | | C1.1, C1.2 | CO2 Emissions (GWP reduction) |
| P1~ P5 | EApr3, EA4 | LR2.2.6 | 2.3 | C2.1 | Refrigerants & Insulants: ODP ; GWP |
| P6 | | LR3.1 | | C2.2 | Acidification Emissions (NOx et SOx) |
| | | | | C2.3 | Photo-Oxidation Emisions (NO & NO2) |
| P8 | | | | C5.1 | Water Course Pollution |
| | | | | N.A | Nuclear Pollution |
| | | | | 11 | **Social Dimension** |
| M25 | | | | G2.2 | Users Safety |
| | | | | G2.3 | Access for Hadicapped Persons |
| | | | | G2.6 | Privacy of Housing |
| | | | | G2.1 | Prevention of Accidents on Construction Site |
| | | | | 12 | **Costs & Economics** |
| M20 | | | | G1.1 | Whole Life Cycle Cost |
| | | | | G1.2 | Reduction of construction costs |
| | | | | G1.3 | Reduction of Operating and Maintenance Costs |
| | | | | G1.4, F3.4 | Affordable Housing |
| | | | | G1.5 | Support of Local Economy (Dynamics) |
| | | | | 13 | **Singular Items** |
| | ID1.1 à 1.4 | | | | Innovation in design |
| | ID2 | | | | Assistance to Rating System's User |

Remarks:

1) - BREEAM: BRE's Environmental Assessment Method.
 - LEED(R): Leadership in Energy and Environmental Design
 - CASBEE: Comprehensive Assessment System for Building Environmental Efficiency.
 - HQE(R): Démarche Haute Qualité Environnementale HQE(R)
 - GBC: Green Building Challenge. Now SBC: Sustainable Building Challenge.
2) Identification codes used in those used by each system (e.g. HW for BREEAM = Health and Wellbeing). See Fig 1 in [1] for complete description These ID's make it easier to know how the environnmental criteria are structured within each method and allow tranversal comparison
3) (*) GBC has been updated to SBC. Yet, only minor changes were undertaken in the structure of the tool (e.g. The cultural criteria were removed from Urban design chapter to a self-standing chapter), so that GBTool is still valid for this comparison.
4) Symbol ~ : from...to...
5) N.A.: not yet active
6) IAQ: Indoor Air Quality

i) The management is considered as a stand-alone concept by BREEAM which leads to more indicators addressing Builders and Owners. By contrast, CASBEE deals with some of these aspects by focusing on Quality of Services: Functionality, Durability, Long-term Performance & Maintenance, etc., as well as various qualitative building amenities. This trend is worthy of note because new and directly address the building's beneficiaries.
ii) The urban context and related topics e.g. open spaces, transport, etc. are especially given attention by the GBC system: CASBEE being strongly inspired from this model is also engaged in this direction. On the contrary, this issue is only partly dealt with in LEED® and even less by NF-HQE®.
iii) The ecological impact on site and atmosphere is given full attention by BREEAM, in that numerous indicators addressing sustainable sites and reduced pollution and loadings. This attention is shared by GBC but less by the other systems.
iv) Human dimension in terms of social and economic aspects, are mainly covered by GBC and to less extent by CASBEE, but still marginal or absent in the other systems.

Table 1 shows the items covered by each system, yet it does not specify how these items are exactly handled. Here again, a discrepancy can be observed: For example, the NF-HQE® system is mainly qualitative, with no particular focus on energy, whereas BREEAM and LEED clearly focus on energy (highest weighting factors) and set quantifiable measures of compliance and the necessary decision aid means (calculation tools) for high standards.
The major outcome of this basic comparison is the difficulty to find consensual *indicators*. What should be assessed? How? and timely for which term? This is discussed below to help propose a new scheme.

## 3 Urban Sustainability indicators

There are probably as many definitions of what should be sustainable urban development as there are studies on the subject. And research in this area is growing worldwide: e.g. the OECD (1998) indicator system (12 issues, 70 indicators); The UN Framework for sustainability indicators (58 indicators) or Eurostat system (46 indicators), etc. [7,8]. All seek to bring together four main tasks: maintaining an ecological environment, support economic productivity, improve human unity, well-being and equity within a participative institutional framework. In this respect, time, scale and scope are major methodological boundaries and every work in this area has to be properly signposted to reach tangible findings. Each assessment method must be clear regarding the scale: Metropolitan, neighbourhood or site-specific, the scope: energy, water, transport, pollution, etc. and the time frame for fulfilment of requirements: short- to long-term.

The search for an operational Sustainable Urban Design SUD strategy obviously faces the same challenge of definition and implementation of appropriate indicators. Most requirements of indicators are [7,8]: representativeness and adequacy, transparency, reproducibility of results, logic, quality of data, measurability, sensitivity to change in time, inclusion of trends, sensitivity to ecological, social, economical and institutional interactions, clarity, availability of data and possibility of regular updates. Herewith a number of keywords to help define suitable indicators:

- Data and Models: indicators require data and should be defined according to Data's availability, and also according to the accessibility to models which will aid in decision-making while comparing alternative strategies.
- Alternative Strategies: Indicators should privilege flexibility and keep as much decision latitude to the design team as possible.
- Quantification: One risk of an indicator is to focus on what is measurable and ignores what cannot be measured. In case of assessing sustainability this may lead to a distinction between two types of indicators measurable and not directly measurable. Issues such as quality, equity, etc. belong to the second case and must be dealt with specifically.
- Evaluation criteria: Indicators being generally descriptive, they need to be appraised with compliance criteria. The use of indices when possible as ultimate dimensionless indicators is advisable.
- Validity and Reliability: Indicators have to be proofed against the loops of validity and Reliability. Validity refers to the accuracy of the indicator in measuring the concept and can be based on consensus, correlation or prediction. Reliability is mostly critical when addressing no measurable concepts such as quality (e.g. quality of life).
- Indicators can be also differentiated according to their Type: analytical (descriptive, combined or systemic), causal (input-oriented; output-oriented; pressure, state, response or impact indicators, time-specific (static or dynamic), appraisal, factual, etc. Understanding these categories facilitates the choice of the most suitable indicator for each case.

## 4. Comprehensive Assessment Method for Environmental & Sustainable Urban Design: CAMESUD

The Table 2 is a draft for a new method for assessing the sustainability of urban neighbourhoods and is named CAMESUD. The major items (1 to 8) are basically inspired from building assessment methods as shown in Table 1.
The major environmental topics (energy, water, materials, etc.) are re-conducted at the urban scale as there will be continuity and no rupture

while moving from single building to urban scale. Indeed, at both scales the indicators of environmental loadings are identical: global warming potential GWP, Resource Consumption, Ozone depletion ODP, Pollution of Air, Soil and Water.

Yet refinements are necessary. In addition, the new method has to bring together multidisciplinary information, e.g. from urban climate research, environmental sciences, as well as practical feedback from recent planning experiences in creating “green neighbourhoods”.

Table 2: Template for CAMESUD: A new Environmental and Sustainable Urban Design assessment Method

| Indicators for sustainable Urban Design | |
|---|---|
| **( 1 )** | **Management and Quality of Services** |
| | - Committment and Sustainability Policy |
| | - Management Plan |
| | - Awareness Support and Concertation |
| | - Integration of Sustainability Issues in Urban Documents |
| | - Commissioning of Urban Systems |
| | - Ease of Maintenance of Infrastructure |
| | - Maintenance of Building Stock |
| | - Waste Management of Neighbourhood |
| | - Construction Site Impacts |
| **( 2 )** | **Urban Location Efficiency and Site Ecology** |
| | - Selection and Site Investigation |
| | - Brownfields and Polluted Sites Redevelopment |
| | - Requalification of Existing Urbanized Zones |
| | - Preservation of Agricultural Land & Green Spaces |
| | - Protection of Natural Ecosystems (Flora & Fauna) |
| | - Improve Biodiversity and Site Ecology |
| | - Site Integration: Respect of Relief and Natural Site |
| | - Landscape View |
| | - Prevention and Protection from Natural Hazards |
| | - Reduce Site Disruptance during Construction |
| **( 3 )** | **Urban Infrastructure & Transport** |
| | - Accessibility & Connectivity of Neighbourh. to City |
| | - Efficient Wastewater Management System |
| | - Promote Non-Pollutant Transportation Systems |
| | - Reduced Parking Footprint |
| | - Pedestrian Areas & Intra-Connectivity of Neighbourh. |
| **( 4 )** | **Land Use, Urban Forms and Quality of Life** |
| | - Mixed Habitat-Working Areas |
| | - Integrated & Diversified Urban Activities and Services |
| | - Availability & Proximity of Parks and Leisure Spaces |
| | - Remote Industry and Pollutant Activities |
| | - Shared Use of Installations |
| | - Compact Urban Design & Contained Development |
| | - Sunshine and Solar Rights: Outdoors & Indoors |
| | - Urban Porosity and Ventilation |
| | - Urban streets, Public Spaces & Pedestrian Areas |
| | - Building Envelope and Urban Typology |
| | - Entrances to Neighbourhood and Buildings |
| | - Cool Urban Surfaces and Pavements |
| | - Integrated Vegetated Areas in Built-Up Areas |
| | - Thermal and Wind Comfort in Outdoor Spaces |
| | - Visual Comfort in Urban Open Spaces |
| | - Noise and Acoustic Comfort |
| | - Ecological & Sustainable Buildings |
| | - Adaptability and Flexibility of the Neighbourhood |
| | - Imageability, Sense of Place & Centrality |
| | - Renovation of Existing Buildings & Open Spaces |
| | - Urban Furniture |

*Continue on the right*

The new system must consider both indoor spaces (buildings) and open spaces (streets, places and parks) which support human activities. A key issue for an assessment method at urban scale is also to understand the mechanisms which lead to the formation of the *urban heat island* UHI and its relation to design choices.

Moreover, the component *Land* as precious non renewable resource takes here a much more dominant place in comparison to building scale, in terms of density and horizontal expansion. The social, economic and institutional dimensions assume consensually an important role. The city is by definition an organized framework for human activities and a concentration of capitals. This extends automatically the new system’s limits beyond the environment to include all these “human-related” issues.

| Indicators for sustainable Urban Design | |
|---|---|
| **( 5 )** | **Efficient Use of Resources [Energy, Water, Materials]** |
| | - Energy-Efficiency of Urban Structure |
| | - Energy-Efficient Buildings |
| | - Urban Lighting |
| | - Renewable Energy Use on Site |
| | - Electricity Production on Site |
| | - Stormwater Management |
| | - Treatment of Rainwater and Greywater |
| | - Conservation of Water for Irrigation |
| | - Water conservation in Buildings |
| | - Local Materials with Low Energy Content |
| | - Recycled and Salvaged Materials |
| **( 6 )** | **Pollution & Environmental Loadings** |
| | - Quality of Air and Pollution Control |
| | - Reduce Nocturnal Light Pollution |
| | - Prevention of Pollution Hazards |
| | - CO2-Emissions from Traffic & Built-Up Areas (GWP) |
| | - Acidification Emissions (NOx et SOx) |
| | - Photo-Oxidation Emisions (NO & NO2) |
| | - Water Course Pollution |
| **( 7 )** | **Society and Culture** |
| | - Urban and Architectural Heritage |
| | - Historical Sites and Monuments |
| | - Social Mix and Population Density |
| | - Quality and Variety of Housing |
| | - Social Connectivity |
| | - Accessibility to Hadicaped People |
| | - Social Participation |
| | - Population Density and Profile |
| | - Eco-Education |
| **( 8 )** | **Economics** |
| | - Affordable Housing |
| | - Support of local Economy |
| | - Investment and Financial Impacts |
| | - Life Cost Assessment |
| | - Potential for Local Autononmy |

## 5. Conclusion

In this paper, a synthesis of several building assessment methods has been shown, as well as a new system to be applied at urban scale CAMESUD. The latter is at draft stage and needs to be refined in its structure and completed with quantifiable compliance criteria to make it operational. Assessment precautions already mentioned for building assessment methods are also valid at urban scale, e.g. Flexibility and adaptability in time, no double counting, the challenge to evolve in terms of simplicity, refining performance measures and compliances indices, improving verification methods, streamlining the certification process, the necessary support documentation together with their capability to manage more complexity in a simple and practical form. Such systems are ideal for acting as platform for interdisciplinary work. CAMESUD is a project under development.

## 6. Literature


1. Ali-Toudert F. (2007). Towards Urban Sustainability: Trends and Challenges of Building Environmental Assessment Methods. International Conference on Sustainable Building SB07. Lisbon 09.12-14.2007.Part 2: 678 – 685.
2. Building Research Establishment Environmental Assessment Method BREEAM [Online], Available: www.breeam.org/ [2007]
3. Leadership in Energy and Environmental Design LEED® [Online] Available: www.usgbc.org/LEED [2007]
4. Comprehensive Asssesment System for Building Environmental Efficiency CASBEE[Online] Available: www.ibec.or.jp/CASBEE [2007]
5. Haute Qualité Environnementale NF-HQE® tertiaire [Online] Available: www.assohqe.org [2007]
6. Green Building Challenge GBC [Online] Available: www.iisbe.org/iisbe [2007]
7. Zegras et al. (2004). Indicators for sustainable urban development. Chapter 6: From Understanding to Action. Sustainable urban development in medium-sized cities in Africa and Latin America. Keiner M. eds. Springer. Zürich.
8. Gehrlein U. (2004). Nachhaltigkeitsindikatoren zur Steuerung kommunaler Entwicklung. VS. Verlag für Sozialwissenschaften.