# Criteria for a Sustainable Built Environment

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## ABSTRACT

This paper analyses the current trends in sustainability implementation. An analysis of the most important sustainability assessment tools indicates that after about 15 years from their launch the recent tendency in sustainability assessment tools development aims at the sustainability assessment of urban areas. Independently of the development of these new tools, a significant number of cities in Europe and around the world are implementing sustainability measures. Although these cities are not being subjected to sustainability assessments, it is noticed that successful sustainability measures that are being applied in these cities have common principles to those assessed in the sustainability assessment tools. This way, as the paradigm of the sustainability assessment tools is changing from the building scale to the urban and the city scale, this new generation of sustainability assessment tools can be used to guide and to help cities and urban areas towards sustainability.

**KEYWORDS**: Urban sustainability assessment, sustainability assessment tools, sustainable cities

## 1. INTRODUCTION

Since 1996, with the launch of BREEAM (Building Research Establishment's Environmental Assessment Method), a significant number of building environmental and sustainability assessment tools (BSA tools) have been developed. Tools such as BREEAM, LEED (Leadership in Energy and Environmental Design) and SBTool (Sustainable Building Tool) constitute the basis for all the other tools and initiatives used throughout the world (Bragança et al. 2010). Usually these methods are characterized by evaluating a series of partial and aggregate features of construction, resulting in environmental ratings or sustainability scores (Assefa et al. 2010).

According to Haapio (2008), the existing building environmental assessment methods and tools should not be underestimated, however should not be considered the only possibility for sustainability assessment, one must widen the viewpoint. The requirements for BSA tools have increased and nowadays it is not enough to evaluate building components or the building separately (Haapio, 2012). The built environment, neighbourhoods, public transport and services, should also be considered simultaneously in these assessments, since the number of people living in urban areas is high and increasing rapidly. Current trends predict that this number will keep rising, reaching almost 5 billion by 2030 out of a world total of 8.1 billion (UN-Habitat, 2007).

The incorporation and integration of the urban dimension has been gaining importance over the last decades due to the process of building of the sustainable development paradigm. Thus, emerged different methods, techniques and tools for urban sustainable assessment, seeking to discover how cities can become more sustainable (Rosales, 2011). It is believed that cities will give answers to a sustainable future, since they are the largest resources consumers of the planet and the largest generators of waste (Souza & Awad, 2012) but cities are also the place where it is possible to act more effectively to save the planet from ourselves (Khanna, 2010).

## 2. FROM SUSTAINABLE BUILDING TO SUSTAINABLE CITY

### *2.1 Buildings sustainability assessment*

The first available environmental assessment tool for buildings was the Building Research Establishment Assessment Method (BREEAM, 2013). This method was established in the UK in 1990 and together with the following two rating and certification systems provided the basis for the other approaches used throughout the world: Sustainable Building Tool (SBTool), developed through the collaborative work of representatives from 20 countries (iiSBE, 2013a); and the Leadership in Energy and Environmental Design (LEED), developed in the U.S.A. (USGBC, 2013).
In Portugal, a building sustainability assessment method has been developed: SBTool$^{PT}$ (Mateus & Bragança, 2009). Sustainable Building Tool Portugal (SBTool$^{PT}$) was developed by Laboratory of Building Physics & Construction Technology of the University of Minho, in coordination with non-profit association iiSBE-Portugal (International Initiative for a Sustainable Built Environment-Portugal) and the private consulting company Ecochoice SA.
The results of these assessments tools are contributing to understand the impacts of the building sector. Assessment tools are proven to provide unique opportunities for designers, owners, contractors and users to make decisions and choices during the project and construction of buildings, in order to increase their sustainability level (Mateus & Bragança, 2011).

### *2.2 From building sustainability assessment to urban planning assessment*

The impacts of the building sector are a very well documented fact, which can be addressed throughout measures that are included in building sustainability assessment tools. However, these impacts can be addressed in a much adequate way if the sustainability measures are implemented in a larger scale such as the urban planning. Additionally, urban expansion, rapid growth of cities as well as urban regeneration of degraded and abandoned areas are the current concerns of authorities, both international and local. These concerns have directed the focus on developing assessment frameworks and tools for urban communities, such as: BREEAM Communities (BRE, 2012), LEED-ND (Neighborhood Development) (US Green Building Council, 2012), SCTool (Sustainable Communities Tool – in development) (iiSBE, 2013b), CASBEE-UD (Urban Development) (CAASBE, 2013), EarthCraft Communities (EarthCraft, 2013) or Green Star Communities (GBC Australia, 2013). The interest in evaluation systems is increasing among authorities, investors and especially developers (Haapio, 2012), since these systems allow the comparison of municipalities and urban areas, serving to support decision-making processes, benefiting authorities, planners and designers during this process.
These tools were designed to give opportunity for projects to demonstrate their environmental, economic and social benefits to the local community, in all the planning stages of development processes. These tools' system consists of frameworks with several indicators, which are grouped into categories. These tools, while evaluating and ranking the sustainability of urban developments, are also instruments that guide and encourage the process of design and development of sustainable, smart and high quality communities throughout the promotion of reference best practices.

### *2.3 Sustainability Assessment Tool for urban planning: SBTool$^{PT}$-PU*

One example of the evolution of the focus of sustainable assessment tools from buildings to urban planning operations is the Portuguese sustainability assessment method, SBTool$^{PT}$. A sustainability assessment tool for urban planning operations is being developed under the scope of the urban scale, SBTool$^{PT}$ Urban Planning. This tool encompasses twelve categories under the scope of the main sustainability dimensions, environment, society and economic. Additionally, an extra category is considered covering the sustainability of buildings and environmental management. The forty one indicators included in this tool, as well as the respective categories and dimensions, are presented in

Table 1. SBTool$^{PT}$ Urban Planning – Structure and Indicators.

| Dimension | Category | ID | Indicator |
|---|---|---|---|
| Environment | C1. Urban Form | I1 | Passive Solar Planning |
| | | I2 | Ventilation Potential |
| | | I3 | Urban Network |
| | C2. Land use and Infrastructure | I4 | Natural Land Aptitudes |
| | | I5 | Density and Flexibility of Uses |
| | | I6 | Reuse of Urban Areas |
| | | I7 | Built Environment Rehabilitation |
| | | I8 | Technical Infrastructures Network |
| | C3. Ecology and Biodiversity | I9 | Distribution of Green Spaces |
| | | I10 | Connectivity of Green Space |
| | | I11 | Indigenous Vegetation |
| | | I12 | Environmental Monitoring |
| | C4. Energy | I13 | Energy Efficiency |
| | | I14 | Renewable Energy |
| | | I15 | Centralized Management of Energy |
| | C5 - Water | I16 | Consumption of Drinking Water |
| | | I17 | Centralize Management of Water |
| | | I18 | Management of Wastewater |
| | C6. Materials and Wastes | I19 | Sustainable Materials |
| | | I20 | Construction and Demolition Waste |
| | | I21 | Management of Urban Solid Waste |
| Society | C7. Comfort of Outdoor Areas | I22 | Air Quality |
| | | I23 | Outdoor Thermal Comfort |
| | | I24 | Acoustic Pollution |
| | | I25 | Light Pollution |
| | C8. Safety | I26 | Safety in the Streets |
| | | I27 | Natural and Technological Risk |
| | C9. Amenities | I28 | Proximity to Services |
| | | I29 | Entertainment Equipments |
| | | I30 | Local Production of Food |
| | C10. Mobility | I31 | Public Transportation |
| | | I32 | Pedestrian Accessibility |
| | | I33 | Cycle Paths Network |
| | C11. Local and cultural identity | I34 | Public Spaces |
| | | I35 | Heritage Valuation and Landscapes |
| | | I36 | Integration and Social Inclusion |
| Economic | C12. Employment Promotion and Investment | I37 | Economic Viability |
| | | I38 | Local Economy |
| | | I39 | Employability |
| | | | |
| | EXTRA | I40 | Sustainable Buildings |
| | | I41 | Information and Communication Technologies |

The structure of this methodology is being developed and adapted to the Portuguese context by the authors, based on the work of Serge Salat (Salat et al. 2011) and on the work of iiSBE SCTool (SBTool Urban), which is also in development. A cooperative effort is being made for the improvement of these methodologies taking into account the latest scientific developments in sustainability at the urban scale.

In the first category on this methodology, Urban Form, there are accessed aspects such as: the passive solar planning, considering the suitability for thermal energy conservation and the production of renewable solar energy; the promotion of natural ventilation of urban spaces, taking into account the dominant winds of the geographic area; and the urban network, to promote connectivity between routes of different hierarchies, to a human scale, reducing distances and travel times in order to

facilitate the movement and commuting on foot and bike lanes. In category 2, Land use and Infrastructure, it is assessed how the urban spaces are defined in conformity with the natural land aptitudes, promoting land use efficiency. There is also a promotion of flexibility of uses of the different areas, as well as an incentive to reuse and rehabilitate or regenerate pre-existing urban areas such as abandoned urban centres. The objective is to avoid urban expansion or urban sprawl that has many impacts such as the construction of long networks of technical infrastructures, which encompasses high environmental impacts.

Category 3 is related to Ecology and Biodiversity. The assessment of this category covers the management of green spaces, promoting the protection and increase in local biodiversity by rewarding varied distribution of green spaces within the urban fabric and designing of urban green spaces network articulated with ecological corridors. It is also promoted the selection of indigenous species for plants and vegetation in these green spaces, as well as the development of an environmental management plan.

The energy related indicators are aggregated in category 4 "Energy". The main aspects of the assessment methods are related to the implementation of measures that improve energy efficiency of the public energy consuming equipments and of systems that produce energy from renewable sources. It is also promoted the central management and monitoring of energy consumption in order to identify problems in time and to disclose consumption data so that decision making and problem solving are made based in knowledge of inhabitants and enabling attitude changing by the population.

In category 5, all the aspects related to water are evaluated. The maim aspects in consideration are the assessment of drinking water consumption and the treatment of wastewater, while there is also promoted the central management of water. The objective is to reduce the water consumption in public spaces through the use of efficient equipments. This will reduce the production of wastewater and reduce the pressure on the drainage systems. Local treatment of effluents will also be promoted, as well as the implementation of a monitoring system.

The indicators related to the materials' life cycle are included in category 6 "Materials and wastes". In this category it is accessed the responsible selection of sustainable materials and the destiny of construction and demolition wastes, as well as the management of urban solid wastes. It is promoted the selection of materials with lower life cycle environmental impacts and the reuse and recycling of RCD's, as well as the selective separation of urban wastes. The objective is to lower the landfill of residue and to reduce the need for the extraction of raw materials.

Category 7, in the social dimension, is related to the health and comfort of inhabitants regarding the air quality, thermal, acoustic and visual comfort. In this category it is promoted the reduction of pollutants and odours in the public spaces (including the use of transportation using alternative fuels), the reduction of the heat island effect and the application of rain protection systems, the reduction of exterior noise and the reduction of glare and nocturnal light pollution.

The safety of inhabitants is addressed in category 8, where it is assessed the pedestrian safety and crime prevention through urban design, by promoting and providing the correct distribution and orientation of streets as well as adequate nocturnal illumination levels and the safety against natural or technological disasters.

In category 9: "Amenities", it is accessed the proximity between the residential areas and working places to key amenities (basic necessity goods), as well as for entertainment equipments. The assessment is related to the promotion of the reduction of travel distances and consequently travelling times, contributing to the easy access of inhabitants to services. It is also promoted the creation of public spaces dedicated to the production of organic food, such as community gardens.

The mobility scheme is also assessed in this methodology, in category 10 "Mobility". This category assesses the promotion of public transport and thus the reduction of the need for the use of private vehicles. With this objective, it is also promoted the creation of a pedestrian network and cycling networks that not only increases inhabitants' satisfaction but are also good for the environment.

Category 11 addresses the issues related to the cultural identity of the urban spaces. In this category it is promoted the maintenance of key identified architectural styles in existing heritage locations, as well as the improvement of the use and stimulation of these public spaces. It is also promoted the

existence of housing affordable to a wide spectrum of social classes (also age, religion, race, genre…) and the civil participation in public affairs.
The economic dimension is assessed in category 12 "Employment Promotion and Investment". Aspects such as the economic viability of constructions, including the analysis of life cycle costs, the promotion of the local economy and the creation of local opportunities for employment and professional education are assessed in this category.
Additionally, another two indicators are assessed in the methodology in an extra category. This category was created in order to promote some measures that are good to the sustainability of urban areas but that are more difficult to implement. To achieve a good grade in these indicators will improve the sustainability rate of the urban area. The first indicator in this category is "Sustainable Buildings" and its goal is to promote the sustainability of buildings through the implementation of sustainable building assessment tools. With the "Information and Communication Technologies" it is intended to promote the integrated management of the functional aspects of the city in order to facilitate the urban functions and to improve the quality of life in cities.

*2.4 Assessing Intervention Strategies with or without Sustainability Indicators: the case of 22@Barcelona*

Cities have been suffering shape influences from urban planning throughout their history. Although the sustainability assessment tools are more in "vogue" nowadays, this fact does not mean that social, environmental and economic concerns constitute something new on urban strategies of today. As an example, in the urban plan of Cerdá for Barcelona, developed in the nineteenth century, concerns related with coordinating spatial and physical aspects with functional, sociological, economical and administrative were considered, treating the city as a complex and integrator organism of several systems (Lamas, 1993). Such concerns allowed a quick upgrade of Barcelona urban areas. Looking to the Project 22@Barcelona, perfectly integrated on urban fabric planned by Ildefons Cerdá, it can be easily seen that Cerdá, without the application of sustainability assessment tools, was capable to support in a very flexible way the successive territory updates. This project arises from the need of a reconversion of Poblenou area of Barcelona (Sales, 2008). It seeks to meet the needs of economic and social dynamics on Poblenou creating a compact and miscellaneous environment. It contemplates for a high quality urban model, mixed, eco-efficient and considerably more economically influent, reflected on productive activities with neighbourhood lifestyle. The development also provides a variety of social opportunities for local inhabitants, while providing new professional opportunities. Nevertheless, it is also important to emphasize that transport network, its infrastructure and public space links the neighbourhood and the district to city centre in a short path. Sustainability on built spaces is not only affected by thinking on the immediate consequences, it is necessary to explore long-term solutions and it is also needed that these solutions are reliable to be implemented without affecting the life of future generations.
Although the 22@Barcelona project has not been subjected to a sustainability assessment, some of the measures implemented in it, can be analysed by the nowadays sustainability assessment tools, such as public transportation systems or public spaces diversity.

*2.5 Urban and city scale as the path to approach sustainability*

Besides 22@Barcelona, there are numerous cities around the world, mainly in northern Europe, that are implementing urban regeneration plans taking into consideration sustainability measures. A common example is the city of Stockholm in Sweden, which was considered by the European Commission as the first European green city (EC, 2010). Some measures implemented by Stockholm are: 95% of the population lives less than 300 metres from green areas and from public transport with an hourly or more frequent service; all trains and inner city buses run on renewable fuels; the greenhouse gas emissions have been reduced by 25 % since 1990 and the city has the target of becoming totally fossil fuels free by 2050; 68% of all trips within the city centre are made on foot or

by bicycle and 78% of all trips to the inner city are made by public transport; 40% of the Stockholm cars are clean vehicles.
Other European cities have been implementing some sustainable measures. Hamburg in Germany has set the goal of reduce its $CO_2$ emissions to 40% by 2020 and to 80% in 2050. Hamburg citizens also have access to optimal public transport within 300 meters of their location.
Vitoria-Gasteiz in the Spanish Basque Country has a high proportion of green public areas, ensuring, like Stockholm, that all citizens live within 300m of an open green space. Vitoria-Gasteiz has implemented measures in order to reduce the water consumption with the goal of reduce this consumption to below 100 litres per capita per day. In France, Nantes has 60% of the urban area occupied with agricultural, natural and green areas. Their inhabitants also live very close to public transportation facilities and to green areas. Copenhagen, in Denmark, performed notable efforts regarding the use of bicycles by their citizens and it is considered the world's best city for cyclists. The goal of this city is to have 50% of people cycling to their place of work or education by 2015. This value was already 35% in 2010. With these measures, Copenhagen aims to be $CO_2$ neutral by 2025. Another goal of Copenhagen is to achieve 90% of organic food consumption. In England, the city of Bristol has committed a budget of 500 M€ for transport improvements by 2015 and up to 300 M€ for energy efficiency and renewable energy by 2020. Bristol is also making a great investment in a green economy. The target is to create 17,000 new jobs in creative, digital and low carbon sectors by 2030.
Additionally, other examples of cities that are recognized as sustainable, since they adopted or are currently implementing sustainability principles are, among others, Gothenburg and Hammarby in Sweden, Leicester Middlesbrough in England, Rotterdam in The Netherlands, Ballerup and Frederikshavn in Finland, Oslo in Norway and Frankfurt, Friburg and Kronsberg in Germany (EC, 2013).
The study of the regeneration plans of these cities often include the production of renewable energy, energy and water saving solutions, traffic reduction strategies such as promotion of public transport, cycling promotion and green areas, as well as other measures that increase the life quality of inhabitants, while reducing the environmental burden. It is also possible to verify that there are many similarities between these measures and those that are addressed in the new generation of sustainability assessment tools. Consequently, a comparative study was made to verify how the measures that were applied in these cities are similar to the indicators that are normally considered in those tools (Table 2).
This study concluded that the measures that are currently being implemented in sustainable cities are very coincident to the indicators that are assessed in sustainability assessment tools. In Table 2 it is shown that in 28 selected indicators, 61% of the city measures can be correlated with these sustainability indicators. This means that the regeneration plans of these cities could be assessed by sustainability assessment tools, which could guide even further these plans in the achievement of even higher goals. Nevertheless, it is not mentioned that these urban regeneration plans had been subject to any sustainability assessment, despite the fact that the sustainability principles used in those cities are the same that are assessed in sustainability indicators. Instead, the cities often limit the focus of such intervention plans on the achievement of some target values.
These public and semi-private initiatives to increase sustainability levels at a broader scale, when compared to building sustainability, clearly indicate that the current trend in sustainability implementation is related to the urban and to the city scale. Sustainability assessment tools must consequently adapt to this new and emergent reality. While there are some tools available in the market that already assess sustainability in urban areas, SBTool international, as well as SBTool PT (Portugal) are examples of sustainability assessment tools that are being developed to include these principles, confirming this emergent trend.
The above mentioned cities implemented some sustainability measures that are addressed by some sustainability assessment tools, even as no tool was used in the development of their regeneration plans. However, these tools are very important in order to have a much clear idea about how to address sustainability and can boost the current results by indicating how well some measures are being implemented. The technical design teams and in many cases politicians can be aware of some

measures that can improve the urban planning quality, but the use of the new generation assessment tools will allow to improve sustainability of the built environment and to evaluate the performance of each measure in comparison to performance benchmarks in order to understand if there is still space for improvement, while allowing the selection of the best solutions.

Table 2. Examples of urban sustainability measures taken into account in some European cities.

| | Stockholm | Hamburg | Vitoria-Gasteiz | Nantes | Copenhagen | Bristol |
|---|---|---|---|---|---|---|
| Public transportation system | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sustainable mobility | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Energy efficient mobility | ✓ | | ✓ | | | |
| Local amenities | ✓ | | ✓ | ✓ | ✓ | |
| Green areas | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Biodiversity promotion | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Management of urban solid waste | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Waste-water treatment | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Minimization of energy demand | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Greenhouse gases | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Renewable energy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Energy centralized management | ✓ | ✓ | | | | |
| Land use efficiency | | | | ✓ | ✓ | ✓ |
| Reuse of urban areas | | | ✓ | | | |
| Thermal quality | ✓ | | | ✓ | | |
| Acoustic quality | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Air quality | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Water quality | ✓ | ✓ | | ✓ | | |
| Water consumption reduction | | | ✓ | ✓ | ✓ | ✓ |
| Night-time lightning pollution | | | ✓ | | | |
| Efficient telecommunication system | ✓ | | | | | |
| Local food production | | | ✓ | | | |
| Organic food consumption | | | | | ✓ | |
| Environmental awareness | ✓ | ✓ | ✓ | ✓ | | |
| Environmental management | | | ✓ | ✓ | | ✓ |
| Population engagement | | | | ✓ | ✓ | |
| Investment Catchment | | ✓ | | | | ✓ |
| Local employment | | ✓ | | | ✓ | ✓ |

## 3. CONCLUSIONS

Sustainability principles can and are leading some cities towards sustainability, despite the fact that the majority of cities' regeneration plans are not subject to sustainability assessments. This indicates that urban sustainability tools can be improved by being transformed in sustainability guides for the improvement of cities or urban areas, while providing at the same time assessment methods that allow the comparison and consequent selection of the best sustainable solutions. This conceptual change in sustainability assessment tools (from building to urban and from assessment focus to best practice manual/guiding focus) allow not only boosting their application but would also improve the sustainability of the built environment, guiding and helping designers, engineers, architects and politicians to develop urban regeneration plans, defining sustainability principles/indicators that should be addressed and allowing the comparison of different measures.

**REFERENCES**


Assefa, G., Glaumann, M., Malmqvist, T. & Eriksson, O., 2010. "Quality versus impact: Comparing the environmental efficiency of building properties using the EcoEffect tool." Building and Environment, 45(5), pp. 1095-1103.

Bragança, L., Mateus, R. & Koukkari, H., 2010. "Building Sustainability Assessment". Sustainability, 2010, 2(7), 2010-2023; DOI:10.3390/su2072010.

BREEAM, 2013. BREEAM - The world's leading design and assessment method for sustainable buildings [Online]. Available at: http://www.breeam.org. Accessed June 2013.

BRE, 2012. BREEAM Communities Technical Manual.

CASBEE, 2013. CASBEE - Comprehensive Assessment System for Built Environment Efficiency [Online]. Available at: http://www.ibec.or.jp/CASBEE/english/index.htm. Accessed June 2013.

Corduente, A.L., "El proyecto 22@BARCELONA, Un programa de trasformación urbana, económica y social" available online at: http://www.ingurumena.ejgv.euskadi.net/r49-565/es/contenidos/informacion/2008ponencias_euskalhiria/es_ponencia/adjuntos/plan22barcelona.pdf checked on 10-05-2012

EarthCraft, 2013. The EarthCraft Communities Program [Online]. Available at: http://www.earthcraft.org/communities. Accessed June 2013.

EC, 2010. Green Cities Fit for Life [Online]. European Commission. Available: http://ec.europa.eu/environment/europeangreencapital/winning-cities/stockholm-european-green-capital-2010/.

EC, 2013. Environment: European Green Capital [Online]. European Commission. Available: http://ec.europa.eu/environment/europeangreencapital/ 2013].

GBC Australia, 2013. Green Star – Communities [Online]. Available at: http://www.gbca.org.au/green-star/green-star-communities/. Accessed June 2013.

Haapio, A., 2012. "Towards sustainable urban communities." Environmental Impact Assessment Review, 32(1), pp. 165-169.

Haapio, A. & Viitaniemi, P., 2008. "A critical review of building environmental assessment tools." Environmental Impact Assessment Review, 28(7), pp. 469–482.

iiSBE, 2013a. iiSBE – International Initiative for a Sustainable Built Environment, SB Method and SBTool [Online]. Available at: http://www.iisbe.org/sbmethod. Accessed June 2013.

iiSBE, 2013b. International Initiative for a Sustainable Built Environment: Working Groups [Online]. iiSBE. Available: http://www.iisbe.org/r-n-d. Accessed June 2013.

Khanna, P., 2010. "Beyond City Limits." The Global Cities Issue, Foreign Policy.

Lamas, J.M.R.G., "Morfologia Urbana e Desenho da Cidade", Fundação Calouste Gulbenkian, 1993, pp. 564.

Mateus, R. & Bragança, L., 2011. "Sustainability assessment and rating of buildings: Developing the methodology SBToolPT-H." Building and Environment, 46(10), pp. 1962-1971, ISSN 0360-1323, DOI: 10.1016/j.buildenv.2011.04.023.

Mateus, R. & Bragança, L., 2009. SBTool – Ferramenta para a Construção Sustentável. Guia de Avaliação SBToolPT-H. Edições iiSBE Portugal. 2009.

Rosales, N., 2011. "Towards the modeling of sustainability into urban planning: Using indicators to build sustainable cities." Procedia Engineering, 21, pp. 641-647.

Sales, M., 2008. "Territórios de intermediação, Uma hipótese para a análise e o projeto da cidade contemporânea" Ph.D thesis, Faculdade de Arquitetura e Urbanismo da Universidade de São Paulo, São Paulo, pp. 297, 2008.

Salat, S., Labbé, F. & Nowacki, C., 2011. "Cities and forms - On sustainable urbanism", Edt. Hermann, Paris, ISBN: 9782705681111.

Souza, C. L. & Awad, J. M., 2012. "Cidades Sustentáveis, Cidades Inteligentes." Bookman, São Paulo.

UN-Habitat, 2006. "State of the world's cities 2006/7." Earthscan, London.

USGBC, 2013. LEED [Online]. Available at: http://www.usgbc.org/leed. Accessed June 2013.

US GREEN BUILDING COUNCIL 2012. LEED 2009 for Neighborhood Development Rating System. US Green Building Council.