A Sustainability Performance Assessment Tool for SMEs

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Abstract
Small- and medium-sized enterprises (SMEs) within the construction and design domain are already been provided with several sustainability assessment techniques. This paper presents an easy to use assessment technique for 20 building projects in terms of a sustainability performance assessment tool. Originally, this assessment tool was conceived within the NEES project supported by the Nordic Periphery Programme.

Introduction
The aim of this paper is to propose an easy to use sustainable building performance assessment technique within the framework of NEES project that can be used to compare sustainability performances of SMEs, particularly in architectural firms. The NEES project is supported by the Nordic Periphery Program and aims to investigate products and services that is in accordance with its natural (N), energy efficient (EE) and sustainable (S) perspective.

Over the years, it has become obvious that sustainable design imposes new demands on architects and planners to broaden their expertise to embrace environmental engineering, ecological ways of constructions, efficient infrastructure, and unique urban development projects (SAR, 2010). Furthermore, it is also clear that characteristics like how a building’s spatial hierarchy is organized, or day lighting, or design affects on indoor climate and energy performances are all important architectural considerations. The building method, materials and construction technology predestinate the carbon footprint of the building and its life cycle. The use of urban space is concerned with the land efficiency; therefore balance between the area of agricultural claims, local climate and livable space minimum is essential. Finally, infrastructure as a whole requires optimization in efficiency and a decrease in waste production.

Professional bodies have realized that sustainable development has implications for the wider relationship between professionals and society. This is particularly the case for the built environment professions, where buildings have a major impact in environmental, economic and social terms (United Nations Environment Programme, 2007). To take one example, buildings are major emitters of carbon, which contributes to global warming: for example, if all the energy used in constructing, occupying and operating buildings is combined then buildings are responsible for 50 per cent of carbon emissions in the UK (Building Research Establishment, 2003). This is also a broader global issue, with the built environment a major contributor to global environmental issues, and with consequent impacts on the natural environment. There have been done several building performance models that are capable to predict an energy performance of a building. The most well-known are the BREEAM (Building Research Establishment’s Environmental Assessment Method), or the LEED (Leadership in Energy and Environmental Design), as well as the Greenbuilding and Miljöklassad byggnad. The latter, the Swedish system is based on scientific and measurable criteria, this quality is not as established in the other systems.
The Swedish Environmental Protection Agency argues that to combat climate change, national climate policies must be developed in correlation with international climate agreements. According to Pérez-Lombard, Ortiz and Pout (2008), in the developed countries buildings contribute between 20-40% of the total energy consumption and therefore it has exceeded other major sectors such as industry and transportation. In Sweden, the energy consumption of buildings are approximately 40% and it costs about 150-200 billions of crowns annually (IVA, 2012) which indicates an energy.

Much of the work on sustainability can be characterized by three key approaches. The first is concerned with definitions of sustainability – where they have emerged from, what they attempt to achieve and how they can be compared (Baker et al., 1997; Haughton and Hunter, 1994; Rees, 1999). The second approach is more reductive, thus the focus is on establishing what is unsustainable, how to make practices more sustainable and how to evaluate sustainable outcomes. This operates with checklists, indicators, triple bottom-line accounting and ecological footprints (Wackernagel and Rees, 1996). It is based on the premise that we know enough about the planet as well as the people (i.e. Redclift, 1996). The third approach discusses sustainability as a dialogue – a way of defining and controlling the agenda for change and development (i.e. Sandilands, 1996).

A sustainability performance assessment tool (SUPERASSIST) as a questionnaire was developed to assess sustainability performance in SMEs. This tool has potential in screening SMEs sustainability performance particularly in building projects. The assessment tool consists of items according to ISO TC 59, which describes the minimum performance measures necessary for sustainability assessment (Seo, Tucker, Ambrose, Mitchell and Wang, 2005). Under each main factor (Indoor air quality, energy, resources and materials and finally environmental impacts to surrounding) ratings can be given on a four-point Likert-scale (1=Agree, 2=Slightly Agree, 3=Slightly Disagree, and 4=Disagree) on each item. In addition, questions related to sustainable project management can be included according to Clements-Croome’s (2013) recommendation. The items representing relevance to sustainability and its combination can contribute to different factor results. Weighing of the items in the factor measure can also be possible, thus a more quantitative result would be achieved. The SUPERASSIST is presented in Table 1.

Table 1. Sustainability performance assessment tool (SUPERASSIST); Scale is from 1=Fully Agree, 2=Slightly Agree, 3=Slightly Disagree to 4=Fully Disagree.

<table>
<thead>
<tr>
<th>Main factors</th>
<th>Sub-factors</th>
<th>Selected items</th>
<th>Scale (1-2-3-4)</th>
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<tbody>
<tr>
<td>Project management</td>
<td>Shared vision</td>
<td>The project briefing based on a well-defined mission and vision at the early stage</td>
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<td></td>
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<td>The project applied adequately a unity of vision between consultants, contractors, manufacturers and facilities managers.</td>
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<td></td>
<td>Information flow</td>
<td>The coordination of information across the whole building process was adequate</td>
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<td>The project applied adequate standardized processes rather than improvisation</td>
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<td>The project applied adequate interoperability of systems and their interfaces</td>
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<td>The project applied adequate documentary evidence on integrated processes</td>
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<td></td>
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<td>The project applied adequate proven and tested processes to be adapted and</td>
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<tr>
<td>Indoor environment</td>
<td>Energy</td>
<td>Resources and materials</td>
<td>Environmental</td>
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<td>Auditing</td>
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<td>Thermal comfort</td>
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<td>Lighting</td>
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<td>Air quality</td>
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<td>Noise &amp; acoustics</td>
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<td>Operational energy</td>
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<td>Efficient operation</td>
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<td>Thermal load</td>
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<td>Natural energy utilization</td>
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<td>Building systems’ efficiency</td>
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<td>Water consumption</td>
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<td>Resource productivity</td>
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<td>Avoidance of pollutant materials</td>
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<td>Pollution</td>
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- The project applied adequate auditing and monitoring processes.
- Performance of room temperature control is adequate.
- Degree of moisture control is adequate.
- Vertical distribution of air temperature is adequate.
- Air velocity is adequate.
- Degree of visual access to the exterior & daylight access is adequate.
- Performance of access to day lighting is adequate.
- Performance of anti-glare measures is adequate.
- Illumination levels are adequate.
- Degree of lighting controllability is adequate.
- Degree of sources control is adequate.
- Performance of ventilation is adequate.
- Performance and quality of operation plan is adequate.
- Level of noise is adequate.
- Level of sound insulation is adequate.
- Level of sound absorption is adequate.
- Total primary energy consumption in operation is adequate.
- Performance of monitoring is adequate.
- Performance of operational management system including commissioning is adequate.
- Building orientation is adequate.
- Thermal load of windows is adequate.
- Insulation level of exterior wall and roof is adequate.
- Degree of direct utilization of natural energy is adequate.
- Degree of indirect utilization of natural energy is adequate.
- Performance of HVAC is adequate.
- Performance of ventilation system is adequate.
- Performance of lighting system is adequate.
- Performance of water heating system is adequate.
- Performance of elevator system is adequate.
- Amount of water consumption is adequate.
- Degree of utilization of rainwater and grey water is adequate.
- Degree of use of recycled materials is adequate.
- Degree of renewable resources is adequate.
- Degree of reuse of existing skeleton is adequate.
- Durability of materials is adequate.
- Performance of waste disposal is adequate.
- Degree of avoidance of hazardous materials is adequate.
- Degree of avoidance of CFCs and halons is adequate.
- Performance of run-off management is adequate.
One of the methods for using SUPERASSIST would include twenty building projects from the north of Sweden. These projects should be expected to perform well on a sustainability related evaluation. Then a panel of experts would evaluate the projects and their results on SUPERASSIST and their results could be compared to the evaluation of the SMEs own design professional. Analysis of the data would include descriptive statistics as well as parametric comparison and differentiation tests. Ratings of the panel and the design professionals would be compared on sustainability performance. Age, gender and years spent in practice would also be taken into consideration.
This sustainability performance tool could be a quick and reliable tool for evaluating design and tackle bottlenecks in design related issues. Furthermore, this tool could be contributing to an open discussion for sustainability awareness and spreading the best practices in the design profession.

References


Kungl. Ingenjörsvetenskapsakademien (IVA), 2012. Energieffektivisering av Sveriges bebyggelse: Hinder och möjligheter att nå en halverad energianvändning till 2050; Ett arbete inom IVAs projekt Ett energieffektivt samhälle. Available at: www.iva.se


