A critical review of seven selected neighborhood sustainability assessment tools

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**A B S T R A C T**

Neighborhood sustainability assessment tools have become widespread since the turn of 21st century and many communities, mainly in the developed world, are utilizing these tools to measure their success in approaching sustainable development goals. In this study, seven tools from Australia, Europe, Japan, and the United States are selected and analyzed with the aim of providing insights into the current situations; highlighting the strengths, weaknesses, successes, and failures; and making recommendations for future improvements. Using a content analysis, the issues of sustainability coverage, pre-requisites, local adaptability, scoring and weighting, participation, reporting, and applicability are discussed in this paper. The results of this study indicate that most of the tools are not doing well regarding the coverage of social, economic, and institutional aspects of sustainability; there are ambiguities and shortcomings in the weighting, scoring, and rating; in most cases, there is no mechanism for local adaptability and participation; and, only those tools which are embedded within the broader planning framework are doing well with regard to applicability.

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1. Introduction

Since ancient times, cities around the world have been spatially divided into districts or neighborhoods (Rohe, 2009). Neighborhoods are building blocks of our cities (Searfoss, 2011), and, from the early years of twentieth century, planners have experimented with programs for improving the quality of life in urban neighborhoods (Rohe and Gates, 1985). Although neighborhood planning has a relatively long history, it was not until the beginning years of the 21st century that planners and environmentalists began to design tools for Sustainability Assessment (SA) in the neighborhood scale.

Abbreviations: SA, Sustainability Assessment; NSA, Neighborhood Sustainability Assessment; EIA, Environmental Impact Assessment; NEPA, National Environmental Policy Act; SEA, Strategic Environmental Assessment; PPPs, Policies, Plans, and Programs; BREEAM, Building Research Establishment Environmental Assessment Method; LEED-ND, Leadership in Energy and Environmental Design for Neighborhood Development; AHURI, Australian Housing and Urban Research Institute; SCR, Sustainable Community Rating; HQE®, Haute Qualité Environnementale et Economique Réhabilitation/High Quality Environment and Economy in Renovation; CASBEE-UD, Comprehensive Assessment System for Building Environmental Efficiency for Urban Development; ICC, EarthCraft Communities; USGBC, U.S. Green Building Council; CNU, Congress for the New Urbanism; NRDC, Natural Resources Defense Council; JSBC, Japan Sustainable Building Consortium; CSTB, Centre Scientifique et Technique du bâtiment; QSAS, Qatar Sustainability Assessment System; AHP, Analytic Hierarchy Process; HUD, Department of Housing and Urban Development.

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The Neighborhood Sustainability Assessment (NSA) tools can be recognized as the latest generation of impact assessment tools. Project scale Environmental Impact Assessment (EIA) tools were the first generation which began in the United States with the passage of the National Environmental Policy Act (NEPA) in 1969 (Shepard, 2005; Turner, 1998). EIA was developed to address the increasing pressure on human environment, following the economic and social transformation of the twentieth century, which was accelerated in scope, scale, and intensity after World War II (Costanza et al., 2007; Gibson et al., 2005), and resulted in public environmental concerns (Gibson et al., 2005). Later, the other generations such as Strategic Environmental Assessment (SEA) for assessment of Policies, Plans, and Programs (PPPs) (Therivel, 2004) and Sustainability Assessment (SA) for assessment of PPPs and projects (Bond and Morrison-Saunders, 2011; Pope and Clayton, 2011) were also introduced in late 1980s (Therivel, 2004) and 1990s (Gibson et al., 2005) respectively.

Also, there are several building environmental assessment tools which have matured remarkably since the introduction of the UK Building Research Establishment Environmental Assessment Method (BREEAM) in 1990 (Retzlaff, 2009, and Sev, 2011). The above examples indicate that there are many assessment tools focusing on the urban and regional level, as well as the level of the single building, while there is a lack of attention and experience on the intermediate level of urban neighborhoods (Blum, 2007; Hurley and Horne, 2006). Choguill (2008) argues that, “no single city can contribute to overall sustainability if its own component parts are found not to be sustainable”. In the recent years, acknowledging this and the fact that neighborhood is the scale at which land development takes place and new buildings and facilities are proposed, debated, and constructed (Benfield, 2010), the focus is turned to
developing assessment frameworks and tools for urban neighborhoods (Haapio, 2012; Retzlaff, 2009). This can be regarded as another step towards fulfillment of Local Agenda 21’s objective of pursuing sustainable development at the local level (United Nations, 1993).

1.1. Previous researches on the NSA tools

Notwithstanding the fact that more than one decade has passed since the introduction of NSA tools, there is a scant amount of research evaluating their performance and effectiveness. Hurley and Horne (2006) made a comparison between Vicurban Sustainability Charter, Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND), and the Australian Housing and Urban Research Institute (AHURI) indicators. Their analysis is mainly focused on differences and similarities among the tools, and themes and criteria used in their assessment system. In another study, (Hurley, 2009) investigated the main focus of Sustainable Community Rating (SCR) tool. There are also studies by Blum (2007) and Coplak and Raksanyi (2003) that respectively introduce Haute Qualité Environnementale et Economique Rénovabilité/High Quality Environment and Economy in Regeneration (HQE2R) and Ecocity assessment processes without evaluating their performance. Garde (2009) surveyed some LEED-ND pilot projects to reveal which criteria are used most and least, and emphasizes on the importance of adaptation to locality, and setting pre-requisites in the revised version. In a recent study by Haapio (2012), she provides a general account of the current situations of three third-party assessment tools (LEED-ND, BREEAM Communities, and Comprehensive Assessment System for Building Environmental Efficiency for Urban Development (CASBEE-UD)). Emphasizing on the importance of applying assessment tools for achieving sustainable communities, she warns about the problems associated with the selection of criteria and transferability of NSA tools to other contexts.

These studies are mainly focused on one, or a limited number, of the existing tools, and are primarily aiming at providing a general introduction of the tools. In some cases they have mentioned associated problems concerning weighting, criteria selection, and lack of a systems approach; however, there is still a lack of in-depth critical evaluation of the NSA tools.

Analyzing multiple cases is necessary to increase the breadth of analysis, verify the findings, and produce findings that are not merely the result of idiosyncrasies of the research setting and are transferable to other cases or generalizable to theory (Cavaye, 1996; Hurley, 2011).

1.2. Aims of the study

The main purpose of this study is to critically review seven well-known NSA tools. The specific objectives are: (a) to fill the gap in literature regarding research on evaluation of NSA tools; (b) to introduce a framework for evaluating the effectiveness of NSA tools; (c) to evaluate to which degree are NSA tools able to incorporate the different dimensions of sustainability; (d) to identify the differences, commonalities, strengths, weaknesses, successes, and failures of NSA tools through cross-comparison of them; (e) to understand various problems and challenges the NSA tools are grappling with; and (f) to discuss some solutions to these problems and challenges, and refinements needed to enhance the efficiency of NSA tools.

Tools and initiatives from different countries are analyzed and discussed, using the designed framework presented in Section 3, to shed light on the issue of SA in the neighborhood level; to discuss the differences, similarities, successes, and failures; and to touch on the prospect of the SA of urban neighborhoods. By criticizing these tools we want to evaluate to which degree they are able to incorporate the different dimensions of sustainability and go towards bringing about sustainable neighborhoods, and furthermore, to highlight the areas where the tools are lagging behind and come up with ideas for their improvement.

1.3. Contents of the study

This paper begins with an introduction about the background of assessment practices, the significance of conducting assessment in the neighborhood scale, previous researches on SA tools for neighborhoods, and aims of the study. Section 2 provides an overview of existing NSA tools, and selected tools for further analyses are briefly introduced. Section 3 presents the criteria used for analyses and framework designed for this research. In Section 4, tools are analyzed against the framework designed in the previous section. Each sub-section of this part of the paper deals with one of the seven criteria identified in Section 3. In each sub-section, first the justification for choosing the criterion, its importance, and its optimal state are described. Following this, selected tools are tested against the criterion and the similarities, differences, strengths, weaknesses, successes, and failures of the tools are highlighted. Section 5 discusses the findings of this study and makes some suggestions for consideration in the future refinements.

2. Overview of NSA tools

A neighborhood is a fundamental building block of a city, and a good starting point to create a truly sustainable community. Recognizing the importance of neighborhoods as the frontlines in the battle for sustainability (Choguill, 2008), in some countries around the world, initiatives have been taken to pave the way for making sustainable neighborhoods, and several tools have been developed to assess the sustainability performance of plans and their success in the way towards achieving sustainability.

NSA tool (also sometimes referred to as: district sustainability assessment tool, neighborhood sustainability rating tool, sustainable community rating tool) is a tool that evaluates and rates the performance of a given neighborhood against a set of criteria and themes, to assess the neighborhoods' position on the way towards sustainability and specify the extent of neighborhoods' success in approaching sustainability goals.

There are currently several NSA tools worldwide which can be divided into two main categories. The first category consists of third-party assessment tools which are spin-offs of building assessment tools and assess the sustainability beyond a single building. The second one includes tools which are embedded into neighborhood-scale plans and sustainability initiatives to assess their sustainability performance. In this paper, wherever the term “spin-off tools” is used, it refers to the former category, and wherever the term “plan-embedded tools” is mentioned, reference is made to the latter category.

Table 1 classifies some of the most well-known NSA tools into these two categories.

For the purpose of this study, first a broad range of tools were identified through a literature review from a wide array of sources. The aim was to cover the tools that most frequently appear in the literature; and, as far as possible, cover the variety of the broad field that can be viewed as SA. Many tools were identified which were relevant to SA at the neighborhood scale. However, due to the limited scope of this study, it was decided to only focus on the tools which are fully developed, consider all three pillars of sustainability, their manuals are accessible (publicly available), and include scoring as part of the process. It was also decided to, as far as possible, have tools from different parts of the world.

The following seven major NSA tools are selected for further analysis:

- LEED-ND
- EarthCraft Communities (ECC)
BREEAM Communities

CASBEE-UD

HQE2R

Eccocity

SCR

EcoDistricts Performance and Assessment Toolkit (Spear)

Sustainable Project Appraisal Routine (SpeAR)

One Planet Living (OPL)

Cascadia Scorecard

LEED-ND

ECC

BREEAM Communities

CASBEE-UD

Qatar Sustainability Assessment System (QSAS) Neighborhoods

Green Star Communities

Green Mark for Districts

Green Neighborhood Index (GNI)

Neighborhood Sustainability Framework

HQE2R

Eccocity

SCR

EcoDistricts Performance and Assessment Toolkit (Spear)

Sustainable Project Appraisal Routine (SpeAR)

One Planet Living (OPL)

Cascadia Scorecard

2.1. LEED-ND

LEED-ND is the latest series of the U.S. Green Building Council’s (USGBC) assessment tools which was developed in partnership with Congress for the New Urbanism (CNU) and the Natural Resources Defense Council (NRDC) (Hurley and Horne, 2006). This third-party NSA tool’s pilot version was launched in 2007 and its latest version is LEED, 2009 for Neighborhood Development (LEED, 2011). Unlike other LEED rating systems, which focus primarily on green building practices and offer only a few credits for site selection and design, LEED-ND places emphasis on the site selection, design, and construction elements that bring buildings and infrastructure together into a neighborhood and relate the neighborhood to its landscape as well as its local and regional context (LEED, 2009).

2.2. ECC

In 2003, the Greater Atlanta Home Builders Association, the Atlanta Regional Commission, the Urban Land Institute Atlanta District Council, and Southface launched the EarthCraft Communities program—a certification system for sustainably planned and constructed communities (EarthCraft, 2011b).

ECC is a developer-certified, third-party verified program that recognizes responsibly designed and constructed communities in the Southeast. It is a regionally-specific tool utilized by land developers and local government agencies to promote smart growth, sustainable land development practices, and healthier communities (EarthCraft, 2011a).

2.3. BREEAM Communities

BREEAM was the first environmental certification scheme for buildings. It was established in 1990 in the UK, initially just for offices (Bonham-Carter, 2010), but now with a specific scheme for neighborhoods. BREEAM Communities is an independent, third-party assessment certification standard based on the established BREEAM methodology (BREEAM, 2011). It was developed by BRE Global in 2009 to help planners and developers take account of the full range of issues that must be considered from the earliest stages of the development process, and to measure and independently certify the sustainability of project proposals at the planning stage of the development process (BRE Global, 2011).

2.4. CASBEE-UD

CASBEE was developed in 2004 by the Japan Sustainable Building Consortium (JSBC), involving committees in academic, industrial, and government sectors (Sev, 2011), and its family covers housing scale, building scale, and urban scale. CASBEE for Urban Development carries on the concepts of CASBEE (building scale), and it is one of the expanded CASBEE tools developed with reference to the Q3 (Outdoor Environment on Site) and LR3 (Off-site Environment) assessment items of CASBEE for Urban Development. It is an independent assessment certification tool developed to contribute to enhancing sustainability in urban plans. The interiors of the buildings are excluded from assessment. However, the CASBEE product family includes “CASBEE for an Urban Area + Buildings”, which enables the use of CASBEE-UD together with building scale assessment (CASBEE for Urban Development, 2007).

2.5. HQE2R

HQE2R was a 30-month European research and development project on sustainable renovation of the built environment and the regeneration of urban neighborhoods (Blum, 2007). The project started in 2001 and continued until 2004. It was coordinated by Centre Scientifique et Technique du bâtiment (CSTB) in France (Charlot-Valdieu et al., 2004). In order to assess the different scenarios and to support decisions for action, HQE2R proposes three tools:

- A model to assess the long term impacts on the neighborhood and sustainability of scenarios for buildings and planning projects, using the indisputable indicators system (INDI model).
- An environmental impact model at both the neighborhood and the buildings scales (ENVI model).
- An economic and environmental assessment model for renovation or construction of a building (ASCOT MODEL) (Nagy and Grossi, 2003).
2.6. Ecocity

Ecocity is an international research project supported by the European Commission within the 5th framework program. The approach of Ecocity is to develop a common concept and design model settlements in seven participating countries with different socio-cultural, legislative, economic and climatic conditions (Coplak and Raksanyi, 2003).

Ecocity was practiced from 2002 to 2005 (Gaffron et al., 2005). It has a self-assessment list with focus on the evaluation of urban structure and transport, and several indicators and benchmarks have been developed for the purpose of assessment. The relative evaluation is conducted by comparing the value of an indicator to a given benchmark value (Gaffron et al., 2008).

2.7. SCR

SCR has been developed by VicUrban, the Victorian Government’s land development agency. It was developed to ensure that VicUrban incorporated “measurable principles of economic, environmental and social sustainability” into its projects (Hurley, 2009).

SCR has developed three assessment tools to measure planned performance for different types of residential communities: Master Planned Community, Urban Renewal Community, and Provincial Community. In this study, the 2007 version of master planned community has been used for analysis (SCR, 2011).

The characteristics of the seven major NSA tools are summarized in Table 2.

3. Framework for analysis

The framework was designed with the intent to address two major phases of NSA process: the development phase, and the application phase.

Analysis of the development phase deals with the contents of the NSA tools, the way they have been developed, their methodology for measuring the conditions, and measures taken to ensure the reliability of assessment results. NSA tools are designed with the aim of facilitating the informed decision-making for sustainable development. Therefore, their competence in responding to the implications of sustainable development is the first issue that needs to be addressed. The meaning of sustainable neighborhood development is discussed in Section 4.1. Since criteria and indicators are the building components of any sustainability framework, here we describe those characteristics that make a group of indicators suitable for assessment of sustainability conditions. Indicators used for sustainability assessment must be integrating (covering multiple principles), developed with input from multiple stakeholders (procedural equity) looking (intergenerational equity), distributional (intragenerational equity), and context-specific.

The performance of the selected NSA tools against “integrity” and “intragenerational equity” principles is scrutinized under the “sustainability coverage” sub-section. This is done by identifying the scope of

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**Table 2**

<table>
<thead>
<tr>
<th>NSA tool</th>
<th>LEED-ND</th>
<th>ECC</th>
<th>BREEAM Communities</th>
<th>CASBEE-UD</th>
<th>HQE®R</th>
<th>Ecocity</th>
<th>SCR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country/region</strong></td>
<td>USA, Canada, and China</td>
<td>USA</td>
<td>UK</td>
<td>Japan</td>
<td>7 European countries (Denmark, France, Germany, Italy, Netherlands, Spain, UK)</td>
<td>7 European countries (Austria, Finland, Germany, Hungary, Italy, Slovak Republic, Spain)</td>
<td>Australia</td>
</tr>
<tr>
<td><strong>Ratings</strong></td>
<td>Certified</td>
<td>40–49</td>
<td>50–59</td>
<td>60–79</td>
<td>80–100</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Silver</strong></td>
<td>Pass</td>
<td>≥25</td>
<td>Fairly poor (B –)</td>
<td>BEE = 1.5–3.0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Gold</strong></td>
<td>Good</td>
<td>≥40</td>
<td>Good (B+)</td>
<td>BEE = 1.0–1.5</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Excellent</strong></td>
<td>Very good</td>
<td>≥55</td>
<td>Very good (A)</td>
<td>BEE = 0.5–1.0</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Outstanding</strong></td>
<td>Excellent</td>
<td>≥70</td>
<td>Excellent (S)</td>
<td>BEE = 0.5–0.5</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Themes</strong></td>
<td>Site selection; water management; planning and design; preservation landscape; community engagement; green building</td>
<td>Climate and energy; resources; place shaping; transport; community; ecology and biodiversity; business; buildings</td>
<td>Resources and heritage; local environment; diversity; integration; social life</td>
<td>Context; urban structure; transport; energy flows; material flows; social infrastructure; management of the local environment</td>
<td>Commercial success performance measurement; housing affordability performance measurement; community well-being performance measurement; urban design excellence performance measurement; environmental leadership performance measurement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Notes:**
- E = excellent; B = good; P = Pass; D = default.
- SCR = Sustainable Communities Rating System.
selected tools and analyzing their success in providing a holistic account of the situations. Considering that the mere inclusion of different criteria does not assure their uptake, “Inclusion of pre-requisites” as a warrant for achieving a certain level of performance is also investigated. Context-specificity of the selected tools is examined in the “Adaptation to locality” sub-section. The rigor and reliability of assessment methodology, measures taken to mitigate the subjectivity, and considerations to fulfill the principle of “intergenerational equity” through using meaningful set of reference points that can best approximate the conditions and requirements in the future time horizons are criticized in the “Scoring and weighting” sub-section. Compliance with the “procedural equity” principle as an important element in the process of sustainability assessment is investigated in the “Participation” sub-section. Considering the importance of proper reporting of the assessment results in helping the NSA tools to achieve their main aim which is to function as decision support systems, “Presentation of results” is explored in a separate sub-section.

For NSA tools to realize their aim of contributing to sustainable development, a comprehensive and reliable NSA tool alone is not sufficient. Application, as the second major phase of assessment process, needs to be also considered. Accordingly, in this paper the applicability of the selected NSA tools is also analyzed.

Based on what was discussed above, the following framework is designed to be used in the analysis:

- **Sustainability coverage**: What are the major themes included in the NSA tools and how successful are they in assessing neighborhoods’ performance in a comprehensive and integrated way?
- **Inclusion of pre-requisites**: Whether there are strategies to assure the achievement of a certain level of performance.
- **Adaptation to locality**: Whether the NSA tools have considered the context-specific needs and priorities in their assessments.
- **Scoring and weighting**: What methods are used by NSA tools to score and weigh different criteria and how rigorous is this process?
- **Participation**: What mechanisms are utilized by the NSA tools to involve different stakeholders during the development and operational stages?
- **Presentation of results**: How do NSA tools report the results of assessment and to what extent are they useful as decision support systems?
- **Applicability**: How practical are the NSA tools and what strategies can be taken to increase their applicability?

Each of the elements of this framework is further explained under the respective sub-section. It should not be forgotten however, that they are all interconnected and must be regarded as complementary elements which should not be used in isolation.

Content analysis of relevant documents such as guidelines, policy papers, and manuals of each of the seven NSA tools, was the main method used for analyzing the tools using this framework. Moreover, in cases where further information was required, interviews (CASBEE-UD) and personal communications (LEED-ND, BREEAM Communities, and SCR) with tools’ developers and experts were conducted to acquire the information necessary for analysis.

### 4. Analysis using the framework

#### 4.1. Sustainability coverage

To investigate the tools’ potential for sustainability coverage, it is necessary to first clarify what we mean here by the term sustainability. Since the publication of Bruntland report (WCED, World Commission on Environment and Development, 1987), numerous definitions of what sustainable development entails have been made (Boyoko et al., 2006; Langeweg, 1998). Often used interchangeably with the term “sustainability”, there is still no consensus on how to define sustainable development. However, despite all these varieties in interpretations, central to most of them is the integration of social, economic, and environmental dimensions, often mentioned as the three pillars of sustainability (Boyoko et al., 2006).

In addition, some authors like Valentin and Spangenberg (2000), Parris and Kates (2003), and Wijngaarden (2001); also, emphasize on the importance of integrating the institutional dimension.

In the urban and neighborhood contexts, where various forces and entities influence the decision-making process, it is crucial to add the institutional dimension to the three pillars of sustainability. What we mean here as institutional is not only interactions between the governmental and non-governmental organizations involved in the decision making, but also a set of norms, laws, and regulations governing these interactions. As Spangenberg (2002) contends, institutional dimension also has the ability to facilitate the linkages between other dimensions and complement them. Accordingly, in this study we consider sustainability as having four pillars.

Although approaching sustainability is the common objective of the tools studied here, there are differences in the way they pursue it. Therefore, despite having similarities, the themes, criteria, and indicators used for assessment are not common within urban assessment tools. It is necessary to briefly describe what is meant here by the terms “theme”, “criterion”, and “indicator”. Themes are the broad topics of concern to sustainability. Each theme has one or more criteria which, as defined by Munier (2004), are “parameters used to evaluate the contribution of a project to meet the required objective”. Each criterion has, in turn, one or more indicators which are variables that provide specific measurements. This can be better explained through an example: “resources and environment” is one of the main themes which includes “energy” as a criterion that can be measured by indicators such as “the amount of neighborhood’s annual heating/or cooling consumption provided by the neighborhood plant” and “the ratio of solar oriented buildings”.

For the purpose of this analysis, a matrix was created to check the availability of indicators across the tools. As the matrix was completed, it was decided to consolidate similar criteria together. Table 3 lists the themes addressed by the seven NSA tools, and the percentages of criteria falling under each theme are also presented. These are percentages of the total number of indicators regardless of the number of points assigned to each after applying the weighting factor. However, since in some tools weighting coefficients are applied to the criteria, the percentages of maximum points available for the themes are also calculated and presented in Table 4. A comparison of these two tables reveals how, in some of the NSA tools, applying the weighting factors makes changes to the importance of some specific criteria. For instance, while in the LEED-ND assessment tool 33% of the total number of criteria is related to the resources and environment theme, points assigned to these set of criteria can, at most, sum up to 18% of the total points available.

As Tables 3 and 4 indicate, different tools have different emphases. All the tools (except HQE®R) are biased towards criteria for resources and environment and pattern and design. HQE®R, which is exclusively designed for regeneration projects, has more focus on social and well-being issues. As tables indicate, criteria related to water, energy, resource conservation, and design elements dominate less tangible socio-economic issues.

All the tools except CASBEE-UD have included some criteria for mixed use development. Since the sustainability issues are inter-related (Mateus and Bragança, 2011; Valentin and Spangenberg, 2000), and mixed use development affects the other issues such as energy and transportation, it is essential to consider this matter at the time of revision.

Tables 3 and 4 suggest that the tools don’t have a similar approach towards inclusion of social criteria. There are many criteria defined for this theme by HQE®R and SCR; whereas, there are fewer social criteria in other tools, and just 6% of CASBEE-UD’s criteria address social and community well-being criteria. Affordable housing and inclusive communities have been highlighted since there were major
differences among the tools. These two should be differentiated because affordability doesn’t necessarily mean inclusiveness and vice versa. It is also worth mentioning that the tools don’t differentiate between social housing and affordable housing, while these two are also different. CASBEE-UD has no criteria for affordable housing and inclusive communities; inclusiveness is also a loophole in the LEED-ND.

Results indicate that with the exception of SCR tool, the criteria related to business, finances and economy have not received enough attention among the selected tools. CASBEE-ND stands out again for not including this theme.

Location is another theme which is common within all NSA tool. Inspired by the smart growth principles, related criteria emphasize on development in the fill, brown field, and previously developed sites, and also on job and housing proximity.

Location is a high priority in LEED-ND and ECC, and this can be explained by the fact that compared with other countries, sprawl is a more severe concern in the US and its dependency on cheap and abundant sources of energy has caused various concerns for American planners.

Innovation is the last theme included in Tables 3 and 4. Innovation ability is seen as a core element of all sustainability strategies (Gleich, 2007). Innovation improves the adaptability, flexibility, and also tool’s capability of incremental improvement. Acknowledging innovation’s significance, LEED-ND, ECC, BREEAM Communities, and SCR award points for innovative ideas. LEED-ND also has two credits for projects which employ a certified accredited professional as a project member.

What is obvious from the results is that NSA tools have failed to address institutional sustainability. Institutions have an essential role in guiding human interactions (Valentin and Spangenberg, 2000), and their performance in various areas such as budget management, planning management, etc. affects the community’s sustainability. Tools studied here have no mechanism for assessment of the performance of governmental and non-governmental institutions in the neighborhood. Furthermore, other vital criteria such as governance, decentralization, legal frameworks and instruments, information systems, and research and education to institutionalize sustainable development are also overlooked.

### Table 3

Percentage distribution of the frequency of indicators falling under each main theme.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Criteria</th>
<th>Percentage of the frequency of indicators falling under each theme and criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LEED-ND</td>
</tr>
<tr>
<td>Resources and</td>
<td>Water</td>
<td>14</td>
</tr>
<tr>
<td>environment</td>
<td>Energy</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Materials, ecosystem, biodiversity, resources</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>conservation, etc.</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>Affordable housing</td>
<td>9</td>
</tr>
<tr>
<td>Social</td>
<td>Inclusive communities</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Safety, community well-being, community</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>outreach, heritage, social networks, etc.</td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td>Local jobs and economy, finances, investments,</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>employment, business</td>
<td></td>
</tr>
<tr>
<td>Location, site</td>
<td>Mixed use</td>
<td>11</td>
</tr>
<tr>
<td>selection</td>
<td>Green infrastructure, compact development,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>access, urban planning and design standards,</td>
<td>29</td>
</tr>
<tr>
<td>Pattern and design</td>
<td>Accredited professionals</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Innovation</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 4

Degree of emphasis on major themes in the seven selected NSA tools.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Criteria</th>
<th>Percentage of the maximum points achievable for each main theme and its sub-themes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LEED-ND</td>
</tr>
<tr>
<td>Resources and</td>
<td>Water</td>
<td>9</td>
</tr>
<tr>
<td>environment</td>
<td>Energy</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Materials, ecosystem, biodiversity, resources</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>conservation, etc.</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>Affordable housing</td>
<td>5</td>
</tr>
<tr>
<td>Social</td>
<td>Inclusive communities</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Safety, community well-being, community</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>outreach, heritage, social networks, etc.</td>
<td>5</td>
</tr>
<tr>
<td>Economic</td>
<td>Local jobs and economy, finances, investments,</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>employment, business</td>
<td></td>
</tr>
<tr>
<td>Location, site</td>
<td>Mixed use</td>
<td>18</td>
</tr>
<tr>
<td>selection</td>
<td>Green infrastructure, compact development,</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>access, urban planning and design standards,</td>
<td>27</td>
</tr>
<tr>
<td>Pattern and design</td>
<td>Accredited professionals</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Innovation</td>
<td>8</td>
</tr>
</tbody>
</table>
As the NSA tools evolve, institutional sustainability criteria are expected to be included in the sustainability checklists to address the issue of governance and need for more efficient administrative procedures. QSAS and Green Star Communities can be regarded as harbingers of this evolution, as they have respectively included management and urban governance in their themes.

Results of this section are in agreement with those reported by Murgante et al. (2011) suggesting that there is a lack of balance between different sustainability dimensions. This section’s analyses indicate that the issue of integrated sustainability which has been emphasized in many studies (e.g., Conroy and Berke, 2004; Dahl, 2007; Hacking and Guthrie, 2008; Roseland, 2000) is not yet well addressed within the framework of NSA tools; and, by and large, environmental dimension dominates other less tangible dimensions.

Table 5

Table 5: Percentages of mandatory and optional elements in NSA tools.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Mandatory</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED-ND</td>
<td>21%</td>
<td>79%</td>
</tr>
<tr>
<td>ECC</td>
<td>24%</td>
<td>76%</td>
</tr>
<tr>
<td>BREEAM Communities</td>
<td>24%</td>
<td>76%</td>
</tr>
<tr>
<td>CASBEE-UD</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>HQE®R</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Ecocity</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>SCR</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

While environmental aspects are essential for achieving the intergenerational equity, other aspects and their essential role in fulfillment of intragenerational equity should not be overlooked. This needs to be considered at the time of refinement.

Developing a set of horizontal standardized methods, similar to CEN/TC 350 standards developed by the European Committee for Standardization, which provides a core set of criteria for assessment in a region is a good way to achieve an integrated and holistic framework that avoids gaps and overlapping. However, since neighborhoods have different meanings in different contexts, this should be in tandem with mechanisms for adaptations which are discussed in Sections 4.3 and 4.4.

It should be mentioned however, that inclusion of a specific criterion in the assessment system doesn’t guarantee its implementation, and there should be other mechanisms for enforcement. Section 4.2 brings up the importance of having pre-requisites in the assessment framework.

4.2. Inclusion of pre-requisites

In the previous section it was warned that inclusion of criteria per se doesn’t necessarily mean that the development will comply with them. Some measures need to be taken to ensure that the minimum sustainability requirements are met.

As Table 5 indicates, all the spin-off tools except for CASBEE-UD have included some mandatory criteria and a minimum of total acquired points that should be met if a development wants to be certified. The only difference between LEED-ND, ECC, and BREEAM Communities is that, unlike the first two tools, the last one allocates points to the mandatory criteria and these points are accounted in the final score acquired. CASBEE-UD however, does not have any mandatory criteria. One of the objectives of the spin-off tools is to provide the certified developments with environmental labeling and market recognition, and this has made them market driven. In an analysis of the scorecards of some of the LEED-ND certified developments, Carde (2009) found out that developers avoid compliance with those criteria which have fewer points and at the same time are costly to achieve.

For achievement of sustainability, all the dimensions should be addressed simultaneously. Under current circumstances, a development might acquire sustainability brand without adequately addressing all the dimensions. For instance, as shown in Table 6, while social and economic sustainability are recognized as two pillars of sustainable development, none of the tools have required the fulfillment of economic criteria, and BREEAM Communities is the only tool that requires the provision of affordable housing and inclusive communities. Although all the spin-off tools need refinement, it is a more urgent need for CASBEE-UD as a tool without any mandatory criteria.

Plan-embedded tools have taken a different approach. In HQE®R and Ecocity, the performance of all the included criteria is displayed by comparing the value of each indicator to a given benchmark. This way the areas needing improvement are highlighted, and planners and developers are supported in making decisions about the best scenarios and the appropriate action plans.

SCR assessment tool doesn’t have any specified hurdle marks and mandatory criteria. The only pre-requisites are that the development should include more than 500 homes and have some elements of mixed use. Although this has made the acquisition of certification easy, it increases the possibility of failing to notice the basic criteria of sustainability.

4.3. Adaptation to locality

Although NSA tools are designed based on the priorities and conditions of their countries and regions of origin, differences in climatic, social, and economic settings and also size and type of developments, make further customization of NSA tools indispensable.

Among the studied NSA tools, only HQE®R and Ecocity have used local benchmarks in their frameworks. In both tools assessment is undertaken in the context of a broader plan; therefore, based on the results of neighborhood diagnosis stage, unique benchmarks are used for each location. This way they have made an effort to adapt to different climatic, social, and environmental conditions.

No matter where and for which type of development (greenfield, brownfield, suburban, etc.) is the assessment tool utilized LEED-ND almost applies the same weightings and benchmarks, and the developer can only acquire four additional credits for addressing geographically-specific environmental, social equity, or public health priorities.

In ECC, for the purpose of addressing locality issues, regions are categorized into “Piedmont and mountain” and “Coastal”. However, only two criteria namely “Protection of flood plains” and “Protection of steep slopes” receive different scores and others are assessed uniformly irrespective of the contextual characteristics.

BREEAM Communities has addressed this issue partially by using compliant assessment methodology and through applying regional weighting coefficients. All the acquired points are multiplied against corresponding regional weightings, specified for 9 regions, to provide the BREEAM Communities score available for that particular local area. However, the benchmarks should also be locally referenced and the issue of development type is also not considered.

CASBEE-UD has slightly considered the differences between developments with standard floor area ratio over 50% and those under 50%. Context and type of development should also be considered for adaptation.

SCR has slightly different criteria and scores for Master Planned Community, “Urban Renewal Community”, and “Provincial Community” as three different types of development. However, it has also failed to address the issue of sensitivity to various climatic, social, and economic contexts.

The adoption of NSA tools in countries than the origin is also a sensitive issue that should be dealt with caution. Among the tools studied here, LEED-ND is the one which has already been used outside US and BREEAM Communities is also aiming at finding clients outside UK. While it is preferable for each country to develop its own framework, this might be impossible due to various constraints. In such situations, the adopted tool must be adapted and customized using suitable benchmarks and weightings to be used in the assessment framework.
Because of significant variations in scope, planners should be aware that one size doesn't fit all and a customized and adapted tool with supplementary information is needed for each development. Therefore, context-specific criteria should be included and weightings should be assigned according to values of relevant specific communities (Gibson et al., 2005). This might impose additional economic burden on the developer, but it is the only way they can assure the viability and reliability of assessment results and providing the decision-makers with a realistic account of the situations. Section 4.4 explores the weighting and its role in taking account of context-specific issues.

4.4. Scoring and weighting

Other important aspects of NSA tools are scoring and weighting which, as Retzlaff (2008) contends, are related to local adaptability that was discussed in the previous section. Similar to comparative assessments involving many relevant factors (Gibson et al., 2005), NSA tools weigh criteria by assigning a score value for each element.

Weighting is one of the most theoretically controversial aspects within the SA systems (Alwaer et al., 2008; Retzlaff, 2009). It implies the significance and importance of different criteria, although it is extremely difficult to compare and rank different elements (Retzlaff, 2009).

The often subjective nature of scoring and weighting different criteria (Garde, 2009; Retzlaff, 2009; Vakili-Ardebili and Boussabaine, 2007), has made this practice vulnerable to ambiguity (Kajikawa et al., 2011).

Weighting procedures were scrutinized to find the basis for weighting across the tools. Each tool has its own unique way of weighting the criteria; however, tools can be classified into four categories based on the similarities among them.

LEED-ND, ECC, and SCR constitute the first category. There are some differences between the criteria used in their lists, but even in the cases where identical criteria are used sometimes different points are awarded. For instance they have respectively allocated 4, 35, and 8 points to the mixed-use criterion. Notwithstanding these differences, these tools have undertaken similar ways to weight elements. None of them use fractions or negative values. Despite using a mixture of qualitative and quantitative measures, it has been tried to, as much as possible, verify the scores objectively; this is a good effort to reduce the subjectivity of scoring. They have developed target performances or benchmarks for each criterion, and points are awarded based on how much the performance is above the target or benchmark. The potential impacts of each criterion are considered when allocating points. As such those with higher potential of causing impacts would be weighed more heavily. As a basis for relative allocation of points, experts use the impact categories and standards set by different institutes and organizations, and the practice of assigning relative importance to the criteria is the time when the problem of subjectivity raises.

Because of its distinctive characteristics, “BREEAM communities” is the single tool of second category. Allocating not more than 3 points to each individual criterion and applying regional weightings are features that distinguish its weighting system from those of the tools in the previous category.

Minimum acceptable performance levels and benchmarks are set which should be satisfied for a criterion to acquire one point as the “minimum”. Two points are awarded when a higher performance level, labeled as “good”, is acquired, and there are three points available for the “best” performance. Likewise the tools in the former category, technical standards and scientific evidence are used to make the tools more objective and credible. However, there are several occasions where the weighting system is ambiguous and prone to subjectivity. This issue can better be understood in the light of an example: The criteria for “Land reuse” states that to attain the minimum point the developer should demonstrate that 50–74% of the development site that was built on previously developed/brownfield land will be brought back into use, and if it can be demonstrated that 75–99% and 100% of the site meet the criteria, two and three points can be awarded, respectively. The problem is that there is no scientific justification for setting 50% as the minimum and awarding the same points for two different projects that their corresponding percentages are in the same range, but with significant difference. For instance, the project which 50% of it is built on brownfield land acquires as many points as the one with 74% built on brownfields.

Moreover, in some cases, assessor’s discretion might be decisive in point allocation. This is a more serious issue when dealing with social issues. The practice of setting regional weightings too, involves subjectivity. Likewise the second category, the third one includes just one tool namely CASBEE-UD. Scoring and weighting is done using a mixture of qualitative and quantitative measures.

Each criterion has 5 score levels from 1 to 5. However, this doesn’t mean that levels 1 and 5 are always designated as respectively the lowest and highest levels of performance. In many cases, one or more levels are designated as inapplicable without giving a specific reason. For instance, in the case of assessing the performance against the criterion for “Reduction of ground subsidence” levels 4 and 5 are defined as inapplicable and level 3 is the highest level of performance.

Unlike tools in the previous categories, weights are not allocated by comparing the performance level against a target level of performance. Level 3 which is an indicator of the normal situation (accepted level of performance in Japan, e.g. for classification, treatment, and disposal of waste, sorting waste into five types is considered as a normal practice and is used for defining level 3), is used as a reference level, and scores from 1 to 5 are assigned according to the performance level (below, equal, or above the reference level). Although in some cases the standards set by other departments are utilized

| Theme                              | Criteria                                                                 | LEED-ND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
|------------------------------------|--------------------------------------------------------------------------|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---| 
| Resources and environment          | Water                                                                    | 2       | 17| 5| 20| 1| 6|  |  |  |  |  |  |  |  |  |  |  |  | 
|                                   | Energy                                                                   | 1       | 8 | 0| 2| 13|  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
|                                   | Other resources (material, ecosystem, biodiversity, resources conservation)| 3       | 25| 5| 20| 3| 19|  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
| Transportation                     | Affordable housing                                                       | 0       | 0 | 1| 4| 2| 13|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
|                                   | Inclusive communities                                                    | 0       | 0 | 0| 1| 6|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
|                                   | Safety, community outreach, health and wellbeing, education, cultural, heritage, social networks, ... | 0       | 0 | 5| 20| 1| 6|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
| Economic                           | Local Jobs and economy, finances, investments, employment                | 0       | 0 | 0| 0| 0|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
| Location, site selection          | Mixed use                                                                | 2       | 17| 1| 4| 1| 6|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
| Pattern and design                | Green infrastructure, compact development, access, urban planning and design standards | 4       | 33| 7| 28| 4| 25|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 
| Total                              |                                                                         | 12      | 100| 25| 100| 16| 100|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 

Table 6

Distribution of mandatory elements across those tools which have required mandatory criteria.
for setting the reference levels, in many cases they are set by teams of experts.

CASBEE-UD applies weights to nested categories of criteria. The weighted scores of sub-criteria are aggregated to give the total score. This way there is no significant difference among the impacts of various criteria on the final score. Moreover, the weighting coefficients are also determined by conducting a questionnaire survey of experts in fields potentially related to the use of CASBEE on the urban scale (109 responses have been received) and using the Analytic Hierarchy Process (AHP) (CASBEE for Urban Development, 2007).

AHP per se is entangled with the issue of subjectivity (Saen, 2007) that renders it heavily relying on the experience and intuitive judgment of the users (Carlsson and Walden, 1995).

In the CASBEE-UD assessment framework, weighting involves a high degree of subjectivity. The use of words such as partial, majority, almost, considerable, somewhat, substantial, etc. is frequent across the weighting system and this is a clear evidence of assessment result’s dependence on the assessor’s discretion and intuitive judgment.

Wherever the criterion has sub-criteria, a different mechanism is used for scoring. For each sub-criterion, levels 1 to 5 are respectively assigned scores from 0 to 4. The final score of that criterion is determined by dividing the total points the sub-criterion acquire by the maximum points available for them. This procedure is presented in Table 7.

Here too, weighting is prone to subjectivity and, likewise the previous category, a small fraction can make a big difference by changing the level the performance acquires. For example, credit ratio 2 will be assigned level 2, and credit ratio 1.99 will be assigned level 1.

Above enumerated matters indicate that CASBEE-UD’s weighting systems suffer from vagueness and is not transparent.

The last category discussed here consists of HQE2R and Ecocity that have a similar framework for weighting the assessment criteria. These tools don’t provide an aggregate index of sustainability; instead, they present the performance of each criterion. Most of the benchmarks are developed during the diagnosis stage and out of the context of the project. In Ecocity, the benchmarks are representing the normal practice, while in HQE2R a reference scenario is developed based on benchmarks developed according to the 21 sustainability targets.

In Ecocity if the indicator matches the benchmark (normal practice), score D is assigned. Scores A, B or C are assigned if the indicator is better than the benchmark for D, which shows an improvement over the normal practice. E would show a result that is worse than the normal practice.

In HQE2R’s INDI model, depending on the sustainability performance, scores between “−3” and “+3” are assigned to each criterion of each development scenario.

Similar to the previous tools, scoring is to some extent influenced by the assessor’s judgment and is subjective.

The analysis of NSA tools’ weighting system suggests that notwithstanding efforts taken to increase the objectivity, all the tools are in some ways dealing with the challenge of subjectivity of assessments. Apart from the issue of subjectivity, as mentioned above, there are some other ambiguities and limitations that deserve more consideration.

Although as Retzlaff (2009) states, “any assignment of weights is essentially a subjective exercise”, there is an essential need for refining the weighting methods to achieve more realistic assessments. One important issue to be considered is that different stakeholders and actors involved in the development have different interests and priorities and accordingly value the criteria differently (Cole, 1998; Haapio, 2012).

The analysis shows that NSA tools have expert-oriented weighting systems and the interests of all parties are not considered. Taking a consensus-based approach is helpful in enhancing the transparency which is pointed out to be an essential characteristic of scoring and weighting systems (Moldan and Dahl, 2007; Singh et al., 2012).

Another problem of weighting systems that causes ambiguity is that in some cases different values are assigned the same score and weighting. Vakili-Ardebleh and Boussabaine (2007) and Baumgartner (2005) suggest that this issue can be partially solved by using fuzzy techniques in which each variable (criteria) carries a certain value and approximates are taken into account. Utilization of fuzzy techniques should be considered as a suitable approach to handle the issue of complexity and subjectivity of weighting system in the NSA tools. Participation as a practice for enhancing the transparency of NSA tools is further explored in Section 4.5.

4.5. Participation

The significance of community involvement during different stages of planning ranging from pre-planning to planning, design, and implementation is widely recognized. In this section, the importance of various stakeholders’ participation in the development of an efficient NSA tool is discussed. Khakee (1998), emphasizing on the inseparability of planning and evaluation, suggests that evaluation should consist of a discourse among all the stakeholders who are in some way affected by the evaluation, and should take the form of negotiations rather than the pursuit for an objective affectivity measure.

Citizens can involve in the development of NSA tools in three main stages. First, at the time of defining the sustainability targets and identifying the core criteria and indicators that are going to be assessed. Roseland (1999) suggests that citizens and community initiatives provide creative and transferable solutions to seemingly intractable social and environmental challenges. There are different parties in a neighborhood that usually have different if not conflicting values, priorities, needs, and positions. Some cities such as Seattle utilize a public participation mechanism for the selection of the criteria (Holden, 2006; Munier, 2011, quoting Aguilar et al., 2002). Enabling the residents to identify and design measurements systems for their neighborhoods is beneficiary because they will be more invested in the reliability and accuracy of data collected; also, consensus-based measurement systems can serve to diffuse conflicts within a community and establish a basis for mutual understanding (Seltzer et al., 2010). This will eventually lead to improvement of decision-making process (Bauler et al., 2007).

Second is during weighing different criteria. Having a consensus based weighting for different categories of indicators, can improve the assessment process (Alwaer et al., 2008; Bauler et al., 2007; Koellner et al., 2005).

Finally, citizens can participate by providing feedbacks that help planners update the system. Using these feedbacks, planners and developers can decide when development changes will be required to bring economic development activity into alignment with ecological limits and social needs (Brugmann, 1996).

Among the selected NSA tools, only HQE2R and Ecocity have set the development framework and objectives and chosen the core criteria for assessment through consultation with neighborhood residents.

A crucial element of the HQE2R approach is the “Shared Diagnosis” which involves an intensive transversal communication process and consensus among involved actors, aiming at informing on the one

### Table 7

The procedure for scoring a criterion which has sub-criteria (CASBEE for Urban Development, 2007).

| Level | | On the efforts to be evaluated [III]: | Credit ratio (|[III]|) = | | | |
|-------|-------|------------------------------------------|----------------------------|-------|-------|-------|
| 1     |       | 0.0 ≤ Credit ratio ≤ 0.2                 |                            |       |       |       |
| 2     |       | 0.2 ≤ Credit ratio ≤ 0.4                 |                            |       |       |       |
| 3     |       | 0.4 ≤ Credit ratio ≤ 0.6                 |                            |       |       |       |
| 4     |       | 0.6 ≤ Credit ratio ≤ 0.8                 |                            |       |       |       |
| 5     |       | 0.8 ≤ Credit ratio                       |                            |       |       |       |

[I] = total points acquired, [II] = maximum points available, and credit ratio ([III]) = |I|/|II|.
hand and knowing the needs, wishes and priorities of residents and users on the other hand.

In Ecocity, community input is acquired through iterative hearings and workshops, and exchanges between developers and stakeholders. CASBEE-UD has taken a step towards adopting a consensus-based approach; however, it has reduced the stakeholders to industry, government, and academia.

In the other tools participation in the process of developing objectives and criteria for assessment is mainly restricted to group(s) of experts working with developer(s).

Regarding the involvement of residents in the weighting and feedback processes, none of the tools have yet provided an arena for involvement of the residents in the practice.

4.6. Presentation of results

The next important issue to be discussed here is the presentation of assessment results. Although it is difficult, if not impossible, to precisely define the degree of sustainability (Bell and Morse, 2008; Haberl et al., 2004), a sustainability report should provide a balanced and reasonable representation of the sustainability, including both positive and negative contributions (Sustainability, 2011).

The assessment results can potentially be used by different stakeholders including planners, developers, local authorities, real estate market, and residents. Notwithstanding the fact that end users’ purposes of using the assessment results might differ from one another, as Coplak and Raksanji (2003) suggest, the core aim of most of assessment tools is to play the role of a decision aid tool. The final results must provide an adequate and reliable snapshot of the situations on the ground, have the potential to guide planning decisions, evaluate actions and the degree of progress towards sustainable development, and raise the awareness of residents.

Due to the significance of the assessment results in the decision-making process, they should be straightforward and transparent to avoid green washing and ill-based decisions.

The ability to track temporal changes is another issue that needs to be considered and is of high usage for the monitoring purposes. Below, the selected tools’ approaches to presentation of results are analyzed to evaluate their ability to address the above mentioned characteristics.

LEED-ND and BREEM communities have a similar way of presenting the final results. The only difference between these two is that in BREEM Communities those projects which fail to acquire threshold points are also labeled. As shown in Table 2, in most of the cases, certified projects are assigned a label based on the scores they’ve achieved. Despite simplicity of presentation, it cannot be regarded as a transparent representation of sustainability. As Koellner et al. (2005) point out, “still, the fundamental objective of both private and institutional investors is to maximize the expected rate of return on their investment”. This market driven nature of the majority of developments, increases the risk of just focusing on some specific highly visible aspects or aspects that have a quick return on investment. An example of such aspects has been demonstrated in a study of some of the LEED-ND pilot projects in the United States (Garde, 2009). Although in practice compromises and trade-offs will be unavoidable in most policy, program, plan and project decisions (Gibson, 2006), the final presentation should identify the strengths and weaknesses of the project in order to inform end users of the situations. This objective can to some extent be achieved by breaking down the results in terms of different aspects (such as economic, social, environmental, institutional). This way, those areas which are lagging behind can be spotted and accordingly proper actions can be taken to improve their performance level.

ECC and SCR have no rating categories and the user must go through all the criteria and their performance, which is not feasible for all users.

CASBEE-UD has to some extent addressed the aforementioned shortcomings by presenting the results of each theme. Moreover, there are two ratings (fairly poor and poor) for performances below the normal performance that highlight the areas needing improvement. The assessment results are displayed in three different formats. First, a graph of BEEUD (Building Environmental Efficiency of Urban Development) with “Environmental Quality in Urban Development” on the vertical axis and “Environmental Load in Urban Development” on the horizontal axis. The steeper the gradient, the more sustainable is the project. Second is a radar chart that is simply indicating the performance of each main theme. Third, six bar charts presenting the performance of the main sub-themes of each of the six major themes. This helps the end user to get a better knowledge of those areas doing well and those needing improvement. Moreover, presenting the data in three formats with increasing details makes it possible for the consumer of the tool to utilize the tool that meets her/his purpose. Fig. 1 shows the CASBEE-UD’s results for a given project.

As can be seen from Figs. 2(a) and 3, HQE-AR and Ecocity present the assessment results in a spider web format (labeled as evaluation compass in the Ecocity). Plan’s performance against each of the 21 main targets is projected on the spokes. There are two differences in the ways that these two tools report sustainability performance. First, in Ecocity there is just one label indicating negative performance while in HQE-AR three levels are designated for this purpose.

Second, as presented in Fig. 2(b), HQE-AR has another diagram which shows the temporal trends of performance assessment. This is the only tool which has paid attention to temporal changes which are good indicators of the degree of effectiveness of plans and lets planners gauge whether their actions are reaching the goals and vision for sustainability. This should be considered in tandem with breaking down the results into main themes to avoid over-concentration on just some aspects. Addressing these two issues helps in providing the audiences a balanced and reasonable picture of sustainability performance levels.

Now that aspects relevant to the development phase of NSA process are analyzed, Section 4.7 scrutinizes the application as the second major phase.

4.7. Applicability

The last issue to be discussed here is the applicability and practicability of NSA tools. This is of high significance because without practically applying the criteria in the real world, it is not possible to approach sustainability. This issue has two faces: one appears when there is an assessment tool with no appeal for it in the community, the other can be seen when there is a sound plan on paper which is certified by the assessment tool, but what is implemented is not in compliance with the earlier certified plan. These can be explained by the voluntary state of NSA tools, additional costs that meeting the sustainability criteria stipulated by them imposes on the developers and residents, and in some cases the complexity and ambiguity of the tool that makes them flat.

The study of selected NSA tools revealed that all of them are in some way dealing with this issue. Here, first the conditions of tools with regard to applicability are presented, and then some suggestions for making them more applicable are offered.

Compared to other NSA tools, LEED-ND has gained a better recognition among developers and local authorities. The three developing organizations and some other departments such as the Department of Housing and Urban Development (HUD), and U.S. Environmental Protection Agency (EPA) are collaborating to foster the utilization of the tool. Currently LEED-ND has certified over 100 projects, another 135 projects are registered, and 31 local and state governments and federal agencies are using LEED-ND to promote green neighborhood-scale development (Benfield, 2011).

Notwithstanding this relative success, there are still major barriers before the widespread adoption of the
LEED-ND assessment tool. Since LEED-ND is a voluntary tool, there is no legal basis for its implementation. Monitoring of projects and plans is not compulsory for the US in its entirety (Ganser, 2008) and as a consequence there is the risk that the tool might just be used by those developers that are seeking market appeal for their project, and as Hurley and Horne (2006) are concerned it might only be used by the already high-achieving “boutique” developers and not the majority of the developer market. There are already some practices such as rewarding height and density bonuses in some jurisdictions for transition from voluntary guidelines to statutory codifications (Berton, 2011), and HUD is also using LEED-ND to score the grant applications (Donovan, 2011) which is a significant step towards further promotion of LEED-ND usage. Economic burdens are causing another major barrier because both the compliance with the assessment criteria and undertaking of assessment itself are costly.

The same problems mentioned above for applicability of LEED-ND are also associated with ECC. As a voluntary tool used in Southeast, ECC is utilized by community or a group of stakeholders to assist them in planning their sustainable development (Adams and Younos, 2008). But, there is no solid mechanism for implementation of assessment results.

BREEAM Communities has a more promising implementation prospect. The European Directive 2001/42/EC on the assessment of the effects of certain plans and programs on the environment (European Commission, 2001), and the U.K. Planning policy statement (PPS1), which requires planning authorities to ensure that sustainable development is treated in an integrated way in their development plans (Office of the Deputy Prime Minister, 2005), provide a concrete legal basis for consideration of local SA, and BREEAM Communities has the potential to accelerate the approval of plans at a lower cost and greater reliability. Currently the integration into the planning system is done through the development plan preparation process that all local planning authorities engage in. Although nationally there is no requirement to use the scheme, the Bristol City Council has stipulated that all new major developments should be assessed against BREEAM Communities (Bristol City Council, 2011), and this is a good sign of BREEAM Communities gaining momentum in planning process in UK.

CASBEE-UD is facing major challenges for its implementation. Although there is an EIA law in place in Japan, its scope is just limited to specific large scale projects and is mainly focused on the environmental aspects of sustainability. Furthermore, unlike Australia, the UK, and the US, Japan is experiencing a declining population growth rate (UN Department of Economic and Social Affairs, 2004), and accordingly the demand for new developments is not high. This diminishes the feasibility and efficacy of incentivizing policies such as offering development bonuses in reward for meeting the tool’s requirements. CASBEE-UD has been developed amid such situations and, as can be expected, it has not garnered proper recognition in the community. Since its development in 2006, “Koshigaya Lake Town” is the only project which has applied CASBEE-UD assessment tool. This project has been developed by Daiwa House Company with the sponsorship of the Ministry of the Environment. This company has applied for CASBEE-UD certification with the aim of gaining market recognition (Yoshihisa Ino, personal communication, June 30, 2011).

The positive point in Japanese context is that grassroots Machizukuri activities, initiated by the residents concerning the quality of their local environment, has gained momentum (Shariﬁ and Murayama, 2011), and using assessment tools to evaluate different scenarios during the plan making process of Machizukuri activities can be a starting point for pushing developers and local authorities to better acknowledge the role of CASBEE-UD as an assessment tool.

HQE2R and Ecocity are doing well in practical use of assessment tools. Other than the existence of European Directive 2001/42/EC on the assessment of the effects of certain plans and programs, assessment is also one stage of broader planning process and developers utilize assessment tools to evaluate the sustainability performance level of different development scenarios.

Despite establishment of urban cities agenda for the nation that requires plans to consider sustainability (Green building council Australia, 2010), there is still no evidence of applying SCR tool in the

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**Fig. 1.** CASBEE-UD’s way of presenting the assessment results (CASBEE for Urban Development, 2007).
real world. Hurley (2011) stated that this is due to ambiguities and lack of hurdle marks in the SCR assessment tool. This space is going to be filled by the introduction of Green Star Communities tool that is going to be developed by Green Building Council of Australia.

As discussed above, there are different barriers on the way of applying NSA tools. A combination of pull and push factors can be helpful in promoting the usage of NSA tools. The statutory codification should be done with caution. By iteratively evaluating the current situations, enforcement conditions, and planning practice against the assessment tool, the different barriers on the way of implementation and those aspects that make the tool onerous will be identified. Using the feedback results, the stakeholders can decide about the policy options and mechanisms and strategies for their implementation. Provision of grants, and rewarding bonuses to developments based on their performance level should also be considered as ways to incentivize the developers to undertake the assessment tools. The last but not the least is the issue of raising public awareness about the significance of applying sustainability criteria. For instance, providing information about the amount of lifetime savings that can be achieved through undertaking sustainability measures can be helpful. Another important aspect is the significance of paying attention to sustainability criteria in achievement of resiliency which is vital in the face of recently frequent instabilities and catastrophes. Applying the sustainability criteria to assessment tools, it would be possible to, among others, enhance social capital, strengthen networks of mutual support, reduce neighborhoods dependency on other areas, and reduce the impacts on climate change. These are all important for achievement of resiliency. It should also be mentioned that by raising awareness the market demand for certified developments will stimulate. This is important for overcoming investor’s concerns over the return of their investment; also, the citizen groups’ demand for certified neighborhoods enables the local authorities to consider the codification of relevant criteria. Therefore, it is necessary to undertake a combination of these efforts to improve the applicability of NSA tools.

5. Discussion and conclusion

In this paper seven NSA tools were analyzed with regard to underlying design used, and processes and procedures taken to measure
sustainability performance and implement action plans outlined in the assessment report.

Despite having the similar aim of approaching sustainability, there are significant differences in how these tools pursue this aim. This large degree of divergence can be explained by corresponding differences in how, where, and why they have been developed and applied to neighborhood development plans. However, NSA tools are similar in that they are composed of a checklist of criteria which are mainly optional. Although in some cases all the criteria are assigned equal value, it is common that some criteria are weighted higher based on their performance against the specified benchmarks or accepted norms. Process of criteria selection and weighting assignment is often subjective. The tools are mainly developed by experts, and citizens are not adequately involved in the process. Also, most of the tools are in some ways, facing the challenge of implementation.

To approach sustainability, positive improvements are needed in all the areas discussed here. In the following paragraphs, in the light of study’s findings, the prospect of NSA tools is discussed, and some solutions and suggestions are made that applying them at the time of refinement can help planners take a further step towards approaching sustainable communities.

Degree of sustainability coverage is one of the issues explored in this study. Here it should be noted that in parallel with EIA’s expansion and introduction of newer assessment tools, developers have considered widening the framework of assessment from merely covering environmental impacts to hitting a balance between environmental, social, and economic impacts.

As Charlot-Valdieu et al. (2004) put it, “assessment tools transfer data overload into information for better decision”. Assessment tools studied here have similar themes; however, the number and variety of criteria addressed under each theme is not consistent across the tools. The content analysis indicated that, concerning the balanced inclusion of sustainability dimensions, only HQE2R, Ecocity, and SCR are doing relatively well. The approximate success of these plan-embedded tools can be attributed to relatively better involvement of a wide array of stakeholders compared with other tools.

Criteria addressed in the tools studied here aligned well with environmental and design aspects. However, important issues such as affordable housing, local economy and jobs, inclusive communities, and mixed use (mainly social and economic dimensions) are still not adequately addressed or even missing in some assessment tools. Both intergenerational equity and intragenerational equity are necessary conditions for sustainable development (George, 1999), and achieving the latter one is not possible without proper acknowledgment of socio-economic criteria.

One noticeable improvement in some of the studied tools, compared with the earlier generations of the assessment tools, is the attention to innovation. While this is important for maintaining the dynamism of processes, it should be mentioned that it can add some additional subjectiveness to the process. Hence, innovation credits should only be rewarded when there is enough evidence demonstrating that significant achievements, beyond what is specified in the standards of the assessment tool, have been made through application of that particular criterion.

This study also emphasized on the importance of institutional sustainability as the fourth pillar which should be considered. It was noticed that acknowledging the importance of the institutional dimension, some under-development tools have already considered their inclusion and this should also be considered at the time of refinement of existing tools.

There were differences among the selected tools regarding the inclusion of mandatory criteria. The analysis revealed that generally NSA tools are not doing well in guaranteeing an accepted level of performance.

By assigning hurdle marks for performance criteria, developers can better approach sustainability, and at the same time enhance the resiliency of neighborhoods through delivering communities with strong local economies that are self-reliant and benefit from networks of mutual support. Those criteria highlighted in this study (relevant to affordable housing, inclusive communities, social networks, mixed use, and local economy) are significant in the sense that they are essential in enhancing a neighborhood’s ability to withstand and recover from hard times, and ensuring that a diverse array of community groups, irrespective of their social and economic status, benefit from the development.

In terms of adaptation to locality, it was stressed that the assessment systems should differ based on the development type and also site-specific issues. This study indicates that only HQE2R and Ecocity have fulfilled these criteria.

Tools should be customized to be sensitive to context and development type and, as Sev (2011) mentions, the benchmarks and weightings should reflect the characteristics of the region. This way the site-specific relevance of tools is assured. This issue should also be considered by planners and developers of other countries and regions who want to adapt the assessment tools for their own community.

The analysis showed that despite efforts taken to verify some elements objectively, due to the normative nature of the concept of sustainable development (Rametsteiner et al., 2011) NSA tools are entangled with the problems of subjectivity and ambiguity of weighting process. This problem can be mitigated by developing a standardized framework using a consensus-based approach to weigh criteria. Utilization of fuzzy techniques can also reduce the complexity and subjectivity of the weighting system.

This study further indicates that most of the tools are expert-oriented and different parties in the community that have different, if not conflicting, values, needs, and priorities are not adequately involved in the judgment about which elements to include, the assignment of weightings, and providing feedback. Here too, HQE2R and Ecocity have a relatively better performance compared with the other tools. An iterative participation practice, intertwined with the assessment process, is helpful in enhancing the reliability and accuracy of the system, establishing a basis for mutual understanding, and providing a learning environment for various stakeholders. This in turn contributes to achieving what Gray and Milne (2002) describe as collective decision-making for the common good.

Concerning the presentation of assessment results this study suggests that the results would be more robust, transparent, and reliable as decision aid tools if they reflect the performance levels of the criteria and also temporal changes.

There are differences among the tools regarding the reporting of assessment results. CASBEE-UD and Ecocity are somewhat successful in reflecting the performance levels of criteria, and HQE2R is the only tool performing reasonably well in presenting both the performance levels of criteria and temporal changes. Labeling and rating the performance levels is a helpful effort to inform engaged stakeholders in their decision-making for sustainable development. However, caution is needed because the level of certification that the development receives does not directly reflect the performance level of each specific criterion. Therefore, it might not be possible to identify and improve the neighborhood’s features with low performance levels. This causes the concern that developers might opt to achieve the greatest points at the lowest cost possible, leaving important criteria that require more investment out of consideration. In addition, the rating would need to reflect changes made to the neighborhood over specific time intervals; this can be achieved by periodic reassessment of the neighborhood performance.

Applicability is the last criteria that NSA tools were examined against in this study. This is important because an assessment tool that sounds good on the paper but there is no adequate recognition and use for it in the real world wouldn’t contribute to achieving sustainability. Among the analyzed tools only HQE2R and Ecocity had adequately been applied to real world projects and LEED-ND has also done relatively well.
Based on the results of this study, voluntary state of tools, the economic burden they impose, and their complexity and ambiguity are the main barriers on the way of having applicable assessment tools. Depending on the context in which the assessment tool is going to be applied, several strategies are suggested to overcome these barriers. These include transition from voluntary guidelines to statutory codification, provision of bonuses and grants to certified developments, attracting investments, making the assessment less costly, raising citizen awareness, and enhancing the transparency and simplicity of the tools. The latter one might affect the stringency of the tool, but bearing in mind that SA is an exercise informed by political decision-making processes (Maclaren, 1996), in practice, compromises and trade-offs will be unavoidable in most policy, program, plan and project decisions to make the tools politically more relevant (Gibson, 2006; Rametsteiner et al., 2011).

The impacts of the most recent economic downturn on the uptake of those tools that have been developed since 2007 should also be considered. As the economy is recovering from recession, it is likely that more people would be interested in approved developments and consequently more investors would invest in these kinds of developments.

From the comparison of studied NSA tools it can be stated that plan-embedded tools have been more successful in gaining their investments, making the assessment less costly, raising citizen awareness, and consequently more investors would invest in these kinds of developments.

The other advantage of integrating assessment tools into planning process is that it will be possible to establish a network of linkages among assessment systems in various geographic scales. The existence of various interactions between neighborhood and its surroundings implies that the optimization of assessment process requires a coordinated assessment framework with inter-linkages among neighborhoods and also between neighborhoods and the upper scales to assure that broader sustainability vision is also acknowledged.

At the end it should be mentioned that although many problems and challenges are still to be tackled, NSA tools have been successful in raising the environmental consciousness and disseminating the idea of SA in the neighborhood level. NSA tools are still in the formative years and they will continue to evolve and improve over time through cooperation among different stakeholders and continuous adjustments that will be applied during the process.

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