Sustainability at the Neighborhood Level: Assessment Tools and the Pursuit of Sustainability

(近隣地区スケールの持続可能性：評価ツールと持続性の追求)

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For my dear parents, Tofigh and Bahieh

Abstract

Neighborhoods play a major role in helping to achieve global sustainability. Within the past decade, numerous assessment tools worldwide have been developed to evaluate the effectiveness of the increasing number of neighborhood (re)development plans. This is an indication of the growing recognition among planners and decision-makers of the significant role that neighborhoods play in planning for sustainable development. Sustainability assessment of the built environment was initially focused on the building level. However, research and development of neighborhood sustainability assessment tools is nascent. Scaling up the sustainability assessment to the neighborhood level enables planners and decision-makers to account for the impacts associated with the spaces between the single buildings and humans and other living organisms that use those spaces for living, working, and other purposes. It furthermore facilitates the consideration of synergies between the broad range of urban elements and activities. Neighborhood is a minimum scale at which social aspects and issues related to the economy of scale can be taken into account.

Despite all contributions that sustainability assessment at the neighborhood level can make to the achievement of sustainability, until now, only few researchers have focused on the neighborhood sustainability assessment and its efficacy in improving the decision-making for sustainable development. This thesis intends to provide a better understanding of the sustainability assessment at the neighborhood level and provide a critical analysis of both the theory and practice of neighborhood sustainability assessment.

The method employed here is a combination of quantitative and qualitative analyses. Evolution of sustainability assessment and neighborhood planning is investigated using a comprehensive literature review. Content analysis is the main method used for critical review of the selected assessment tools. To examine the empirical aspects of neighborhood sustainability assessment, a comparative case study approach is adopted. Data were compiled from a number of several sources. These include literature on neighborhood planning and sustainability assessment; guidelines, policy papers, and manuals of the selected assessment tools; the assessment reports of the selected cases; site visits and personal observations of each case study area; websites of local authorities responsible for providing services to the

local population; interviews with key decision-makers and developers of the case study areas; and personal communications with other people with expertise related to the selected neighborhood sustainability assessment tools.

Four main analyses are performed in this thesis. The first three analyses are concerned with the theoretical aspects of the subject. The last analysis is focused on the empirical aspects of neighborhood sustainability assessment.

Through reviewing the related literature and providing a chronological account of impact assessment theories, this study looks at the place of neighborhood sustainability assessment in the broader context of impact assessment and traces the evolution of impact assessment theories from project scale impact assessment to the neighborhood sustainability assessment. Investigation of the evolutionary process of impact assessment theories revealed that, over time, assessment theories have evolved to reflect the requirements of sustainable development. Initial tools such as environmental impact assessment were largely one-dimensional and limited in scope. Over time, a considerable progress has been made to shift from project-oriented and sector-based impact assessment to a pluralistic impact assessment that takes account of various dimensions of sustainable development. Following the introduction of strategic environmental assessment, the importance of public involvement, and alternative-making is now widely recognized. However, there are still shortcomings in terms of providing a holistic account of sustainability, addressing the specificities of specific locations, and integrating assessment practices across different scales. Sustainability assessment offers a spark of hope for further evolution of impact assessment.

The second analysis seeks to understand the evolution of the notion of neighborhood since the early years of the twentieth century. It also discusses the main relevant problems that, despite more than one century of continued efforts both in research and practice, are still unresolved. Evolutionary analysis of the neighborhood planning movements since the early twentieth century revealed that, at least in rhetoric, some improvements have been made with regard to recognizing the significance of involving residents in the planning process, enhancing the equitability of developments, and modifying land use and transportation patterns to reduce the vehicle miles travelled. Sustainable neighborhood development as a nascent form of neighborhood planning should further contribute to this evolution by shifting

the planning paradigm from physical determinism to sustainability-based pluralism. One major cause for concern is that there are still many difficulties in terms of putting the neighborhood planning rhetoric into practice. This analysis also questioned the validity of traditional definitions of neighborhood for use in sustainability assessment, and revealed that, due to financial difficulties, planners have always had difficulties in achieving their aim of creating equitable and diverse neighborhoods.

In the third main analysis, seven tools from Australia, Europe, Japan, and the United States are selected for further analysis. These tools are, Sustainable Community Rating (SCR), Australia; Ecocity, European Union; Haute Qualité Environnementale et Economique Réhabilitation/ High Quality Environment and Economy in Regeneration (HQE^2R), European Union; Building Research Establishment Environmental Assessment Method (BREEAM) Communities, United Kingdom; Comprehensive Assessment System for Building Environmental Efficiency for Urban Development (CASBEE-UD), Japan; EarthCraft Communities ,United States; and Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND), United States. All the assessment tools selected for this study are practiced on a voluntary basis. In fact neighborhood sustainability assessment has not yet been institutionalized. These tools are 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 analysis. Results of the this analysis 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.

To provide an insight into the empirical aspects of neighborhood sustainability assessment and examine the feasibility of developing global standards, the last analysis investigates three cases form U.S., U.K., and Japan that have been highly ranked under LEED-ND, BREEAM Communities, and CASBEE-UD, respectively. These three assessment

tools have received a considerable amount of publicity and are widely recognized as exemplary neighborhood sustainability assessment tools. Common to all these three third-party assessment tools is the fact that they are the extended versions of the earlier methodologies that only evaluate the building level performance (LEED for New Construction, BREEAM New Construction, CASBEE for New Construction).Various types of the data relevant to these assessment tools are publicly accessible which makes it possible to precisely investigate different cases. Selected cases for analysis are, respectively, Hoyt Yards, MediaCityUK, and Koshigaya Lake Town. Hoyt Yards is a brownfield redevelopment project located in Pearl District of downtown Portland. This project has been awarded the LEED-ND Platinum certification. MediaCityUK is part of a larger project aimed at reclaiming the previously derelict land that was once the site of Manchester Docks. This regeneration project has received BREEAM Communities Excellent ranking. And finally, Koshigaya Lake Town is a greenfield development located 22 km northeast of central Tokyo. It is the only development certified under CASBEE-UD and has received the excellent ranking. The case study analysis is done through investigating compliance of each case with the principles of sustainable development and undertaking a series of comparative case studies to evaluate each case using assessment tools other than the ones that have, in reality, been used for certifying the developments.

In addition to highlighting the strengths and weaknesses of each development, results of the case study analyses show that the social, economic, and institutional aspects are not adequately accounted for in practice. The practice of sustainability is, to a large extent, characterized by the dominance of the environmental aspects of sustainability. The practice of neighborhood sustainability assessment is highly influenced by market mechanisms and developers are inclined to focus on sustainability elements that require less financial investment. The overall uptake of assessment tools proved to be low. However, compared with BREEAM Communities and CASBEE-UD, LEED-ND has been applied to more developments. The comparatively better uptake of the LEED-ND assessment scheme can be explained by several factors such as collaboration between different parties involved in the urban development to encourage the use of LEED-ND; its use by local and state governments and federal agencies to promote green neighborhood development; and rewarding height and density bonuses and grants to certified projects. These are strategies worth considering by

local authorities in other contexts. Results of this analysis suggest that there is no single, best method for assessing the sustainability of the neighborhood developments. Generally, there is more focus on environmental issues at the expense of other important aspects. Affordability of the certified developments turned out to be a major challenge for achieving sustainability at the neighborhood level. None of the three cases studied here have addressed this issue appropriately. LEED-ND, BREEAM Communities, and CASBEE-UD and their certified projects are respectively doing well with regard to location and connectivity, economic sustainability, and resilience. These tools can reinforce one another by learning from their strengths and weaknesses. In terms of the assessment methodology, results suggest that the heavily unbalanced weighting of criteria in LEED-ND can be a reason for the developer's tendency to only comply with highly weighted criteria. CASBEE-UD's approach of applying weights to nested categories of criteria can be helpful in alleviating this problem.

Concerning the development of global standards, findings provide robust evidence that cast doubt on its viability. Using cross-evaluation, it was proved that indicators and benchmarks designed for a specific location are not necessarily applicable to other contexts with different specifications. Because of various contextual differences, it is necessary to utilize customized benchmarks for assessment.

Regarding the future of neighborhood sustainability assessment, this research emphasizes the significance of protecting greenfields. This requires more focus on existing urban areas (infill, brownfield, etc.). In the end, it is called for further work to develop strategies for integrating assessment across various scales.

Results can be used for optimizing the assessment tools at the time of revision, and caution the practitioners against the adoption of assessment tools in contexts other than the origin.

論文の要旨

本研究は、米国の LEED-ND、英国の BREEAM Communities、日本の CASBEE-UD に代表される、建物とその間の空間、公共空間等で構成される近隣地区を対象とする持続可能性評価ツール（Neighborhood Sustainability Assessment Tools）の理論と事例を分析するものである。

近隣地区は、地球の持続可能性の達成において重要な役割を果たす。この 10 年間、世界各国において、近隣地区開発計画の評価を目的とする持続可能性評価ツールが開発されている。これは、持続可能な開発に向けた取り組みにおける近隣地区計画の重要性がプランナーや意思決定者の間で認識されていることを示す。物的環境に対する従来の持続可能性評価は個々の建物を対象とするものであり、現在、近隣地区を対象とする持続可能性評価ツールの研究・開発はその萌芽期にあると言える。持続可能性評価を個々の建物のレベルから近隣地区のレベルにスケール・アップさせることは、プランナーや意思決定者に、複数の建物の間の空間や公共空間、そうした空間を使用する諸活動の影響を評価する機会を与える。近隣地区の持続可能性評価の根幹である評価ツールの分析・評価・改善に焦点を当てた研究が少ない中、本研究は、近隣地区スケールの持続可能性評価ツールの理論と事例を次の方法で分析・評価するものである。

まず、持続性評価と近隣地区計画の理論の展開は、包括的な文献調査を通じて整理した。次に、世界各国で適用されている 7 つの代表的な近隣地区の持続性評価ツールの評価は、内容分析を通じて行った。そして、米国の LEED-ND、英国の BREEAM Communities、日本の CASBEE-UD とその適用事例を対象とする分析では、比較事例分析の方法を用いた。以上の分析に必要な情報は、文献、評価ツールのガイドライン・方針文書・マニュアル、適用事例の持続可能性評価報告書、現地踏査、自治体のウェブサイト、キーパーソンであった意思決定者や開発者へのインタビュー、この分野に詳しい専門家との情報・意見交換を通じて収集した。

以上を背景に、本研究では、次の４つの分析を行った。

１つ目の分析（第２章・第３章）では、文献調査を通じて、持続可能性のアプローチ及び原則と影響評価理論の展開過程を整理し、近隣地区の持続性評価をより広い文脈の中で位置づけた。ここでは、評価理論が時を経て持続可能な開発の要件を取り入れるよう進化したことが確認された。環境影響評価をはじめとする初期の評価ツールは１つの側面に着目した視野が限られたものであったが、その後、個別事業志向・分野特化型の影響評価から、持続可能な開発の多様な側面を視野に入れた多元的な影響評価にシフトしたことが分かった。戦略的環境影響評価の導入に続き、現在では、市民参加と代替案作成の重要性が広く認識されている。しかし、持続可能性の全体的な説明を行うこと、具体的な場所の具体的事項を扱うこと、様々なスケールの評価を統合することといった点において、課題が残されていた。

２つ目の分析（第４章）では、文献調査を通じて、20 世紀初頭以降の近隣地区の概念の展開を概説し、近隣地区の計画は、研究・実務両面で１世紀以上の取り組みがあるにもかかわらず、持続可能性の主要な課題に未対応であることを議論した。20 世紀初頭以降の近隣地区計画の概念には、少なくとも言説としては、計画プロセスに住民を巻き込むことの意義、開発の公正性、自動車走行距離削減に向けた土地利用・交通パターンの再編を認識するなど、いくつかの改善が見られた。近隣計画の派生としての持続可能な近隣地区開発には、さらに、物的環境決定主義から持続可能性を基礎とする多元主義へのパラダイム・シフトが求められることを示唆した。また、いつの時代でも、資金の問題によって公正で多様な近隣地区の実現が妨げられていたことも確認した。

３つ目の分析（第５章）では、内容分析を通じて、ヨーロッパ、米国、オーストラリア、日本で適用されている７つの代表的な近隣地区の持続性評価ツールについて、現状を把握すること、長所・短所・成功・失敗を明らかにすること、将来の改善に向けて提案を行うことを目的に、持続可能性の対象範囲、前提条件、地域適応性、点数化と重み付け、参加、報告、適用可能性という視点から批判的に分析した。

対象としたのは、オーストラリアの Sustainable Community Rating (SCR)、EU の ECO-City、EU の High Quality Environmental and Economy in Regeneration (HQE^{2}R)、英国の Building Research Establishment Environmental Assessment Method (BREEAM) Communities、日本の Comprehensive Assessment System for Building Environmental Efficiency for Urban Development (CASBEE-UD)、米国の EarthCraft Communities、米国の Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND)である。これら世界の７つの代表的な近隣地区の持続性評価ツールは、いずれも、ボランティア・ベースで実践されているものであり行政制度化されておらず、また、持続可能性の社会的、経済的、制度的側面を取り扱うことにうまく対応できていないことが明らかになった。重み付け、点数化、順位付けにあいまいさと欠点があること、多くの評価ツールは地域への適応と参加の仕組みがないこと、適応可能性についてはより広いプランニングの枠組みに埋め込まれている評価ツールのみがうまく対応していることを示した。

４つ目の分析（第６章）では、近隣地区の持続可能性評価の実態を理解し、評価ツールの特徴を明らかにするために、米国、英国、日本においてそれぞれ LEED-ND、BREEAM Communities、CASBEE-UD において高く評価された３つの事例の分析を行った。分析対象として選定したのは、それぞれ、Hoyt Yards（ポートランド都心部の Pearl District に位置するブラウンフィールド再開発事業；LEED-ND のプラチナ評価を獲得）、MediaCityUK（マンチェスター造船所跡地を再整備する大規模事業の一部；BREEAM Communities の Excellent 評価を獲得）、越谷レイクタウン（東京都心から北東 22km に位置する新開発；CASBEE-UD の Excellent 評価を獲得）である。事例分析は、各事例と持続可能な開発の原則の対応に関する分析と、各事例を実際に適用された自国のものではない他の２つの評価ツールを用いてクロス評価する比較事例分析で構成される。

本研究の主要部分である４つ目の分析により、各事例の共通点と相違点、長所と短所が明らかになった。例えば、実務では、持続可能性の環境的側面が支配的で、社会的、経済的、制度的側面が適切に取り扱われていないことが明らかとなった。

認証された開発のアフォーダビリティは、いずれの事例においても確保されておらず、近隣地区スケールの持続可能性の達成において大きな挑戦である。また、LEED-ND は BREEAM Communities や CASBEE-UD に比べて広く普及している。この背景には、LEED-ND の利用を推奨する都市開発関係主体の協働、環境に優しい近隣地区開発を推進する自治体、州政府、連邦機関による利用、認証されたプロジェクトへの高さ・密度ボーナスや補助金の付与等のいくつかの要因があった。そして、評価方法については、LEED-ND の評価項目の重み付けの大きな偏重は開発業者の重み付けが重い評価項目のみに対応する傾向を促していること、その問題の軽減には CASBEE-UD のように評価項目の群に重み付けをする方法の採用が有効であることの可能性を示した。

本研究の４つの分析を通じて、以上の知見が得られたほか、近隣地区の持続性評価の今後については、単純な国際標準化には問題があり、地域の文脈の違いを反映できる枠組みが必要なこと、新規開発・大規模再開発のみならず、既成市街地の漸進的な改善を評価するツールが必要なこと、近隣地区スケール、都市スケールを含め、多層の空間スケールにおける持続性評価を統合する戦略が必要なことが示唆された。

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Abbreviations

NSA	Neighborhood Sustainability Assessment
LEED-ND	Leadership in Energy and Environmental Design for Neighborhood Development
AHURI	Australian Housing and Urban Research Institute
SCR	Sustainable Community Rating
HQE^2R	Haute Qualité Environnementale et Economique Réhabilitation/HighQuality Environment and Economy in Regeneration
BREEAM Communities	Building Research Establishment Environmental Assessment Method for Communities
CASBEE-UD	Comprehensive Assessment System for Building Environmental Efficiency for Urban Development
EIA	Environmental Impact Assessment
WCED	World Commission on Environment and Development
NEPA	National Environmental Policy Act
LCA	Life-Cycle Assessment
CBA	Cost-Benefit Analysis
MCA	Multi-Criteria Analysis
HIA	Health Impact Assessment
SEA	Strategic Environmental Assessment
PPPs	Policies, Plans, and Programs
JSBC	Japan Sustainable Building Consortium
BEE	Built Environment Efficiency
GHG	Greenhouse Gas
CIAM	Congrès International d'Architecture Moderne (International Congress of Modern Architecture)
SA	Sustainability Assessment
DSS	Decision Support System
ECC	EarthCraft Communities

Chapter 1 Introduction

> The only joy in the world is to begin.
>
> *Cesare Pavese*

A defining moment in the history of planning occurred when, in 2008, the global urban population exceeded the rural population for the first time (Seto, Sanchez-Rodriguez, & Fragkias, 2010). Cities are now home to the majority of world's approximately seven billion population. Urbanization is an irreversible trend and cities are expected to absorb all global population growth within the coming decades (Buhaug & Urdal, 2012). Along with its positive impacts, the ever increasing urbanization has caused various environmental, social, and economic problems. Climate change, droughts and shifting weather patterns, resource depletion, energy security, economic crisis, political instability, and socio-economic inequality are among the major challenges that threaten the sustainability of contemporary and future urban life (Blizzard & Klotz, 2012; PSU, 2011; Walliser et al., 2012). These problems pose serious threats to the sustainability of human life on earth. With the prospect of an increasing urbanization rate, it would be no exaggeration to say that the quest for sustainability will be decided in cities (Sharifi & Murayama, 2012).

Acknowledging the significance of cities in the battle for sustainability, along with efforts to enhance the sustainability at the global and regional scales, both scholars and practitioners have paid special attention to the urban scale. Since the Rio Earth Summit in 1992, which emphasized the importance of local level for achievement of sustainable development (Rydin, 2007; Sitarz, 1993), there has been an increase in the size and number of programs designed to promote local sustainable development. Given the inter-disciplinary nature of sustainability, actions to promote it emerge from a considerably diverse set of academic and professional sectors. Developed to address one or more aspects of sustainability, these programs are available at a variety of scales ranging from metropolitan to a single building.

Numerous tools are also available for assessing the consistency of these programs with the principles of sustainable development. Assessment tools are in place to fulfill several different goals. In some rare cases, and for developments with special conditions, assessment

is undertaken as a mandatory requirement by the local authorities (BCC, 2011). However, in most cases assessment is still practiced on a voluntary basis. Assessment tools often function as decision support systems. In addition, authorities undertake assessment as a measure for showing their accountability, justifying their actions, and enhancing the transparency of the decision-making process (Seasons, 2002).

Over the past decade, there has been a burgeoning interest in the development and application of assessment tools at the intermediate scale of urban neighborhood. Targeting various types of developments (greenfield, brownfield, etc.), these assessment tools are claimed to be created to improve the sustainability of neighborhood (re)development plans. Their main aim is to encourage the incorporation of sustainability principles into the planning and design of developments, early in the decision-making process.

This thesis tries to find out the extent to which these tools have been successful in achieving their goals. This is pursued through critical analysis of both theory and practice of Neighborhood Sustainability Assessment (NSA).

1.1. Previous research on NSA

The previous research related to NSA can be divided into four main categories: sustainability, impact assessment, neighborhood planning, and the nexus of the previous three fields. A literature review of the main theories and works focused on the first three fields is presented in chapters 2 through 4. Here, the main works focused on the NSA will be briefly reviewed.

NSA tools were introduced at the turn of the millennium and are increasingly gaining ground among scholars and practitioners. As will be discussed in detail in Chapter 4, while NSA plays a fundamental role in decision-making for sustainable development, NSA tools are relatively neglected in the impact assessment literature, and there is as yet limited understanding of their efficacy and real-world application. Theoretically, much of our knowledge of NSA tools comes from studies focused on the examination of differences and commonalities among them (AlQahtany, Rezgui, & Li, 2012; Cable, 2008; Garde, 2009; Haapio, 2012; Hurley, 2009), and the soundness of the methodology they use for assessment (Stangl & Guinn, 2011).

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 systems. 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 Réhabilitation/HighQuality Environment and Economy in Regeneration (HQE^2R) and Ecocity assessment processes without evaluating their performance. In a recent study by Haapio (2012), she provides a general account of the current situations of three third-party assessment tools (LEED-ND, Building Research Establishment Environmental Assessment Method (BREEAM Communities), and Comprehensive Assessment System for Building Environmental Efficiency for Urban Development (CASBEE-UD)). Emphasizing 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 about them. In some cases they have mentioned associated problems concerning weighting, criteria selection, and lack of a systemic approach; however, there is still a lack of in-depth critical evaluation of the NSA tools.

Empirically, there are few studies which concentrate on single developments and their performance against specific assessment tools (Saynajoki, Kyro, Heinonen, & Junnila, 2012). Garde (2009) surveyed some LEED-ND pilot projects to reveal which criteria are used most and least, and emphasizes the importance of adaptation to locality, and setting pre-requisites in the revised version.

Kyrkou, Taylor, Pelsmakers, and Karthaus (2011) have conducted a case study analysis to examine the applicability of LEED-ND in the English context. Saynajoki et al.(2012) have conducted a similar study about the appropriateness of LEED-ND, BREEAM

Communities, and CASBEE-UD for application in the Finnish context. Both these studies emphasize the importance of adaptation to locality.

To the best of my knowledge, there is at present no research surveying multiple developments from different countries, using various types of 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. Research goal and objectives

The main goal of this research is to extend the current understanding of sustainability assessment at the neighborhood level through providing a critical analysis of both theoretical and empirical aspects. The specific objectives of this research are:

a) to trace the evolution of impact assessment from traditional impact assessment tools to NSA,
b) to fill the gap in literature regarding research on evaluation of NSA tools,
c) to introduce a framework for evaluating the effectiveness of NSA tools,
d) to evaluate to which degree NSA tools are able to incorporate the different dimensions of sustainability,
e) to identify the differences, commonalities, strengths, weaknesses, successes, and failures of NSA tools through cross-comparison of them,
f) to understand various problems and challenges the NSA tools are grappling with,
g) to discuss some solutions to these problems and challenges, and refinements needed to enhance the efficiency of NSA tools,
h) to provide better insight into NSA in action,
i) to find out how the rhetoric is different from the reality through the analysis of the certified projects,
j) to highlight the lessons that tools can learn from one another,
k) and, to examine the feasibility of developing global standards.

With these objectives in mind, this study seeks to determine whether NSA tools have been successful in approaching their goal of disseminating the sustainability concept at the local level.

1.3. Research approach

The research aims will be achieved through adopting a combination of qualitative and quantitative research methods. Research methods vary depending on the specific objectives and types of data available for each particular analysis. Evolutionary analysis of the Impact assessment theories is performed using an exploratory approach that uses the existing literature as the main data source. An in-depth content analysis of the selected NSA tools is the approach taken in the second main analysis conducted for the purpose of this study. For the purpose of case study analysis, two different approaches are taken. First a "compliance checking approach" to evaluate the degree of compliance of the certified projects with the stipulations of their corresponding NSA tools. Second a cross-evaluation approach to highlight the idiosyncrasies of each NSA tool and examine the viability of developing universal standards.

Details of each method are presented in the respective chapters of this thesis.

1.4. Importance of the study

The study is important for a number of reasons:

First, neighborhood is a level with significant implications for sustainable development. Planning for sustainability at the neighborhood level and developing assessment frameworks to evaluate the extent of success of the plans in achieving their aims is an effective measure to complement the sustainability assessment at the building scale which is better practiced and institutionalized. Through sustainability assessment at the neighborhood level, other urban elements such as spaces and elements between the buildings, humans and other living organism and also the interactions between these elements can be taken into account. Moreover, neighborhood is a level at which socio-economic impacts can be better analyzed and citizen involvement can be easier and more meaningfully facilitated.

Neighborhood is small enough for practicing innovative ideas and large enough to display meaningful impacts (PSU, 2011).

NSA is a relatively neglected subject in the literature of impact assessment. This is in spite the fact that it has been around for more than one decade. The problem, therefore, merits further investigation.

Second, the significance of assessment results in the decision-making process for sustainable development amplifies the need for the development of assessment tools that provide decision-makers with the most accurate account of the present and future conditions. This warrants closer scrutiny of the assessment framework, its components, and qualitative/quantitative methodologies used. Having robust and comprehensive assessment systems, capable of functioning as decision support systems that provide decision-makers with realistic information about the development and its impacts would be a major step towards achieving the aims of sustainable development.

Third, the availability of different tools, from different countries, provides a window of opportunity for sharing experiences that can be helpful to avoid reinventing the wheel. Comparative case study analysis can be a potential approach for enhancing the assessment methodology and practice.

Last, but not the least, is the issue of timing. The study is of relevance because NSA is still in its formative stage and further investigation into both its theoretical and practical aspects may reveal the underlying problems which need to be resolved. Moreover, there is still some considerable controversy as to whether global standards can be achieved. The case studies presented here provide some evidence that can be used to examine the feasibility of applying assessment tools in contexts other than the origin.

1.5. Thesis structure and synopsis

This monograph is divided into seven chapters. The overall structure of the thesis is displayed in Figure 1-1. The first Chapter has set the context for later chapters by describing the background of the research, explaining the approach taken, and outlining the major goals and objectives pursued in this study.

In Chapters 2, 3, and 4, a brief review of the related literature is presented. Chapter 2 gives a concise review of the literature on the concept of sustainable development. Beginning with an explanation of a series of events that have led to the emergence of the sustainability concept, this chapter continues to articulate various approaches towards sustainability. The chapter also presents and discusses the main principles of sustainability, namely, integration, inter-generational equity, intra-generational equity, procedural equity, and context-specificity. These five main principles are later used for evaluating theory and practice of NSA. The last section summarizes the chapter and discusses the implications for research.

The third Chapter focuses on the chronology of impact assessment tools and explores their evolution from traditional impact assessment tools (mainly focused on single sectors at the project level) to NSA. Likewise the previous chapter, it begins with describing the genesis of impact assessment theories in early 1970s. Following this, eight major assessment tools, their main focus, and the way they have evolved to accommodate sustainability concerns are presented. These tools include: life-cycle assessment, cost-benefit analysis, risk assessment, multi-criteria analysis, EIA, social impact assessment, health impact assessment, and strategic environmental assessment. Further, this chapter examines the influence of the sustainability discourse on the impact assessment theories and provides a brief overview of the major assessment tools designed to address sustainability concerns at city, neighborhood, and building level. Finally, a summary of the chapter and its implications for research are presented.

Chapter 4 looks at neighborhood which is the main unit of analysis in this thesis. It begins with describing the significance of planning for neighborhoods. This is followed by clarifying what is meant by neighborhood in this paper. Next, three main movements in the twentieth century that have contributed to the emergence and expansion of the sustainable neighborhood development are analyzed. These movements are categorized in three main classes: garden city movement, modernism movement, and neo-traditional planning movement. The main figures of each movement, their basic principles, and their conditions in terms of sustainability are presented in this chapter. This analysis will later be used to investigate whether the current theory and practice of NSA has been successful in addressing the challenges that neighborhood planning has been facing since the beginning of the

twentieth century. This chapter ends with a summary which briefly re-states its main points and explains its implications for research.

The two chapters that follow move the research forward by first analyzing the success of several existing NSA tools in addressing the sustainability concerns, and then conducting a case study analysis to evaluate the situations on the ground.

In Chapter 5, after presenting the methodology taken for evaluation in the chapter, 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. A content analysis is undertaken to investigate the issues of sustainability coverage, pre-requisites, local adaptability, scoring and weighting, participation, reporting, and applicability. At the end, a summary of the main findings and the conclusion of the chapter are presented.

Chapter 6 is focused on the practice of NSA. In this chapter, issues related to implementation of NSA tools, and development of universal standards are investigated. The chapter begins with an examination of the extent of compliance between rhetoric (that is stipulated by the NSA tools) and reality (that is actually practiced by the developers). Hoyt Yards, MediaCity UK, and Koshigaya Lake Town are three developments respectively certified under LEED-ND, BREAAM Communities, and CASBEE-UD. These three developments are selected for the purpose of analysis in this chapter. In each case, the compliance is analyzed through probing into the assessment score sheet to find out the main issues that are missed out. Next, a brief overview of all the score sheets of all other certified assessment tools is also undertaken to find out if there are similarities across the certified projects in terms of the uptake of the sustainability criteria, and if a trend can be discerned. Throughout this chapter, the extent of compatibility of the selected case studies with the sustainability principles introduced in Chapter to is also discussed. Finally, in the conclusion section the results of the analysis taken in this chapter are summarized. Results show that the social, economic, and institutional aspects are not adequately accounted for in practice. Furthermore, results highlight the main problems on the way of implementing NSA tools and show some strategies that might be effective in improving the situations.

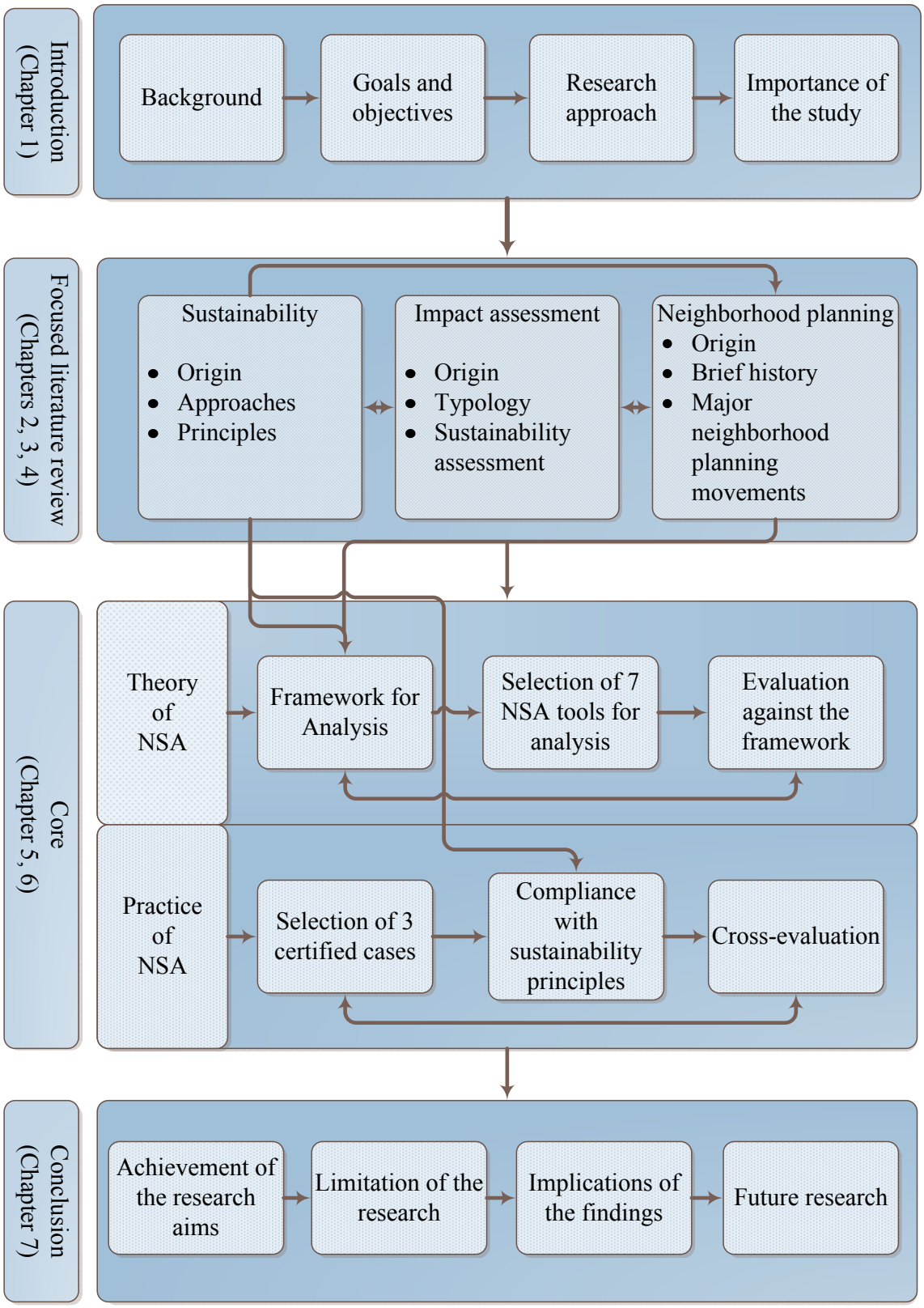


Figure 1-1. The overall structure of the thesis

This chapter continues to present the results of a cross-evaluation analysis undertaken with the aim of investigating the viability of developing global standards. A series of comparative case studies are undertaken to evaluate each case using assessment tools other than the ones that have, in reality, been used for certifying the developments. Concerning the development of global standards, findings provide robust evidence that cast doubt on its viability. The results can be used for optimizing the assessment tools at the time of revision, and caution the practitioners against the adoption of assessment tools in contexts other than the origin. A summary of the main findings and conclusion of the analysis are presented at the end of this chapter.

The last chapter concludes this thesis by drawing together the main findings of the research, and briefly reiterating how the main aims of the research have been met. In addition to pointing out the limitations of the research, this chapter discusses the main implications for both theory and practice, arguing for the significance of attention to the issue of context-specificity and the necessity of developing a framework for integrating assessment methodologies across different scales. At the end, some ideas for future research are presented.

Chapter 2 Sustainability: Major approaches and principles

> We do not inherit the earth from our ancestors; we borrow it from our children.
>
> *Native American proverb*

To have a critique of NSA tools and their application, it is essential to first have an understanding of sustainable development and clarify what it means and tries to achieve. It is safe to say that sustainability (which is often used interchangeably with sustainable development) is one of the most common buzzwords among the academic society. It is also used, in a large scale, in the media, commercials, political discussions, daily conversations of the local people and so on. Obviously, this could not happen by chance. Over the last several decades there has been a growing concern over the consequences of human activities on the environment. These concerns have even multiplied in the wake of various disasters that have revealed the vulnerability of human settlements and have signaled the necessity of major changes in the existing patterns of living. Some of these major disasters include extreme weathers, historic droughts, extreme storms, and financial breakdowns.

This chapter begins with an exploration into the origins of the concept of sustainability.

2.1. Origins of sustainable development

Sustainability, as used in contemporary discourses, does not have a long history. It is largely a product of intellectual and political developments in the past few decades. However, as is the case for any emerging concept, various events have led to the evolution of the concept of sustainability throughout the history. Human-environment connections are widely recognized as fundamental and leading causes of the modern concept of sustainability (Edwards, 2005). Pointing to the human-environment relationship as the central element of the sustainability discourse, Hurley (2011) argues that the concept of sustainable development is the product of the evolving relationship between humankind and the environment.

Started with the symbiotic relationship between the primitive communities of hunter-gatherers with the nature, the human-environment relationship has gradually turned into a parasitic one, where humankind has rapidly started to exploit the environment for his own

benefit. As humankind started to urbanize and developed technologies that led to agricultural revolution, the pressure on environment mounted significantly (Hurley, 2011).

The industrial revolution of the early nineteenth century, that triggered growth in many parts of the world, was a turning point in the human-environment relationship (Hurley, 2011). The post-industrial period is marked by a drastic increase in the consumption of resources. This was mainly propelled by the technological innovations facilitating the use of new types of machines and energies (Edwards, 2005; Hurley & Horne, 2006). These technological advancements induced the "perception of mastery of nature" in the society and increased the appeal for further economic growth (Hurley, 2011, p.50). Mass consumption of resources and production of great amounts of waste began to become the dominant pattern in this period.

Amidst this unrestrained greed for economic growth and resource consumption, some scholars tried to remind society of the important role that the ecological system plays in the human life. These values are reflected in the eighteenth-century writings of authors such as Thoreau and Emerson (Edwards, 2005).

Nevertheless, like many other examples in the human history, the nature conservation did not become a pressing topic until the crisis reached a tipping point in early 1970s. The enormous size of growth in the post-World War II period resulted in various types of environmental crises. Among the many activists pushing for limiting the unleashed economic growth, Rachel Carson is perhaps the most prominent figure. In her seminal work, *Silent Spring*, she warned about the detrimental effects of pollutants and agricultural pesticides such as DDT on humans and ecological systems and called for actions to avoid further deterioration of the situations (Carson, 1962). Her work was successful in raising awareness about the impacts of unrestrained growth on the carrying capacity of the environment (Edwards, 2005; Hurley, 2011).

Following the increase in the environmental consciousness, the environmental movement gained unprecedented momentum during the period of 1970s and 1980s. Environmental crisis became the main agenda of several conferences and academic meetings

(Edwards, 2005; Hurley, 2011) and many grassroots social movements emerged from these meetings.

One such event was the Earth Day in 1970, founded by senator Gaylord Nelson of Wisconsin, which "attracted over 20 million people to enthusiastic and peaceful rallies throughout the United States" (Edwards, 2005, p.14). Concerns over the environmental crisis were expanded to the international level when the United Nations Conference on the Human Environment was held at Stockholm, Sweden, two years later (Edwards, 2005). This conference was effective in garnering political support for the cause (Hurley, 2011) and one of its main outcomes was the establishment of many national environmental protection agencies and the United Nations Environment Program (UNEP) (Edwards, 2005; Hurley, 2011).

The year 1980 marks a key point in the history of sustainable development. The term "sustainable development" was used and defined for the first time in the *World Conservation Strategy* released by the International Union for the Conservation of Nature (Moldan, Janouskova, & Hak, 2012). This document stated that "for development to be sustainable it must take account of social and ecological factors, as well as economic ones" (Moldan et al., 2012, p.4). Its main focus, however, was on environmental conservation and consideration of the carrying capacity of ecosystems (Hurley, 2011).

More work on the concept of sustainable development was done by the World Commission on Environment and Development (WCED) created by United Nations in 1983. Headed by Gro Harlem Brundtland, former prime minister of Norway, this commission was asked to design a framework for better management of environment. After five years of work, the Brundtland report, entitled Our Common Future, was published in 1987 (Edwards, 2005). The Brundtland report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development (WCED), 1987). This is arguably the most referred definition of sustainable development in the literature.

In 1992, the concept of sustainability was further developed in the United Nations Conference on Environment and Development (UNCED), known as the Earth Summit, that

was held in Rio de Janeiro, Brazil (Edwards, 2005). Delegates from many countries participated in this summit and agreed to the 27 principles of the final declaration calling for an integrated approach towards economic, environmental, and social aspects of the environment (Edwards, 2005). It was also during this summit that the Agenda 21 was adopted. This agenda emphasized the importance of the local level for achievement of sustainable development (Sharifi & Murayama, 2012).

Since the Rio Summit, other summits on sustainable development have been held to review the progress towards achieving the aims stated in the previous summits. The 2002 and 2012 summits respectively took place in Johannesburg, South Africa, and Rio de Janiero (Rio+20). Unlike the Rio Summit, these two summits have tried to strike a balance between environmental, economic, and social issues.

2.2. Different approaches to sustainability

The Brundtland's definition for sustainable development suggests that the needs of the future generation should be considered. However, it neither specifies what exactly should be sustained, nor recommends a specific way for considering the needs of future generations.

Therefore, various paradigms of sustainability have been suggested in the literature. Hediger (2006, p.364) argues that four different shades of sustainability can be distinguished, Namely, "very strong sustainability", "strong sustainability", "weak sustainability", and "very weak sustainability". All these paradigms agree that the cumulative amount of the human capital and natural capital that is handed over to the future generations should remain constant. However, when it comes to the proportions of human and natural capital, they have different approaches.

He defines the very strong sustainability as a condition whereby every single environmental asset is strictly preserved. The proponents of this paradigm argue that to successfully preserve the natural capital, minimum sustainability standards, "that are defined by the rate of regeneration and the assimilative capacity of the environment"[1] are needed.

[1] (Hediger, 2006, p.363)

The strong sustainability paradigm is based on the "biophysical principles"[2]. It reflects a perspective whereby "certain properties of the physical environment must be sustained. However, it is not clearly defined in the literature what it is that should be sustained"[3].

Weak sustainability on the other hand, is based on the argument that natural capital can be substitutable for human capital (A. J. Bond & Morrison-Saunders, 2011). The lost natural capital can be compensated for through innovative practices enhancing the human capital.

The very weak sustainability paradigm "requires a constant level of consumption per capita over time" (Hediger, 2006, p.388). Here the goal is to maintain the total production capacity of the system (Hediger, 2006).

This diversity of sustainability paradigms implies that the sustainable development practices may also vary to a great deal to reflect the opinions of different groups of the society. This issue if further discussed in the following section.

2.3. The principles of sustainability

Sustainability is a contested concept. Since the publication of the Brundtland report in 1987, defining sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"(World Commission on Environment and Development (WCED), 1987), many other definitions have emerged. But, there is still no consensus on how to define sustainability. One reason is the ambiguity and complexity of its meaning (Evans & Jones, 2008; Rydin, 2007; Turcu, 2012), which renders it open to different interpretations in different contexts. Since sustainability is a concept used by individuals with different backgrounds, its ambiguity and openness to different interpretations seems unavoidable (Cornwall, 2007).

It should also be mentioned that not everybody agrees that sustainability and development can be achieved simultaneously. One argument is that any kind of development involves some degree of encroachment on finite resources which make it unsustainable.

[2] (Hediger, 2006, p.361)
[3] (Hediger, 2006, p.362)

Therefore some scholars such as Boff (1997) maintain that sustainable development is an oxymoron composed of two contradictory concepts.

Speaking of ambiguity and disagreement, there is an obvious resemblance between the "definition of sustainability" and the "determination of its constituent dimensions". One reason is that the sustainability concept is utilized in various disciplines. Different categories may be used for the classification of the sustainability dimensions in different disciplines. This varies depending on the specific features of each context and the main purpose for which the sustainability research is undertaken. For instance, in their study about developing sustainability indicators for tourism management, Choi and Sirakaya (2006) classify the sustainability indicators into six different categories: economic, social, cultural, ecological, political, and technological.

Despite all these variations in interpretations, there is a broad consensus that sustainability is an umbrella term that coalesces environmental, social, and economic dimensions, often referred to as the three pillars of sustainability (Boyko, Cooper, Davey, & Wootton, 2006). Some scholars describe these three pillars of sustainability. Three Es is another common term used in the literature. These three Es refer to the consideration of "ecology/environment", "economy/employment", and "equity/equality" (Edwards, 2005, p.17).

Institutional sustainability is another dimension which has increasingly gained recognition as the fourth pillar of sustainable development (Hunt, Lombardi, Rogers, & Jefferson, 2008; Valentin & Spangenberg, 2000). Valentin and Spangenberg (2000, p.382) define institutional sustainability as "human interaction and the rules by which they are guided, i.e., to the institutions of the society".

In the urban and neighborhood contexts, where various forces and entities influence the decision-making process, it is crucial to add the institutional dimension. What we mean here as institutional is related to not only interactions between the different stakeholders involved in the decision-making for sustainable development, but also a set of norms, laws, and regulations governing and facilitating these interactions. Figure 2-1 is a simple illustration of the four major sustainability dimensions used for the purpose of this study.

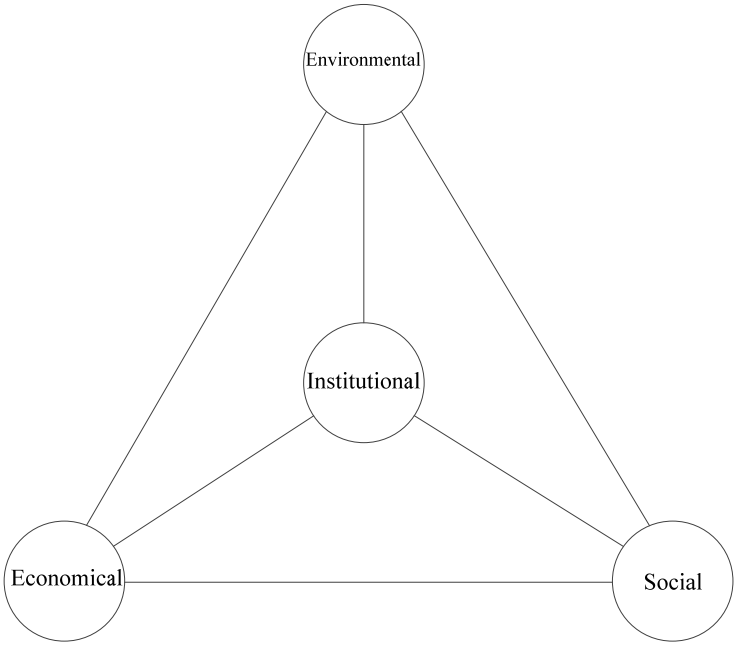


Figure 2-1 The four main dimensions associated with sustainable development. Adapted from (Valentin & Spangenberg, 2000).

It was noted above that sustainable development is a contested concept and there is still no single categorical definition for it. The same is true for sustainability assessment. Different criteria for assessment have been used in different contexts and based on the contextual conditions and judgments of different stakeholders.

In this study, the principles put forward by Maclaren (1996) as the basis for evaluating the degree of success of a program in approaching the goal of sustainable development are used. In addition to the criteria she suggested, this research has also used the criterion for evaluating the context-specificity. Maclaren (1996, p.186) suggested that indicators used for sustainability assessment should be "integrating" , "forward looking" (inter-generational equity), "distributional" (intra-generational equity), and "developed with input from multiple stakeholders in the community" (procedural equity). Since one size does not fit all, the context-specificity criterion should also be added to this list of criteria. These criteria are used to analyze the degree of compliance of the selected tools and their certified developments with the principles of sustainable development. Below the way that these criteria embody different principles of sustainability is briefly explained.

2.3.1. Integration

Integration implies that developers should take a holistic approach and address the four intertwining dimensions of sustainability. To fulfill this aim, developments should be designed so that not only various sustainability aspects are included, but their inter-linkages and inter-dependencies are also recognized. Integration and consideration of inter-linkages are essential factors for taking a holistic and systemic approach towards sustainable development.

An integrated sustainability assessment framework should also account for indirect as well as direct impacts both within and outside the boundaries of the development (Gibson, Hassan, Holtz, Tansey, & Whitelaw, 2005). This systemic approach would have the potential to reduce adverse cumulative impacts and promote positive cumulative impacts (Basiago, 1998).

It should, nevertheless, be borne in mind that in practice, it might be difficult, if not impossible, to take full account of all four dimensions of sustainable development (Gibson et al., 2005). Pointing to the example of the UK Government's "Sustainable Communities Plan" in which economic and social dimensions have been prioritized, Rydin (2007, pp. 351-352) argues that "alternative combinations, balances and trade-offs" between various dimensions might prove inevitable.

2.3.2. Inter-generational equity

Central to any sustainability related practice is the consideration of the needs of future generations. In its ideal state, sustainability discourse aims at developing a set of moral and legal obligations to assure an identical level of the quality of life is passed on to the future generations. The current generation should feel responsible for making this happen. The inter-generational principle focuses on taking measures concerning the time dimension to ensure the long-term effects of today's decisions are taken into consideration (Lozano, 2008), and the ability of future generations to meet their own needs is not compromised (WCED, 1987). Although the uncertainty of future conditions makes the prediction task for setting the reference points difficult and complicated, it is essential to have a meaningful set of reference points that can best proximate the conditions and requirements in the future time horizons.

2.3.3. Intra-generational equity

For a development to be sustainable, it must also be fair across all citizens (Maclaren, 1996). The notion of equity embodies a wide range of measures that require the fair distribution of benefits and burdens (Schlosberg, 2007). This include, among others, equal accessibility to the resources and facilities; equal distribution of financial resources; equal housing for all; reduced social inequalities; an equal platform for all groups of individuals irrespective of their gender, age, ethnicity to participate in the decision-making process; improved living standards of poor, disadvantaged, and minorities and consideration of their cultural aspirations; enhanced safety for all, and consideration of trans-boundary issues and impacts (Maclaren, 1996; Meter, Coalition, & Center, 1999; Sharifi & Murayama, 2012; United Nations. Dept. of Economic and Social Affairs., 2001).

Intra-generational equity plays a substantial role in maintaining the overall well-being of the community. It is not an easy task to disseminate values such as tolerance, social cohesion, civic involvement, mutual respect etc., in an environment where citizens feel that benefits and burdens are not fairly distributed (Edwards, 2005)

2.3.4. Procedural equity

Decision-making for sustainable development should involve discourse among all stakeholders (Khakee, 1998). Involving multiple stakeholders in the decision-making process is important for enhancing the procedural equity, and can be an effective way to develop a common vision; improve the project according to local needs; reduce the risk of failure or delay (Chai, 2009); promote the sense of ownership (Hunt et al., 2008); and provide a learning environment for various stakeholders, thereby enhancing civic activities (Gibson et al., 2005).

Stakeholders must be involved during three main phases of sustainability assessment: first, in defining the sustainability targets and objectives, and identifying the core criteria and indicators for assessment; second, during prioritizing the selected indicators; and finally after assessment is finished, through providing feedback on development.

This criterion is mainly related to the social and institutional dimensions of sustainability. It would not be an easy task to gain input from citizens and involve them in the decision-making process in a community characterized by a weak civil society. Institutionally, it is necessary to have some specific levels of devolution of power to the local authorities and establish a legal basis for civic participation.

2.3.5. Context-specificity

Although the globalization process has diminished many differences between various parts of the world, there are still major local characteristics that separate countries or even local areas within one country from each other. It is obvious that situations of a local environment in a hot and arid area are starkly dissimilar to those of a cold area with high amounts of precipitation. When it comes to the development of general standards, this issue requires adequate consideration.

Context-specificity is concerned with the consideration of local characteristics and idiosyncrasies of each development. This requires taking adequate account of the differences between various localities with different climatic, social, and economic settings; as well as, acknowledging that different types of development (new development, brownfield regeneration, etc.) require different approaches.

2.4. Summary and implications for research

In this chapter the main purpose was to clarify the concept of sustainable development. There are a number of points worth reiterating in this section. Over the last few decades; sustainability, which in the beginning was only used sporadically, has evolved into a very powerful buzzword and a core element of many academic and professional discourses.

Although there are some few arguments against the validity of the concept of sustainable development (Beckerman, 2003), it is generally recognized as a paradigm fundamental for ensuring an appropriate level of the quality of life for all citizens both now and in the future.

Sustainability is a normative concept subject to many interpretations. The literature is replete with different approaches towards the definition of sustainability and its

operationalization. The main controversy is over the nature and composition of what we are responsible to pass on to the future generations. Advocates of the strong sustainability paradigm maintain that the natural capital and human capital are separate and the enhancement of the latter cannot compensate for the decline of the former. Meanwhile, proponents of the weak sustainability paradigm argue that the cumulative amount of capital is an issue that needs to be concerned. Therefore they believe that in the case of decline in the natural capital, the human capital should be improved through measures such as technological innovation to keep a constant combined amount of capital.

In a similar vein, there is no consensus on the dimensions and principles of sustainability. Variations exist which are mainly due to the goals that different disciplines and their sub-disciplines are pursuing.

For the purpose of this study, sustainability is viewed as having four dimensions, namely, environmental, economic, social, and institutional. The principles adopted for evaluating the extent of compatibility with the sustainability goals are: integrity, inter-generational equity, intra-generational equity, procedural equity, and context-specificity. These principles are used for evaluating the performance of several neighborhood sustainability assessment tools as well as three cases of sustainable neighborhood development.

The contested nature of the sustainability concept implies that sustainability assessment should account for the varieties in interpretation and be able to strike a balance between, sometimes, conflicting perceptions of the subject. The comparative approach taken in this study has the potentials to reveal some of these differences and outline solutions for better accounting of impacts associated with a neighborhood development.

Given the fact that NSA is still not a mature field of research and practice, it is necessary to clarify the issue of the transferability of indicators and standards to avoid the inappropriate utilization of NSA tool and maximize benefits of the practice.

Chapter 3 Evolution of impact assessment

> Nature provides a free lunch, but only if we control our appetites.
>
> *William Ruckelshaus*

The concept of impact assessment has been very influential in the development of the sustainability in general and sustainability assessment in particular. Nowadays, impact assessment plays a major role in different levels of planning. The general awareness of the importance of control and management of the development, and consequently the demand for creating more sustainable communities is rising rapidly worldwide. In response to this growing demand, planners and policy-makers use impact assessment tools as decision support systems.

At the outset of the second half of the twentieth century, planning experienced a shift from the classical paradigm associated to Patrick Geddes's survey-analysis-plan to the rational planning. Ever since this transition, evaluation has been part of the planning process (Oliveira & Pinho, 2010) and as Khakee (1998) agues these two domains are inseparable.

The role that evaluation plays in the planning process varies from one context to another. While in some contexts there is a legal basis for conducting evaluation, in some places it is only practiced on a voluntary basis. The scope of the evaluation practice is also subject to variations. Some authorities might commission a comprehensive evaluation of the merits and demerits of the proposed plan, whereas authorities in another area might only be interested to know about the costs of the plan that they are going to implement.

Evaluation can also be conducted during different phases of the planning process: ex-ante, ongoing, and ex-post. These respectively correspond to the practices undertaken during the preparation of the plan, its implementation, and after the plan is completed through monitoring and revision (Oliveira & Pinho, 2010).

Evaluation is of interest of planners and decision-makers for a number of reasons. In terms of policy-making, evaluation is a good means of enhancing the credibility of the decisions made and legitimate them in the eyes of citizens (Oliveira & Pinho, 2010). Other benefits that Oliveira and Pinho mention are that evaluation improves the planning process, provide a basis for decision-making, and provide a learning platform for various stakeholders. Here, it should be added that evaluation is necessary in the sense that it can help planners and decision-makers avoid the possible loss of resources (time, money, etc.) due to inappropriate decisions.

Impact assessment is one of the very common forms of evaluation practiced in the context of urban and regional planning. Most of the characteristics described above apply to the impact assessment as well. It is widely recognized as a necessary practice that can enhance the decision-making process for sustainable development. Impact assessment intends to bring to the surface both the positive and negative points associated with the proposed development. Therefore, the process takes the role of a decision support system and provides the relevant authorities with adequate information to decide whether to accept or reject the development proposal.

As can be understood from the last paragraph, the focus of this research is mainly on the impact assessment during the preparation and approval stages of planning (ex-ante). In this research assessment is viewed as a mechanism to be applied early in the planning process before the irreversible actions are made.

This chapter begins with a brief explanation about the genesis of impact assessment.

3.1. Origins of impact assessment

Impact assessment theories and practices are very largely the product of the last four decades. There is a close association between the genealogy of impact assessment and sustainable development. The environmental crisis of the late 1960s, caused by the unrestrained economic development of the years following World War II, raised concerns among many scholars such as Rachel Carson, and spawned the grass-roots environmental movements in many parts of the world (Gibson et al., 2005).

By the late 1960s many industrialized nations had some mechanisms in place to address the environmental crises (Gibson et al., 2005). United States was the first country to pass an act requiring the Environmental Impact Assessment (EIA) in 1969 (Fischer, 2001). The National Environmental Policy Act (NEPA) of 1969 made the preparation of environmental impact assessment necessary for "projects that involved US federal land, federal tax dollars or federal jurisdictions" (Burdge, 1991, p 93).

The International Association for Impact Assessment was established in 1981 and facilitated the communication and knowledge sharing between scholars interested in the theory and practice of impact assessment (Burdge, 1991). In 1986 the World Bank became committed to incorporate EIA in the process of project appraisal (Burdge, 1991). This was a major advancement in the field of impact assessment and made it more influential.

Another important event happened in 1989 when the European Economic Community made its earlier recommendation for preparation of environmental impact statement by its members a requirement (Burdge, 1991).

In the meanwhile, a series of environmental disasters that were caused by inadequately informed decisions reinforced the necessity of incorporating environmental assessment into the planning process (Burdge, 1991). The publication of the Brundtland report in 1987 was a major event that further bolstered the position of impact assessment, and made it more internationalized (Burdge, 1991). In the next section, some of the mostly practiced impact assessment tools are introduced.

3.2. Definition and typology of traditional impact assessment tools

"Impact assessment, simply defined, is the process of identifying the future consequences of a current or proposed action. The impact is the difference between what would happen with the action and what would happen without it" (IAIA, 2013).

Since the passage of the NEPA in 1969, the field has developed to generate an ever-expanding number of assessment tools for a wide variety of scopes and scales. A fairly large number of these tools deal with assessment of various types of urban development plans. It should be mentioned, however, that not all the impact assessment tools have been developed

and expanded from EIA. Tools such as Cost-Benefit Analysis and Risk Assessment are from distinguished fields and origins (Hacking & Guthrie, 2008).

In his study about several impact assessment tools and their relations, Vanclay (2004) found that more than 140 types of assessment tools are practiced worldwide. Although not all the tools shown in Vanclay's study are major assessment tools, it is a clear indication of the widespread recognition of impact assessment in research and practice. Given the dynamic nature of the field, it would be no surprise to find out further new impact assessment tools through an updated search for the term in internet search engines.

It would be beyond the scope and size of this thesis to explain all the impact assessment tools. Here the analysis is restricted to some major tools. It can be said that many of the other assessment tools excluded in this study are only slightly different.

3.2.1. Life-cycle assessment

Life-Cycle Assessment (LCA) is a largely independent and well-established branch of impact assessment tools that is mainly concerned with the products used in the urban development. It is different from most of the other impact assessment tools in the sense that it has a limited scope mainly focused on the environmental impacts of the urban infrastructure at the project level. Life-Cycle Costing is a closely related, but less well-established assessment tool that accounts for the economic impacts throughout the life cycle of the development (Sahely, Kennedy, & Adams, 2005).

LCA is a structured methodology that is used to analyze the environmental implications of products throughout their life cycles from raw material extraction through to waste disposal and decomposition (Ness, Urbel-Piirsalu, Anderberg, & Olsson, 2007; Sahely et al., 2005). "The four components of LCA are goal and scope definition, inventory analysis, impact analysis, and improvement analysis" (Sahely et al., 2005, p.74). The output of LCA is utilized for enhancing the product development, and helps consumers with their product choice (Ness et al., 2007).

The major drawbacks of LCA are that it is a complicated and time-consuming process, requires large amounts of data, have no concrete methodology for defining the boundaries, and fails to explicitly account for the socio-economic impacts (Sahely et al., 2005).

3.2.2. Cost-benefit analysis

Utilization of Cost-Benefit Analysis for investigating the costs and benefits of a project dates back to the early years of the twentieth century (Ness et al., 2007). In the context of the urban sustainability assessment, CBA can be used during the evaluation of different proposed alternatives by planners and decision-makers. Decision-makers apply CBA early in the planning process to compare the viability of different competing projects (Ness et al., 2007; Poveda, 2011).

Social CBA and economic CBA are two main types of CBA. The monetary value of both the cost and benefits are used as a common basis for comparison among projects (Poveda, 2011). This impact assessment tool is criticized for trying to monetize the benefits of a development (Ness et al., 2007), which increases the risk of overlooking some important issues that are not necessarily convertible into monetary units.

3.2.3. Risk assessment

Risk assessment (sometimes used interchangeably with risk analysis) is another type of impact assessment tool that has a history longer than EIA. Nowadays it is practiced both independently and as integrated with EIA (Vanclay, 2004). Risk analysis assesses the possible damages that might occur as a result of "a particular event or series of events" (Ness et al., 2007, p.504). It is a "a process intended to calculate or estimate the risk to a given target organism, system or (sub)population, including the identification of attendant uncertainties, following exposure to a particular agent, taking into account the inherent characteristics of the agent of concern as well as the characteristics of the specific target system" (Korre & Durucan, 2009, p.7). This process is mainly conducted in four stages: it "begins with identification of the risk, and moves on to a qualitative and/or quantitative assessment of the risk—leading to certain management decisions regarding the minimization of that risk. The final stage of the Risk Analysis includes communication with stakeholders concerning the assessment and the corresponding decisions involved with minimizing the risk" (Ness et al., 2007,p.504). Despite being intended to account for all different kinds of risk, it is mainly considering the environmental risks that a project can cause. Given the association between risk and uncertainty, risk assessment is often conducted together with uncertainty assessment (Ness et al., 2007). Vulnerability assessment is another closely related assessment which considers

issues related to the resilience of human-environment systems. Based on the results of the vulnerability analysis, decision-makers decide whether it is necessary to undertake risk assessment (Ness et al., 2007).

3.2.4. Multi-criteria analysis

Above, it was mentioned that CBA is not appropriate for assessing those impacts that are difficult to be converted into monetary units. Multi-Criteria Analysis is an alternative valuation method that employs non-monetary measures for weighting and ranking impacts (Poveda, 2011). Compared with the assessment tools explained hitherto, MCA has a broader scope and is often used to investigate the suitability of plans and projects that cover a relatively larger spatial scale.

Its main application is in situations when various "competing evaluation criteria" are available (Ness et al., 2007, p.504). MCA uses both qualitative and quantitative methods and involves identification of goals and objectives, selection of a set of related criteria, weighting these criteria using input from various stakeholders, and identifying an optimal policy after making a trade-off between different criteria (Ness et al., 2007; Poveda, 2011). In the end, accuracy of the results of the MCA and the weights gained through the analysis is checked using sensitivity analysis (Poveda, 2011).

MCA is useful for helping decision-makers with the difficult task of ranking various options and choosing the optimal one. Its main strength is the capability of including both quantitative and qualitative data, which is essential for enhancing the quality of decision-making process (Ness et al., 2007).

3.2.5. Environmental Impact Assessment

As the mostly practiced impact assessment tool, EIA has been used in the planning process since the early years of 1970s after the introduction of NEPA (Vanclay, 2004). This well-established assessment tool involves a process of identifying and forecasting the potential impacts of a proposed project on its surroundings (Vanclay, 2004). It is mainly applied to large development projects and in most cases is mainly focused on the environmental impacts (Ness et al., 2007).

EIA is usually conducted in five main stages: screening, which is deciding whether or not EIA is needed; Scoping, in which the main environmental issues than need to be considered are specified; prediction and mitigation, which focuses on the main issues specified in the scoping stage to predict their potential impacts and propose measures for mitigating them; monitoring, that is mainly concerned with preparing a plan for management of the environment and creating an environmental action plan (this is usually called Environmental Impact Statement); and finally the audit stage which is usually conducted by a different group of experts and involves reviewing the procedures undertaken and examines the techniques used in the assessment process (Wathern, 1988).

Since EIA has been applied in many countries around the world, there are some slight variations in the way it is used in different contexts. EIA made a tremendous progress in the field of impact assessment through providing some mechanisms for public participation in the decision-making process (Poveda, 2011). It is now found a legal basis in many countries (Poveda, 2011), which makes it distinguished from many other impact assessment tools. Nevertheless, EIA has its own limitations that have led planners and decision-makers to seek other complementary types of assessment tools. This issue is further discussed below.

3.2.6. Social Impact Assessment

EIA made tremendous advancements in the field of impact assessment and provided a structured methodology for identification, prediction, and evaluation of impacts. However, it was soon realized that some issues such as social impacts are not adequately addressed. In response to this problem, social scientists developed a tool for Social Impact Assessment (SIA) (Hacking & Guthrie, 2008; Vanclay, 2004). Likewise its ancestor, SIA is mainly practiced at the project level.

SIA is not the only new tool that has sprouted from EIA and acts on its own. As Hacking and Guthrie (2008) suggest, there are two main reasons for the emergence of new assessment tools out of EIA as the main trunk: the first reason lies in the concept of environment which is open to different interpretations ranging from definition of environment as a bio-physical entity through to considering it as a comprehensive entity incorporating various other dimensions; the second reason relates to the efforts of scholars and practitioners

from various disciplines to bring their own concerns to the attention and customize the assessment tool to their own field of research and activity.

SIA might be practiced on its own or as a part of the EIA process (Hacking & Guthrie, 2008; Vanclay, 2004). The main aims of a SIA process are to identify the impacts that the development may have on the community, propose measures for mitigating the adverse impacts and create a forum for citizen participation and social learning (Hacking & Guthrie, 2008; Vanclay, 2004).

Hacking and Guthrie (2008) argue that SIA has not been successful in gaining a powerful position in the political decision-making process. It is mainly functioning as a report to policy makers about the possible impacts of the development proposal on various groups of the community, and includes advice on mitigation measures. The final decision on whether to approve or reject the proposal remains at the discretion of the policy makers which use SIA as a decision aid tool. It is also worth bearing in mind that, in many cases, the same argument applies to other assessment tools such as EIA.

3.2.7. Health Impact Assessment

Following a path similar to what SIA has taken (Hacking & Guthrie, 2008); Health Impact Assessment (HIA) has grown to become one of the impact assessment tools widely used at the project level. The World Health Organization defines HIA as "a means of assessing the health impacts of policies, plans and projects in diverse economic sectors using quantitative, qualitative and participatory techniques" (WHO, 2012).

Likewise other assessment tools, HIA aims at helping decision-makers make more informed choices about development alternatives. It is also expected to make improvements to the initial plan to prevent (or at least decrease) adverse impacts on the human health and enhance the well-being of the community (WHO, 2012).

Standing at the "intersection of EIA and SIA" HIA has received a considerable recognition among domestic and international institutes around the world. Endorsement by the World Health Organization has also contributed significantly to the diffusion of HIA as a decision aid tool (Vanclay, 2004, p.275).

Here, too, the problem is that no categorical definition is available for the term "health". Definitions vary greatly from the one having a narrow scope that only considers the physical health to those considering health as a broad term that covers other facets such as mental and social health (Vanclay, 2004). Another problem is that in many cases there is an overlap between the scopes of EIA, SIA, and HIA. Since there are also commonalities between these different assessment tools in terms of the data and techniques that are used for assessment, it could be promising to use them as complementary assessment tools to develop an integrated assessment framework (Hacking & Guthrie, 2008). This way a considerable amount of resources could be saved.

3.2.8. Strategic environmental assessment

Strategic Environmental Assessment (SEA) is perhaps the most widely used impact assessment tool after EIA. SEA was introduced in early 1990s in response to several deficiencies of EIA (Ness et al., 2007; Vanclay, 2004). EIA and SIA were initially intended to address environmental issues at various levels of Policies, Plans and Programs (PPPs). However, in reality it was mainly applied to the project level. Furthermore, both EIA and SIA were not successful in considering the cumulative impacts. SEA was introduced to address these shortcomings of EIA and SIA (Vanclay, 2004).

Noble (2000, p. 205) defines SEA as "the proactive assessment of alternatives to proposed or existing PPPs, in the context of a broader vision, set of goals or objectives to assess the likely outcomes of various means to select the best alternative(s) to reach desired ends". As can be understood from this definition, one unique characteristic of SEA is the proactive analysis of several development alternatives. This is considerably different from previous methods where assessment was reactive in nature and mainly focused on calibrating a single development proposal (Hacking & Guthrie, 2008).

"Strategic actions can be taken in different levels (PPPs) and different scales (international, national, regional, urban, and local). Depending on the level of strategic decision making, SEA takes different roles. There are just slight differences between SEA stages mentioned by different scholars" (Sharifi & Murayama, 2013b, p.2)[4]. Therivel (2004)

[4] Available in section M-6-1of the proceedings of the 11th international congress of Asian Planning Schools Association, Tokyo, 2011.

has mentioned five key stages of the SEA process. Sharifi and Murayama (2013b) have borrowed her proposed structure to illustrate the SEA process. This is shown in Figure 3-1.

SEA has gained legitimacy in many countries around the world. Also, "its importance has been acknowledged in international arena through the endorsement of two important legal documents, namely, the European SEA Directive (2001/42/EC) and the United Nations Economic Commission for Europe (UNECE) 2003 SEA Protocol" (Chaker, El-Fadl, Chamas, & Hatjian, 2006, p.16).

SEA was successful in moving the impact assessment field forward through providing more legitimacy for assessment, introducing a more integrated approach that accounts for various aspects, taking a proactive approach that requires conducting assessment early in the decision-making process, and facilitating a better environment for public participation. These are all qualities that are emphasized by the currently dominant sustainability assessment frameworks including NSA tools.

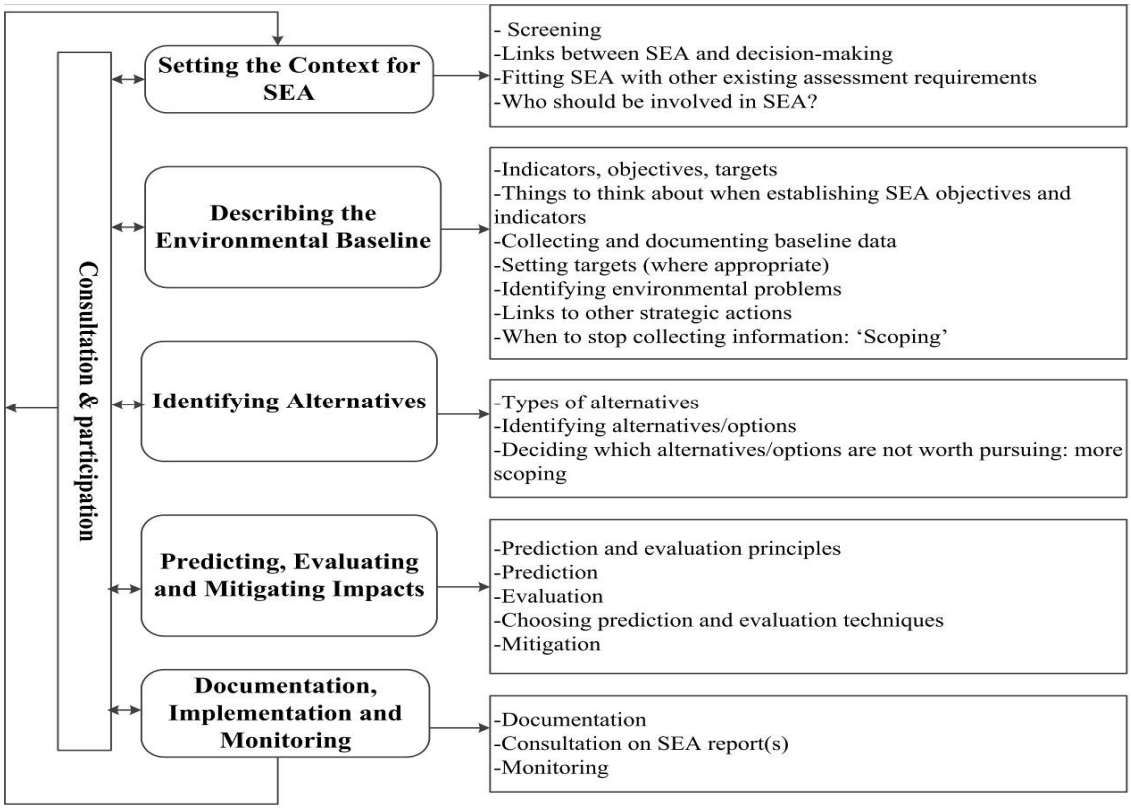


Figure 3-1. The main stages of SEA process. Source: (Sharifi & Murayama, 2013b)

Despite all these improvements, some problems are still unsolved that made further advancement of the field indispensable. One problem is that in reality, SEA is still predominantly environmental and in many occasions, socio-economic aspects are not adequately addressed (Hacking & Guthrie, 2008; Poveda, 2011). Another major problem is that SEA process relies heavily on time and resources (Poveda, 2011), which affects its effectiveness in the decision-making process for human environment as a dynamic entity.

To address these deficiencies, and also to make assessment further in line with the requirements of the sustainability discourse, in the last two decades there has been an increase in the number of tools targeting sustainability assessment. This will be further discussed in the following section.

3.3. Emergence of sustainability assessment tools

Although as White and Noble (2013), and Bond, Morrison-Saunders, and Pope (2012) argue, sustainability is implicit in all assessment frameworks; introduction of SEA was the first major shift in the impact assessment field that laid the foundations of sustainability-based impact assessment. SEA improved the assessment process significantly. However, as mentioned above, there were some constraints that needed to be overcome.

These problems have given rise to the use of a new generation of assessment tools that have sustainability at their core. Unlike SEA, which is mainly applied at the strategic level, sustainability assessment tools can be applied to development at any level. Around the world, a variety of sustainability assessment practices are undertaken in different scales and contexts (Pope & Dalal-Clayton, 2011). Although the normative character of sustainability (A. Bond et al., 2012; Evans & Jones, 2008) makes the tools subject to variations; as a common goal, they are all pursuing a framework which is holistic, context-specific, pluralistic, applicable, distributional, and forward-looking (A. Bond & Morrison-Saunders, 2013). These are characteristics that in the previous chapter were identified as being associated with sustainable development.

Sustainability assessment tools are available under different rubrics (such as sustainability appraisal) and for various scales. In the context of urban planning, these assessment tools have targeted three main levels: single building, neighborhood, and city. In

most of these sustainability assessment tools, the development is ranked based on its performance.

3.3.1. Sustainability assessment at the city level

Compared with the building and neighborhood levels, sustainability assessment tools for the city level are underdeveloped. It should be mentioned, however, that sustainability indicators are increasingly used for guiding (re)development plans at the city level. But, unlike the building and neighborhood levels, not enough attention has been paid to develop comprehensive assessment tools. This may in part be due to the fact that cities are developed incrementally and therefore there would be few, if any, developers to undertake such large scale projects and apply for sustainability certification. There is, however, another trend that focuses on the ranking of the sustainability of the existing cities which is beyond the scope of this thesis. The most well-established tool for assessing sustainability at the city level is perhaps CASBEE-City which was first introduced by Japan Sustainable Building Consortium (JSBC) in 2011, and its 2012 version has recently been published.

CASBEE-City is intended to provide a holistic account of the sustainability performance of a city. Therefore, not only environmental performance, but also the quality of life of the residents and their economic well-being is also considered.

Likewise other assessment tools from the CASBEE family, a hypothetical boundary is set around the target area of assessment (See Figure 3-2). The CASBEE-City framework evaluates the environmental quality (Q) within the boundary and environmental load (L) on the area outside the hypothetical boundary. The performance of the assessed city would be calculated by dividing Q by L which is called the Built Environment Efficiency (BEE) (JSBC, 2012).

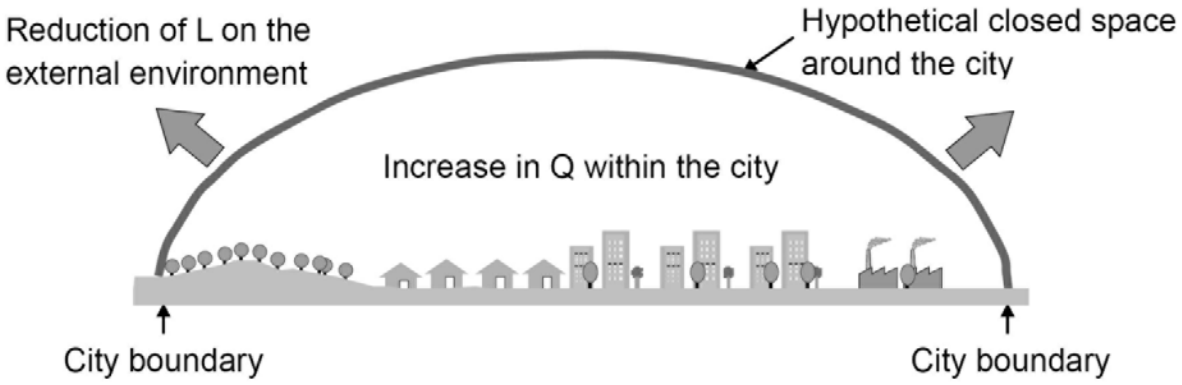


Figure 3-2. Hypothetical boundary of the assessment area in CASBEE-City. Source: (JSBC, 2012)

Sustainability assessment for the city level is still at its embryonic stage and is expected to develop in the future.

3.3.2. Sustainability assessment at the neighborhood level

Sustainable neighborhood planning has gained momentum since the turn of the century. Commensurate with this trend, the NSA tools have also been burgeoning. This occurred after it was realized that assessment of the single buildings is not enough for achieving the sustainability goals (Berardi, 2011; Haapio, 2012).Today there is a large number of assessment tools exclusively designed for evaluating sustainability at the neighborhood level. These NSA tools are available for assessing the performance of neighborhoods in different stages of development ranging from planning stage, to construction stage, and post-occupation stage. As will be further discussed in Chapter 5 these tools can be divided into two main categories: those embedded into the planning process, and those used as certification systems for rating the performance of the development. As this is the main theme of this thesis and will be further discussed later, further details would not be explored at this point. Next section introduces the building sustainability assessment tool and their significant role in the development of NSA tools.

3.3.3. Sustainability assessment at the building level

Performance assessment of buildings and building industry has a quite long history. However, it was not until release of BREEAM in 1990 that an assessment tool for simultaneously assessing various types of environmental issues in buildings was developed

(Cole, 1998). Since then, building assessment systems (sometimes called green building assessment systems) have proliferated. Today many other building assessment systems such as LEED, CASBEE, Earthcraft, SBTool, etc., are available to be used by developers (Retzlaff, 2009; Sev, 2011)

Earlier assessment tools for buildings were mainly focusing of one aspect of the building construction (construction costs, energy efficiency, illumination, earthquake resistance, waste management etc.). By developing this new generation of assessment tools, developers were seeking to consolidate the previous isolated assessment efforts (Cole, 1998).

Most of green building assessment tools are comprised of a group of criteria which are used to evaluate the performance of buildings (Retzlaff, 2008; Sev, 2011). Many of these green building assessment systems are used on a voluntary basis. In some jurisdictions, however, the acquisition of a certain level of performance is mandatory (Retzlaff, 2008).

Assessing the performance of buildings is useful for several reasons such as getting information of the degree of success in achieving the targeted levels and performance, identifying the areas in need of improvement, enhancing public awareness of the importance of the building performance, creating a database on buildings, promoting innovation through instigating communication between building design experts (Cole, 1998), getting market recognition(Cole, 1998; Retzlaff, 2008), expediting building permit issuance, helping local authorities to defend their decisions, and promoting sustainability as a broader goal (Retzlaff, 2008).

Building assessment systems have contributed significantly to the diffusion of sustainability assessment. Cole (1998, p.14) believes that their most significant contribution has "been to acknowledge and institutionalize the importance of assessing buildings across a broad range of considerations beyond established single performance criteria such as energy". Nevertheless, a number of problems related to their structure and operation exists that is worth mentioning at this point. These problems include, but are not limited to, lack of concrete mechanism to be linked to other performance issues, lack of legal basis, subjectivity of the weighting process, lack of a common-basis for evaluation, inability to be used for different levels of assessment (Cole, 1998), being generic and having no specific mechanism for

addressing the local-specific issues (Cole, 1998; Retzlaff, 2008; Sev, 2011), and failing to adequately address socio-economic aspects of sustainability (Retzlaff, 2008; Sev, 2011)

3.4. Summary and implications for research

The purpose of this chapter was to present an overall account of the impact assessment field, trace its evolution over time, and identify the main problems that are still unsolved. It was discussed that a wide variety of assessment tools with different scopes and methodological approaches exist.

Earlier generations of the impact assessment tools have often been single-purposed and designed to address the specific needs of a particular discipline. The first major breakthrough came when NEPA was signed into law in 1970. This act introduced EIA as an assessment tool for addressing various environmental, economic, and social issues. However, after several years of operating EIA, its inability to comprehensively embrace various aspects was revealed.

To address this deficiency, tools such as SIA and HIA were developed to fit the particular interests of practitioners in a number of fields such as social sciences and health. As a result the problem of integration remained unresolved.

At the same time, the field was also facing some other problems. Most of the assessment tool has a reactive nature which renders them difficult, if not impossible, to reverse the decisions that have already been made. Their narrow perspective, and also their limitations in accounting for the indirect and cumulative impacts invoked the diffusion of Strategic Environmental Assessment (SEA) as a tool for strengthening the project level EIA (Dalal-Clayton & Sadler, 2005; Fischer, 2001). SEA improved the decision-making process through applying an integrated and transparent assessment that extends beyond the project level to policies, plans, and programs. A major distinction between SEA and earlier impact assessment tools is its emphasis on assessment of alternative options during the decision-making process. This was a major shift in the impact assessment theory and practice and made it a more open process. SEA can also be regarded as a major effort towards incorporating sustainability issues (as the dominant discourse in the planning and impact

assessment domain since the early years of 1990s) into the impact assessment theory and practice.

The main problems are related to the operationalization of SEA; its weakness in concretely defining the scope of sustainability (A. Bond et al., 2012), uncertainty of the conditions, and the limitations in accessibility to information (SEA, 2012). Particularly germane to the subject of this research is the fact that SEA covers a large area and is hardly ever applied at the local level (A. Bond et al., 2012; Devuyst, 2001; SEA, 2012).

Sustainability assessment is regarded as a new trend in the field of impact assessment. Tools for sustainability assessment are now available for different scales and stages of developments. Among them, tools developed for assessing the performance at the building level are probably the most well established. As discussed in detail, these tools have made a great contribution to diffusion and institutionalization of the sustainability concept. Despite this, problems such as failure to provide a holistic account of sustainability, and lack of adequate mechanisms for local adaptation are still unsolved.

Since NSA tools are still in the formative years, it is necessary to learn from the experiences of the previous tools and guide them in a direction that makes them appropriate to be used as a guiding tool for sustainable development. Acknowledging these important implications, this research takes a critical approach to find out promises and pitfalls of the current theory and practice of NSA and provide a number of suggestions to be used during the revision of the NSA tools.

Chapter 4 Introduction of sustainability assessment to neighborhood planning

> Do not buy the house, buy the neighborhood.
>
> *Russian Proverb*

Technological advances of the last several centuries have markedly changed the rules governing human interactions. We are now less dependent on direct and immediate relations with our neighbors. The availability and frequency of advanced means of transportation and communication means that our material and emotional needs are met from sources that are more dispersed geographically. The ever expanding globalization means that this trend might be further increased in the future. Meanwhile, there is a growing awareness in the society that these transformations have imposed various types of costs on humans and the environment. This has led many people to believe that a shift towards a more locally based lifestyle is necessary (Gilchrist, 2000).

Neighborhoods are the places where (in most cases) our first encounters with the world outside home occur. In many communities, neighborhoods' role in the daily life of the population is evident throughout the different stages of life. Through providing play space for children, neighborhoods play a significant role in shaping their social identity and preparing them to enter the society. As adults, we use the community spaces in our immediate neighborhood as a place for various activities such as social exchange and physical exercise. This basic planning unit continues to play a fundamental role in the later stages of our lives when, due to physical limitations, we face difficulties in reaching distant places.

The role of neighborhood in organizing the structure of the city is also widely acknowledged. In his seminal work, *The Image of the city*, Kevin Lynch emphasized the fundamental role of districts (with a scale similar to neighborhoods) in shaping the place and enhancing the legibility of the city (Forsyth & Crewe, 2009; Lynch, 1960).

Therefore, it should come as no surprise that neighborhood is often used as a basic unit for research in social sciences. Social scientists have frequently conducted studies about important issues such as crime, satisfaction with life, social cohesion etc. in the neighborhood and have found relationships between the status in terms of these kind of issues and various

types of conditions in the neighborhood. Interest in using neighborhood as a unit of analysis is not limited to social scientists. A plethora of studies from various fields including architecture, energy management, water management, waste management, and health can be found that analyze specific problems in relation to neighborhoods.

As an interdisciplinary field, lied in the intersection of many disciplines including social science, engineering, economics, and architecture, urban planning has a long tradition of viewing neighborhoods as laboratories for conducting research. Examples can be found in the plethora of research that analyzes issues such as density, transportation, civic engagement, and Greenhouse Gas (GHG) emissions in relation to neighborhoods.

Barton (2000) outlines ten main reasons for the desirability of planning for neighborhoods. These reasons are shown in Table 4-1.

Table 4-1. Reasons for the desirability of planning for neighborhoods. Source: (H. Barton, 2000)

Reasons	Objectives
1- Cutting greenhouse gas emissions	• Reduce the need to travel • Reduce car reliance • Increase energy efficiency in buildings
2- Closing local resource loops	• Reduce demand for non-renewable resources • Reuse and recycling of resources locally • Local water sourcing, treatment and aquifer recharge • Local low-input food production
3- Enhancing local environmental quality	• Promote local distinctiveness and heritage • Create an attractive public realm • Enhance local habitat diversity
4- Creating a healthy environment	• Improve local air quality • Promote an active life-style (especially walking) • Encourage consumption of fresh fruit and vegetables
5- Increasing street safety	• Reduce the chance of vehicle/pedestrian accidents • Reduce the fear of violence
6- Increasing accessibility and freedom of choice	• Choice of transport mode for trips • More facilities accessible locally
7- Equity and social inclusion	• Choice of facilities within easy walking distance • Viability of public transport
8- Local work opportunities	• Accessible jobs for those tied to the locality • Reduce transport emissions
9- Value of local community	• Facilitate accessible social networks • Promote mental health
10- Increasing local self-determination	• Increase user/citizen control • Management of decentralized systems

As was stated earlier, interest in pursuing sustainability goals through planning at the neighborhood level has also been burgeoning in the recent years. This chapter tries to further

set the context for the research on sustainability assessment at the neighborhood level. This is done through making clear what is meant by the term neighborhood, clarifying how the notion of neighborhood in sustainability assessment departs from the generally held concept that neighborhood should have a certain size and identifiable boundaries, describing the necessity of conducting sustainability assessment at the neighborhood level, and also describing how the planning field has evolved over time to incorporate the principles of sustainable neighborhood development. In doing so, this chapter seeks to identify the major neighborhood related problems that previous planning movements have failed to resolve. In the following chapters, it will be investigated whether the current practice of NSA has been successful in addressing these problems, or it has only repeated the same fallacies.

4.1. Defining neighborhood

There seems to be no general definition of neighborhood in the literature. Neighborhood boundaries can be defined both objectively and subjectively. Subjectively, the mental borders of the neighborhood can be defined by local residents. Residents' perception can be used to map the boundaries of neighborhoods (Hugh Barton, Grant, & Guise, 2003). Emphasizing the significance of the pedestrian scale, Friedmann (2010, p.154) defines neighborhood as "the area that neighbors acknowledge as their home or, as sociologists would say, as their primary space of social reproduction". When it comes to identifying the borders of neighborhood, there might be a limited consensus between individuals. In a study conducted in Brisbane, Australia, it was found that residents define the boundaries of their neighborhoods very differently (Minnery, Knight, Byrne, & Spencer, 2009). This indicates that definition of neighborhood is largely individually-based; a clear identification of its boundaries is difficult, if not impossible.

Dover and King (2008) argue that objective measures such as discernible center and edges, walkable size, mixed-use, network of walkable streets, and civic centers are fundamental for defining the neighborhood.

Neighborhoods can also be defined using the administrative boundaries such as existing wards or districts (Hugh Barton et al., 2003; Dempsey, Brown, & Bramley, 2012), and census collection districts (Minnery et al., 2009). It should be noted, however, that in

many occasions the borders of administratively defined neighborhoods do not necessarily coincide with the borders defined based on other factors such as cognition, function, or aesthetics (Minnery et al., 2009).

Figure 4-1. Typical urban pattern in the planned cities (Phoenix, Arizona).

Figure 4-2. Typical urban pattern in historic areas (Fes, Morocco).

Barton et al. (2003) note that neighborhood boundaries can also be defined "aesthetically", and "functionally". Aesthetically, neighborhoods can be distinguished from each other using their distinctive characteristics (Hugh Barton et al., 2003, p.16). For example density, size of plots, and/or street patterns might differ between adjacent parts of a city. However, this cannot always be used for demarcating the neighborhood boundaries. As a case in point, consider the urban patterns presented in Figures 4-1, and 4-2.

The first figure shows how several areas with distinctive characteristics can be distinguished in a planned area of Phoenix, Arizona. A marked contrast can be seen in the second figure which displays the urban pattern of the old city quarters in Fes, Morocco (a typical urban pattern in many old cities, especially in Middle East and North Africa). Obviously, it would not be an easy task to identify the neighborhood borders in such a context and alternative methods need to be used.

Functionally, neighborhood boundaries are defined by the catchment areas for local services such as shopping centers, primary schools, and places of worship (Hugh Barton et al., 2003).

It should be noted that in literature, the term "neighborhood" is sometimes used interchangeably with "community", and "district" (Choguill, 2008; Sharifi & Murayama, 2013a; Smith, 2010). Barton et al. (2003, p.18) caution against using the terms "neighborhood" and "community" interchangeably. Their argument is that while neighborhood is a concept related to place, the notion of community is about people. They continue to say that neighborhood as a physical object can be planned, but community as a social entity cannot be planned and occurs "through people's choices and actions".

The term "district" is also not completely suitable for the purpose of this thesis. Throughout the world, it has been used to refer to areas that vary greatly in size. It might also be confused with special-purpose districts such as school districts which are functioning as administrative entities governing the activities of related facilities in a municipal area. Therefore, in this thesis the term neighborhood is adopted. Also, since the term "scale" carries somewhat strong connotations of well-defined boundaries, the term "level" is used in this study. This makes the activities more relevant to various tiers of the planning hierarchy.

As will be further explained below, although the majority of planning movements developed since the early years of the twentieth century embrace clear social reformist outlooks and aims, they have barely defined neighborhood using social and perceptual principles. In most cases, spatial elements and boundaries have been employed by planners and urban visionaries to define the term neighborhood. It is worth noting, however, that, despite sharing a spatial approach to defining neighborhood boundaries, they have sometimes differed fundamentally in their approach to spatial definition.

For the purpose of this study, the term "neighborhood" refers to any area within a city, the size of which ranges from one to several city blocks. The size may vary widely according to various types of factors such as the location of the development, financial resources of the developer, and institutional support available for sustainable neighborhood (re)development. After briefly exploring the evolution of the concept since the early years of the twentieth century, further justification for this approach toward the definition of neighborhood is provided at the end of this chapter. It should be acknowledged, however, that a minimum number of dwellings is necessary for a neighborhood to be constituted. Therefore, those certified cases that only include two or three buildings are not selected for case study analysis.

4.2. Evolution of the notion of neighborhood in the context of planning

From the earliest cities to present, human settlements have been spatially divided into districts and neighborhoods (Friedmann, 2010; Smith, 2010), which is an indication of the importance of neighborhoods in the fabric of the city. It is beyond the objectives and scope of this study to review the theories and practices, related to neighborhood planning, since the ancient times. Because of their crucial role in the formation of the theory and practice of sustainable neighborhood development, here only the major relevant theories and movements emerged since the early years of the twentieth century when Ebenezer Howard offered the "Garden City" concept as an alternative to the industrial city (Grant, 2006) will be briefly pointed out. Based on the similarities of these movements, these theories and movements are classified into four main categories: garden city movement; neighborhood unit movement; modernism movement; and neo-traditional movement.

4.2.1. The garden city movement

In the first half of the twentieth century urban planning field was greatly influenced by the utopian and radical ideas of a group of urban visionaries. Ebenezer Howard is widely known as the person who started a new wave of utopian thinking in early twentieth century. His utopian vision of a planned community has been a consistent object of attention ever since. His works influenced later scholars and visionaries such as Lewis Mumford, Clarence Stein, Henry Wright (Modarres & Kirby, 2010), and Patrick Geddes (Hirt, 2007). Howard's visionary principles of green, efficient, self-reliant, and affordable communities are still dominant in the literature and among the major challenges on the way of achieving neighborhood sustainability.

His vision which was considered to be an amalgam of the best features of city and countryside was a "constellation" of inter-connected, self-contained new towns placed around a large main city (Bergman, 2011; Wheeler, 2004). According to his proposal, these small towns should be connected to each other and the older city by rail and be separated by greenbelts in order to restrict the growth and preserve land for agriculture and recreation (Bergman, 2011; Daniels, 2009). Each of these satellite towns were designed to accommodate up to 30, 000 people who were working there as well (Daniels, 2009). Howard called the resulting urban clusters Social Cities (Basiago, 1996; Howard, 1985).

Each satellite town would be in circular form and cover an area of about 400 ha (Basiago, 1996). A circular garden of about 2 ha would be at the center of the town. Other facilities such as "town hall, lecture hall, theater, library, museum, picture-gallery and hospital" would surround this town center (Basiago, 1996, p.137).

Transportation network in the garden city would be characterized by radial roads, and winding routes. Land uses would be separated, and residents would enjoy living in detached dwellings located in large tracts of land. The overall density would be low (Banister, 2012). These form of design would make it possible to incorporate the village characteristics into urban life (Watson, 2009).The employment and shopping activities would be located along the central avenues, "and ownership patterns, would become essentially cooperative rather than private" (Wheeler, 2004, p.187).

One significant issue mentioned in Howard's proposal is the composition of the population. He envisioned a community that accommodates a socially mixed population (Hirt, 2007).

Howard's proposal to divide the garden city into several wards can be considered as one of the earliest efforts to introduce the idea of neighborhood to the planning context (Minnery et al., 2009). As illustrated in Figure 4-3, each ward has identifiable physical boundaries.

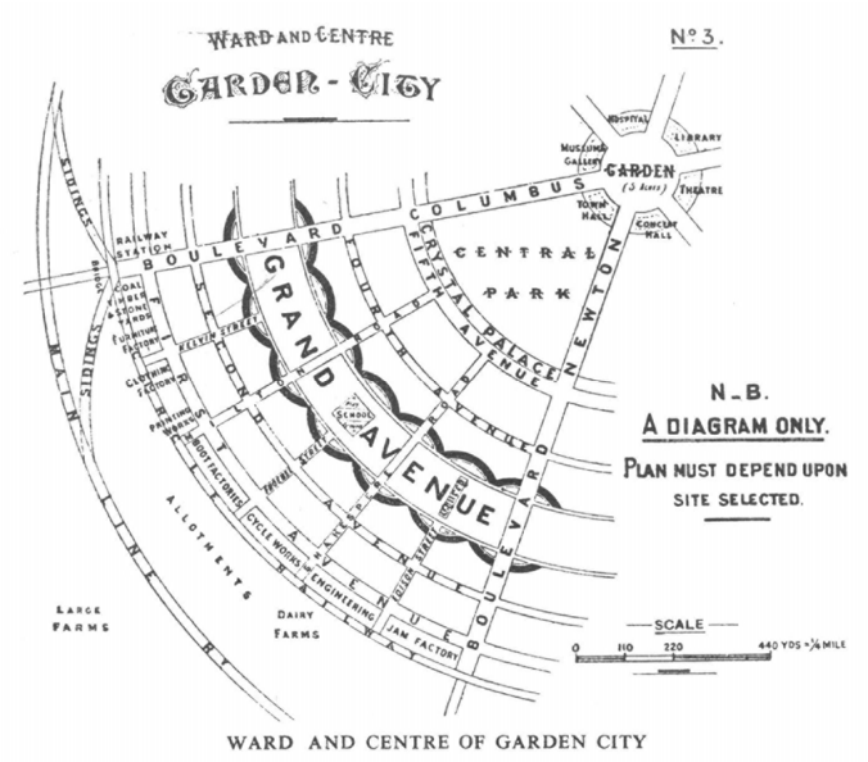


Figure 4-3. Configuration of a typical ward in garden city. Source: (Howard, 1985)

Main features of Howard's garden city such as ample green space, single-family residential units, and street patterns were repeated in the plans proposed by his successors. These aspects are still dominant in the conventional pattern of suburban development (Filion & Hammond, 2003), which is widely blamed for its egregious impacts on resources and environment. In terms of social reform, although Howard's purpose was to create a community that caters for the needs of various social groups, in reality the market forces

prevented him from operating his initial ideas and equitable development was traded off for soliciting market support (Fainstein, 2000).

Howard's vision of garden city was not widely practiced. Raymond Unwin and Barry Parker were among the first who tried to realize the ideals of the garden city concept in Letchworth. Howard, himself, contributed to the development of two pilot garden cities in the suburban area of London: Letchworth and Welwyn (Daniels, 2009). It has also been used as a basis for building several British and Swedish New Towns after World War and three "American Greenbelt Communities in the 1930s" (Wheeler, 2004, p.187).

The garden city movement was effective in introducing some fundamental principles of neighborhood planning. However, as Grant (2006) argues, in practice achieving the aims of this movement proved challenging, and developments were often driven by the market appeal.

4.2.2. The neighborhood unit movement

Above, it was mentioned that Howard's idea was not well received in the real-world. However, as stated earlier, it became an inspiration for his disciples from various disciplines. As a landscape architect, John Nolen developed his own version of garden city in Mariemont, Ohio. The difference between his work and Unwin's work in Letchworth was that in the former a "more comprehensive park system" was incorporated (Stephenson, 2002, p.106).

In 1923, Clarence Perry, inspired by his previous involvement in the community-based social activities and influenced by the preceding concepts such as the garden city, offered the *neighborhood unit* as an instrument for addressing social problems such as alienation, youth delinquency and lack of civic participation through enhancing the physical design of the community (Brody, 2009; Rohe, 2009). Johnson (2002) argues that the term "neighborhood unit" was coined by architect William E. Drummond. Perry's plan resembles that of Drummond in the sense that the latter has also set boundary and size for the neighborhood, specified the placement of different land uses and facilities, and suggested to divert through traffic in order to create tranquil and safe internal streets (Johnson, 2002).

Each neighborhood unit in Perry's plan would be of around 65 ha in size that provides housing area for a population of 5,000 to 10,000 people. Elementary school and public

facilities would be located at the center, and shops at the edge of the unit (Forsyth & Crewe, 2009; Perry, 1929). The neighborhood unit would be surrounded by arterial roads, and the internal roads would be designed so that the through-traffic is discouraged and a safe pedestrian environment is guaranteed (Banister, 2012). The basic principles of Clarence Perry's proposal for neighborhood unit are shown in Figure 4-4.

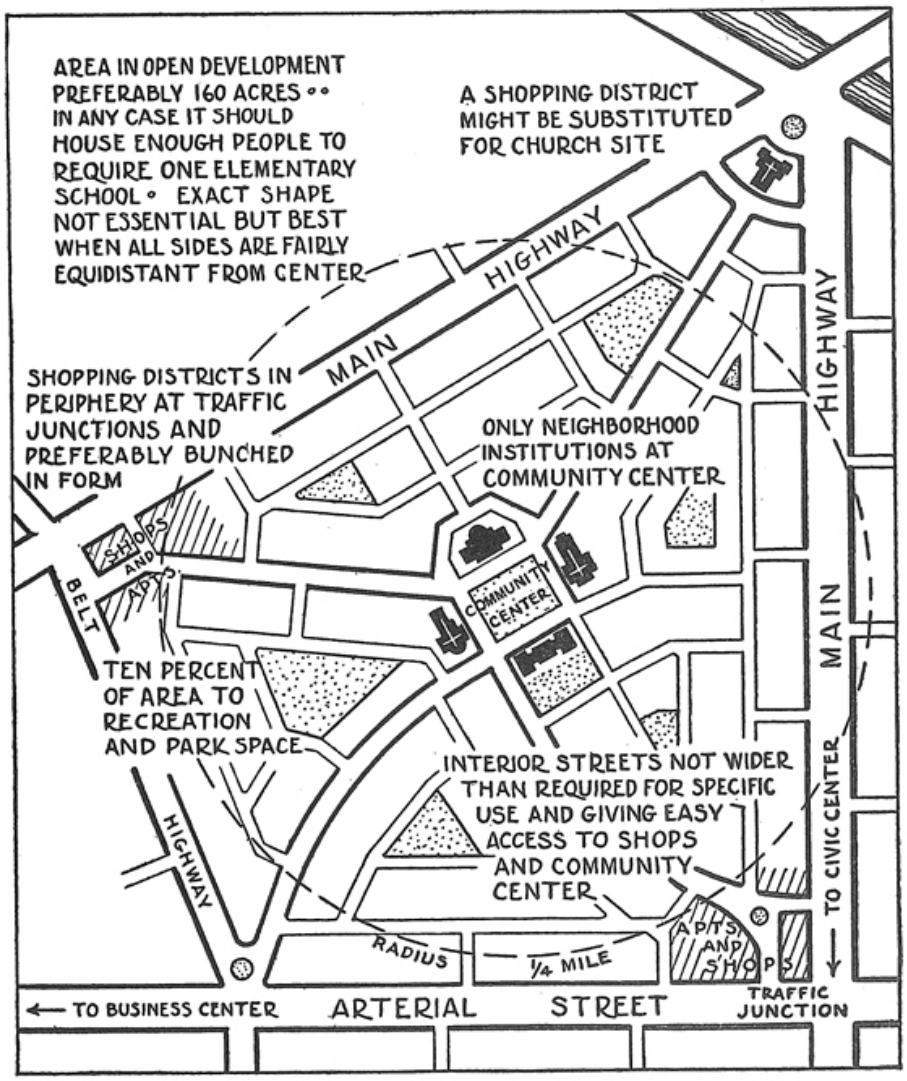


Figure 4-4. The basic components of Clarence Perry's neighborhood unit. Source: (Perry, 1929)

Neighborhood unit has been criticized for advocating social homogeneity which might be used to discriminate against some groups in the society (Rohe, 2009; Silver, 1985). It is also denounced for having a physical deterministic approach that considers physical design sufficient for bringing about social reform (Silver, 1985). Furthermore, Perry's idea to

separate work and living areas is regarded as a principle that gave rise to the widespread suburban development in US in the years following WWII (Brody, 2009; Silver, 1985).

Despite these all, the neighborhood unit theory has played a major role in building on the earlier efforts. It has also been used to guide some of the succeeding movements such as New Urbanism (Banai, 2013; Brody, 2009; Farr, 2008). Therefore, it is fair to say that neighborhood unit theory has made a significant contribution to the evolution of the neighborhood sustainability principles.

Clarence Perry's ideas were realized in Radburn. This neighborhood unit was designed by Henry Wright and Clarence Stein (1928). As Banister (2012, p.2) describes it: "Closely related to garden cities, this (Radburn) layout is characterized by cul-de-sacs and super blocks free of traffic, where cars and pedestrians are separated from each other, and public facilities and shops are located on pedestrian networks and embedded in open space".

4.2.3. The modernism movement

Modernism is used to describe a number of visionary plans proposed by planners and architects in the inter-war period of the 1920s and 1930s. Seeking solutions to problems such as obsolescence, muddle, inequality, and sprawl, the modernist movement added other elements to the garden city principles.

There is an obvious resemblance between the modernism movement and the garden city movement in terms of the circumstances that led to their emergence and the goals that they were pursuing. Here, too, the main purposes were to reunite humans with nature and restore the symbiotic relationship between the two, liberate humans from highly crowded urban areas (Basiago, 1996; Fishman, 1977), and tackle widespread problems such as social injustice, lack of beautiful spaces, and lack of human spaces (Fishman, 1977). In reality, however, modernism movement has led to urban forms starkly different from those envisioned in the garden city and neighborhood unit movements.

The turning point for the modernism movement came in 1928, when the International Congresses of Modern Architecture was founded. The neighborhood, as promoted by the modernism movement, was composed of high-rise functional buildings, abundant open space, superblocks with internal pedestrian networks, and modern, high-speed public transportation (Wheeler, 2004). This makes them distinguished from those proposed in the garden city and neighborhood unit movement, where more attention was paid to the human scale, high-rise buildings were not emphasized, and there was a limit to the city size in terms of area and population.

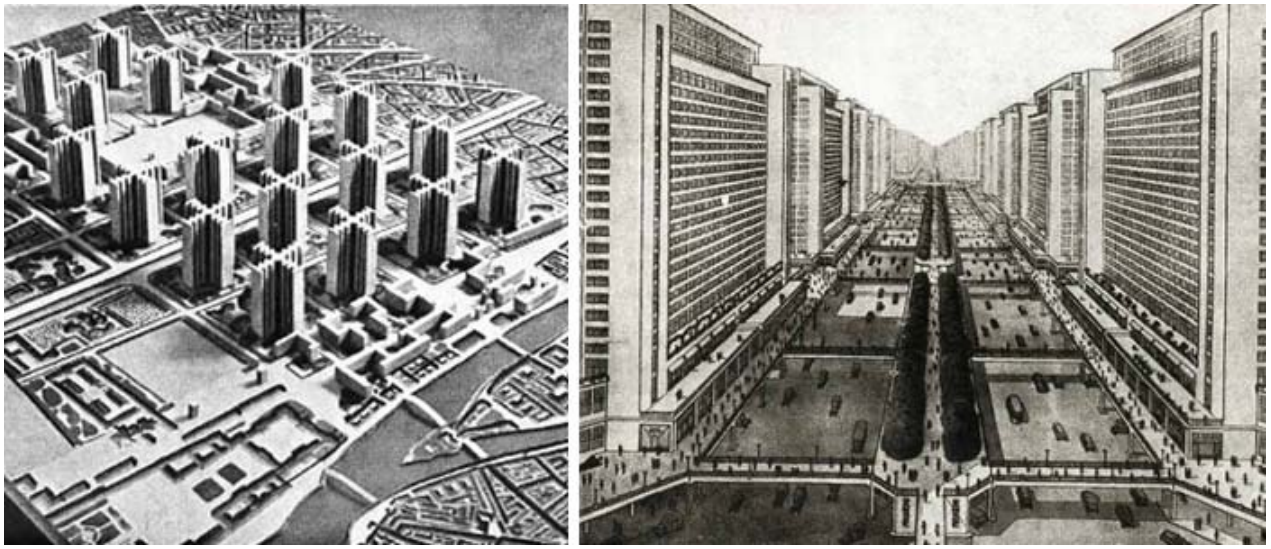


Figure 4-5. Two scale models of the Radiant City. Source: http://www.curbsandstoops.com/gaia/

In the "Contemporary City" and "Radiant City" models, Le Corbusier suggested to build thoroughly modern compact communities that provide abundant open space for their residents living in high-rise buildings. Public transit would be used to access the extensively provided community services (Grant, 2006). In his proposal for the "Radian City", Le Corbusier proposed "tower-blocks "floated" in open space, connected by car-accessible parkways" (Banister, 2012, p.3). "Le Corbusian modernism inspired skyscraper development and the City Beautiful Movement drew on the boulevards and promenades of the great European capitals" (Watson, 2009, p.166). His proposal for the "Radian city" is illustrated in Figure 4-5.

According to Le Corbusier, planners should control the society through ideal city forms that are organized, have no slums, are divided into functional zones, and equipped with modern transit network (Watson, 2009). In so doing, the physical determinism fallacy of

earlier movements was repeated in an even more extreme form. Here, there was also a clear emphasis on technological determinism. Following this philosophy, the modernist urban environment was created without soliciting the opinion of people for whom the city would be built.

On the other side of the Atlantic, Frank Lloyd Wright (another widely known figure of the modernism movement) proposed a more radical idea about the modern city. Influenced by his love of nature, Wright advocated for replacing large cities with low density settlements dispersed in space (Hirt, 2007). In his plan for the "Broadacre City", Wright proposed that the car ownership and extensive networks of highways could be utilized for the dispersion of homes and occupations. According to his proposal each household can own a large tract of land (at least 0.4 ha). Therefore people could live in a home surrounded by nature. The availability of cheap energy and the high rate of car ownership could be utilized to facilitate the connection between people (Banister, 2012; Basiago, 1996; Hirt, 2007; Watson, 2009). Wright believed that this is the only urban form that could give humans back their lost freedom and reunite them with nature (Hirt, 2007). His ideas can be regarded as highly influential in the promotion of suburban development in the United States which has led to numerous problems still challenging American planners.

Modernism movement had profound impacts on neighborhood planning. Modernist tenets were applied to both suburban subdivisions and downtown renewal plans (Hirt, 2009). However, viewing physical design as a panacea for various convoluted urban problems and failing to notice other underlying forces, these renewal plans have proved largely unsuccessful (Rohe, 2009). The modernist city was composed of disintegrated subdivisions. Urban subdivisions (neighborhoods) were in the form of superblocks where high-rise buildings were surrounded by abundant open space. Streets were designed with vehicles in mind. This resulted in the creation of quite streets and non-active frontages (Filion & Hammond, 2003), and deteriorated the social conditions and intensified the problem of social segregation.

The modernism movement has been widely criticized for its adverse impacts on both humans and environment. Urban historian, Lewis Mumford denounced modernism for its failure to make "a synthesis of nature, the machine, and human activities and purposes". This failure has caused serious damages to the nature (Basiago, 1996, p.143).

Buchanan (2012, p.137) decried that modernism has reduced architecture "to the level of functional appliance, a machine for living in, with a subservient status of a tool and of value only when in use". He continued to say that this is against the traditional role that buildings have played as "cultural artefacts" linking us to our ancestors and guiding our behavior in an appropriate form. Closely related to this criticism, Jane Jacobs has also reprimanded modernism for its inhumane scale (Silver, 2006).

A drawback, particularly germane to neighborhood sustainability, is the rigidity of zoning in the modernism proposals that segregates land uses, significantly increases the automobile dependency, and thereby has adverse impacts on environment and the livability of the developments. Seeking a way to address these shortcomings a new movement frequently called "Neo-traditional Planning" emerged in early 1980s. This movement will be further discussed in the following section.

4.2.4. The neo-traditional movement

In spite all frequent efforts to build self-contained communities with balance of job and housing, and reduced inequalities, the landscape of the cities in the latter half of the twentieth century was highly suburbanized. There were still a variety of unresolved problems such as sprawl, inequality, social segregation, traffic congestion, and pollution (Grant, 2006; Rohe, 2009). As stated above, previous movements came under fire from a number of scholars and practitioners for failing to build livable, healthy, and lively communities. In response to these criticisms, in early 1980s planners started to develop the neo-traditionalism as a form of postmodern urbanism (Sharifi & Murayama, 2013a). The efforts to develop neo-traditional planning were mainly initiated in the United States where figures such as Duany and PlaterZyberk , and Calthorpe were trying to imitate from traditional American neighborhoods, before the dominance of suburbanization, that were more walkable and compact (Basiago, 1996; Silver, 2006).

Over the last two decades, different names have been used to describe programs that have focused on neo-traditional principles. The Traditional Neighborhood Development (TND), Transit-Oriented Development (TOD), Urban Villages, New Urbanism, and Smart Growth are the most outstanding examples of neo-traditionalism. New-Urbanism is perhaps

the most well-known name across the planning community. It began to become widely used after the Congress for New Urbanism was founded in 1993 (Wheeler, 2004). Mixed use, mix of housing types, housing-job proximity, public transportation, minimized automobile dependence, human-scaled and attractive streetscape, walkable environment, clear edges, identifiable civic center, adequate open space, compact form, and medium-high density are the design principles common to all neo-traditional approaches.

TND and TOD are two outstanding forms of neo-traditional development. It can be said that they are complementary and their combination constitutes New Urbanism (Rutheiser, 1997). TND was mainly developed by the well-distinguished couple, Duany and Plater-Zyberk. They have been influenced by earlier planners such as Clarence Perry, Raymond Unwin, John Nolen, and Christopher Alexander. Their design philosophy which was first applied to Seaside, Florida (shown in Figure 4-6) , has widely diffused over the last two decades (Rutheiser, 1997). The basic constituting elements of this approach are "the neighborhood, the district, and the corridor" (Duany, Plater-Zyberk, & Speck, 2000, p.263).

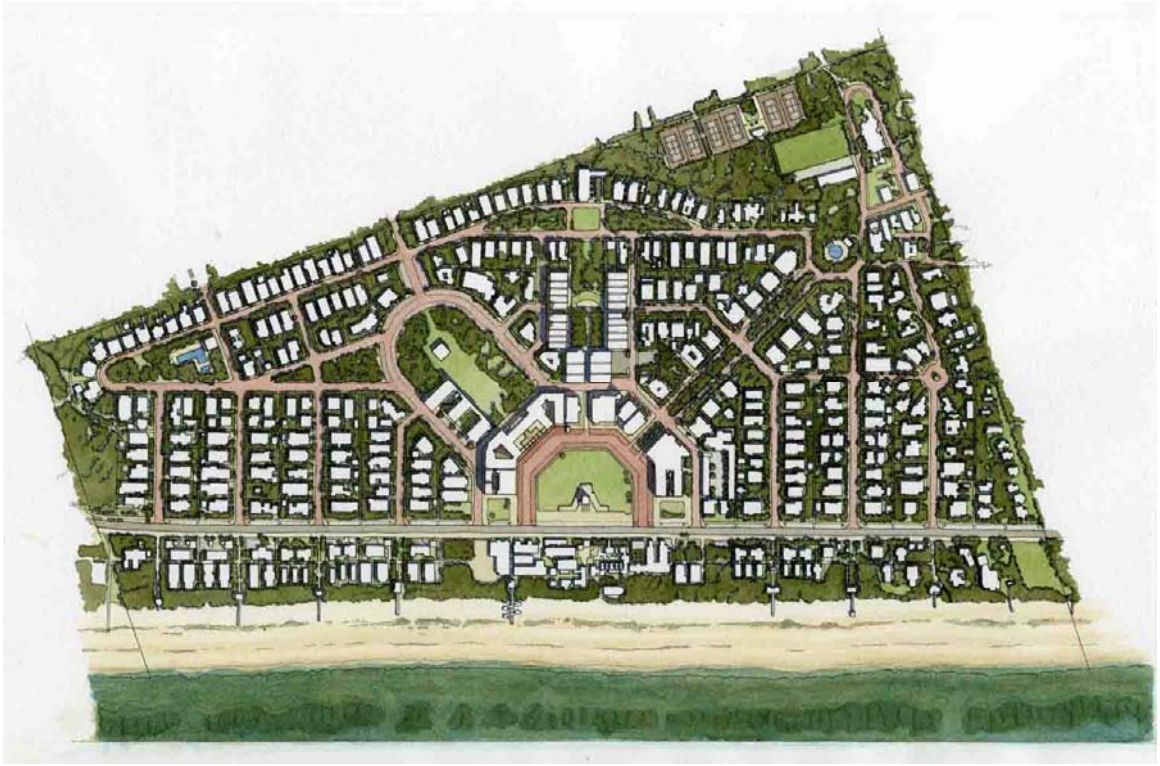


Figure 4-6. Seaside, Florida, planned by the planning and design team of Duany & Plater-Zyberk. Source: http://www.dpz.com/

TOD is mainly developed by Peter Calthorpe which was more influenced by Ebenezer Howard and Lewis Mumford (Rutheiser, 1997). Based on TOD principles "higher densities and better public transport access are traded off against the greater flexibility of the car" (Banister, 2012, p.4). Calthorpe suggests that pedestrians should be located within 10-minute walk distance of a transit station (Basiago, 1996). He emphasizes controlling sprawl, the need for infill and brownfield development, high density around transit nodes (Rutheiser, 1997), and incorporation of sidewalks leading towards central civic spaces for promotion of social encounters (Basiago, 1996). So, what makes him distinguished from Duany and Plater-Zyberk is that he pays more attention to the conservation of natural land (greenfield) (Rutheiser, 1997). This in turn has major implications for managing regional growth (Basiago, 1996).

Since the mid-1990s Smart Growth has been widely considered as a strategy for dealing with the problems associated with sprawl (Downs, 2005; Tregoning, Agyeman, & Shenot, 2002).

To address the problems caused by urban sprawl and enhance the conservation of environmental resources, Smart Growth advocates the following major principles: fostering development in areas where infrastructure already exists and revitalizing downtown areas and existing neighborhoods; limiting the outward expansion of urban areas and encouraging compact development; improving social equity and fulfilling the housing needs of people from various income groups; providing various transport choices and encouraging the use of public transit; creating mixed-use, walkable communities; improving urban aesthetics; encouraging citizen participation and collaboration between various stakeholders; and improving the transparency and fairness of decision-making for urban development (Berlin, 2002; Downs, 2005; EPA, 2012;Tregoning et al., 2002).

In terms of the institutional aspect of sustainability, smart growth involves the municipalities in the planning for growth within the regional urban framework, thereby reducing the negative externalities (Grant, 2006).

In reality, however, Smart Growth has not gained a considerable success in achieving its goals. Downs (2005, p.377) argues that more political support is needed to carry out the

principles of smart growth and asserts that unless the proponents of Smart Growth acknowledge this need it will “remain as a vision”.

As will be seen later in this thesis, a majority of the principles espoused by neo-traditional movements are used by the NSA tools to assess the sustainability of a neighborhood development (Furuseth, 1997; Grant, 2006; Stangl & Guinn, 2011). In addition to ensuring a good quality design, some of the elements of these models have also contributed to the environmental sustainability of communities. Because of focusing growth around transit nodes, TOD is an effective model for controlling sprawl and its environmental, social, and economic ramifications. Urban village model has further promoted sustainability through its emphasis on urban renewal and brownfield redevelopment.

All neo-traditional movements have a heavy focus on neighborhood as a basic planning unit. Neo-traditional movement and its precedents are not mutually exclusive. As a backlash against Modernism, the neo-traditionalist approach toward neighborhood bears a considerable resemblance to that of the planning movements in the early decades of the twentieth century (Fainstein, 2000). As in the earlier movements, the neo-traditional neighborhood is defined by edges and a well-defined center (Fainstein, 2000). However, there is less emphasis on a fixed size. Neo-traditional neighborhood movement is more flexible in this regard and is more focused on the catchment area of daily needs and the placement of facilities within walkable distances. Instead of carving out the neighborhood from the urban fabric, it is tried to establish a seamless integration across various scales. In his theory of transect, Duany (2002, p. 255) argues that a continuum from neighborhood to rural environment is needed to create an integrated landscape where “all component elements reinforce each other”. This is reflected in Duany Plater-Zyberk’s update of Perry’s neighborhood unit. As illustrated in Figure 4-7, measures such as replacing the surrounding highways with boulevards, and aligning the internal streets with those of the abutting neighborhoods are taken to enhance the integration with the surrounding neighborhoods (Farr, 2008).

Neo-traditional movement encourages planners to locate commercial facilities in the neighborhood center, instead of locating them close to traffic junctions. In so doing, planners aim to improve the sustainability and livability of the neighborhood. The major differences

between these movements are that, unlike the earlier movements, neo-traditional movement espouses medium-high densities, mixed use development, and citizen participation in the planning process.

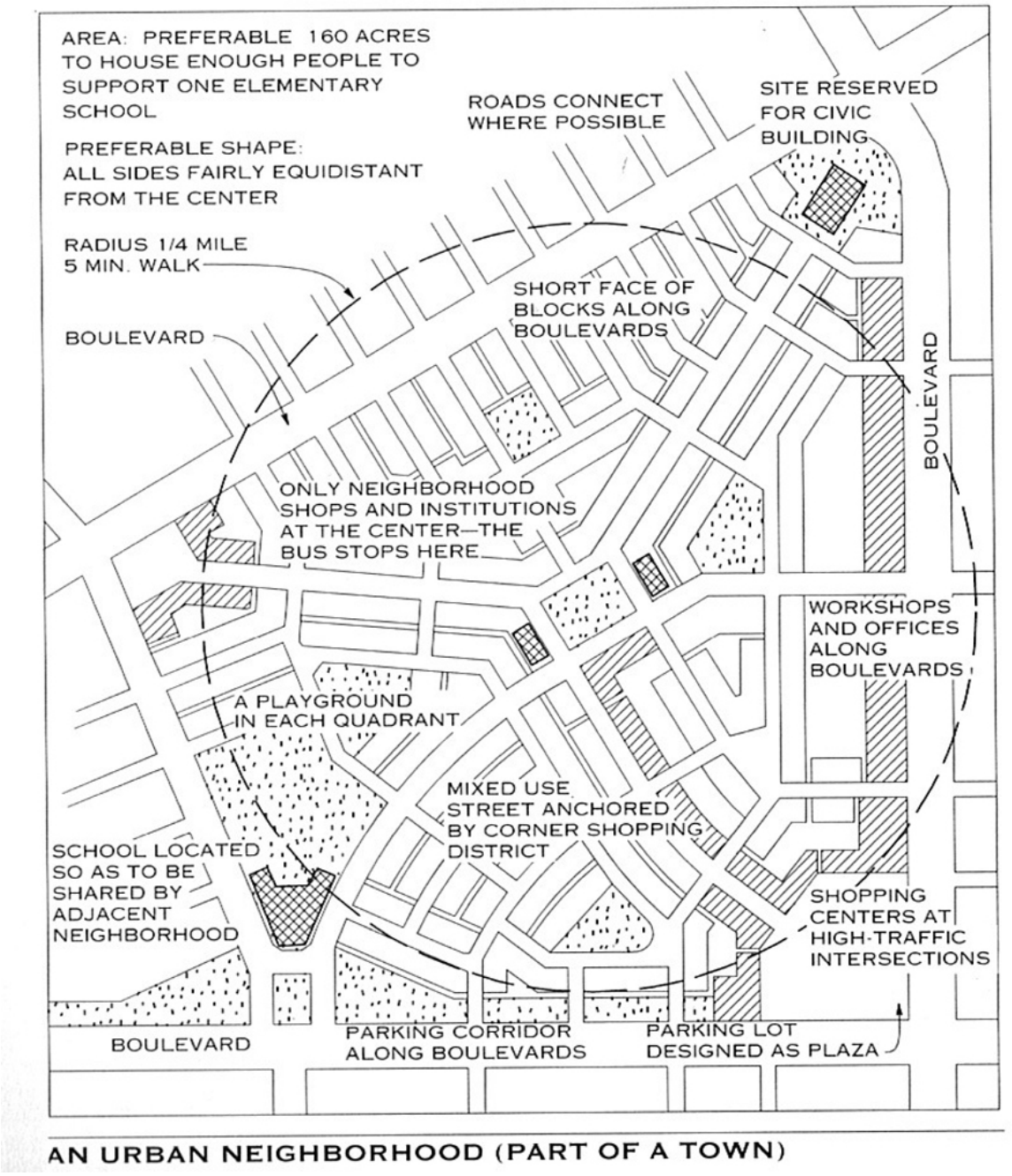


Figure 4-7. Duany Plater-Zyberk's version of Neighborhood Unit. Source: http://www.placemakers.com/2012/08/30/the-five-cs-of-neighborhood-planning/

Besides being praised and advertised as appropriate models for sustainable neighborhood development, in the literature, neo-traditional planning movements have been criticized for a number of reasons. Silver (2006) argues that New Urbanism has failed to learn from the mistakes of the previous urban movements. Critics point to the fact that, likewise the planners of the earlier movements, neo-traditionalists focus on physical form and believe that urban design alone can create better communities (Fainstein, 2000; Silver, 2006; Sohmer & Lang, 2000). Likewise the Neighborhood Unit Plan, New Urbanism has not been effective in reducing the socio-economic segregation in American cities (Fainstein, 2000; Silver, 2006). Another negative point, raised by Silver (2006) and Fainstein (2000), is that New Urbanism has mainly been practiced on greenfields and thus has not been successful in reversing suburban sprawl and addressing the ecological concerns.

Another harsh criticism of New Urbanism is made by Vanderbeek and Irazabal (2007). Acknowledging the major differences between Modernism and New Urbanism in terms of their origins and the political contexts in which they have been developed, Vanderbeek and Irazabal (2007) argue that both movements have sought to revolutionize the status quo through physical design. Both Modernism and New Urbanism believe in environmental determinism and the ability of physical design in creating communities that are livable and socially cohesive (Silver, 2006; Vanderbeek & Irazabal, 2007). Both movements have failed to acknowledge that despite being able to change the social situations of residents, the process of change is not easy to control. It is difficult to "predict the behavioral outcomes to which strict formal controls will eventually lead" (Vanderbeek & Irazabal, 2007, p.54).

The crucial role of the institutional support is another important issue that New Urbanism has failed to consider. Likewise what stated above, Rutheiser (1997) relates this to New Urbanism's faith in environmental determinism. He warns that for New Urbanism to be successful in achieving its goals, it should also consider the role of political forces that steer development.

The gap between rhetoric and reality of neo-traditional movement is another negative point that is worth noting here. Despite espousing tenets such as mixed use and mixed income , in reality the neo-traditional neighborhoods are largely homogeneous and can hardly be regarded as plural (Hirt, 2009). This can be explained by the importance of market forces

and the reliance of planners on private developers "to build and finance their visions" (Fainstein, 2000). Since the early years of modern planning, this has always been an impediment to full achievement of the planning goals.

We now have a general understanding of efforts taken during the past several decades to enhance the livability of urban neighborhoods. In the next section the way a new movement has begun that focuses on assessing the sustainability at the neighborhood level will be explained. Also, the necessity of using NSA tools as part of neighborhood planning process will be described.

4.3. Neighborhood and sustainability assessment

During the early 1990s, a new movement evolved following the widespread recognition of the concept of sustainable development among various parties involved in the research and practice of urban development. In essence, this movement has been seeking to encourage the creation of more livable, equal, and environmental friendly communities through the fusion of the principles of neighborhood planning, green construction, and sustainable development.

The initial focus of this movement was on the building scale. This was started when, in 1990, BREEAM was launched in UK to provide the construction industry with a set of standards for sustainable building design. Since then, the movement has expanded and numerous other assessment tools for the building level have been introduced.

Within the past decade the movement has moved toward assessment at the intermediate level of neighborhood. As stated earlier, the need to shift from building environmental assessment to NSA is gaining more and more recognition among researchers (Berardi, 2011; Cole, 2010). There are several reasons behind this trend. Systems theory can help us understand the underlying complexities of urban environments and their implications for impact assessment. Expanding the boundaries of assessment to the neighborhood level means that not only the single buildings, but also the spaces between them, the services that are provided, humans and other organisms that are living there, and the synergies between these broad range of elements and activities had to be considered in the assessment process

(Cole, 2010). Another reason is that assessment at the building scale is often reduced to the environmental dimensions and as Berardi (2011) argues, neighborhood is the minimum scale to take account of the social aspects. The same argument applies to the economic and institutional dimensions of sustainability. A neighborhood is likely to be the minimum level where the economies of scale can be better exploited and issues such as employment and job-housing proximity can be considered. It is also the level at which community-based interventions can be organized and residents can be involved in the decision-making process. However, it should be borne in mind that compared with assessment at the building level, NSA is a more challenging task. This is because it should also account for the inter-linkages between different constituents of the neighborhood. This often involves a higher amount of uncertainty.

NSA can also overcome one of the major limitations that assessments at municipal and metropolitan levels have to cope with. Heterogeneity of the latter scales makes it difficult, if not impossible, to generalize the assessment results to the whole study area and the policy interventions based on such results may fail to address the context-specific problems and be irrelevant to all the neighborhoods in an urban or metropolitan area (Berardi, 2011; Marique & Reitwr, 2011).

Through incorporating sustainability assessment into the neighborhood planning process, planners hope to foster sense of competition among the developers. This competition can enhance the whole process through raising standards and leading to innovation. In the meantime, it can be viewed as a learning and educational process that enhances the knowledge and awareness of different stakeholders involved in the process.

4.3.1. The notion of neighborhood in NSA

Above analysis of successive planning movements since the early years of the twentieth century made it clear that no single unique definition of neighborhood has been used. Perhaps physical features such as roads and rivers are the most commonly used boundaries for defining neighborhoods. Some similarities can also be found in terms of the context in which the planners' and urban visionaries' proposals for neighborhood development have been implemented. A look at the genealogy of neighborhood planning in

the twentieth century reveals that neighborhood planning has been mainly practiced in the form of suburban development. This implies that planners have had more land at their disposal, thereby giving them more room for maneuver to shape neighborhoods in the forms they wished to.

Since the introduction of the concept of sustainable development, the underlying mechanisms that shaped the city in general, and neighborhoods in particular, have undergone major transformations. Nowadays, the society is more aware of the ramifications of unrestrained development. Although, there might still be a considerable interest in suburban development which gives people a wider range of freedom in their life, concerns about the implications of this model of lifestyle have persuaded many people and policy-makers to look for alternative models (Hirt, 2009).

Sustainable neighborhood development has a special focus on protecting greenfields, controlling sprawl, and revitalizing inner urban areas. LEED-ND, BREEAM Communities , and CASBEE-UD are three NSA tools that have received a considerable amount of publicity. An investigation of 99 neighborhoods certified under these tools revealed that sixty percent are brownfield developments. Also, as can be seen from Figure 4-7 most of these neighborhoods occupy a relatively small area. The median size is 9.19 ha which is far smaller than size of neighborhoods in earlier neighborhood planning movements. Perry's neighborhood unit, for instance, covers an area of approximately 65 ha. The relatively smaller size of recent neighborhood development plans can be explained by two facts. First, there is a change of direction toward brownfield and incremental development which involves limited land availability. The second, and related, factor is the limitations in the financial resources available for neighborhood (re)development.

It should be noted, however, that flexibility in terms of size and drawing the boundaries does not mean that neighborhoods advocated by NSA tools have nothing in common with those of other neighborhood planning movements. Here, too, catchment area of facilities such as elementary schools, civic facilities, retail, and other services is used to ensure the walkability of the neighborhood. This is coupled with various other measures aimed at creating a pedestrian-friendly, livable, safe, green, and low-carbon neighborhood.

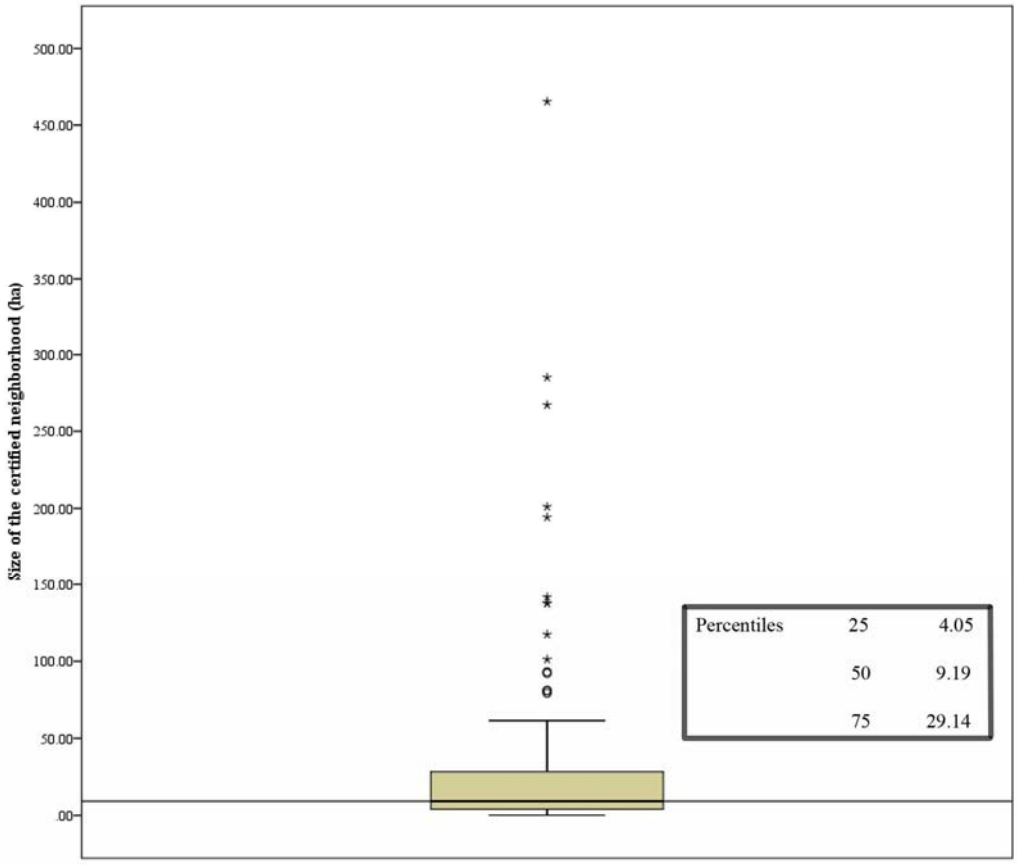


Figure 4-8. Distribution of the size of neighborhoods certified under NSA tools.

The neighborhood boundaries, as defined in the NSA tools, are blurred. This can be regarded as a positive effort to integrate the neighborhood the broader urban context and create a systemic whole. This is in contrast to earlier definition of neighborhood in which there was a risk of creating segregated communities carved out from the city structure.

The flexibility in identifying the neighborhood boundaries and defining the distance to facilities has several other merits. This can be regarded as a move to acknowledge the results of social research that emphasize the normativeness of the practice of identifying neighborhood boundaries. It is also in line with the pluralistic nature of the concept of sustainability (A. Bond & Morrison-Saunders, 2013). No need to mention that flexibility can facilitate policy interventions for incremental neighborhood development.

4.3.2. Existing research and unresolved issues

Although the significance of NSA is widely recognized among the scientific community, as it was noted earlier, the research conducted on this topic is still scarce. Existing research is mainly focused on the theoretical aspects of NSA. There are several studies that have examined some of the NSA tools to find out how successful they have been in addressing the sustainability concerns (AlQahtany et al., 2012; Black, 2008; Haapio, 2012).

Most of these studies have concentrated on the theoretical aspects of NSA tools. 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 (HQE^2R) 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 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, CASBEE-UD). Emphasizing 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.

In contrast, the empirical aspects are largely overlooked. In one of the few studies about the applicability of LEED-ND, Garde (2009) surveyed some LEED-ND pilot projects to

reveal which criteria are used most and least. He found out that implementation is highly market-oriented. Kyrkou et al. (2011) have conducted a case study analysis to examine the applicability of LEED-ND in the English context. Saynajoki et al. (2012) have conducted a similar study about the appropriateness of LEED-ND, BREEAM Communities, and CASBEE-UD for the Finnish context. Both these studies emphasize the importance of adaptation to locality.

To the best of my knowledge, there is no research that investigates the theoretical and practical aspects and applicability of these NSA tools in different contexts through evaluating multiple cases from different countries. This is the approach taken in this thesis. Both theoretical and empirical aspects of NSA are scrutinized using tools from different countries. This approach can provide more insights about the NSA in action, and gives a better basis for judgment of the viability of developing universal standards.

The theoretical issues are mainly discussed in Chapter 5, and the results of the detailed analysis of the empirical aspects are reported in Chapter 6. Since the methodologies applied for analyses in these two chapters are different, the methodology and materials used for research will be described at the outset of the respective chapters. It is worth bearing in mind that due to the interconnections between the theoretical and practical aspects of NSA, each chapter does not exclusively address the theoretical or practical issues and in some cases it is necessary to simultaneously consider both of them.

Next section concludes this chapter by outlining the main issues raised and highlighting their implications for this research.

4.4. Summary and implications for research

This chapter began with a brief explanation of the significance of planning at the neighborhood level. It was emphasized that neighborhood as an immediate living environment plays a crucial role in maintaining the socio-economic sustainability of the urban environment. As a constructing element of the city, it has also the important physical role of shaping the urban environment.

It was noted that neighborhood has historically been considered as a fundamental element of the city. Due to the size limitations of this thesis, only the major relevant planning practices since the beginning of the twentieth century were reviewed. Based on the similarities between the neighborhood planning theories and practices, they were divided into four main categories of movements. These are “the garden city movement”, “the neighborhood unit movement”, “the modernism movement”, and “the neo-traditional movement”.

Garden city was initiated in early 1990s in response to the various problems and dilemmas associated with the industrialized city. Ebenezer Howard (widely recognized as the harbinger of the garden city movement) proposed a plan to combine the good qualities of town and country through building small, self-contained towns around an older city. Clarence Perry was another person who contributed to this movement through his plan for “neighborhood unit”.

These utopian plans were successful in stimulating research and planning for better environment and created a basis for future thinking on neighborhood planning. However, they had a limited success in achieving the goals of social reform and were rarely operationalized.

During the inter-war period of 1920s and 1930s, the modernism movement started to gain recognition among planners. Advocates of this movement were in favor of using the modern technologies (such as highways, cars, etc.) for making better environments. Likewise the garden city movement, this movement was trying to reunite human and nature through providing abundant green space in the city. To this end, they proposed the complete destruction of the existing cities and replacing it with a new urban structure built based on the utilization of modern technologies.

They were, however, unable to pass the test of time. Having strong faith in environmental determinism, modernist figures such as Le Corbusier and Frank Lloyd Wright failed to reunite human and nature and their products had adverse impacts on both. They were also rarely put into practice and mainly adopted by the socialist countries. Their separation of city into functional zones increased the car dependence and emissions from driving. The social structure of the modernist city was fragmented and most of the population (especially

in the US) was living in highly homogenous suburbs. This left the inner areas of most cities abandoned and unsafe.

In response to these problems, the neo-traditional planning movements was introducing during 1980s. Leading figures such as Peter Calthorpe, and Duany and Plater-Zyberk sought to solve these problems through applying good design codes. Issues such as mixed use, walkability, civic center, open-space, and medium-high density were highly emphasized.

However, critics of neo-traditional planning argue that it has repeated the mistakes of the previous movements by assuming that physical design is able to solve the urban problems. In most of the cases, neo-traditional planning has been practiced on greenfields and therefore has not contributed to the control of suburban sprawl. Other important shortcoming of this movement is its failure to take into consideration the role that the institutional dimensions and the political context play in creating an equal, livable, and sustainable urban environment.

Over the past decade, there has been an increasing interest in combining the principles of neighborhood planning and sustainable development. Several tools (both country-specific and international) have been developed to assess the sustainability of neighborhood (re)development plans. Planners and local authorities are hopeful that these NSA tools and the rating that they provide can be helpful in motivating developers to build communities that are more sustainable.

NSA's definition of neighborhood does not completely match the definition provided in earlier movements. It was argued that traditional definitions, such as those provided in the "neighborhood unit" or "garden city", are not fully valid for use in sustainability research. Sustainability assessment requires a flexible definition that is in line with the pluralistic nature of sustainability and facilitates policy intervention.

The review of the major neighborhood planning movements since the early years of the twentieth century revealed that in most cases they have faced major difficulties in putting the theory into action. Despite all these efforts, cities today are facing various problems that threaten their sustainability. Issues such as equity are not well addressed. Greenfields are still consumed by cities at a great rate. There is still a high degree of dependence on car and most

cities are not walkable. The current urban patterns have resulted in the increase of energy use and emission. This has enormous implications for the global sustainability.

Against this backdrop, this thesis tries to investigate whether the existing NSA theory and practice has been successful in learning lessons from the past mistakes and correcting them, and if practicing them can improve the prospect of sustainability in urban environments.

Next chapter is mainly concerned with the theoretical aspects of NSA and examines seven selected NSA tools to find out if they have been successful in addressing the sustainability concerns.

Chapter 5 Critical review of seven NSA tools

> Your criticism polishes my mirror.
>
> *Rumi*

Critical research refers to a variety of research methodologies that are used to "challenge" existing and/or accepted theories, principles, and courses of action (University of Strathclyde, 2013). It aims at gaining knowledge about the constructing elements of the object of study, revealing its downsides, shedding light over its positive aspects, and providing suggestions for its future improvement.

As the word "criticism" implies, it can be expected that a critical report would be mainly dealing with the shortcomings of the object of the study. This is the approach that has been taken in this thesis. The focus of this chapter is on the critical analysis of tools developed to assess the capability of a proposed development to contribute to sustainable development.

The main purpose of this chapter 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.

In this chapter the main focus would be on the theoretical aspects of the NSA tools. Tools and initiatives from different countries are analyzed and discussed, using a designed framework presented in section 5.2, 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 the purpose is to evaluate to which degree they are able to incorporate the different dimensions of sustainability and go towards bringing about sustainable neighborhoods. Furthermore, it was intended to

highlight the areas where the tools are lagging behind and come up with ideas for their improvement.

Section 5.1 provides an overview of existing NSA tools, and categorizes some of the mostly practiced ones. Section 5.2 presents the research methodology used in this chapter, and briefly introduces the criteria used for analyses and framework designed for this research. It also clarifies the rationale for selecting some of the tools for further analysis. Based on this rationale, seven tools are selected to be analyzed against the designed evaluation framework. Section 5.3 briefly introduces the NSA tools selected for analysis in this chapter. In Section 5.4, 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 5.3. 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 5.5 discusses the findings of this study and makes some suggestions for consideration in the future refinements.

5.1. An overview of existing NSA tools

Neighborhood is widely recognized as a fundamental building block of a city, and a good starting point to create a truly sustainable community. Earlier, the way sustainable neighborhood planning has gained momentum since the turn of the century was described. This happened after the importance of neighborhoods as the frontlines in the battle for sustainability (Choguill, 2008) was acknowledged. This is a reason why in some countries around the world, initiatives have been taken to pave the way for making sustainable neighborhoods.

Also, after realizing that assessment of the single buildings is not enough for achieving the sustainability goals (Berardi, 2011; Haapio, 2012), many of those countries that practice planning at the neighborhood level developed tools to assess the sustainability performance of neighborhood plans and their success in the way towards achieving sustainability.

Over the past decade or so, the neighborhood sustainability assessment tools have been burgeoning. Today there is a large number of assessment tools exclusively designed for evaluating sustainability at the neighborhood level.

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. Depending on the stage of neighborhood development in which the assessment is undertaken, NSA tools might have different purposes.

When applied at the early stages of the plan making process, the main purposes of an NSA tool are to inform decision-makers about the possible impacts of the proposed development, and uncover the weaknesses of the proposal and find ways for bolstering them. It can be said that at this stage, NSA tool would mainly play the role of decision support systems (DSSs). Since the construction work has not yet started and the proposed plan can still be modified, this is perhaps the most important stage at which an NSA tool can and should be applied.

When the project is under construction, an NSA tool can play the role of a guiding tool. It can reveal impacts that have not been addressed earlier. In the case no assessment has been taken in the previous stage, NSA can take up some of the roles that assessment tool should have played at the planning stage and make necessary modifications to the proposed plan.

The main purposes of an NSA tool at the post-construction stage are to assess the neighborhoods' position on the way towards sustainability, and specify the extent of neighborhoods' success in approaching sustainability goals. Therefore, it can be said that, at this stage, it would be mainly used as a monitoring tool.

While the assessment tools considered in this study can be used at all these different stages, the main focus in this thesis would be on NSA tools applied early in the plan making process.

Table 5-1. Some of the tools available for certifying neighborhood (re)developments.

	Tool's name	Developer(s)	
Spin-off tools	LEED-ND	USGBC, CNU, NRDC	US
	EarthCraft Communities (ECC)	The Greater Atlanta Home Builders Association, the Atlanta Regional Commission, the Urban Land Institute Atlanta District Council, and Southface	US
	Star Community Index	International Council for Local Environmental Initiatives (ICLEI), USGBC, National League of Cities, Center for American Progress	US
	BREEAM Communities	Building Research Establishment (BRE)	UK
	CASBEE-UD	JSBC/ Japan Green Building Council (JaGBC)	Japan
	DGNB for Urban Districts	German Sustainable Building Council	Germany
	Qatar Sustainability Assessment System (QSAS) Neighborhoods	Gulf Organization for Research and Development	Qatar
	Green Star Communities	Green Building Council of Australia	Australia
	Green Mark for Districts	Building and Construction Authority (BCA)	Singapore
	Green Neighborhood Index (GNI)	Malaysian Institute of Architects (PAM) and the Association of Consulting Engineers Malaysia (ACEM).	Malaysia
	Neighborhood Sustainability Framework	Beacon Pathway	NZ
	Pearl Community Rating System	Abu Dhabi Urban Planning Council	UAE
Plan-embedded tools	HQE^{2}R	CSTB	EU
	ECOCITY	EU research project (John Thompson and Partners , to be checked)	EU
	Sustainable Community Rating (SCR)	Victorian State Government	Australia
	EcoDistricts Performance and Assessment Toolkit	Portland sustainability institute (PoSI)	US
	Cascadia Scorecard	Sightline Institute	US
	One Planet Living (OPL)	BioRegional Development Group and WWF International	UK
	One Planet Communities	BioRegional	UK
	Sustainable Project Appraisal Routine (SPeAR)	ARUP	UK

There are currently several NSA tools worldwide which can be divided into two main categories. The first category consists of third-party assessment tools. Most of these tools are spin-offs of building assessment tools, and assess the sustainability beyond a single building. These are mainly commercialized certification programs for the neighborhood level. The second one includes tools which are embedded into neighborhood-scale plans and sustainability initiatives, to assess their sustainability performance. In this chapter tools from both categories are used for analysis. In this thesis, 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 5-1 lists some of the tools available for certifying the sustainability of neighborhood (re)development plans. In the next section the methodology used in this chapter is described. The methodology also involves introduction of some criteria for selecting some NSA tools for an in-depth analysis. Based on these criteria, seven tools are selected for further analysis.

5.2. Methods and materials

Here, first the method used for the analysis in this chapter will be described. Following this, the rationale for selecting seven cases for an in-depth analysis, and materials used for the analysis in this chapter will be explained.

5.2.1 Research Methodology

A combination of qualitative and quantitative methods has been used for the purpose of this chapter. This combination of methods is utilized in a multiple case study analysis. Analyzing multiple cases expands the scope of the work and provides a better basis for analysis. Results of such analyses would, therefore, be more reliable, verifiable, and generalizable (Cavaye, 1996; Hurley, 2011; Yin, 2003).

The case study of several NSA tools would be helpful in clarifying the effectiveness of the NSA tools, investigate their application as an "intervention" in "the real-life context", shed light over the "situations" where that "intervention" has occurred (Yin, 2003, p.15).

The framework for analysis was designed with the purpose of answering the main research question of this chapter which is to what degree and how sustainability has been incorporated into NSA tools. Since the topic of this chapter revolves around the concept of sustainability, an extensive review of literature on sustainability was used as a basis for developing the framework for analysis. Details about the literature review on sustainability are presented in Chapter 2. Moreover, results of literature review on impact assessment were also used to identify criteria for evaluating the performance of the selected NSA tools. The literature review on impact assessment (presented in Chapter 3) indicated that, in some cases, impact assessment tools have not performed well in addressing issues related to adaptation, applicability, and participation. Therefore, these criteria were considered in the 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. As stated earlier, one aim for which NSA tools are designed is 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 detail in Chapter 4. Since criteria and indicators are the building components of any sustainability framework, here those characteristics that make a group of indicators suitable for assessment of sustainability conditions will be described. Indicators used for sustainability assessment must be integrating (covering multiple issues and considering linkages among them ((Maclaren, 1996), forward looking (intergenerational equity), distributional (intragenerational equity), developed with input from multiple stakeholders (procedural equity) (Maclaren, 1996 ; Haughton and Hunter, 2003), 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 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 proximate 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 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.

5.2.2. Materials used and cases selected for further analysis

Yin (2003) argues that "six sources of evidence" can be used in a case study research. Table 5-2 summarizes these sources and compares their strengths and weaknesses.

This table is used as guidance for data collection for the case study analysis here and in the next chapter. For the purpose of this chapter's analysis, documentation and interviews were the sources of data collection. 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 the introduced framework. Most of these documents are available online. 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.

Several factors were considered for selecting cases for in-depth analysis. The intention was to select cases for which enough data is publicly available. Since sustainability is the main focus of the analysis, it was also necessary to select cases, in which a relatively holistic approach toward sustainability is taken (tools including a minimum number of criteria for assessing environmental, social, economic, and institutional aspects of sustainability). As shown in Table 5-1, NSA tools can be divided into two main types: independent, third-party assessment tools, and those embedded in the broader planning framework. As it was intended to investigate the impact of incorporating NSA tool into the broader planning framework on its success and uptake, care was also taken to select NSA tools from both categories. The last criteria for selecting tools was to, as much as possible, have tools from a broad range of geographical locations.

Table 5-2. Different sources of evidence for use in a case study research. Source: (Yin, 2003)

Sources of Evidence	Strengths	Weaknesses
Documentation	• Stable-can be reviewed repeatedly • Unobtrusive- not created as a result of the case study • Exact- contains exact names, references, many events, and many settings	• Retriveability- can be low • Biased selectivity, if collection is incomplete • Reporting bias- reflects (unknown) bias of author • Access-may be deliberately blocked
Archival Records	• [Same as above for documentation] • Precise and quantitative	• [Same as above for documentation] • Accessibility due to privacy reasons
Interviews	• Targeted- focuses directly on case study topic • Insightful- provides perceived causal inferences	• Bias due to poorly constructed questions • Response bias • Inaccuracies due to poor recall • Reflexivity- interviewee gives what interviewer wants to hear
Direct Observation	• Reality- covers events in real time • Contextual- covers context of event	• Time-consuming • Selectivity- unless broad coverage • Reflexivity- event may proceed differently because it is being observed • Cost-hours needed by human observers
Participant Observation	• [Same as above for direct observations] • Insightful into interpersonal behavior and motives	• [Same as above for direct observations] • Bias due to investigator's manipulation of events
Physical Artifacts	• Insightful into cultural features • Insightful into technical operations	• Selectivity • Availability

After an initial inspection of the NSA tools presented in Table 5-1, it was found that many of them comply with the above mentioned conditions for an appropriate case. However, compliance rate was higher among tools in the "spin-offs" category. Given the time and size limitation of this research, it was not possible to survey all the tools. Therefore it was decided to select a limited number that meet the criteria stated above.

Accordingly the following seven major NSA tools are selected for further analysis: LEED-ND, (ECC), BREEAM Communities, CASBEE-UD, HQE^{2}R, ECOCITY, and SCR. The first four tools are from the "spin-off" category. Rests of them are tools embedded in the broader planning framework. The characteristics of these seven major NSA tools are summarized in Table 2. It can be seen that there are some major differences in terms of the structure and also contents of the selected assessment tools. However, all these selected tools comply with the criteria for case selection that was outlined above. In the next section a brief description of each of these selected tools is presented.

Table 5-3. Characteristics of the selected NSA tools

NSA tool	Development date	Country/ Region	Ratings		Themes
LEED-ND	2009 (pilot 2007)	USA, Canada, China	* Certified	40-49	Smart location and linkages; Neighborhood pattern and design; Green infrastructure and Buildings; Innovation and design; Regional priority credit
			* Silver	50-59	
			* Gold	60-79	
			*Platinum	80-100	
ECC	2003	USA	Minimally acceptable green development : 100 points plus the pre-requisites		Site selection; Water management; Planning and design; Preservation landscape; Community engagement; Green building
BREEAM Communities	2009	UK	Unclassified	<25	Climate and energy; Resources; Place shaping; Transport; Community; Ecology and biodiversity; Business; Buildings
			Pass	≥25	
			Good	≥40	
			Very good	≥55	
			Excellent	≥70	
			Outstanding	≥85	

CASBEE-UD	2006 (Revised 2007 Edition)	Japan	Poor(C)	BEE≥3	Natural environmental quality in urban development; Service function for the designated area; Contribution to the local community (history, culture, scenery, and revitalization); Environmental impact on microclimates, façade, and landscape; Social infrastructure; Management of the local environment
			Fairly Poor (B-)	BEE=1.5-3.0	
			Good (B+)	BEE=1.0-1.5	
			Very Good (A)	BEE=0.5-1.0	
			Excellent (S)	BEE<0.5	
HQE²R	2001-2004	7 European Countries (Denmark, France, Germany, Italy, Netherlands, Spain, UK)	-3 -2 -1 0 1 2 3		Resources and heritage; Local environment; Diversity; Integration; Social life
ECOCITY	2002-2005	7 European Countries (Austria , Finland, Germany, Hungary, Italy, Slovak Republic, Spain)	* E	Poor	Context; Urban structure; Transport; Energy flows; Material flows; Socio-economic issues; Processes
			* D	Normal Practice	
			* C	Advanced	
			*B	Best Practice	
			* A	Innovative	
SCR	2007	Australia	-		Commercial success performance measurement; Housing affordability performance measurement; Community well-being performance measurement; Urban design excellence performance measurement; Environmental leadership performance measurement

5.3. Brief description of the selected NSA tools

For the sake of brevity, each tool is only briefly introduced here. For complete details on these three tools, see the corresponding references at the end of this paper.

5.3.1. LEED-ND

In 2007, United States Green Building Council (USGBC), Congress for New Urbanism, and the National Resources Defense Council (NRDC), came together to found LEED-ND as a voluntary tool for guiding sustainable neighborhood development. LEED-ND is the latest product of the U.S. Green Building Council's (USGBC) family of assessment tools. This third-party NSA tool's pilot version was launched in 2007 and its latest version is LEED 2009 for Neighborhood Development (LEED, 2012). Many projects in US have adopted LEED-ND as a guiding framework for neighborhood development plans. It has also been used by developers in other countries such as Canada, China, Malaysia, and South Korea. LEED-ND is highly influenced by the principles of smart growth, new urbanism, and green building, described in Chapter 4.

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 (USGBC, 2011).

Assessment criteria are categorized into five themes: "smart growth and linkages", "neighborhood pattern and design", "green infrastructure and buildings", "innovation and design process", and "regional priority credit" (LEED, 2012). Each theme is further divided into individual criteria. Based on the opinions of the panel of experts involved in the development of the assessment scheme, weights are allocated to each of the criteria. Those deemed to have more impacts are weighed more heavily than others. There are specific benchmarks for assessing success of the development in addressing the criteria. The performance is compared against the benchmark to determine the number of credits each criterion can achieve. The achieved credits are then added together to give the overall LEED-

ND score. A list of the main themes of assessment and the four levels of certification are shown in Tables 5-3. The 2009 version of LEED-ND has been used for analyses in this paper.

5.3.2. 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). A list of the assessment themes used for assessing the sustainability performance are presented in Tables 5-3.

5.3.3. 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 the latest assessment tool in the BREEAM assessment family. BREEAM Communities is an independent, third-party assessment certification standard based on the established BREEAM methodology (BRE, 2011; BREEAM, 2012). It was first developed in 2011 by BRE Global, and its 2012 version has recently been released.

BREEAM Communities advocates for the consideration of sustainability principles at the earliest stage of the design process for the development, and to measure and independently certify the sustainability of project proposals at the planning stage of the development process (BRE, 2011). The 2011 version, which has been used in this study, divides the assessment criteria into nine separate themes: “climate and energy”, “resources”, “place shaping”, transport and movement”, “community”, “ecology and biodiversity”, “business and economy”, “buildings”, and “innovation” (BRE, 2011). Each of these themes is further broken down into

individual criteria. Depending on the performance of the development, each criterion can receive up to three credits. To acquire one credit, minimum acceptable performance levels related to that criterion must be satisfied. Higher performance levels are needed for acquiring two credits, and if the entire requirements are met, the development can be awarded all three available credits for that specific criterion. These credits are then multiplied against the corresponding regional weighting to provide the credits achievable for that particular criterion (BRE, 2011). The final score of each theme is calculated by dividing the total number of the acquired credits by the total number of credits available for that specific theme. The arithmetic mean of the scores of all nine themes is then multiplied by 100 to yield the final score. A list of the assessment themes and the six levels used for ranking the sustainability performance are presented in Tables 5-3.

5.3.4. CASBEE-UD

As one of the earliest schemes for assessing neighborhood development, CASBEE-UD is a collaborative product of Japan Green Building Council (JaGBC), and Japan Sustainable Building Consortium (JSBC). Committees from academia, industrial, and government sectors were involved in the development of CASBEE-UD (Sev, 2011). It was developed in 2006 and its 2007 version has been used in this thesis. 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 New Construction. It is an independent assessment certification tool developed to contribute to enhancing sustainability in urban plans. Unlike the other two assessment tools used in this study, CASBEE-UD excludes the interiors of buildings 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 (IBEC, 2007, p.3).

CASBEE-UD applies a unique methodology for assessment in which environmental efficiency is calculated by dividing the environmental quality (QUD) within the site boundary to environmental load (LUD) on the spaces beyond the site boundary. The criteria for environmental quality are divided into three themes of “natural environment”, “service functions for the designated area”, and “contribution to the local community”. In a similar

vein, “environmental impact on microclimates, façade, and landscape”, “social infrastructure”, and “management of the local environment” are three themes used for assessing the environmental load.

Each of these themes is further divided into different criteria, which in turn are broken down into individual sub-criteria and indicators. Each sub-criterion is evaluated on a one-to-five scale. Level three which represents the normal situations in Japan is used as the reference level for assessment. Credits are awarded based on how much the performance is above or below level three. To mention one example: In Japan, normally between five to ten percent of the development area is covered with pervious materials. If a given development includes between ten to fifteen percent of pervious area, it will acquire four credits for this particular criterion. Five credits are available for coverage rate of more than fifteen percent, and two and one credits for less than five percent and zero percent respectively.

CASBEE-UD applies weights to nested categories of criteria. The weighted scores of sub-criteria are added up to give the total score of the higher level criteria. This procedure is reiterated until the scores for environmental quality (Q) and environmental load (L) are obtained. The final score for the development is called Building Environment Efficiency of Urban Development (BEEUD), and is calculated using Equation 1:

$$(1)\ BEE_{UD} = \frac{25 \times (Q_{UD} - 1)}{25 \times (5 - L_{UD})} \text{ (IBEC, 2007)} \qquad (1)$$

A list of the assessment themes and the five levels used for ranking the sustainability performance are presented in Tables 5-3.

5.3.5. 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 co-ordinated by Centre Scientifique et Technique du bâtiment (CSTB) in France (Charlot-Valdieu, Outrequin, & Robins, 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 & Grossi, 2003).

A list of the assessment themes and the seven levels used for ranking the sustainability performance are presented in Tables 5-3.

5.3.6. 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 & 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, Huismans, & Skala, 2008).

A list of the assessment themes and the five levels used for evaluating the sustainability performance are presented in Tables 5-3.

5.3.7. 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, p.7).

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).

A list of the assessment themes used for ranking the sustainability performance are presented in Tables 5-3.

In the next section each of these NSA tools is evaluated against the framework introduced in Section 5.2.

5.4. Analysis using the framework

5.4.1. Sustainability coverage

To investigate the tool's potential for sustainability coverage, it is necessary to first clarify what is meant here by the term sustainability. A more complete description of this term is presented in Chapter 2. Here, only the approach taken for this analysis will be described.

Since the publication of Bruntland report (World Commission on Environment and Development (WCED), 1987), numerous definitions of what sustainable development entails have been made (Boyoko, Cooper, Davey, & Wootton, 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 is meant 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 sustainability is considered 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.

Theme, criterion, indicator, and benchmark are four terms that are frequently used in the rest of this thesis. To avoid confusion, it is necessary to briefly describe what is meant here by each of these terms. Themes are the broad topics of concern to sustainability. Each theme has one or more criteria which, as defined by Munier (2004, p.47), 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. And finally, benchmark denotes a point of reference against which the performance of each indicator is measured.

This can be better explained through giving examples: "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 reduction in neighborhood's annual heating /or cooling consumption" and "the ratio of solar oriented buildings". To measure the performance of these indicators, "five percent annual reduction" and "eighty percent solar oriented buildings" can be used as benchmarks.

As another example, consider "neighborhood design" to be a theme which includes "green space" as a criterion, and "size of the green space" as an indicator. To measure the performance of this indicator, "2 ha" can be used as a benchmark.

For the purpose of this analysis, a matrix was created to check the availability of indicators across the selected NSA tools. As the matrix was completed, it was decided to consolidate similar criteria together. Table 5-4 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 5-5. 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.

Table 5-4. Percentage distribution of the frequency of indicators falling under each main theme.

Theme	Criteria	Percentage of the frequency of indicators falling under each theme and criteria													
		LEED-ND		ECC		BREEAM		CASBEE-UD		HQE^{2}R		EcoCity		SCR	
Resources and environment	Water	14		11		3		13		7		3		4	
	Energy	9		4		6		9		7		15		6	
	Materials, ecosystem, biodiversity, Resources conservation, etc.	10	33	18	33	14	23	19	41	12	26	8	26	8	17
Transportation		9		12		19		10		7		15		8	
Social	Affordable housing	2		1		2		0		2		3		4	
	Inclusive communities	0		3		3		0		5		3		2	
	Safety, community well-being, community outreach, heritage, social networks, etc.	7	9	11	15	6	11	6	6	38	45	9	15	20	26
Economic	Local Jobs and economy, finances, investments, employment, business	2		2		8		0		5		6		15	
Location, site selection		11		14		5		3		2		6		4	
Pattern and design	Mixed use	2		1		2		0		2		3		4	
	Green infrastructure, compact development, access, urban planning and design standards , etc.	29	31	22	23	30	32	40	40	13	15	29	32	21	25
Innovation	Accredited professionals	2		0		0		0		0		0		0	
	Innovation	3	5	1	1	2	2	0	0	0	0	0	0	5	5

As tables 5-4 and 5-5 indicate, different tools have different emphasizes. All the tools (except HQE^{2}R) are biased towards criteria for resources and environment and pattern and design. HQE^{2}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.

Table 5-5. Degree of emphasis on major themes in the seven selected NSA tools.

Theme	Criteria	Percentage of the maximum points achievable for each main theme and its sub-themes													
		LEED-ND		ECC		BREEAM		CASBEE-UD		HQE²R		EcoCity		SCR	
Resources and environment	Water	9		9		4		13		7		3		5	
	Energy	6		11		6		9		7		15		5	
	Materials, ecosystem, biodiversity, Resources conservation, etc.	3	18	13	33	13	23	19	41	12	26	8	26	5	15
Transportation		5		8		17		10		7		15		8	
Social	Affordable housing	6		4		1		0		2		3		13	
	Inclusive communities	0		5		3		0		5		3		2	
	Safety, community well-being, community outreach, heritage, social networks, etc.	5	11	3	12	7	11	6	6	38	45	9	15	15	30
Economic	Local Jobs and economy, finances, investments, employment, business	3		2		7		0		5		6		25	
Location, site selection		18		12		5		3		2		6		1	
Pattern and design	Mixed use	4		11		2		0		2		3		1	
	Green infrastructure, compact development, access, urban planning and design standards, etc.	27	36	20	31	29	31	40	40	13	15	29	32	11	12
Innovation	Accredited professionals	1		0		0		0		0		0		0	
	Innovation	8	9	2	2	6	6	0	0	0	0	0	0	9	9

All the tools except CASBEE-UD have included some criteria for mixed use development. Since the sustainability issues are inter-related (Mateus & Braganca, 2011; Valentin & 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 5-4 and 5-5 suggest that the tools do not have a similar approach towards inclusion of social criteria. There are many criteria defined for this theme by HQE²R 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 does not necessarily mean inclusiveness and vice versa. It is also worth mentioning that the tools do not 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 framework.

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 infill, brownfield, 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 & 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.

As the NSA tools evolve, institutional sustainability criteria are expected to be added to the sustainability checklists in order 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, Borruso, and Lapucci (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 & Berke, 2004; Dahl, 2007; Hacking & 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. 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 5.4.3 and 5.4.4.

It should be mentioned however, that inclusion of a specific criterion in the assessment system does not guarantee its implementation, and there should be other mechanisms for enforcement. Section 5.4.2 brings up the importance of having pre-requisites in the assessment framework.

5.4.2. Inclusion of pre-requisites

In the previous section it was warned that inclusion of criteria per se does not 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 5-6 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, Garde (2009) found out that developers avoid compliance with those criteria which have fewer points and at the same time are costly to achieve.

Table 5-6. Percentages of mandatory and optional elements in NSA tools.

	LEED-ND	ECC	BREEAM Communities	CASBEE -UD	HQE²R	ECOCITY	SCR
Mandatory	21%	24%	24%	0%	0%	0%	0%
Optional	79%	76%	76%	100%	100%	100%	100%

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 5-7, 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 EQH²R 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.

Table 5-7. Distribution of mandatory elements across those tools which have required mandatory criteria

Theme	Criteria	LEED-ND		ECC		BREEAM	
Resources and environment	Water		7		0		
	Energy						3
	Other Resources (Materials, ecosystem, biodiversity, Resources conservation)		5		0		9
Transportation							3
Social	Affordable housing						
	Inclusive communities						
	Safety, community outreach, health and wellbeing, education, cultural, heritage, social networks,…				0		
Economic	Local Jobs and economy, finances, investments, employment						
Location, site selection			7				
Pattern and design	Mixed use						
	Green infrastructure, compact development, access, urban planning and design standards		3		8		5
Total		2	00	5	00	6	00

SCR assessment tool does not 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 acquirement of certification easy, it increases the possibility of failing to notice the basic criteria of sustainability.

5.4.3. 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.

Table 5-8 suggests that among the studied NSA tools, only HQE^{2}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.

Table 5-8. NSA tools' way of adapting the assessment tool to different situations.

Tools	Characteristics
LEED-ND	4 credit for addressing geographically-specific environmental, social equity, or public health priorities.
ECC	Categorizes regions into Piedmont &mountain, and Coastal, however the conditions are just different for two criteria: Protection of flood plains and protection of steep slopes.
BREEAM Communities	All the acquired points are multiplied against corresponding regional weightings - specified for 9 regions- to provide the BREEAM Communities score available for that particular issue.
CASBEE - UD	CASBEE-UD has slightly different weightings for City-center type (high usage development, mainly with standard floor-area ration 500% or more), and general type.
HQE^{2}R	Assessment is undertaken in the context of a broader plan and as such based on the results of neighborhood diagnosis stage, unique benchmarks are used for each region.
ECOCITY	Assessment is undertaken in the context of a broader plan and as such based on the results of neighborhood diagnosis stage, unique benchmarks are used for each region.
SQR	Has three different assessment tools for Master Planned community; Urban Renewal community; Provincial community. Some of the criteria and their corresponding score is different across these tools.

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 500% and those under 500%. 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 does not 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 5.4.4 explores the weighting and its role in taking account of context-specific issues.

5.4.4. Scoring and Weighting

Other important aspects associated with 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 other 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, Sibley, & Lewis, 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 & Boussabaine, 2007), has made this practice vulnerable to ambiguity (Kajikawa, Inoue, & Goh, 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 quantitative and qualitative 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 does not 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 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 has been received) and using the Analytic Hierarchy Process (AHP) (IBEC, 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 & 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.

As a case in point, consider the example for performance assessment of conservation of water bodies shown in Table 5-9.

Table 5-9. Different levels for performance assessment of conservation of water bodies. Source: (IBEC, 2007)

Level 1	No conservation
Level 2	Inapplicable
Level 3	Partial conservation
Level 4	Conservation of a majority
Level 5	Conservation of almost entire area

Wherever the criterion has sub-criteria, CASBEE-UD uses 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-criteria acquire by the maximum points available for them. This procedure is presented in table 5-10.

Table 5-10. The procedure for scoring a criterion which has sub-criteria. Source: (IBEC, 2007)

Level 1	On the efforts to be evaluated [III]: 0.0≤Credit ratio<0.2	
Level 2	On the efforts to be evaluated [III]: 0.2≤Credit ratio<0.4	
Level 3	On the efforts to be evaluated [III]: 0.4≤Credit ratio<0.6	
Level 4	On the efforts to be evaluated [III]: 0.6≤Credit ratio<0.8	
Level 5	On the efforts to be evaluated [III]: 0.8≤Credit ratio	
[I]=Total points acquired	[II]= Maximum points available	Credit ratio([III])=[I]/[II]

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 suffers from vagueness and is not transparent.

The last category discussed here consists of HQE^{2}R and Ecocity that have a similar framework for weighting the assessment criteria. These tools do not 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 HQE^{2}R 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 HQE^{2}R'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, p.10) 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 & Dahl, 2007; Singh, Murty, Gupta, & Dikshit, 2012).

Another problem of weighting systems that causes ambiguity is that in some cases different values are assigned the same score and weighting. Vakili-Ardebili 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 5.4.5.

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 citizen 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), and (N. Munier, 2011) quoting (Aguilar, Arredondo, Munier, Calvo, & D'Urquiza, 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, Smith, Cortright, Bassett, & Shandas, 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, Weber, Fenchel, & Scholz, 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 HQE^{2}R 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 HQE^{2}R approach is the "Shared Diagnosis" which involves an intensive transversal communication process and consensus among involved actors, aiming

at informing on the one 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.

5.4.6. 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 & Morse, 2008; Haberl, Fischer-Kowalski, Krausmann, Weisz, & Winiwarter, 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, residents, 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 Raksanyi (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 BREEAM communities have a similar way of presenting the final results. The only difference between these two is that in BREEM for Communities those projects which fail to acquire threshold points are also labeled. As shown in Table 5-3, in most of the cases, certified projects are assigned a label based on the scores they have achieved. Despite simplicity of presentation, it cannot be regarded as a transparent representation of sustainability. As Koellner et al. (2005, p.54) 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 United States (Garde, 2009). Although in practice compromises and trade-offs will be unavoidable in most policy, program, plan and project decisions (Gibson et al., 2005), 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. 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.

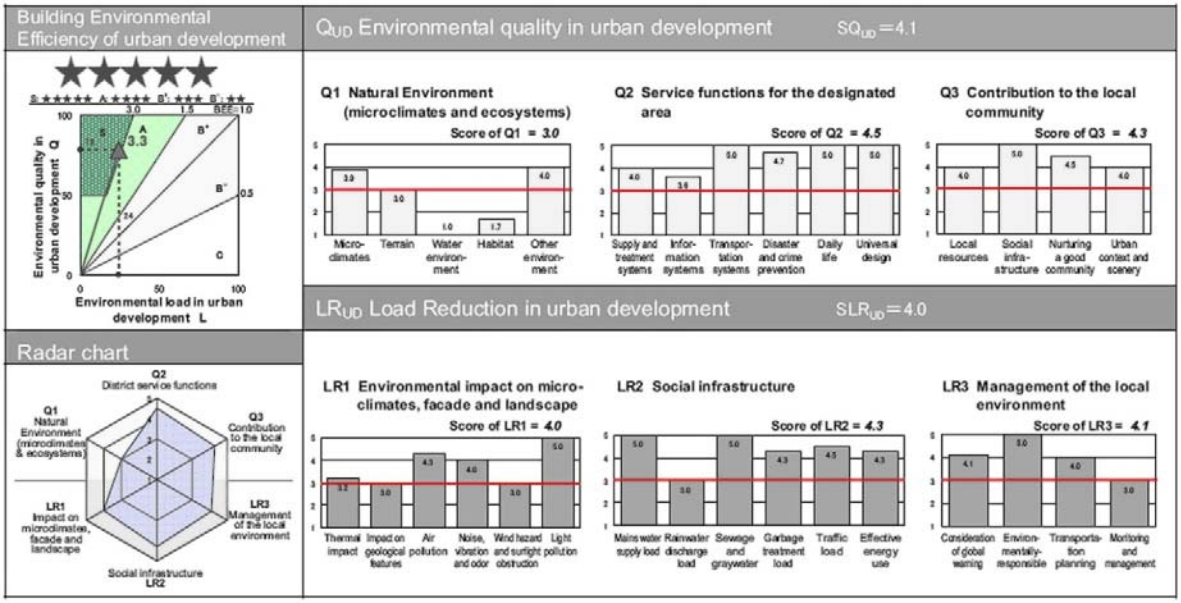
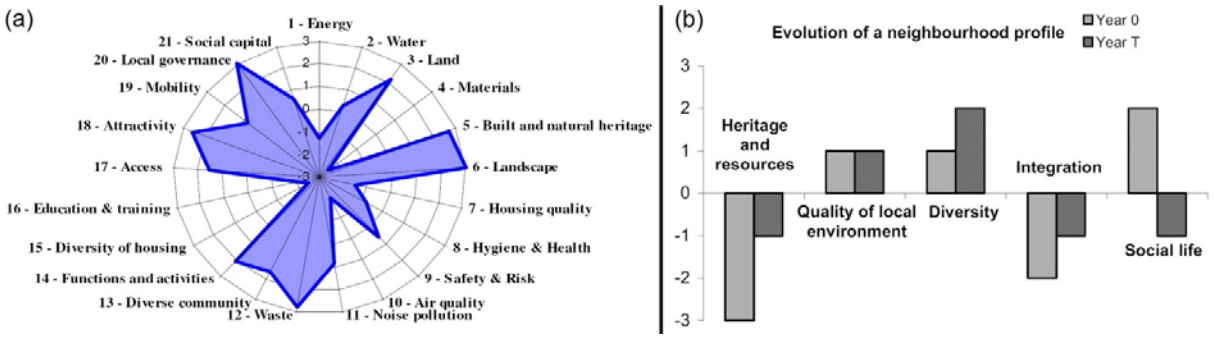


Figure 5-1. CASBEE-UD's way of presenting the assessment results. Source: (IBEC, 2007).

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) Figure 5-1 shows the CASBEE-UD's results for a given project.



. **Figure 5-2.** (a) Evaluation compass for criteria used in the HQE²R assessment tool. Source: (Charlot-Valdieu et al., 2004). (b) Presentation of changes over a specific time. Source: (Charlot-Valdieu & Outrequin, 2003)

Figure 5-3. Evaluation compass for criteria used in the Ecocity assessment tool. Source: (Gaffron et al., 2008).

As can be seen from Figures 5-2(a) and 5-3, HQE^{2}R 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^{2}R three levels are designated for this purpose. Second, as presented in Figure 5-2(b), HQE^{2}R 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 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 5.4.7 scrutinizes the application as the second major phase.

5.4.7. 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.

Comparing 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. ECC as a voluntary tool used in Southeast, is utilized by community or a group of stakeholders to assist them in planning their sustainable development (Adams & 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, 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, UK, and 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 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 residents concerning about the quality of their local environment, has gained momentum (Sharifi & Murayama, 2013b), and using assessment tools to evaluate different scenarios during the plan making process of Machizukuri activities can be starting point for pushing developers and local authorities to better acknowledge the role of CASBEE-UD as an assessment tool.

HQE^2R 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, 2011), there is still no evidence of applying SCR tool in the 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.

5.5. Discussion and Conclusion

In this paper seven NSA tools are 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 typically 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 weighed 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.

5.5.1. Extent of sustainability coverage

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, p.48) 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 HQE^{2}R, 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 intragenerationl equity are necessary conditions for sustainable development (George, 1999), and achieving the latter one is not possible without proper acknowledgement 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 assuring that a diverse array of community groups, irrespective of their social and economic status, benefit from the development.

5.5.2. Suggestions for making NSA tools more context-specific

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 HQE^{2}R 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, Pulzl, Alkan-Olsson, & Frederiksen, 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, HQE^{2}R 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.

5.5.3. The need for a more transparent presentation of the assessment results

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 HQE^{2}R 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.

5.5.4. Strategies for improving the applicability of NSA tools

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 would not contribute to achieving sustainability. Among the analyzed tools only HQE^2R 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, 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 specified objectives. Furthermore, they had a better performance when examined against the criteria set for this study. SCR is an exception because work on the development of a new and more comprehensive tool has been initiated by the Australian Green Building Council a short time after its introduction. The relative success of plan-embedded tools brings in the significance of intertwining the assessment tools with the broader process of planning.

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.

Chapter 6 The practice of NSA: Analysis of three selected cases

> Think global, act local.
>
> *Patrick Geddes*

Case study research is a common method frequently used in the urban literature. Gerring (2007, p.37) defines case study research as "an intensive study of a single unit or a small number of units (the cases), for the purpose of understanding a larger class of similar units (a population of cases)".

Several reasons can be put forward for this popularity of case study research among urban researchers. One is the complexity of relationships between different elements (variables) used in the urban research. These complexities make it undermine the suitability of standard statistical methods used in cross-case analyses. Therefore, researchers utilize case study analysis (single case and/or multiple case) to "capture" these complexities (Gerring, 2007, p.4). Case study research facilitates better understanding of exceptional cases which are common in the urban context (Campbell, 2003). Yin (2003, p.13) argues that case study is a practical method that "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". This definition matches quite well with the conditions of any given phenomenon in the urban context (Campbell, 2003), and make the application of case study research highly desirable.

Case study research is further utilized for testing "the theoretical prediction of a general model" (Gerring, 2007, p.5). This is particularly pertinent to one of the purposes of this chapter which is to explore the real-world performance of NSA tools as models for promotion of neighborhood sustainability. Case study research is also appropriate for handling multiple "sources of evidence", which is again a characteristic of a typical urban research (Gillham, 2000, p.2).

It is worth being aware; however, that case study approach toward research is not without limitations. Despite its strength in terms of internal validity, the external validity of case study research is questionable. It is argued that results of a case study analysis are not necessarily generalizable (Campbell, 2003; Gerring, 2007).

In this chapter, neighborhood is the unit (case) to be analyzed. This case study involves exploratory as well as comparative analyses. This will be further explained in Section 6.2 where the research method is presented.

As already noted, the empirical aspects of NSA have received very little attention in the literature. The bulk of the existing research (although it is also relatively limited in size) is focused on the theoretical dimensions of NSA. The theoretical aspects of NSA have also received a reasonable attention in Chapter 5 of this thesis. Since several years have passed since the introduction of the first generations of NSA tools in the first decade of the new millennium, it should be the right time to touch on the NSA in action. Another rationale for the case study analysis in this chapter is that the issue of viability of developing standards is still controversial.

While there is an ongoing debate over the feasibility of developing a universal assessment system, to date, there has not been adequate empirical research exploring this issue. To address this lacuna in literature, this study investigates three cases form U.S., U.K., and Japan that have been highly ranked under LEED-ND, BREEAM Communities, and CASBEE-UD, respectively.

According to what stated above, the aim of this study is fourfold: first, to provide better insight into NSA in action; second, to determine whether NSA tools have been effective in enhancing sustainability of the developments; third, to highlight the lessons that tools can learn from one another; and finally, to examine the feasibility of developing global standards.

The study is of relevance because NSA is still in its formative stage and further investigation into its practical aspects may reveal the underlying problems which need to be resolved. The case studies presented here provide some evidence that can be used to examine the feasibility of applying assessment tools in contexts other than the origin.

This chapter is organized as follows. Next section elaborates the case study methodology used in this paper. In section 6.2 the three neighborhoods in which the case study research was conducted are briefly described. Section 6.3 examines the extent of compliance of each neighborhood with the sustainability criteria outlined in its corresponding NSA tool. Section 6.4 reports on the results of the performance evaluation of each case under

different NSA tools. The concluding section discusses the findings and relates them to the literature. It also draws implications from the study's findings that may be useful for the enhancement of the NSA, and enable planners to make better decisions for their jurisdictions.

Next section describes the methods and materials used for the purpose of this analysis.

6.1. Methods and materials

Adopting a comparative case study approach, a combination of quantitative and qualitative techniques was employed in this study. Analyzing multiple cases enhances the breadth of analysis and validity of the results and provides a greater weight to the generalizations (Campbell, 2003; Cavaye, 1996).

As one of the aims of this research was to examine the feasibility of developing global standards, NSA tools from three different contexts were chosen. Of the NSA tools introduced in Chapter 5, LEED-ND (U.S), BREEAM Communities (U.K.), and CASBEE-UD (Japan), are widely recognized as exemplary NSA tools (AlQahtany et al., 2012; Marique & Reitwr, 2011). Common to all these three third-party assessment tools is the fact that they are the extended versions of the earlier methodologies that only evaluate the building level performance (LEED for New Construction, BREEAM New Construction, CASBEE for New Construction).Various types of the data relevant to these assessment tools are publicly accessible which makes it possible to precisely investigate different cases.

One certified case from each of the above three NSA tools was chosen for the comparative case study. Several factors were considered in the selection of the three cases for detailed analysis. First factor was the character of the development. Earlier, it was mentioned that NSA is in its formative stage and needs to be improved. Campbell (2003) argues that selecting exceptional and best practice cases, rather than typical ones, may lead to innovative ideas and push theory forward. Accordingly, one best practice case from each of the NSA tools was chosen. The second factor considered was the size of the projects. Since, at the time of writing the manuscript, both BREEAM Communities and CASBEE-UD were only applied to one project, the LEED-ND certified project was chosen so that the sizes are comparable. As the third factor, a similar approach was taken regarding the city in which the project is located.

The final factor was the construction phase of the development. Only those cases in which the majority of the construction of the project was completed and the development was occupied for either live or work purposes were selected. Accordingly the three cases shown in Table 6-1 were selected for detailed analysis.

Table 6-1 Basic specifications of the selected cases.

Project	NSA tools	Certificate	Size (ha.)	Location	Population
Hoyt Yards	LEED-ND	Platinum	13.7	Portland	583,776
MediaCity UK	BREEAM Communities	Excellent	14.5	Salford	229,000
Koshigaya Lake Town	CASBEE-UD	Excellent	6.5	Koshigaya	328,644

As Table 6-1 indicates, each of these cases has already been rated against one of the three selected NSA tools. Not only each case's sustainability was analyzed based on the criteria outlined in Chapter 2, but it was also evaluated against the other two assessment tools selected for this analysis. To put it another way, each of the three cases mentioned above were evaluated against its non-corresponding NSA tools. To cite one example: Hoyt Yards was assessed using BREEAM Communities, and CASBEE-UD. This cross-evaluative approach has two advantages: first, it sheds more light on the feasibility of applying assessment tools in different contexts; and second, it reveals the strengths and weaknesses of the selected assessment tools and their respective certified projects, thereby highlighting the lessons that tools and developments can learn from one another.

Data were compiled over a 15-month period between July 2011 and September 2012. They were collected from a number of sources including the selection of manuals and guidelines of each of the selected NSA tools, the assessment reports of the selected cases, site visits and personal observations of each case study area, websites of local authorities responsible for providing services to the local population, interviews with key decision-makers and developers of the case study areas, and personal communications with other people with expertise related to the selected NSA tools. All the required spatial analyses were conducted using ArcGis Version 10 (ESRI, Inc). Therefore, four types of different sources of evidence presented in Table 5-2 were used for the purpose of this chapter.

Throughout this paper, wherever scoring of the criteria is concerned, the terms “score”, “credit”, and “point” are used interchangeably.

Next section provides a brief description of the cases chosen for analyses in this chapter.

6.2. Brief description of the selected case study neighborhoods

The following three sections provide short descriptions of the three cases chosen for further analysis. For each case, some basic information is provided. They are listed in the same order as their corresponding assessment tools mentioned above. Note also that hereafter, whenever issues related to the selected NSA tools and the selected cases are discussed this order remains the same.

6.2.1. Hoyt Yards

Hoyt Yards is located on a 13.7 ha brownfield site in the Pearl District of downtown Portland close to the Willamette River. This development is part of the Pearl District Development Plan. Once a marshland, the area now known as “Pearl District” has been associated with warehousing and railroad yards for most of the twentieth century. Since the early 1980s Pearl District has undergone major transformations as part of the city’s plan for the revitalization of the downtown area (Pearl District, 2001).

In October 2001, the City Council approved the Pearl District Development Plan. It is now one of the liveliest parts of Portland with abundant open spaces and areas for both work and living. Since 1997, Hoyt Street Properties has cooperated with the City of Portland to transform the abandoned rail yards in the heart of a warehouse district into a vibrant urban community (Hoyt, 2009).

This mixed use development has received the LEED-ND Platinum certification. Fourteen out of the twenty three planned blocks have already been completed. At completion, the neighborhood will contain 1,675 residential units, 5,760 m^2 of retail space, 33,352 $m^2$of employment space, 3,000 parking spaces, and three public parks. Figure 6-1 shows the location of this development. Figure 6-4.a displays the case study area before the development.

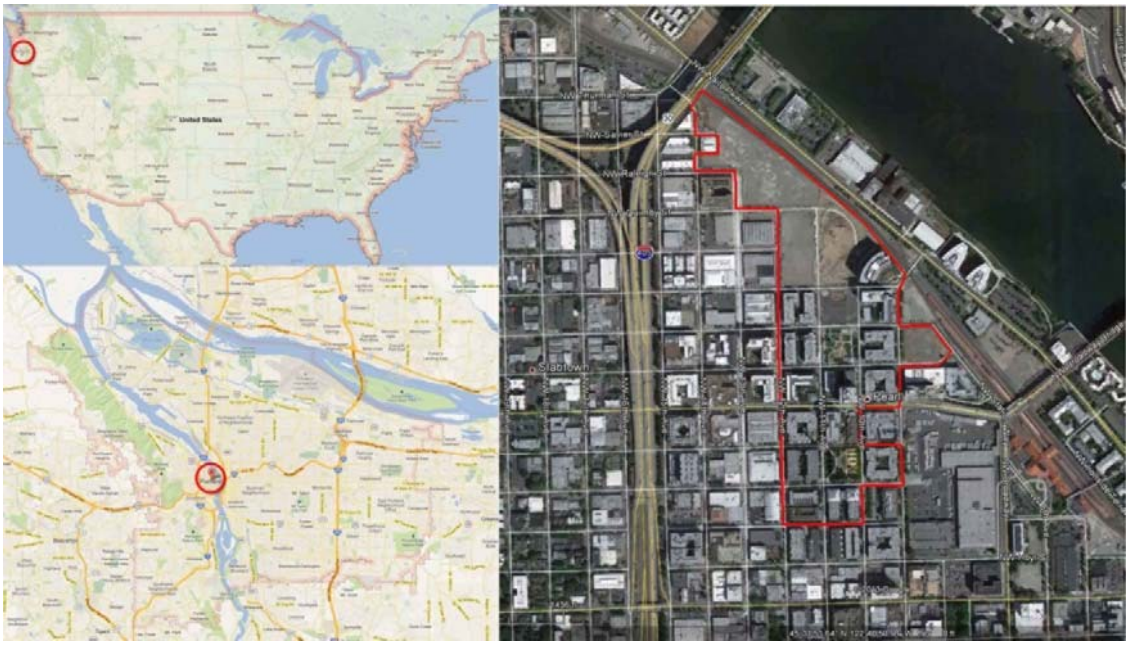


Figure 6-1. Location of Hoyt Yards. Source: Google Maps (left) and Google Earth (right).

6.2.2. MediaCityUK

Situated in Salford Quays (alongside the Manchester Ship Canal), MediaCityUK is part of a major regeneration project. It is the last remaining part of the previously derelict land which is planned to be reclaimed. The area that is now known as Salford Quays was previously the site of Manchester Docks, Built by Manchester Ship Canal Company at the late years of the ninetieth century. In early 1980s Salford City Council acquired a major part of the former docks and since then a major redevelopment project has started that has transformed the once derelict area to one of the most modern areas in Greater Manchester (Slalford City Council, 2008).

The first phase of MediaCityUK, which was awarded BREEAM Communities Excellent ranking, is spread over 14.5 ha. Peel Media is responsible for the development, and Salford City Council has also involved in the development of the site and its transport infrastructure.

The British Broadcasting Corporation (BBC) and the University of Salford are the anchor tenants. The development consists of 29,729m² of office and studio space, 378 apartments divided between two buildings, a 218 bed hotel, one supermarket, and open plaza

and a public park (SCC, 2012). The location of this development is illustrated in Figure 6-2. Figure 6-4.b shows the project site before the development.

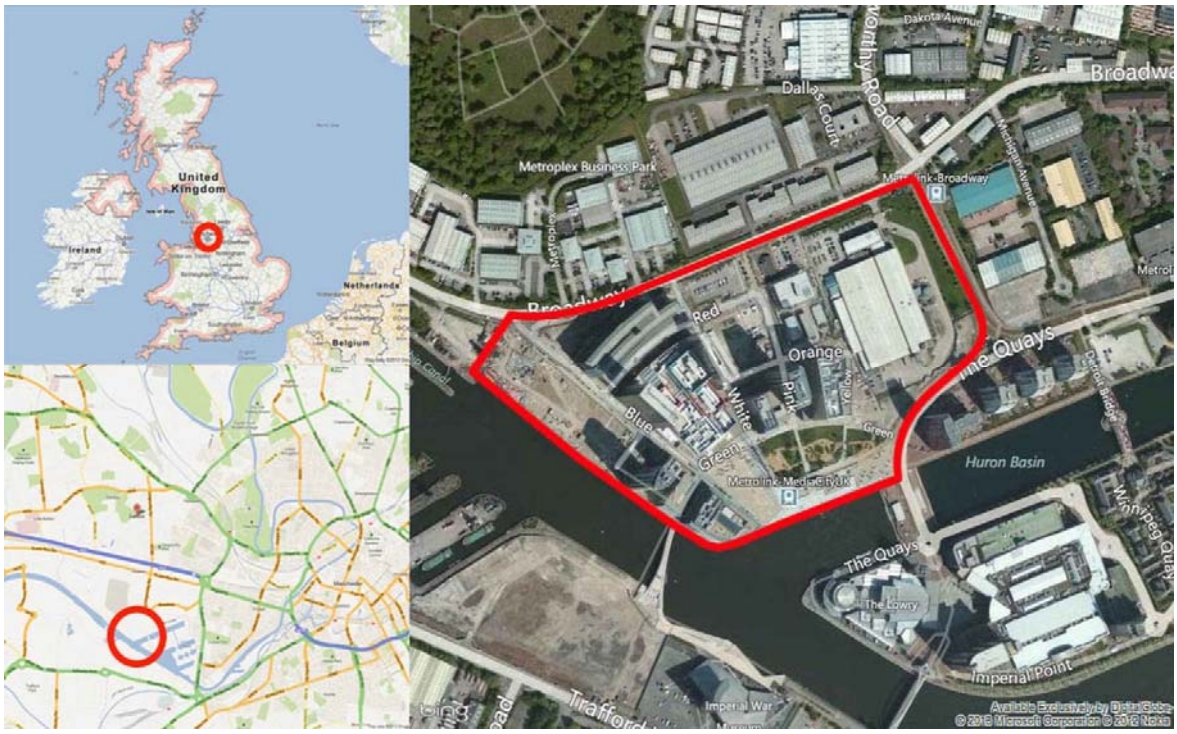


Figure 6-2. Location of MediaCityUK. Source: Google Maps (left) and Bing Maps(right).

6.2.3. Koshigaya Lake Town

Koshigaya Lake Town is the first and only time an appraisal of any neighborhood development plan has been carried out using CASBEE-UD. The neighborhood is situated 22 km northeast of central Tokyo. The total area to be built is approximately 225.6 ha, of which, the roughly 6.5 ha area delineated in Figure 6-3 has been awarded the CASBEE-UD's excellent ranking.

Daiwa House Industry, a private enterprise, and Urban Renaissance Agency, started the development in 2007 under the sponsorship of Japanese Ministry of the Environment and it was ready to be occupied in 2010. The development is composed of 500 apartments and 132 two-story detached houses. This is a greenfield development built on former farmland. There are however, settlements close to the development site that have existed before the start of the development. Figure 6-4.c shows the previous land use of this site.

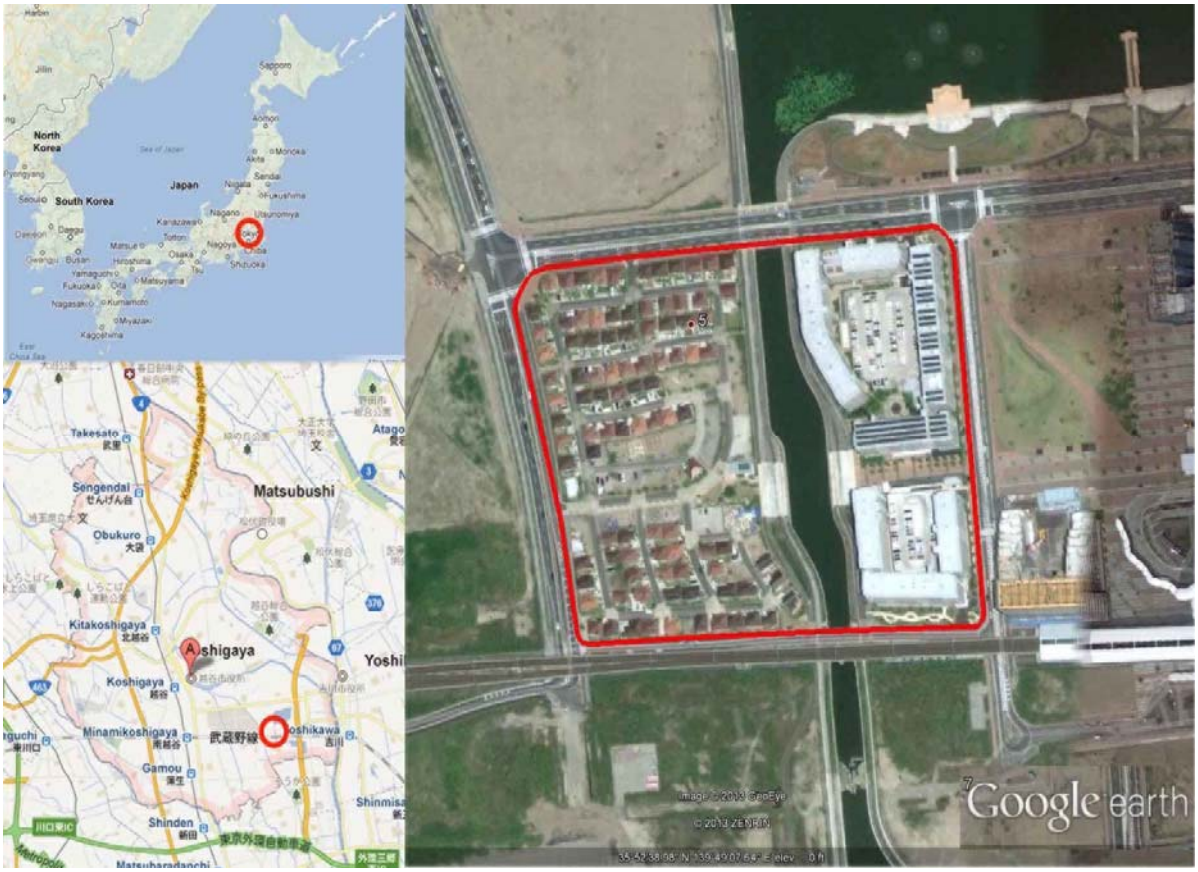


Figure 6-3. Location of Koshigaya Lake Town. Source: Google Maps (left) and Google Earth (right).

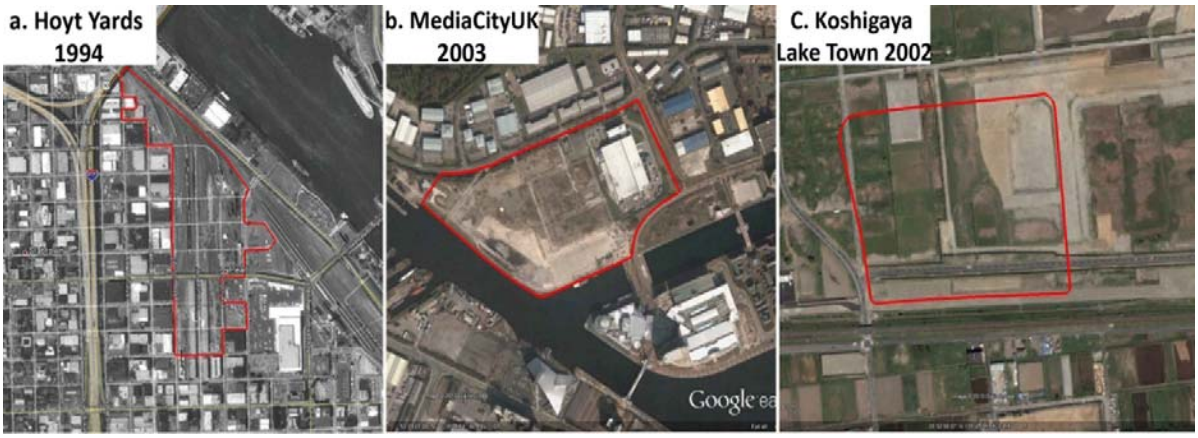


Figure 6-4. Pre-development land use for the three selected cases. Source: Google Maps.

In the following two sections, the results of assessing these cases against their corresponding and non-corresponding NSA tools are presented.

The results of this case study analysis can be divided into two categories: first, an analysis of the extent to which issues specified in each of the NSA tools have been

incorporated in that tool's corresponding certified project, and second, an examination of the performance of each case against its non-corresponding NSA tools. To avoid confusion, it should be noted that assessments in the first category are done by the accredited assessors. The available assessment reports have been used to analyze the extent of success in achieving the determined goals and highlight issues that are overlooked. Assessments in the second category are conducted by authors. The main aims were to analyze the degree of success in providing a holistic assessment of the neighborhood (re)development practices, and to examine the viability of developing universal standards.

6.3. Degree of compliance with the NSA tools

Because of the idiosyncrasies of the selected cases, as well as, the variation in the criteria used by each NSA tool, the degree of compliance with each NSA tool will be presented in a separate section. These inspections reveal how successful the selected neighborhoods have been in putting the sustainability criteria into practice. Note that, in the following three sections only the extent to which each development is in compliance with its corresponding NSA tool will be investigated. Results of comparison between the tools are presented in section 6.3.

6.3.1. Hoyt Yards

Certified as Platinum, Hoyt Yards embodies various types of qualities that LEED-ND attempts to incorporate into the neighborhood (re)development practices. The most remarkable point about this development is that, as part of Pearl District redevelopment, Hoyt Yards has turned a post-industrial brownfield area into one of the densest and liveliest residential communities in the state of Oregon (COP, 2008).

This development has considered different ways of reducing the automobile dependence in the community, and has pledged to reduce weekday peak period trips by twenty percent until 2020. There are many publicly accessible intersections in the area that enhance the walkability of the neighborhood. This has also been reinforced through minimizing the street-facing building façade setbacks, reducing the distance between the functional entries to buildings, facilitating natural surveillance, minimizing the length of blank

walls along sidewalks, providing continuous sidewalks and minimizing sidewalk intrusions, meeting the minimum building-height-to-street-width ratio of 1:3 in more than forty percent of all street frontage, providing on-street parking, and reducing traffic speeds. Figure 6-5 displays an example of active frontages in the neighborhood.

Figure 6-5. Provision of active frontages in Hoyt Yards. Source: (Hoyt, 2009)

The neighborhood is served by two Portland Streetcar lines. Three bus lines are also available within less than 500 m distance of the neighborhood geographic center. Hoyt Yards includes streets with bike lanes integrated into Portland's extensive bike network. Ample bicycle parking space is provided through installing bicycle racks and corrals. Residential buildings have bike parking for all residents, and parking and shower facilities are available in the new commercial buildings to encourage commuting via bicycle.

The developed retail space amounts to 9,290 m^2 and the final build-out will include an additional 22,761 m^2 retail space. The housing-job proximity is well addressed in Hoyt yards which is located such that the geographic center is within 800 m walk distance of existing

full-time-equivalent jobs whose number is greater than the number of dwelling units in the project.

More than seventy percent of the dwelling units are within 800 m distance of an elementary school. This makes the neighborhood suitable for raising children. Jamison Square, Tanner Springs, and The Fields, are three parks in the neighborhood that lie within 400 m walk distance of all dwelling units and provide adequate space for recreation, physical exercise, and social encounters. One example of such activities is displayed in Figure 6-6.

Figure 6-6. An example of using the Jamison Square Park of social activities. Photo by Harvey Kline. Downloaded from the Facebook page of the Pearl District Neighborhood Association

The stormwater management system in Hoyt Yards will harvest ninety percent of the site s rainwater, which will then be used for irrigation, central plant cooling, and non-potable uses. The Tanner Springs Park is considered as a model for sustainable stormwater solutions. Moreover, all new buildings will be designed to use thirty percent less water, and at least fifty percent of the waste water will be treated and reused on site (Hoyt, 2009).

Figure 6-7. Tanner Springs Park.

Tanner Springs Park is nationally recognized as a model for sustainable park design. This park provides both social and ecological functions. It is constructed to collect and purify stormwater and also create a bio-diverse meadow that provides habitat for birds and insects. There are also benches, grassy amphitheater, and a boardwalk that provide opportunities for relaxation and social gathering. Likewise other parks in Portland, Tanner Springs has incorporated an art piece into the landscape design. The Art Wall located on the eastern side of the park represents the former rail yard, and is made of discarded rails (Dinep & Schwab). These different elements can be seen in Figure 6-7. Together with the other two parks in the district, Tanners Springs establishes an ecological corridor that connects the neighborhood to Willamette River.

The universal design principles have been addressed in Hoyt Yards, making it livable for everyone, regardless of their age or ability.

In addition to securing a diversity of uses, this neighborhood facilitates the diversity of housing types and affordable rental housing to make it livable for people from a wide range of income levels, household size, and age groups.

Regarding the efforts to improve energy efficiency, The North Pearl's district power plant has the potential to be powered by bio-fuel from the local brewing industry, and creates clean power and heating for neighborhood's new buildings. To provide optimum use of solar energy, all blocks are solar-oriented and have one axis in the geographical east-west alignment. Solar energy is used for lighting the new and existing streetlights, and all new buildings will be designed to use twenty percent less energy (Hoyt, 2009).

Recycled content is used in the infrastructure. For the purpose of reducing the volume of waste deposited in landfills, several efforts have been taken which include, but are not limited to: waste sorting, installing compost stations, and providing recycling station. Community meetings have been held to involve the neighborhood stakeholders in the decision-making process for the development, and the residents can also continue their involvement through joining the Pearl District Neighborhood Association.

Despite its successes and innovations, Hoyt Yards has several shortcomings. The development has failed to meet the requirements for affordable housing for sale, management of habitat and wetlands, local food production, and light pollution reduction. Further investigation of this finding led to the discovery that these criteria make a relatively smaller contribution to the overall LEED-ND score. To determine if this is a general pattern among the LEED-ND certified developments, the scorecards of all the LEED-ND pilot projects certified as of November 2012 were examined. Table 6-2 compares the degree of inclusion of various criteria in ninety seven LEED-ND pilot certified projects. These scorecards are available for download from the USGBC website (USGBC, 2012).

The results agree by and large with those reported in a study of seventy three LEED-ND-registered pilot projects by Garde (2009). It is important to bear in mind that not all the registered projects have received LEED-ND certification.

Table 6-2. The degree of incorporation of different criteria in ninety seven LEED-ND certified developments.

Item	% of projects receiving points	Results of Garde's study	Possible points	Mean	SD
Smart Location and Linkages	NA	NA	30	18.70	4.48
Preferred Locations	97.9	95.9	10	7.66	1.78
Reduced Automobile Dependence	90.7	91.8	8	4.68	2.50
Housing & Jobs Proximity	84.5	84.9	3	2.52	1.10
Brownfields Redevelopment	58.8	45.2	2	1.18	0.99
School Proximity	72.2	72.6	1	0.72	0.45
Steep Slope Protection	63.9	65.8	1	0.64	0.48
Bicycle Network	46.4	76.7	1	0.46	0.50
High Priority Brownfields Redevelopment	27.8	13.7	1	0.28	0.45
Site Design for Habitat or Wetland Conservation	32	56.2	1	0.32	0.47
Restoration of Habitat or Wetlands	10.3	34.2	1	0.10	0.31
Conservation Management of Habitat or Wetlands	14.4	35.6	1	0.14	0.35
Neighborhood Pattern and Design	NA	NA	39	21.38	6.09
Compact Development	94.8	86.3	7	4.10	2.36
Diversity of Uses	93.8	98.6	4	3.33	1.22
Diversity of Housing Types	73.2	80.8	3	1.92	1.37
Street Network	85.6	79.5	2	1.43	0.73
Reduced Parking Footprint	70.1	69.9	2	1.40	0.92
Walkable Streets	71.1	95.9	8	4.02	2.83
Access to Surrounding Vicinity	62.9	87.7	1	0.63	0.49
Access to Public Spaces	67.0	89.0	1	0.67	0.47
Access to Active Spaces	72.2	91.8	1	0.72	0.45
Community Outreach & Involvement	70.1	90.4	1	0.72	0.49
Affordable Rental Housing	39.2	47.9	2	0.62	0.83
Affordable For-Sale Housing	30.9	57.5	2	0.46	0.75
Transit Facilities	48.5	63.0	1	0.48	0.50
Transportation Demand Management	25.8	54.8	2	0.29	0.52
Universal Accessibility	34.0	63.0	1	0.34	0.48
Local Food Production	12.4	27.4	1	0.12	0.33
Green Construction and Technology	NA	NA	31	12.39	5.56
Minimize Site Disturbance through Site Design	86.6	82.2	1	0.87	0.34
Minimize Site Disturbance during Construction	88.7	82.2	1	0.89	0.32
Construction Waste Management	77.3	71.2	1	0.77	0.42
Reduced Water Use	71.1	79.5	3	1.49	1.16
Stormwater Management	57.7	86.3	5	1.95	2.04
Heat Island Reduction	69.1	75.3	1	0.69	0.46
Comprehensive Waste Management	69.1	74.0	1	0.69	0.46
LEED Certified Green Buildings	44.3	63.0	3	1.16	1.46
Energy Efficiency in Buildings	47.4	72.6	3	1.19	1.34
Building Reuse & Adaptive Reuse	35.1	32.9	2	0.56	0.82
Infrastructure Energy Efficiency	42.3	63.0	1	0.42	0.50
Recycled Content in Infrastructure	42.3	53.4	1	0.42	0.50
Light Pollution Reduction	30.9	64.4	1	0.31	0.46
Reuse of Historic Buildings	21.6	17.8	1	0.22	0.41
Contaminant Reduction in Brownfields Remediation	17.5	20.5	1	0.18	0.38
Solar Orientation	9.3	31.5	1	0.09	0.29
On-Site Energy Generation	16.5	23.3	1	0.16	0.37
On-Site Renewable Energy Sources	15.5	30.1	1	0.15	0.36
District Heating & Cooling	6.2	15.1	1	0.06	0.24
Wastewater Management	7.2	21.9	1	0.07	0.26
Total	NA	NA	100	56.00	11.77

≥75% | ≥ 50% and < 75% | ≥ 25% and < 50% | < 25%

The results lend strong support to the argument that, in most cases, developers prefer to incorporate the higher-weighted criteria. Of the 29 criteria with maximum 1 point to achieve, 18 criteria have only been incorporated into less than half of the 97 pilot certified projects. On the contrary, a majority of the certified projects have complied with the higher-weighted criteria. This might be an indication of the necessity of modifying the assessment framework. When closely compared with those reported by Garde (2009), this results show that, by and large, each criterion is incorporated into a smaller proportion of the projects. Likely explanations for these differences in the results are that this research has examined a larger number of scorecards, and Garde's study was based on the scorecards of registered pilot projects which might not necessarily have received the final certification.

Analysis of these 97 scorecards confirms that the criteria overlooked in the Hoyt Yard project are among those criteria that in most certified cases have not been satisfied. This issue will be further discussed in the discussion section of this chapter.

6.3.2. MediaCityUK

As the first BREEAM Communities-approved development in the world, MediaCityUK has incorporated a wide array of sustainability criteria into the individual buildings and the neighborhood as a whole. Similar to the previous section, here the development's performance against its corresponding assessment tool will be reported.

One particularly noticeable feature of this development is its success in revitalizing a post-industrial derelict area (abandoned Manchester Docks). This previously isolated area is now one of the well-connected areas in Salford and Greater Manchester. This has been achieved through working with the Salford City Council to establish an integrated transport network. The existing Metrolink tramline has been extended to serve those living and working in MediaCityUK. All the buildings in this development are within 400 m distance of the MediaCityUK metrolink station which provides access to other areas in Salford, and also to Manchester Piccadilly as a national transport hub. As seen in Figure 6-8, this area is also served by bus service, Salford Quayslink, and bike routes. In order to benefit the leisure potentials of the area and improve the linkage between MediaCityUK and the rest of Quays, a

grid of pedestrian and cycling friendly streets is proposed and will further improve the conditions in the future (SCC, 2007b).

As another measure to reduce the automobile-dependence, this neighborhood provides a mix of uses in a walkable distance. Following the Home Zones concept (known as Woonerf in some other countries), the vehicle traffic inside the neighborhood is limited, making it a safe environment for pedestrians and safe and appropriate for children to play. Figure 6-9 shows one of the measures taken to create a pedestrian zone in the neighborhood. One supermarket is provided inside the development. In addition, Lowry outlet is within 600 m distance of all buildings in MediaCityUK. Recreational facilities such as the leisure areas of the Lowry Centre are also easily accessible. The open plaza and its neighboring park provide a suitable environment for physical exercise, as well as socialization.

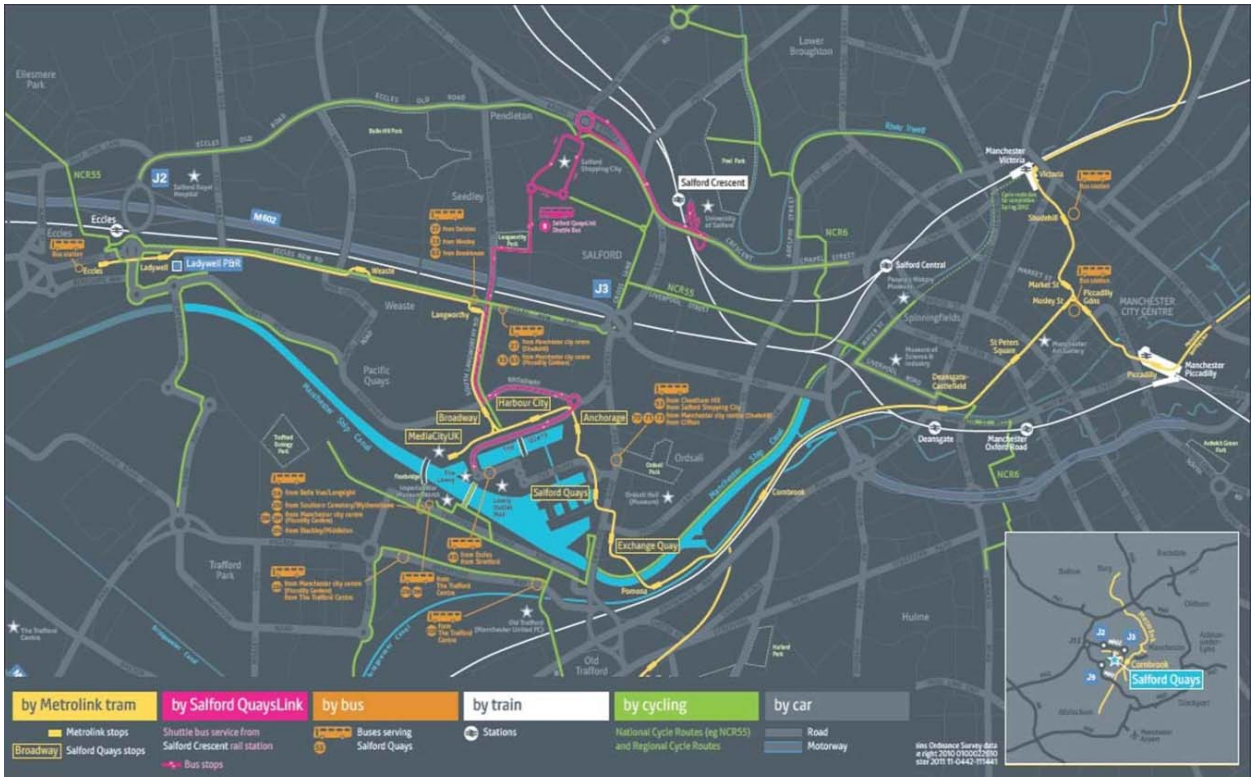


Figure 6-8. Transportation to and from MediaCityUK. Source: Transport for Greater Manchester.

Figure 6-9. Use of raising road blockers to limit the vehicle movement in the neighborhood.

Figure 6-10. The plaza is sometimes used as a venue for selling locally grown products.

In some occasions, as shown in Figure 6-10, residents bring their locally grown products to the plaza and sell them directly to the customers.

Provision of adequate shaded green space and open water, appropriate choice of external coatings to avoid heat absorption, and design for the appropriate circulation of air within the development, are among the efforts taken to reduce the heat island effect in the neighborhood.

To enhance the energy efficiency, a low carbon site-based tri-generation system has been installed. This system simultaneously produces heat, cooling, and power. Heat and power is generated by a Combined Heat and Power (CHP) engine, and an absorption chiller uses the recycled canal water to create chilled water for cooling purposes. The Manchester Ship Canal water is also used to cool the existing studios in winter months. This way the development saves approximately 20,000 tons of CO2 annually (Vital, 2012).

To ensure that the character of the landscape is respected and enhanced, a planting scheme has been developed in collaboration with a qualified ecologist. This has introduced at least seventy native plant species to be planted in the neighborhood (SKM, 2011).

More than twenty percent of materials used during the construction process have been locally sourced. Adequate preventive measures against groundwater pollution have being installed during the construction process and the groundwater sources are not adversely affected.

In terms of economic sustainability, various efforts have been taken to promote business and employment in MediaCityUK. BBC and University of Salford are two priority business sectors that have already moved to the site and an additional 18, 580 m^2 of office space is still available to other businesses (SKM, 2011). The development is expected to create 3, 439 additional jobs in the region (SKM, 2011).

The two residential towers in the neighborhood have received the “very good” rating under the Ecohomes scheme. Three of the non-residential buildings have achieved BREEAM Excellent at design stage, and the studio building has achieved Very Good.

The development has engaged with various stakeholders, including Government Office for the North West, Salford City Council, Central Salford Urban Regeneration, Manchester City Council, Greater Manchester Ecology Unit, Greater Manchester Archaeological Unit, Highways, North West Regional Development, and North West Regional Assembly (SKM, 2011) The immediate neighbors have also been consulted with regarding the development.

Despite MediaCityUK's success in addressing many sustainability related aspects, it has failed to take account of several important issues. The most striking finding is that no affordable housing and social housing has been provided in the development. The available housing stock is not diverse, which increases concerns over the inclusiveness of the community.

Regarding the local employment, there is no evidence showing that local people are employed in the area. This is significant because the majority of jobs might be for those moving from London to Manchester to work in the BBC studios.

Rainwater harvesting is not used in the development. There is no green roof element in MediaCityUK and the pavements are not pervious. A typical pavement pattern is displayed in Figure 6-11.

Figure 6-11. A typical pavement pattern used in MediaCityUK.

Not adequate parking space has been provided for bicycles. Only few bicycle parking spaces exist in the residential buildings. The bicycle racks near the metrolink station are also lacking appropriate safety and security measures. Figure 6-12 shows the conditions of the bicycle racks located in front of the MediaCityUK metrolink station.

Figure 6-12. Bicycle racks in front of the MediaCityUK metrolink station.

Above, it was mentioned that the CHP plant has made a significant contribution to reducing the energy consumption level. However, other renewable sources such as solar energy technologies are not installed in MediaCityUK.

The last issue to be discussed here is the consideration for the universal design principles. Although this has been addressed relatively well in the public spaces and rights of ways, the project has failed to consider it in the interiors of the buildings.

Further shortcomings of MediaCityUK will be discussed in section 6.4, when presenting results of the cross-evaluations. Those cross-evaluations will be useful for uncovering some other drawbacks of the development.

6.3.3. Koshigaya Lake Town

Like the other two cases presented above, this neighborhood is widely regarded as a model for sustainable neighborhood development in its own context. In addition to being awarded the CASBEE-UD Excellent ranking, Koshigaya Lake Town has also received the Gold Award of The International Awards for Liveable Communities 2009 as another accolade for its sustainability achievements (LivCom, 2009).

The primary focus of Koshigaya Lake Town's sustainability efforts is environmental. The neighborhood consists of two main types of residential buildings: two-story detached houses, and condominium buildings. The site containing detached houses is designed to allow the optimum air circulation (see Figure 6-13) . At summer the prevailing wind (east to west) blows over the adjacent pond and is then channeled into the residential areas. This makes a significant contribution to the reduction of heat island effects.

In addition to its cooling effects, this 40 ha pond functions as a flood control reservoir with the potential to retain up to 1.2 million m^3 of water (ALMEC, 2011). This is a significant measure for managing the flood risk in an area vulnerable to flash floods. Moreover, this pond has an important wildlife value. Different species of fishes exist there, and it also attracts birds to the area. A view of this reservoir is illustrated in Figure 6-14.

Also, countermeasures are taken against the prevailing winter wind which blows from the northwest. Two lines of Bamboo-leaf Oak (Quercus Myrsinifolia) are planted alongside the western and northern borders of the development site to mitigate the effects of these strong winds (Daiwa, 2011).

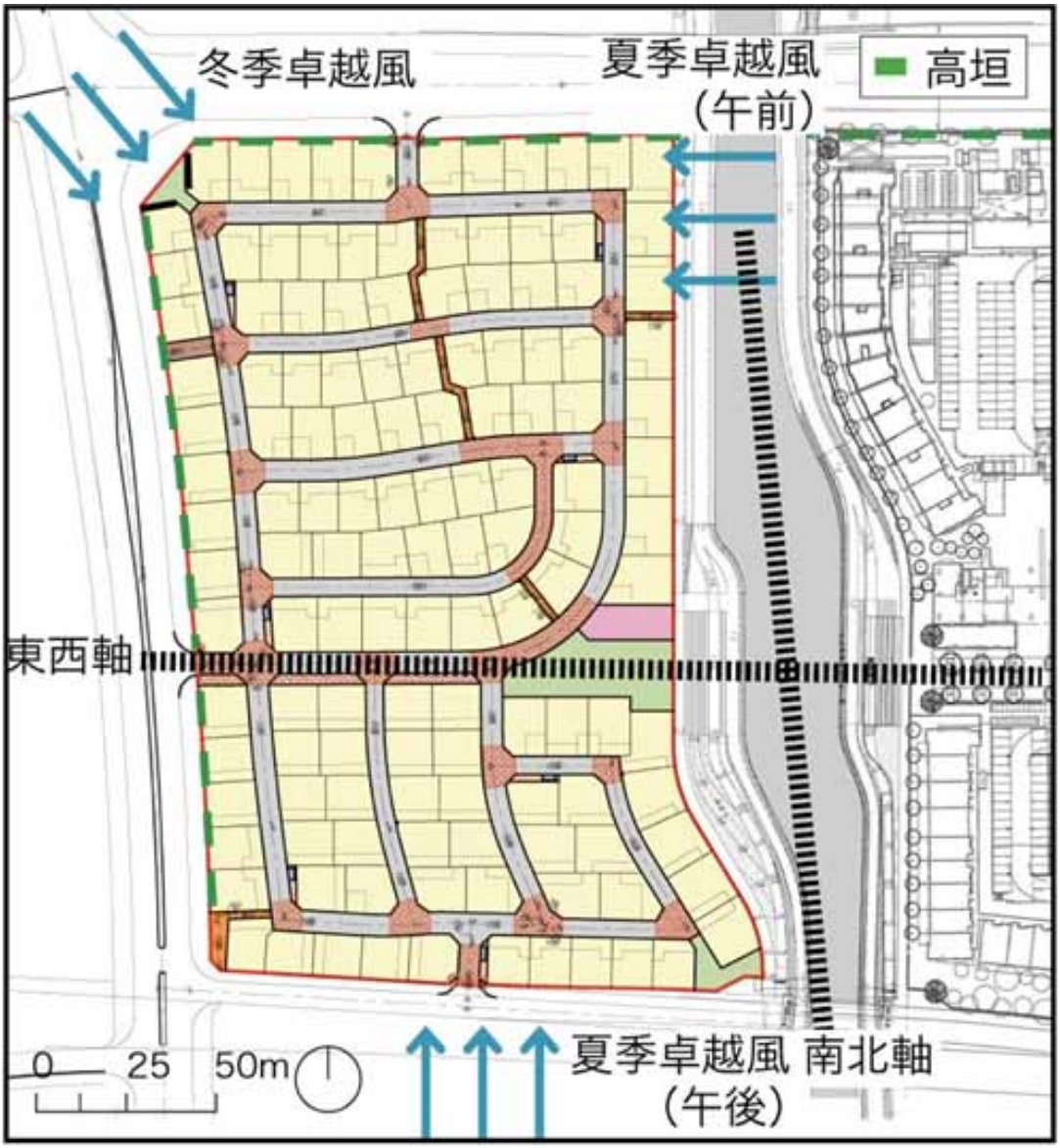


Figure 6-13. Consideration of the wind direction in design of Koshigaya Lake Town. Source: Nagata (2012)

Residents can use the lake-side promenade for exercise, as well as, recreational and leisure purposes. Water sports facilities are also available for use by the neighborhood residents. These elements are furthermore capable of attracting visitors from the surrounding

communities which in turn enhances the socio-economic conditions of Koshigaya Lake Town.

Figure 6-14. A view of the flood control reservoir in Koshigaya Lake Town.

The energy efficiency issues have been considered through installing photovoltaic facilities in the neighborhood. The solar heating system introduced, in the condominium buildings, for heating and hot water purposes is the largest of its kind in Japan (ALMEC, 2011).

Other noticeable achievement of this development is its consideration of the ecological values of the area. Not only has an ecological survey been conducted to specify the native flora of the area, but a survey about the bird species has also been done over a three year period.

Based on the results of this survey, efforts are taken to use native species and create porous spaces and livable habitats for resident and migratory birds. Native trees and hedges have been planted to encourage wildlife. The designed landscape is not only aesthetically pleasing, but also provides shelter and food for species. An example of these shelters is shown in Figure 6-15.

To reduce the noise impact, trees have been planted along the arterial roads. The light pollution issues are also considered and the exterior lightings are in compliance with the standards defined in the guideline entitled: The checklist for a well-illuminated environment.

The garbage load is reduced through incorporating centralized storage facilities. Composting is employed in the neighborhood, and following the strict Japanese regulations for waste sorting, garbage is segregated into fifteen different categories.

Through introduction of high-efficiency energy systems, efficient air-conditioning system, and exploitation of solar energy, the development has moved a significant step toward energy saving and uses 29.9 percent less energy (Daiwa, 2011).

Figure 6-15. An example of providing suitable habitat for species. Photo by Itsuki Nagata.

A new station has been developed on the existing Japan Railways line to serve the residents of the neighborhood. This station is within 500 m walk distance of all the dwelling in the neighborhood.

Notwithstanding all the above positive points, Koshigaya Lake Town has failed to address some of the criteria specified in the CASBEE-UD framework.

No facilities related to local industry and culture have been developed. As a related issue, there is no evidence to suggest that locally-sourced materials have been used for building cladding, paving, and other materials.

Regarding the provision of appropriate pedestrian and cycling networks, some major drawbacks were found in this study. Cycling routes are only limited to those along the arterial roads and there are no separate bicycle lanes in the inner areas. This neighborhood lacks pedestrian-friendly sidewalks and active frontages as well. As shown in Figure 6-16, the continuity of the walking environment is also suffering from frequent interruptions by cars parked in front of buildings. This diminishes the pedestrian environment and disrupts the urban fabric as well.

Figure 6-16. Lack of pedestrian friendly sidewalks in the neighborhood.

As the results of this section indicate, when assessed against the CASBEE-UD scheme, Koshigaya Lake Town appears to have very few deficiencies. However, it would be interesting to find out that there are some other major drawbacks to this development. As will

be shown further below, evaluation of Koshigaya Lake Town against the two other NSA tools reveals some major dilemmas that it is grappling with.

6.4. Results of the cross-evaluations

As described in Section 6.1, the performance of each case against its non-corresponding NSA tool was also evaluated. Totally, six analyses were conducted that offered interesting results on the strengths and shortcomings of the developments, and the feasibility of developing global standards. The following six sections show how each case fares when assessed using a different assessment scheme. Consistent with the order of the above analyses, this analyses start by using LEED-ND to evaluate the performance of the other two certified projects. This would be followed by evaluations against BREEAM Communities and CASBEE-UD.

6.4.1. MediaCityUK performance against LEED-ND

As well as uncovering several problems associated with the MediaCityUK development that have not been noticed until now, this analysis also provides examples of the pluralistic nature of sustainability indicators and benchmarks that are used across the selected NSA tools. As detailed in Table 6-3, when assessed against LEED-ND, MediaCityUK performs poorly on the following criteria: external connectivity (see the glossary in supplementary Appendix), internal connectivity, bicycle network and storage, mixed-income diverse communities, neighborhood schools, local food production, wastewater management, solar orientation, and light pollution. Below, the problems associated with these criteria will be briefly explained.

Connectivity, together with smart location and walkability, has a pivotal role in receiving LEED-ND certification. Although only five out of the fifty one existing LEED-ND criteria are directly related to these three issues, they account for approximately thirty percent of the possible points. This means that it is difficult, if not impossible, for a development to get LEED-ND certification without performing well on these issues.

The external connectivity criterion encourages the development to be located in an area with frequent publicly accessible intersections. This is to ensure the walkability of the

development. Depending on the number of intersections within 800 m distance of the project boundary, the development might acquire up to five points. Detailed requirements related to this criterion are shown in Table 6-4.

Table 6-3. The performance of MediaCityUK against LEED-ND

			LEED 2009 for Neighborhood Development Project Scorecard		
Project Name: MediaCityUK					
Yes	?	No	Smart Location and Linkage		27 Points Possible
16					
Y			Prereq 1	Smart Location	Required
Y			Prereq 2	Imperiled Species and Ecological Communities	Required
Y			Prereq 3	Wetland and Water Body Conservation	Required
Y			Prereq 4	Agricultural Land Conservation	Required
Y			Prereq 5	Floodplain Avoidance	Required
5			Credit 1	Preferred Locations	10
2			Credit 2	Brownfield Redevelopment	2
6			Credit 3	Locations with Reduces Automobile Dependence	7
			Credit 4	Bicycle Network and Storage	1
1			Credit 5	Housing and Job Proximity	3
1			Credit 6	Steep Slope Protection	1
1			Credit 7	Site Design for Habitat or Wetland and Water Body Conservation	1
			Credit 8	Restoration of Habitat or Wetlands and Water Bodies	1
			Credit 9	Long-Term Conservation Management of Habitat or Wetlands	1
Yes	?	No			
24			Neighborhood Pattern and Design		44 Points Possible
Y			Prereq 1	Walkable Street	Required
Y			Prereq 2	Compact Development	Required
Y			Prereq 3	Connected and Open Company	Required
9			Credit 1	Walkable Streets	12
5			Credit 2	Compact Development	6
4			Credit 3	Mixed-Use Neighborhood Centers	4
			Credit 4	Mixed-Income Diverse Communities	7
			Credit 5	Reduced Parking Footprint	1
			Credit 6	Street Network	2
1			Credit 7	Transit Facilities	1
1			Credit 8	Transportation Demand Management	2
1			Credit 9	Access to Civic and Public Spaces	1
1			Credit 10	Access to Recreation Facilities	1
			Credit 11	Visitability and Universal Design	1
1			Credit 12	Community Outreach and Involvement	2

			Credit 13	Local Food Production	1
1			Credit 14	Tree-Lines and Shared Streets	2
			Credit 15	Neighborhood Schools	1
Yes	?	No			
17			Green Infrastructure and Buildings		29 Points Possible
Y			Prereq 1	Certified Green Building	Required
Y			Prereq 2	Minimum Building Energy Efficiency	Required
Y			Prereq 3	Minimum Building Water Efficiency	Required
Y			Prereq 4	Construction Activity Pollution Prevention	Required
3			Credit 1	Certified Green Buildings	5
2			Credit 2	Building Energy Efficiency	2
			Credit 3	Building Water Efficiency	1
1			Credit 4	Water-Efficient Landscaping	1
			Credit 5	Existing Building Use	1
			Credit 6	Historic Resource Preservation and Adaptive Reuse	1
1			Credit 7	Minimized Site Disturbance in Design and Construction	1
2			Credit 8	Stormwater Management	4
1			Credit 9	Heat Island Reduction	1
			Credit 10	Solar Orientation	1
3			Credit 11	On-Site Renewable Energy Sources	3
2			Credit 12	District Heating and Cooling	2
1			Credit 13	Infrastructure Energy Efficiency	1
			Credit 14	Wastewater Management	2
			Credit 15	Recycled Content in Infrastructure	1
1			Credit 16	Solid Waste Management Infrastructure	1
			Credit 17	Light Pollution Reduction	1
Yes	?	No			
5			Innovation and Design Process		6 points
1			Credit 1.1	Innovation & Exemplary Performance : Offsite Accredited Renewable Energy	1
1			Credit 1.2	Innovation & Exemplary Performance: Waste Treatment Plant	1
1			Credit 1.3	Innovation & Exemplary Performance: Shipping Canal	1
1			Credit 1.4	Innovation & Exemplary Performance: CHP System	1
1			Credit 1.5	Innovation & Exemplary Performance: Use of Phase Change Material	1
			Credit 2	LEED Accredited Professional	1
Yes	?	No			
			Regional Priority Credit		4 points
			Credit 1.1	Regional Priority Credit	1
			Credit 1.2	Regional Priority Credit	1
			Credit 1.3	Regional Priority Credit	1
			Credit 1.4	Regional Priority Credit	1
Yes	?	No			
62			Project Totals (Certification Estimates)		110 Points
			Certified: 40-49 Points, Silver: 50-59 Points, Gold: 60-79 Points, Platinum: 80+ Points		

Table 6-4. Points for connectivity within 800 m of project. Adapted from (USGBC, 2011)

Intersections per 2.6 km^2	Points
≥ 200 and < 250	1
≥ 250 and < 300	2
≥ 300 and < 350	3
≥ 350 and < 400	4
≥ 400	5

Figure 6-17 indicates the location of the qualified intersections in the study area. Results of this analysis show that in this case there are only 124 intersections per 2.6 km^2. Therefore no point can be awarded on this indicator. In the case of Hoyt Yards there are 355 intersections per 2.6 km^2. Comparing Figures 6-17 and 6-18 clearly demonstrates the difference in the intensity of intersections in these two neighborhoods.

Closely related to external connectivity is internal connectivity. The differences are that the buffer distance is reduced to 400 m and intersections inside the development are also counted toward the connectivity requirement. This is to promote multi-modal transportation and enhance the walkability of the development. Only those developments with more than 300 intersections per 2.6 km^2 are eligible for receiving the minimum one point. There are only 125 qualified intersections within the specified area and accordingly MediaCityUK fails to acquire this point.

LEED-ND requires the development to be located within 400 m distance of an existing bicycle network of at least eight continues kilometers. In addition, the developer(s) must provide at least one enclosed bicycle storage space per unit in the multiunit residential buildings. As can be seen in Figure 6-8, the former requirement is met. However the development fails to meet the second requirement.

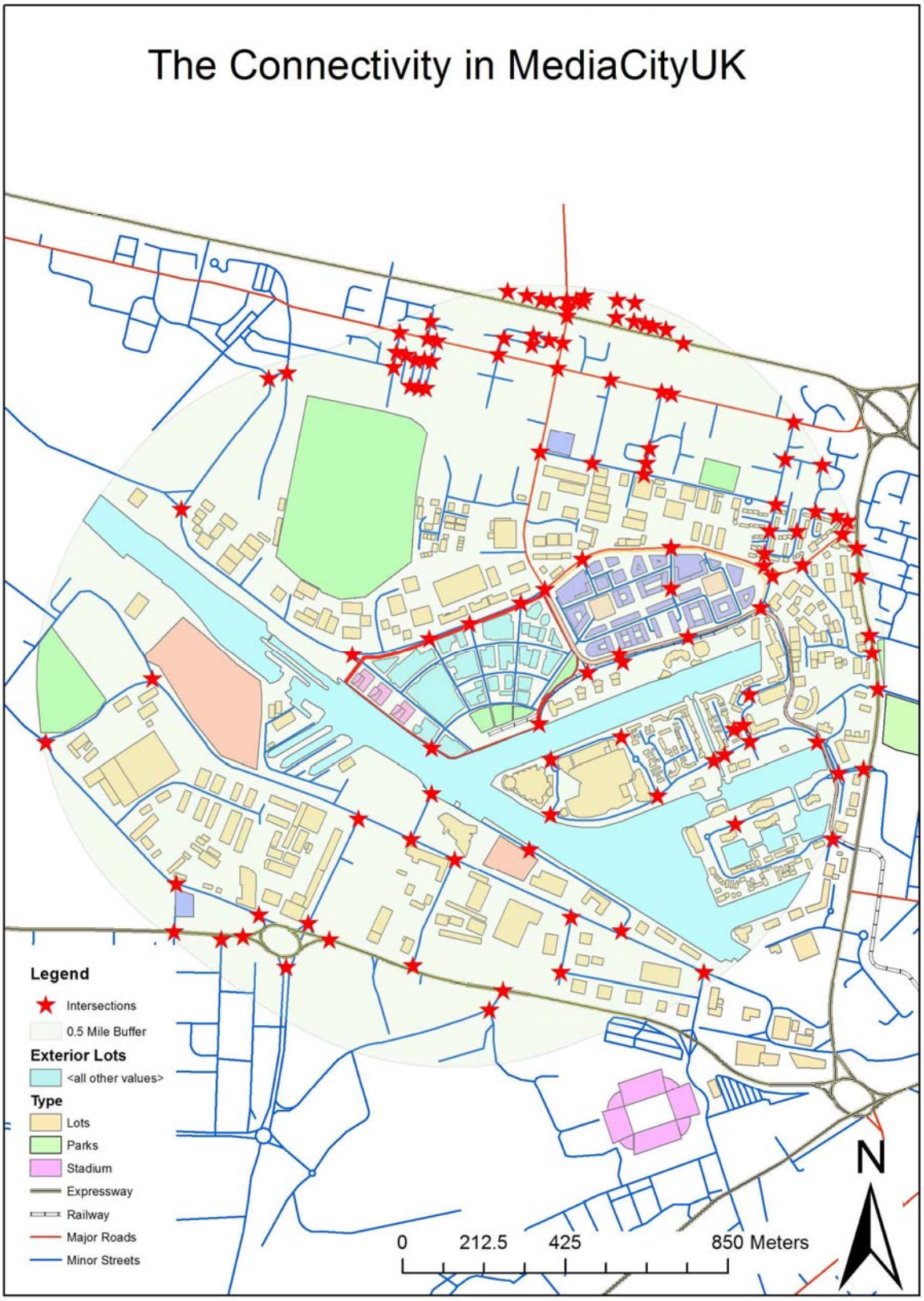


Figure 6-17. The publicly accessible intersections within 800 m boundary of MediaCityUK.

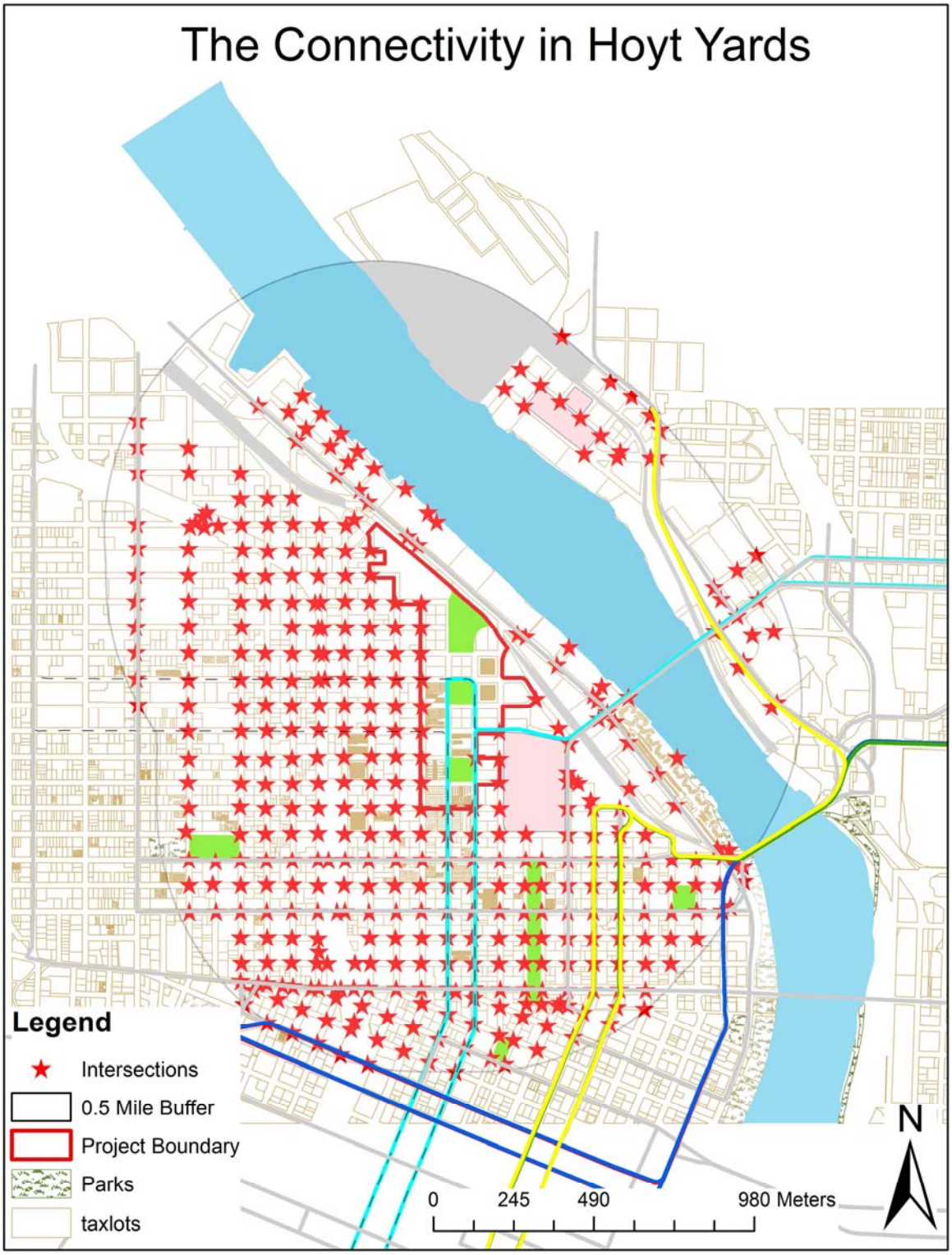


Figure 6-18. The publicly accessible intersections within 800 m boundary of Hoyt Yards.

As a measure to ensure that the development considers the principles of intragenerational equity, LEED-ND allocates seven points for the provision of mixed-income diverse communities. To receive all the possible points, a development must provide a diversity of housing types and consider the varying needs of different income groups.

The Simpson Diversity Index (see the supplementary Appendix) is used for measuring the diversity of the housing stock available in the neighborhood. This index calculates the probability that any two dwelling units randomly selected from the housing stock will be of a different type (USGBC, 2011). The Simpson Index calculated for MediaCityUK equals 0.37. This is less than the minimum acceptable score of 0.5, meaning that a sufficient diversity of housing types is not available.

In addition, rental housing is not available in the neighborhood and, as mentioned earlier, the for-sale dwelling units do not meet the affordability criteria. Thus, intragenerational inequity is one of the main drawbacks of this development.

As mentioned in Chapter 4, from the early years of the neighborhood planning movement, schools have always been considered as elements that play a significant role in creating active and healthy neighborhoods. This is also reflected in LEED-ND assessment framework that encourages accessibility to elementary, middle, and high schools.

Even though University of Salford, as an educational institution, is one of the anchor tenants in MediaCityUK, and MediaCityUK is within 1000 m of a new high school; this development does not meet the LEED-ND criteria because residential component constitutes less than thirty percent of the project's total building area. Another point to be considered is that no elementary school exists within 800 m walk distance of the development, making the neighborhood less desirable for families with small children.

Among the three NSA tools selected for this study, LEED-ND is the only one that takes account of local food production in the neighborhood farms. Neighborhood farms can contribute to the sustainability of the neighborhood through providing access to fresh food, supporting local economic development, minimizing food transportation, and reducing the adverse impacts of industrial agriculture (Sarté, 2010). Likewise Hoyt Yards and Koshigaya Lake Town, no local food production practice is available in the MediaCityUK. Despite its

positive impact on the neighborhood sustainability, facilities related to local food production have seldom been incorporated into the developments certified under the selected NSA tools. The survey of ninety seven certified LEED-ND projects showed that only about 12% of them have received the credit for this criterion.

To encourage water reuse and ensure that pollution from wastewater is reduced, LEED-ND recommends the development to be designed so that at least twenty five percent of the average annual wastewater by the project is retained on-site and reused as potable water (USGBC, 2011). This is again a criterion seldom met by the LEED-ND certified projects. Hoyt Yards is one of the few developments satisfying this criterion, whereas MediaCityUK receives no point on it.

Encouraging energy efficiency through optimum use of passive and active solar energy is one issue considered across the three selected NSA tools. But the strategies they employ are to a large extent different. LEED-ND recommends the blocks to be oriented such that seventy five percent or more of them have "one axis within plus or minus fifteen degrees of geographical east-west, and the east-west lengths of those blocks are at least as long as the north-south lengths of the blocks" (USGBC, 2011, p.96). MediaCityUK does not satisfy this requirement.

The last major drawback of MediaCityUK to be discussed here is concerned with light pollution. This criterion is designed to minimize phenomena such as light trespass and sky-glow, and reduce negative impacts on wildlife environments. To receive the credit for this criterion, among other specifications, a development must install motion sensors to turn off exterior lighting when no lighting is required during nighttime (USGBC, 2011). This is not accounted for in MediaCityUK. A night-time shot of MediaCity UK is shown in Figure 6-19.

The results of this section indicate that evaluating a given project using a different assessment tool might lead to contradictory results. In this case, this stems from the variations in the indicators and benchmarks used across the assessment tools. Above, some of these variations were discussed. Other criteria that exist in both LEED-ND and BREEAM Communities, but are assessed using starkly different benchmarks include: employment, bicycle network and storage, habitat conservation, affordable housing, certified green

buildings, accessibility of local amenities, automobile parking, and energy efficiency. Below the way the performance of MediaCityUK against the first criteria differs when LEED-ND is used for assessment will be discussed.

Figure 6-19. MediaCityUK at night.

Both LEED-ND and BREEAM Communities consider creating employment opportunities as an indispensable element for making sustainable communities. LEED-ND goes one step further and recommends job creation to be accompanied by housing provision. This is to ensure the proximity of housing and jobs. To meet the requirements of this criterion, at least thirty percent of the development's total building area must be residential. This analysis shows that the residential component constitutes roughly fifteen percent of the total building area. Thus despite its capability of contributing to the local economy through adding 15,000 new jobs (SCC, 2011), MediaCityUK fails to satisfy LEED-ND requirements on the employment criterion.

Overall results of the assessment show that MediaCityUK can receive the LEED-ND Gold certification. Figure 6-20 compares the scores for the main themes across the three selected cases.

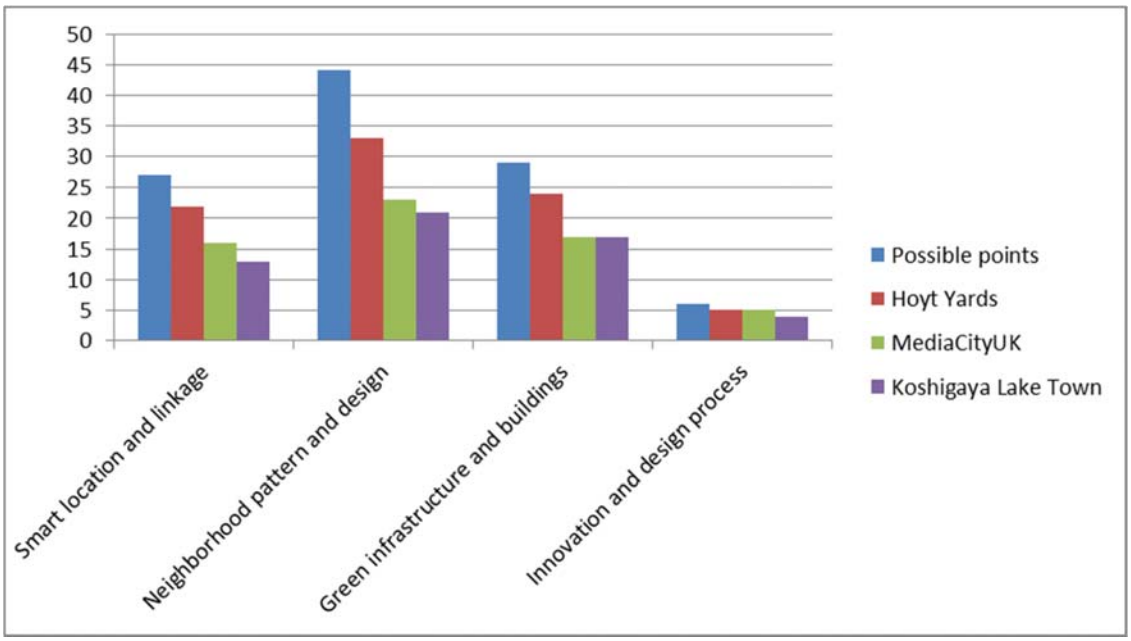


Figure 6-20. Performance of each case against the LEED-ND framework.

6.4.2. Koshigaya Lake Town performance against LEED-ND

The results of this analysis (available in detail in Table 6-5) show that Koshigaya Lake Town, as an exemplary CASBEE-UD certified development, would only achieve a mediocre level of performance when evaluated using LEED-ND framework. The development is ranked as "Excellent" under CASBEE-UD, whereas it would only receive the "Silver" ranking under LEED-ND. This is the largest discrepancy between the performances of a specific development on two different NSA tools that has been observed among all the six cross-evaluations conducted in this study.

It was noted earlier that, due to the heavy focus of LEED-ND on location, connectivity, and walkability; it is difficult, if not impossible, to achieve a high LEED-ND ranking without proper consideration of these criteria. The corresponding table of the supplementary Appendix shows the distribution of credits that Koshigaya Lake Town would receive. It can be observed from this table that Koshiaya Lake Town does not cover most of the requirements of the following highly weighted criteria: preferred location, walkable streets, mixed-income

diverse communities, and green certified buildings. The development would only receive nine out of the thirty four credits available for these four criteria.

Table 6-5. The performance of MediaCityUK against LEED-ND

			LEED 2009 for Neighborhood Development Project Scorecard		
Project Name: Koshigaya Lake Town					
Yes	?	No	Smart Location and Linkage		27 Points Possible
13					
Y			Prereq 1	Smart Location	Required
Y			Prereq 2	Imperiled Species and Ecological Communities	Required
Y			Prereq 3	Wetland and Water Body Conservation	Required
Y			Prereq 4	Agricultural Land Conservation	Required
Y			Prereq 5	Floodplain Avoidance	Required
3			Credit 1	Preferred Locations	10
			Credit 2	Brownfield Redevelopment	2
6			Credit 3	Locations with Reduces Automobile Dependence	7
			Credit 4	Bicycle Network and Storage	1
2			Credit 5	Housing and Job Proximity	3
1			Credit 6	Steep Slope Protection	1
			Credit 7	Site Design for Habitat or Wetland and Water Body Conservation	1
1			Credit 8	Restoration of Habitat or Wetlands and Water Bodies	1
			Credit 9	Long-Term Conservation Management of Habitat or Wetlands	1
Yes	?	No			
22			Neighborhood Pattern and Design		44 Points Possible
Y			Prereq 1	Walkable Street	Required
Y			Prereq 2	Compact Development	Required
Y			Prereq 3	Connected and Open Company	Required
3			Credit 1	Walkable Streets	12
6			Credit 2	Compact Development	6
4			Credit 3	Mixed-Use Neighborhood Centers	4
3			Credit 4	Mixed-Income Diverse Communities	7
			Credit 5	Reduced Parking Footprint	1
			Credit 6	Street Network	2
1			Credit 7	Transit Facilities	1
1			Credit 8	Transportation Demand Management	2
1			Credit 9	Access to Civic and Public Spaces	1
1			Credit 10	Access to Recreation Facilities	1
			Credit 11	Visitability and Universal Design	1
			Credit 12	Community Outreach and Involvement	2
			Credit 13	Local Food Production	1

2			Credit 14	Tree-Lines and Shared Streets	2
			Credit 15	Neighborhood Schools	1
Yes	?	No			
17			Green Infrastructure and Buildings		29 Points Possible
Y			Prereq 1	Certified Green Building	Required
Y			Prereq 2	Minimum Building Energy Efficiency	Required
Y			Prereq 3	Minimum Building Water Efficiency	Required
Y			Prereq 4	Construction Activity Pollution Prevention	Required
			Credit 1	Certified Green Buildings	5
2			Credit 2	Building Energy Efficiency	2
1			Credit 3	Building Water Efficiency	1
1			Credit 4	Water-Efficient Landscaping	1
			Credit 5	Existing Building Use	1
			Credit 6	Historic Resource Preservation and Adaptive Reuse	1
			Credit 7	Minimized Site Disturbance in Design and Construction	1
3			Credit 8	Stormwater Management	4
1			Credit 9	Heat Island Reduction	1
1			Credit 10	Solar Orientation	1
3			Credit 11	On-Site Renewable Energy Sources	3
			Credit 12	District Heating and Cooling	2
1			Credit 13	Infrastructure Energy Efficiency	1
1			Credit 14	Wastewater Management	2
1			Credit 15	Recycled Content in Infrastructure	1
1			Credit 16	Solid Waste Management Infrastructure	1
1			Credit 17	Light Pollution Reduction	1
Yes	?	No			
3			Innovation and Design Process		6 points
1			Credit 1.1	Innovation & Exemplary Performance	1
1			Credit 1.2	Innovation & Exemplary Performance	1
			Credit 1.3	Innovation & Exemplary Performance	1
			Credit 1.4	Innovation & Exemplary Performance	1
			Credit 1.5	Innovation & Exemplary Performance	1
1			Credit 2	LEED Accredited Professional	1
Yes	?	No			
			Regional Priority Credit		4 points
			Credit 1.1	Regional Priority Credit	1
			Credit 1.2	Regional Priority Credit	1
			Credit 1.3	Regional Priority Credit	1
			Credit 1.4	Regional Priority Credit	1
Yes	?	No			
55			Project Totals (Certification Estimates)		110 Points
			Certified: 40-49 Points, Silver: 50-59 Points, Gold: 60-79 Points, Platinum: 80+ Points		

Below, first the shortcomings of Koshigaya Lake Town in terms of these four criteria and other LEED-ND criteria that are not factored in are described. This is followed by a brief overview of its strong points, and discussion about variations in the benchmarks used by LEED-ND and CASBEE-UD.

With regard to the location of the development, LEED-ND awards up to five points to a development which is located on an infill site (See the glossary in the supplementary Appendix for the definition) that is also a previously developed site. As noted earlier, Koshigaya Lake Town is located on former agricultural land. However, its location presents all the characteristics that an infill site must have. According to the LEED-ND specifications, an infill site that is built on previously undeveloped site would receive three points. Related to location, is the existing connectivity within 800 m distance of the project boundary. The benchmarks for this indicator are already shown in Table 6-3. Maximum five points are available for a development with more than 400 intersections within the specified distance. Similar to what was found for the MediaCityUK case, this development fails to meet the minimum requirements for connectivity. It was found that there are 168 eligible intersections within the specified distance. Thirty two more intersections are needed to acquire the minimum one point available for this indicator. These intersections are presented in Figure 6-21.

As far as the walkability is concerned, the results of this analysis suggest that Koshigaya Lake Town would not achieve a high rating. LEED-ND evaluates this criterion using sixteen individual indicators. Koshigaya Lake Town meets the requirements of seven of these indicators, which would enable it to acquire three points. These indicators are concerned with reducing the distance of the building facades from the property line; avoiding blind facades; considering the minimum building-height-to-street-width ration of 1:3; designing the streets in the residential quarters for a target speed of no more than 40 kph; and limiting the number of at-grade crossings with driveways. Further inspection of the remaining nine indicators led us to a very significant finding. Koshigaya Lake Town would not satisfy the requirements of seven of these indicators only because it is a single-use development. To put it another way, incorporating non-residential elements into Koshigaya Lake Town would enable it to achieve eight more points on this criteria, thereby making it qualified for

achieving the LEED-ND “Gold” certification. This clearly demonstrates the interrelatedness of walkability and mixed-use criteria in the LEED-ND framework and its significance for achieving a high ranking.

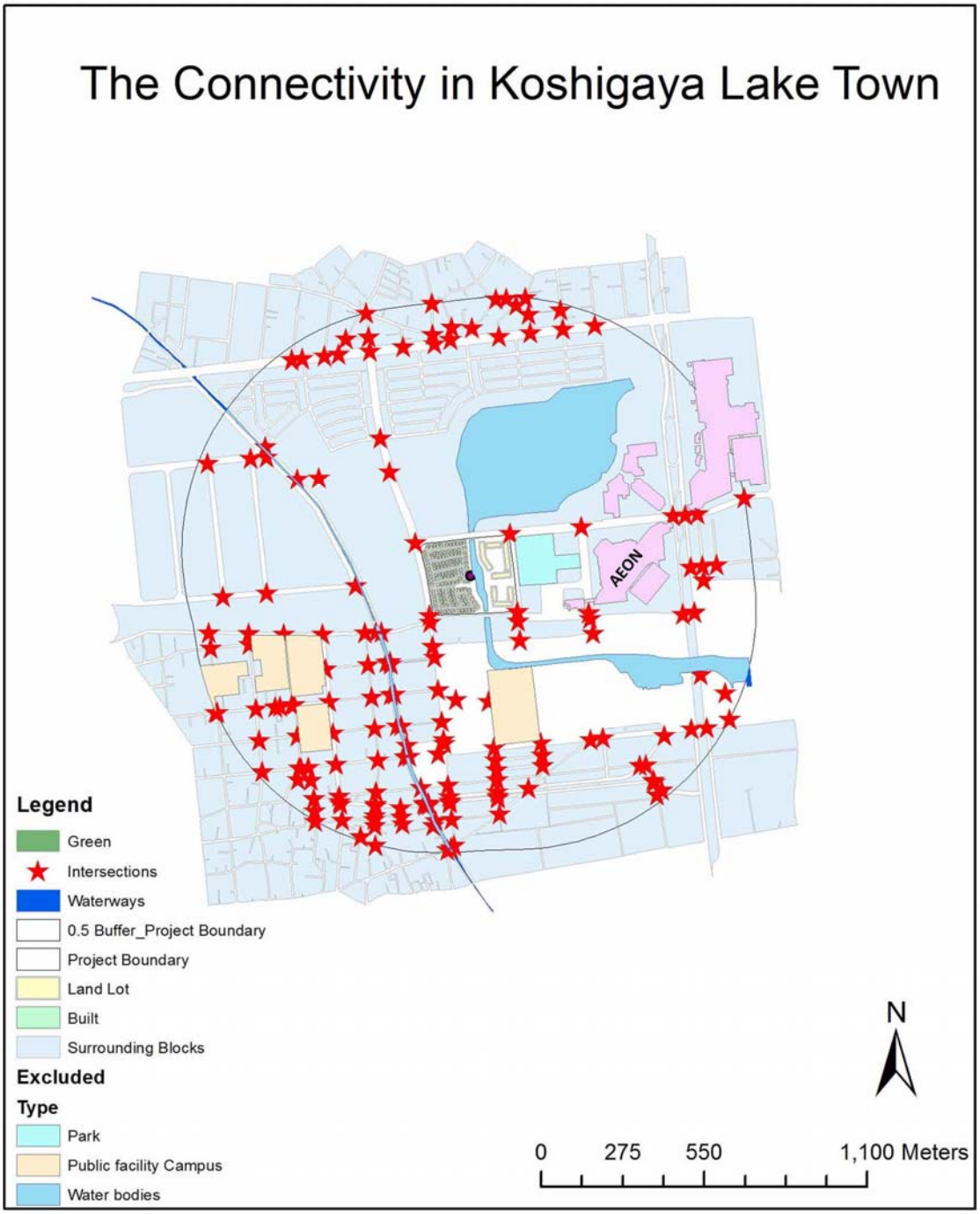


Figure 6-21. The publicly accessible intersections within 800 m boundary of Koshigaya Lake Town.

Other issues that were found out through this analysis are related to the provision of pedestrian-friendly sidewalks and active frontages. These issues are not well considered in Koshigaya Lake Town. As shown in Figure 6-16, the continuity of the walking environment is suffering from frequent interruptions by cars parked in front of the buildings. This diminishes the pedestrian environment and discourages the pedestrian usage of the streets in the neighborhood.

In relation to the incorporation of the principles of mixed-use development into the project, it was found out that Koshigaya Lake Town would receive one point in the LEED-ND scheme. This is an interesting finding because as stated above, Koshigaya Lake Town is not a mixed-use development. The reason for this rather contradictory result is that LEED-ND does not require the non-residential uses to be within the project boundary. Points are awarded based on the number of diverse uses within 400 m walk distance from fifty percent of the dwelling units. Interestingly, in this case all the non-residential uses that count toward meeting the mixed-use requirements are located outside the project boundary. This is an issue that requires further consideration. Other differences related to the indicators and benchmarks used for measuring the mixed-use criterion would be further discussed at the end of this section.

Regarding the creation of mixed-income diverse communities, the Simpson Diversity Index for the area within 400 m of the project's geographic center was calculated. The Simpson Diversity Index score for Koshigaya Lake Town is 0.8 which means that enough diversity of housing type and size has been provided in the development. However, it would be rash to conclude from this that the development meets the housing needs of different income groups. Since rent and property values are higher than the citywide average (Sharifi & Murayama, 2012), the neighborhood is also not sustainable in terms of affordability.

In terms of incorporating green certified buildings, none of the existing buildings have being certified and therefore, Koshigaya Lake Town would not be eligible for achieving the five possible points.

In addition to failure in meeting the above mentioned highly-weighted criteria, Koshigaya Lake Town would fail to pass the LEED-ND requirements for several other

criteria which are relatively less important in terms of points available to be awarded. These criteria, for each of which either one or two points are available, include: “brownfield redevelopment”, “site design for habitat or wetland and water body conservation”, “minimized site disturbance in design and construction”, “bicycle network and storage”, “reduced parking footprint”, “street network”, “visitability and universal design”, “local food production”, “neighborhood schools”, “district heating and cooling”, and “historic resource preservation and adaptive reuse”.

Since Koshigaya Lake Town is a greenfield development, it would not pass the requirements of the first three criteria which require all or parts of the development be built on brownfield areas. Weak performance in terms of site design for habitat protection is contrary to the expectations of this research. Earlier the various efforts taken in this regard were mentioned, and it was showed that it is highly appreciated under CASBEE-UD. This apparent discrepancy may be explained by the fact that measures taken in Koshigaya Lake Town are mainly mitigatory and compensatory, whereas LEED-ND attempts to conserve the habitat in the first place.

With regard to the provision of bicycle network as a means of promoting public health and reducing the vehicle miles travelled (VMT), this analysis found that Koshigaya Lake Town would not pass the LEED-ND requirements. There is no bicycle network of at least eight continuous kilometers within 400 m bicycling distance of the project boundary. Cycling routes are only limited to those along the arterial roads and there are no separate bicycle lanes in the inner areas. Moreover, these routes do not connect the neighborhood to surrounding schools which are already suffering from lack of sidewalks on both sides of the streets that lead them to the dwelling units.

A related issue which has not been well considered in this development is the parking footprint. LEED-ND encourages the parking lots to be located at the rear or side of building so that the building frontages are not blocked. As can be seen from Figure 6-16 this is not well addressed in Koshigaya Lake Town. Furthermore, the neighboring AEON retail store provides a huge amount of surface parking that raises concerns about the success of this development in reducing VMT.

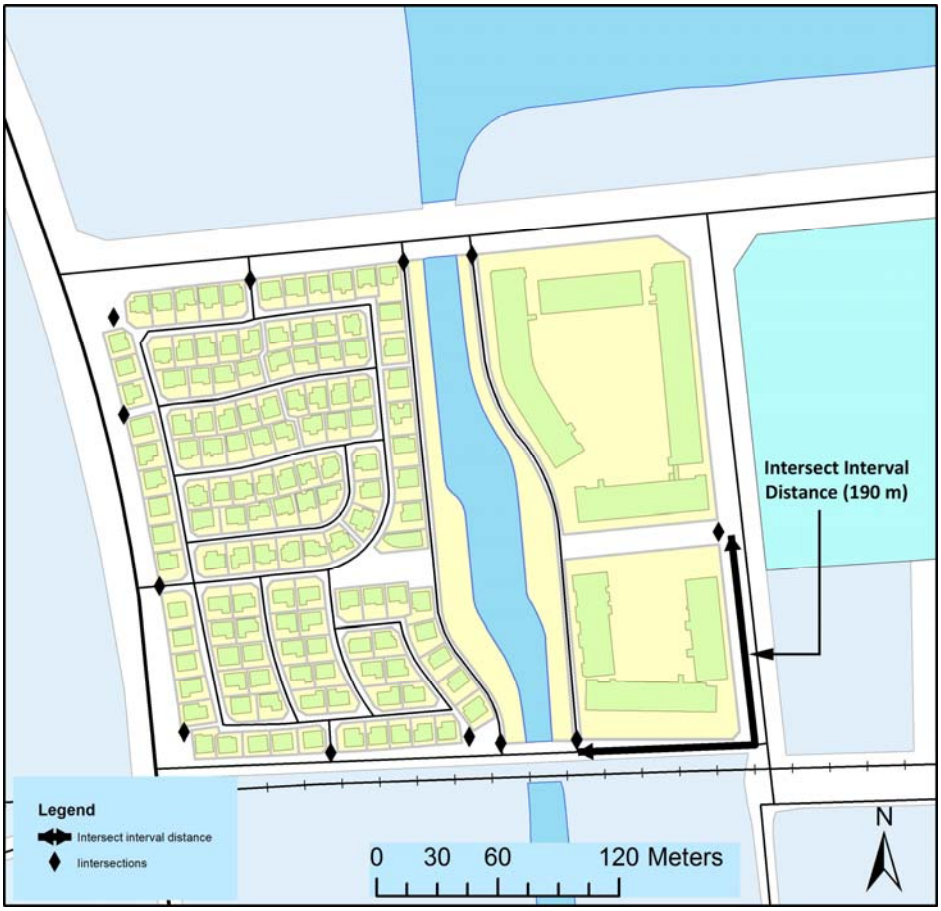


Figure 6-22. Non-compliance with LEED-ND's requirement for internal connectivity.

At the beginning of this section the development's weakness in terms of external connectivity was discussed. Internal connectivity is a closely related criterion. It was found out that this criterion has not been well addressed in Koshigaya Lake Town. The internal connectivity criterion requires the development to be located in a way that a through-street/or non-motorized right-of-way intersects the project boundary at least every 122 m. As seen in Figure 6-22, the eastern blocks do not comply with this requirement. The intersect interval distance in this figure is 190 m. The other requirement is that the density of intersections within 400 m distance of the project boundary should be higher than 115 intersections per square kilometer. In this case there are only 104 intersections per square kilometer.

The other two notable criteria for which Koshigaya Lake Town would not receive any points are district heating and cooling and local food production. It is important to point out that the latter criterion has been overlooked in all the three cases studied here.

Now, it is time to consider the major achievements of Koshigaya Lake Town based on the results of this analysis. As the corresponding table in the supplementary Appendix shows, the development performs high on the following criteria: “location with reduced automobile dependence”, “transit facilities”, “restoration of habitats or wetlands and water bodies”, “building energy efficiency”, “stormwater management”, “on-site renewable energy sources”, “solid waste management”, “tree-lined and shaded streets”, “housing and jobs proximity”, and “compact development”.

All these criteria, except for the last two ones, have already been discussed in Section 6.3.3, and therefore will not be repeated again. Only the achievements related to the last two criteria are briefly explained here.

In terms of housing and jobs proximity, Koshigaya Lake Town would acquire all the available points because there are several establishments within 800 m distance of the development that provide jobs whose number is greater than the dwelling units in the development. It is worth noting however, that there is no guarantee that all the residents work in those establishments.

The compact development criterion requires the developments with existing transit service to have 157 or more dwelling units per hectare. In this case there are 175 dwelling units per hectare which is much higher than the defined benchmark.

Similar to the previous analysis, it is now time to discuss the major issues related to differences in the benchmarks used for assessment, and the viability of applying universal standards. Returning to the criterion of compact development, defining a meaningful benchmark is probably the most important step in judging the performance of a development. The fact that residential densities of American cities are often significantly lower than their European and Asian counterparts (Shelton, 1999), implies that, in the case of adopting this criterion in a different context, benchmarks need to be adjusted as well.

The minimum LEED-ND point for this criterion is awarded to any development that provides twenty five dwellings per hectare. This is specified for the American context where the average urban residential density is around four dwellings per hectare (U.S. Census Bureau., 2004). Residential density in most urban areas of Europe and Asia is already higher

than twenty five dwellings per hectare (Whitehead, 2008), meaning that a higher threshold is necessary to encourage building denser communities. It is also important to bear in mind that even within the American context some denser areas such as New York and Los Angeles exists that make the adjustment of the benchmarks indispensable.

A similar argument can be made about one of the indicators used for measuring the walkability in the neighborhood. LEED-ND mandates that the street-facing building facades in the project should be no more than 8 m distant from the property line. Again, this is a benchmark that is appropriate for the American context. As Shelton (1999) argues, a typical Japanese house sits close to the property line, making this benchmark irrelevant. The typical forms of setbacks in Japanese and American cities are illustrated in Figure 6-23. It clearly shows the stark difference between Japanese and American cities in terms of distance from the property line. As already noted, measurement of the degree of compliance with the mixed-use principles is different across the selected NSA tools. Apart from variations in the optimum distances, one major difference is related to the diversity of uses and the methods used for counting them. According to CASBEE-UD, seven different categories of services exist. These are food, welfare, financial, medical, administrative, educational, and cultural. One establishment from each category is necessary and there is no restriction on locating all establishments in one building.

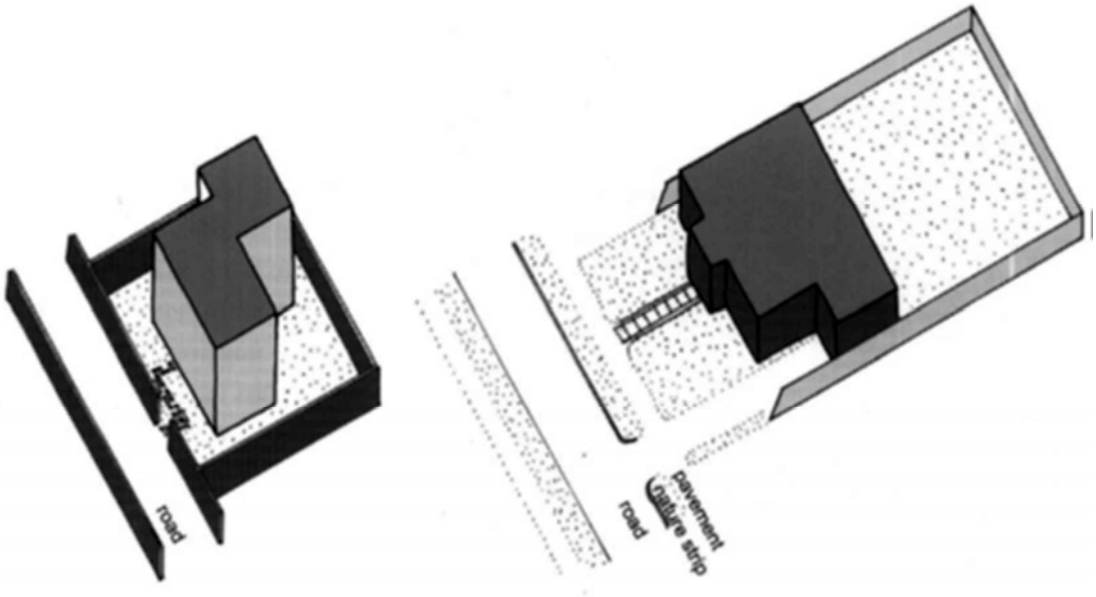


Figure 6-23. Typical forms of setbacks in Japanese (left) and American cities (right). Source: Shelton (1999).

By contrast, LEED-ND divides twenty seven diverse uses into four categories of food retail, community-serving retail, services, and civic and community facilities. At least one use from each of these categories must be included in the project. The other condition is that when several enterprises are situated in a single building, only those with separate exterior entrances to the outdoors are counted. This is the reason why despite providing a variety of uses inside the AEON building (location is shown in Figure 6-21), Koshigaya Lake Town is only eligible for one out of the four possible points for mixed-use.

This is an issue that should be dealt with carefully. Although street facing uses are significant for creating a more active urban environment, the extreme cold and/or hot weathers in some parts of the world might make it more reasonable to place the diverse uses inside mixed-use buildings. In the meantime, caution is required to avoid accrediting single-use developments such as Koshigaya Lake Town where the majority of uses are situated in a single building and there is little activity inside the neighborhood.

The next section presents the results of evaluating Hoyt Yards using BREEAM Communities and takes up some other issues related to the variations in the benchmarks used for assessment across the three selected tools.

6.4.3. Hoyt Yards' performance against BREEAM Communities

The evaluation of Hoyt Yards using BREEAM Communities revealed that among the sixty three criteria outlined in the assessment framework, there are only six criteria that receive no credit : "building reuse", "flexible parking", "home zones", "domestic buildings" "non-domestic buildings", and " building refurbishment". Hoyt Yards' performance on these criteria is described below. The detailed results of this assessment are presented in Tables 6-6 and 6-7.

Since the development is built on a former rail yard, there has been no building appropriate to be reused. The "flexible parking" criterion requires the development to provide flexible spaces that can accommodate other uses, such as play and market, outside the areas of peak parking demand (BRE, 2011). No such spaces are provided in Hoyt Yards.

Home zone, which is also called Woonerf in some countries, is a street designed to be shared by pedestrians, cyclists, automobiles, and everyone else who uses the street (BRE, 2011). Only those developments which fifty percent of their residential streets meet the design requirements of home zones can receive the minimum one credit for this criterion. Hoyt Yards does not meet this criterion.

BREEAM Communities mandates that all residential and non-residential buildings within the development must be assessed under an appropriate building assessment tool. Among the existing buildings, the Metropolitan Condominium is the only one certified as Silver under LEED-NC (LEED scheme for new construction).

Since no building was retained in the Hoyt Yards case, "building refurbishment" is not relevant.

The analysis demonstrates that business, as one of the primary focuses of BREEAM Communities, is not adequately considered in the development of Hoyt Yards. BREEAM Communities emphasizes the significant implications of the presence of business priority sectors for the sustainability of neighborhood development. There is no evidence of such sectors in Hoyt Yards.

Table 6-6. Hoyt Yards' performance against BREEAM Communities

			Pre-requisite	Credits Available	Credits Achieved
	CE1	Flood Risk Assessment (Location)	✓	3	3
	CE2	Surface Water Runoff	✓	3	3
	CE3	Rainwater SUDS		3	1
	CE4	Heat Island		3	3
	CE5	Energy Efficiency	✓	3	3
	CE6	Onsite Renewable(s)	✓	3	3
	CE7	Future Renewable(s)		3	1
	CE8	Services		3	1
	CE9	Water Consumption		3	1
	CE10	Design Weather Resilience		3	2
	CE11	Sub/smart metering		3	2
	RES1	Low Impact	✓	3	1
	RES2	Locally Sourced Materials		3	3
	RES3	Road Construction		3	3
	RES4	Resource efficiency		3	1
	RES5	Groundwater		3	3
	RES6	Land Remediation		3	3
	PS1	Sequential Approach		3	3
	PS2	Land Reuse		3	3

	PS3	Building Reuse		3	0
	PS4	Landscaping		3	1
	PS5	Design and Access	✓	3	3
	PS6	Green Areas		3	2
	PS7	Local Demographics	✓	3	1
	PS8	Affordable Housing	✓	3	2
	PS9	Secure by Design		3	3
	PS10	Active Frontages		3	2
	PS11	Defensible Spaces		3	3
	PS12	Local Vernacular		3	1
	PS13	Security Lighting		3	1
	PS14	Form of Development, connectivity		3	2
	PS15	Form of Development-Pedestrian Movement		3	3
	TRA1	Location/Capacity		3	2
	TRA2	Availability/Frequency		3	2
	TRA3	Facilities		3	2
	TRA4	Local Amenities		3	3
	TRA5	Network/Cycling		3	2
	TRA6	Facilities/Cycling		3	1
	TRA7	Car Clubs		3	2
	TRA8	Flexible Parking		3	0
	TRA9	Local Parking	✓	3	3
	TRA10	Home Zones		3	0
	TRA11	Transport Assessment	✓	3	2
	TRA12	Electric Vehicle Charging Points		3	2
	TRA13	Transport Impacts		3	3
	TRA14	Commercial LGV Plan		-	2
	COM1	Inclusive Design	✓	3	3
	COM2	Consultation	✓	3	3
	COM3	Development User Guide		3	3
	COM4	Management and Operation		3	1
	ECO1	Ecological Survey	✓	3	3
	ECO2	Biodiversity Action Plan		3	2
	ECO3	Native Flora		3	1
	ECO4	Wildlife Corridors		3	1
	BUS1	Business Priority Sectors		3	1
	BUS2	Labour and Skills		3	2
	BUS3	Employment		3	2
	BUS4	New Business		3	1
	BUS5	Business facilities		3	3
	BLD1	Domestic	✓	3	0
	BLD2	Non Domestic	✓	-	0
	BLD3	Building Refurbishment		-	0
	Innovation	Innovation Credits		3	3

Table 6-7. The performance of Hoyt Yards under each main theme of BREEAM Communities

Theme	Credit Available	Credit Achieved	% Score Achieved
Climate and Energy	33	23	70.00%
Resources	18	14	77.78%
Place Shaping	45	30	66.66%
Transport and Movement	42	26	61.90%
Community	12	10	83.33%

Ecology and Biodiversity	12	5	58.33%
Business and Economy	15	9	60.00%
Buildings	9	3	33.33%
Innovative Credits	15	12	80.00%
Rank = Very Good			65.70%
BREEAM rating			% score
Outstanding			≥ 85
Excellent			≥ 70
Very Good			≥ 55
Good			≥ 45
Pass			≥ 30
Unclassified			< 30

One interesting and important finding is that acquiring LEED-ND's highest credit, on a specific criterion, does not guarantee achieving the highest score under BREEAM Communities. Put another way, Hoyt Yards receives the highest credit on some of the specific criteria under LEED-ND, but just an average score from BREEAM Communities on the same exact criteria. Three specific examples of these variations in performance evaluation scores are given below. It should, nevertheless, be borne in mind that this argument applies to many of the criteria used and is not only restricted to the examples discussed here. Other identical criteria for which different indicators and benchmarks are used include, but are not limited to, local amenities, car clubs, universal design, employment, business, energy efficiency, and water efficiency.

Accessibility of green space is a criterion included in all three NSA tools selected for this study. While there is an ample area of green space in the neighborhood, and Hoyt Yards achieves the related credits in LEED-ND, the provided green space is not large enough to receive all the three available credits under BREEAM Communities. For a development to achieve all three points, not only should the green area be within 300 m walk distance from all dwellings, but it should also be larger than two hectares (BRE, 2011). These requirements are stricter than those mandated by LEED-ND that requires a green space of at least 675 m^2 in size within 400 m of ninety percent of dwellings (USGBC, 2011).

Provision of active frontages, aimed at enhancing walkability in the neighborhood, is a criterion emphasized in both LEED-ND, and BREEAM Communities. However, the indicators these two NSA tools use for assessing compatibility with this criterion are different.

To achieve the highest BREEAM Communities score for active frontages, fifty percent of a development must incorporate the following characteristics: more than fifteen premises every 100 m; more than 25 doors and windows every 100 m; a large range of functions; no blind facades and few passive ones; much depth and relief in building surface and; high quality materials and refined details (BRE, 2011).

On the other hand, LEED-ND awards the highest credit to those developments in which: functional entries to the buildings occur at an average of 9 m or less along non-residential or mixed use buildings or blocks; no more than forty percent of length or 15 m , whichever is less, of those facades extending along the sidewalks is blank; all ground-level retail, service, or trade windows are kept un-shuttered at night; and some other issues important for improving the walkability of urban neighborhoods are considered (USGBC, 2011). Under LEED-ND, Hoyt Yards receives a high credit for this criterion. However, it does not fulfill all the requirements of BREEAM Communities and can only receive an average score.

The third example to cite here is related to the provision of transit facilities. Similar to the previous two examples, Hoyt Yards receives the highest available credit under LEED-ND, but fails to acquire the highest BREEAM Communities score.

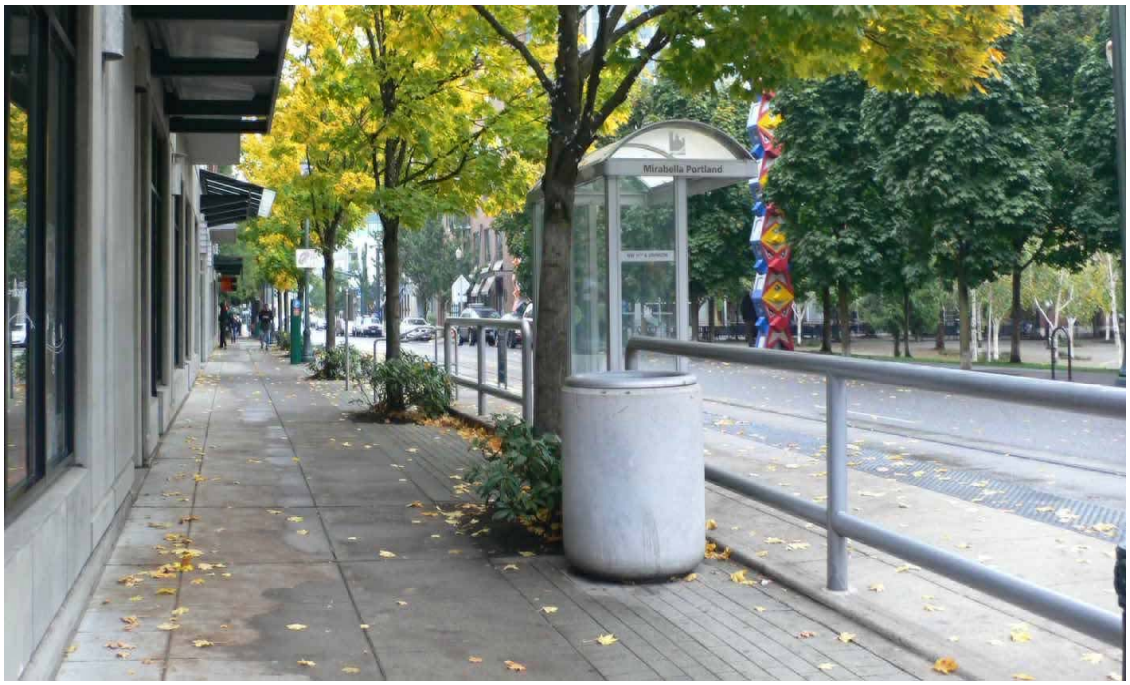


Figure 6-24. A typical train station in Hoyt Yards

In addition to the provision of safe, convenient, sheltered station with timetable and seating, which are mentioned in LEED-ND as well, BREEAM Communities requires the stations to be served by real timetable information and CCTV (closed-circuit television). Existing stations in the neighborhood do not provide the latter services and are not eligible for receiving the maximum BREEAM Communities score. Figure 6-24 shows the conditions of a typical station in the study area.

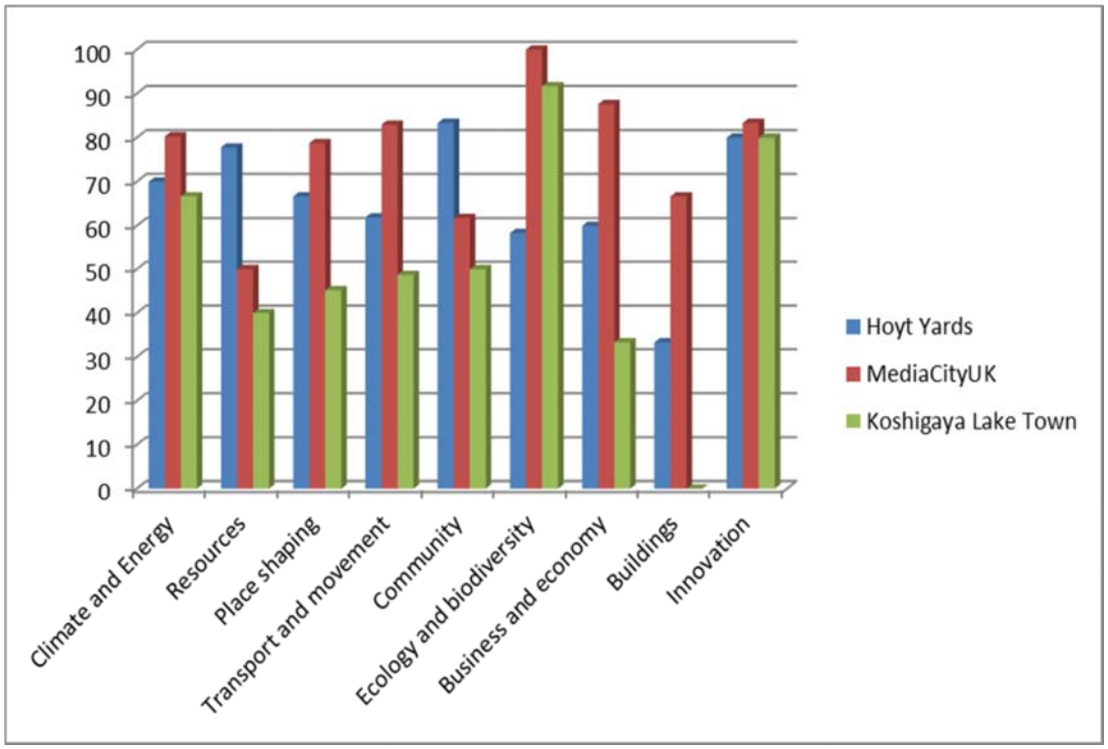


Figure 6-25. Performance of each case against the BREEAM Communities framework.

A related, but separate, finding is that failure to receive the LEED-ND credits for a specific criterion does not necessarily imply that it is impossible to achieve the corresponding BREEAM Communities credits. To mention one example: despite the conduction of ecological surveys and development of Tanner Springs Park, as an exemplary practice of wetland restoration and sustainable park design, Hoyt Yards does not achieve the related credit because the restored area is smaller than ten percent of the development footprint. However, BREEAM Communities does not specify a minimum size for the restored wetland area. Therefore, this development can receive the related points under BREEAM while failing to receive the credits for the same criteria under LEED-ND.

The Hoyt Yards' performance by each theme and the comparative performance of all the three case studies against BREEAM Communities are illustrated in Figure 6-25. Overall, the development can be awarded BREEAM Communities "Very Good" ranking.

Again, one interpretation of these findings is that assessments are significantly influenced by the variations in the indicators and benchmarks used in the NSA tool. This demands paying a special attention to the context-specifies. Once the rest of cross-evaluations are completed, these findings will be further discussed in Section 7.

6.4.4. Koshigaya Lake Town performance against BREEAM Communities

The detailed results of this analysis are presented in Tables 6-8 and 6-9. Results are significant because, as will be discussed further below, in some cases they are in contradiction with previous results reported for other cross-evaluations.

As the results show, this development would receive the BREEAM Communities Good rating. Koshigaya Lake Town's performance by each theme of BREEAM Communities is shown in Figure 6-25. As is evident, the themes that rank high, in term of achieved credits, are "ecology and biodiversity", "climate and energy", and "innovation". Themes that rank low include "buildings" and "business and economy". More details on the strengths and weaknesses are given below

With regard to the strong points, results can be divided into three categories. Firstly, those which corroborate what were found in the previous analyses. Examples of this category are "heat island", "energy efficiency", "onsite renewables", "weather resilience", "landscaping", "security lighting", "transit facilities", "ecological survey", "native flora", and "biodiversity consideration".

Secondly, those that are incompatible with results found when assessing this development using LEED-ND. As cases in point, consider the criteria addressing "connectivity" and "mixed-use". The development's performance on these criteria was criticized when LEED-ND was used for assessment. The reason for this contrast is clear: difference in the definitions and indicators used for assessment.

LEED-ND and BREEAM Communities have different approaches towards connectivity. The former emphasizes the density of intersections in and around the development with the aim of facilitating pedestrian movement. Whereas, the latter is inclined towards vehicle movement and encourages direct connection of the main routes within the development to main routes in the wider area, as well as, provision of direct sight lines across the neighborhood streets.

In terms of mixed-use principles, unlike LEED-ND, CASBEE-UD does not require the different enterprises to be situated in premises with exterior entrances to outdoors. Therefore, diverse enterprises inside the AEON building may each count and Koshigaya Lake Town would receive the maximum points.

Thirdly, results that reveal further achievements of Koshigaya Lake Town. The most notable examples are related to the local vernacular and measures taken to ensure that the local character is incorporated into the development. These include planting cherry blossom trees along the canal to make it harmonized with the local scenery, and careful choice of wall claddings and colors.

Table 6-8. Koshigaya Lake Town's performance against BREEAM Communities

			Pre-requisite	Credits Available	Credits Achieved
	CE1	Flood Risk Assessment (Location)	✓	3	2
	CE2	Surface Water Runoff	✓	3	1
	CE3	Rainwater SUDS		3	0
	CE4	Heat Island		3	3
	CE5	Energy Efficiency	✓	3	3
	CE6	Onsite Renewable(s)	✓	3	3
	CE7	Future Renewable(s)		3	1
	CE8	Services		3	3
	CE9	Water Consumption		3	1
	CE10	Design Weather Resilience		3	3
	CE11	Sub/smart metering		3	2
	RES1	Low Impact	✓	3	0
	RES2	Locally Sourced Materials		3	0
	RES3	Road Construction		3	3
	RES4	Resource efficiency		3	2
	RES5	Groundwater		3	1
	RES6	Land Remediation		-	-
	PS1	Sequential Approach		3	1
	PS2	Land Reuse		3	0
	PS3	Building Reuse		-	-
	PS4	Landscaping		3	3

	PS5	Design and Access	✓	3	1
	PS6	Green Areas		3	2
	PS7	Local Demographics	✓	3	0
	PS8	Affordable Housing	✓	3	0
	PS9	Secure by Design		3	2
	PS10	Active Frontages		3	0
	PS11	Defensible Spaces		3	1
	PS12	Local Vernacular		3	3
	PS13	Security Lighting		3	3
	PS14	Form of Development, connectivity		3	3
	PS15	Form of Development-Pedestrian Movement		3	0
	TRA1	Location/Capacity		3	2
	TRA2	Availability/Frequency		3	3
	TRA3	Facilities		3	3
	TRA4	Local Amenities		3	3
	TRA5	Network/Cycling		3	1
	TRA6	Facilities/Cycling		3	1
	TRA7	Car Clubs		3	0
	TRA8	Flexible Parking		3	0
	TRA9	Local Parking	✓	3	0
	TRA10	Home Zones		3	0
	TRA11	Transport Assessment	✓	3	3
	TRA12	Electric Vehicle Charging Points		3	2
	TRA13	Transport Impacts		3	1
	TRA14	Commercial LGV Plan		-	-
	COM1	Inclusive Design	✓	3	1
	COM2	Consultation	✓	3	0
	COM3	Development User Guide		3	3
	COM4	Management and Operation		3	2
	ECO1	Ecological Survey	✓	3	3
	ECO2	Biodiversity Action Plan		3	3
	ECO3	Native Flora		3	3
	ECO4	Wildlife Corridors		3	2
	BUS1	Business Priority Sectors		3	1
	BUS2	Labour and Skills		3	1
	BUS3	Employment		3	1
	BUS4	New Business		3	1
	BUS5	Investment		-	-
	BLD1	Domestic	✓	3	0
	BLD2	Non Domestic	✓	-	-
	BLD3	Building Refurbishment		-	-
	Innovation	Innovation Credits		15	12

Table 6-9. The performance of Koshigaya Lake Town under each main theme of BREEAM Communities

Category	Credit Available	Credit Achieved	% Score Achieved
Climate and Energy	33	21	66.66%
Resources	15	6	40.00%
Place Shaping	42	19	45.23%
Transport and Movement	39	19	48.71%
Community	12	6	50.00%
Ecology and Biodiversity	12	11	91.67%
Business and Economy	12	4	33.33%

Buildings	9	0	00.00%
Innovative Credits	15	12	80.00%
Rank= Very Good			50.62%
BREEAM rating			% score
Outstanding			≥ 85
Excellent			≥ 70
Very Good			≥ 55
Good			≥ 45
Pass			≥ 30
Unclassified			< 30

In much the same way as the classification of the strengths of the development, results showing the weaknesses can be divided into three categories. Firstly, those confirming the findings obtained from evaluating this development using LEED-ND. These are related to "green roofs and green walls", "locally sourced materials", "land reuse", "inclusive communities", "affordability", "active frontages", "pedestrian environment", "parking footprint", "bicycle network and storage", "home zones", and "certified green building".

Secondly, results that are in contrast with the findings under LEED-ND. Take, for example, the case of consultation and citizen involvement. Approaches towards citizen involvement are different across the three selected NSA tools. They all encourage the participation of various stakeholders early in the planning process, and recommend that the initial plan should be modified according to the input received from the participants. As an additional measure to improve the quality of decision-making process, BREEAM Communities awards the maximum credits to developments that allow stakeholders to make choices from a range of alternatives. This is the point that makes a significant difference across the tools, and is the reason why despite receiving the credits for consultation under LEED-ND and CASBEE-UD, Koshigaya Lake Town would fail to obtain the corresponding credits under BREEAM Communities.

Thirdly, results that highlight problems not revealed in previous analyses. These include shortcomings in issues related to construction materials, transportation, and business and employment.

Utilization of locally sourced materials in this development is limited to the road construction which is not enough to meet the requirements of BREEAM Communities.

In relation to transportation facilities, there is further evidence showing that Koshigaya Lake Town is relatively unsuccessful in encouraging the reduction of automobile dependence. Developers have taken no measures to reduce car dependency through support for establishment of a car club. Unlike BREEAM Communities which calls for maximum car parking standards, in order to reduce levels of available car parking, CASBEE-UD rewards those developments which satisfy minimum car parking standards. This is reflected in Koshigaya Lake Town where developer has provided two parking lots for each detached house, and one parking lot for each unit in the condominium complex (IBEC, 2009).

Regarding the business and employment opportunities, results show that this development has a poor performance. No measures have been taken to introduce business priority sectors and offer employment in the neighborhood.

This section is concluded by reporting the findings related to variability of standards used for assessment. Findings indicate that, besides the above examples, these two assessment tools have used considerably different indicators and benchmarks for evaluating performance against the following criteria: universal design; accessibility of facilities; availability and frequency of transit services; resource efficiency; energy and water consumption; and habitat improvement.

As far as the utilization of different indicators and benchmarks is concerned, universal design is the only one that, so far has not been commented on. As a criterion used in all three selected assessment tools, universal design is aimed at improving the environment in order to enable a broad spectrum of people, regardless of their age and physical ability to participate in community life (USGBC, 2011). In much the same way as specified by LEED-ND, BREEAM Communities requires both interior and exterior spaces in the development to be in compliance with the principles of universal design. CASBEE-UD however, only evaluates the conditions of exterior spaces. This analysis showed that universal design principles are not well addressed inside the buildings. Therefore, despite meeting the requirements of CASBEE-UD, Koshigaya Lake Town fails to satisfy the specifications of BREEAM Communities and

LEED-ND. The principal reason for this discrepancy is that under CASBEE-UD the interior space of buildings is excluded from assessment and is advised to be evaluated under the CASBEE scheme for building.

The next two sections report on the sustainability of Hoyt Yards and MediaCityUK based on CASBEE-UD standards.

6.4.5. Hoyt Yards' performance against CASBEE-UD

The assessment of Hoyt Yards using CASBEE-UD scheme yielded additional insights into the weaknesses of this case. It also provided further evidence for discussing the possibility of developing a universal NSA tool.

Detailed results of the analysis are shown in Table 6-10. These results demonstrate that, when evaluated against CASBEE-UD, Hoyt Yards's performance on the following criteria is below the normal level (level three): "mitigation of heat island effect with green space and open water"; "providing a suitable habitat for flora and fauna"; "ensuring good air quality, acoustic and vibration environments"; "planning of building group layout and forms to avoid blocking wind"; "mitigation of light pollution from lighting and advertising displays"; "and classification, treatment, and disposal of waste". Below, the Hoyt Yards' performance on these criteria will be briefly described.

Heat island mitigation is the primary focus of CASBEE-UD. To ensure that the minimum possible amount of heat is absorbed within the development, and thus minimizing the need for artificial cooling, eight criteria are designated exclusively for assessing the heat island impacts. To earn the highest score for heat island mitigation through green space and water surface provision, a development should meet these requirements: the provided green space and water surface area must constitute at least fifteen percent of the development footprint; paved area must be less than ten percent; development must include green roofs open to public; and the rate of green walls in the development be greater than twenty percent (IBEC, 2007). Of these strict requirements, Hoyt Yards only meets the first one.

In Section 6.3.1, the significant efforts taken in the Tanner Springs Park for enhancing the habitat for flora and fauna were explained. Despite this, and contrary to expectations, Hoyt

Yards does not meet the corresponding CASBEE-UD specifications which encourage the compartmentalization between human space and habitat, planting food trees favored by organisms living in the area, and providing porous spaces for organisms to live in (IBEC, 2007).

Addressing the noise and vibration impacts is one important issue that the LEED-ND framework is missing. In contrast, CASBEE-UD adequately considers it and encourages the provision of buffer zones (green space, acoustic walls, etc.) for mitigating pollution, noise, and vibration impacts. This issue is not appropriately considered in Hoyt Yards.

As another measure for reducing heat island impacts, CASBEE-UD specifies that the area of the building's elevation facing the prevailing summer wind must be reduced, and adequate spacing between adjacent blocks (in directions perpendicular to the prevailing summer wind) be provided for easing the air movement. Summer prevailing wind direction in the area is NNW (north by west wind which goes towards south by south east) (WRCC, 2012), which is different from the direction of spacing between the blocks.

Table 6-10. Hoyt Yards' performance against CASBEE-UD

Concerned Categories	Score	Weight	Overall
Q_{UD} Environmental Quality in Urban Development			3.8
$Q_{UD}1$ Natural Environment (microclimates & ecosystems)		0.25	3.3
1.1 Consideration and conservation of microclimates in pedestrian space in summer	3.2	0.35	3.2
1.1.1 Mitigation of heat island effect with the passage of air	4.0	0.30	
1.1.2 Mitigation of heat island effect with shading	4.0	0.20	
1.1.3 Mitigation of heat island effect with green space and open water etc.	2.0	0.30	
1.1.4 Consideration for the positioning of heat exhaust	3.0	0.20	
1.2 Consideration and conservation of terrain	3.6	0.20	3.6
1.2.1 Building layout and shape design that consider existing topographic character	3.0	0.33	
1.2.2 Conservation of topsoil	3.0	0.33	
1.2.3 Consideration of soil contamination	5.0	0.33	
1.3 Consideration and conservation of water environment	3.0	0.15	3.00
1.3.1 Conservation of water bodies	-	-	
1.3.2 Conservation of aquifers	3.0	1.00	
1.3.3 Consideration of water quality	-	-	
1.4 Conservation and creation of habitat	3.5	0.10	3.5
1.4.1 Grasping the potential of the natural environment	5.0	0.25	
1.4.2 Conserving natural resources (Conservation or regeneration of natural resources)	4.0	0.25	
1.4.3 Creating ecosystem networks	3.0	0.25	
1.4.4 providing a suitable habitat for flora and fauna	2.0	0.25	
1.5 Other consideration for the environment inside the designated area	3.3	0.20	3.3
1.5.1 Ensuring good air quality, acoustic and vibration environments	2.0	0.33	
1.5.2 Improving the wind environment	4.0	0.33	
1.5.3 Securing sunlight	4.0	0.33	
$Q_{UD}2$ Service functions for the designated area		0.45	4.0
2.1 Performance of supply and treatment systems (mains water, sewerage, …)	3.0	0.20	3.0
2.1.1 Reliability of supply and treatment systems	3.0	0.50	
2.1.2 Flexibility to meet changing demand and technical innovation in supply and treatment systems	3.0	0.50	
2.2 Performance of information systems	3.6	0.15	3.6
2.2.1 Reliability of information systems	3.0	0.33	

	2.2.2 Reliability to meet changing demand and technical innovation in information systems	3.0	0.33	
	2.2.3 Usability	5.0	0.33	
2.3 Performance of transportation systems		5.0	0.15	5.0
	2.3.1 Sufficient capacity of transportation systems	5.0	0.50	
	2.3.2 Securing safety in pedestrian areas etc.	5.0	0.50	
2.4 Disaster and crime prevention performance		3.7	0.20	3.7
	2.4.1 Understanding the risk from natural hazards	3.0	0.25	
	2.4.2 Securing open space as wide area shelter	4.0	0.25	
	2.4.3 Providing proper evacuation routes	4.0	0.25	
	2.4.4 Crime prevention performance (surveillance and territoriality)	4.0	0.25	
2.5 Convenience of daily life		4.3	0.15	4.3
	2.5.1 Distance to daily-use stores and facilities	4.0	0.33	
	2.5.2 Distance to medical and welfare facilities	4.0	0.33	
	2.5.3 Distance to educational and cultural facilities	5.0	0.33	
2.6	Consideration of universal design	5.0	0.15	5.0
$Q_{UD}3$ Contribution to the local community (history, culture, scenery and revitalization)		4.1	0.30	4.1
3.1 Use of local resources		3.0	0.20	3.0
	3.1.1 Use of local industries, personnel, and skills	3.0	0.50	
	3.1.2 Conservation and use of historical, cultural and natural assets	3.0	0.50	
3.2 Contribution to the formation of social infrastructure		4.0	0.30	4.0
3.3 Consideration for nurturing a good community		4.0	0.20	4.0
	3.3.1 Formation of local centers and fostering of vitality and communication	3.0	0.50	
	3.3.2 Creation of various opportunities for public involvement	5.0	0.50	
3.4 Consideration for urban context and scenery		5.0	0.30	5.0
	3.4.1 Formation of urban context and scenery	5.0	0.50	
	3.4.2 Harmony with surroundings	5.0	0.50	
Concerned Categories			Weight	Overall
LR_{UD} Load reduction in urban development				3.9
$LR_{UD}1$ Environmental impact on microclimates, façade and landscape			0.3	3.7
1.1 Reduction of thermal impact on the environment outside the designated area in summer		3.8	0.3	3.8
	1.1.1 Planning of building group layout and forms to avoid blocking wind	1.0	0.2	
	1.1.2 Consideration for paving materials	5.0	0.2	
	1.1.3 Consideration for building cladding materials	3.0	0.2	
	1.1.4 Consideration for reduction of waste heat	5.0	0.4	
1.2 Mitigation of impact on geological features outside the designated area		4.4	0.15	4.4
	1.2.1 Prevention of soil contamination	5.0	0.7	
	1.2.2 Reduction of ground subsidence	3.0	0.3	
1.3 Prevention of air pollution affecting outside the designated area		3.4	0.1	3.4
	1.3.1 Source control measures	3.0	0.4	
	1.3.2 Measures concerning means of transport	5.0	0.2	
	1.3.3 Atmospheric purification measures	3.0	0.4	
1.4 Prevention of noise, vibration and odor affecting outside the designated area		3.3	0.1	3.3
	1.4.1 Reduction of the impact of noise	3.0	0.33	
	1.4.2 Reduction of the impact of vibration	3.0	0.33	
	1.4.3 Reduction of the impact of odor	4.0	0.33	
1.5 Mitigation of wind hazard and sunlight obstruction affecting outside the designated area		4.0	0.25	4.0
	1.5.1 Mitigation of wind hazard	4.0	0.50	
	1.5.2 Mitigation of sunlight obstruction	4.0	0.50	
1.6 Mitigation of light pollution affecting outside the designated area		2.5	0.10	2.5
	1.6.1 Mitigation of light pollution from lighting and advertising displays…	20	0.50	
	1.6.2 Mitigation of light reflection from building façade & landscape mat.	3.0	0.50	
$LR_{UD}2$ Social infrastructure			0.45	4.2
2.1 Reduction of mains water supply (load)		5.0	0.15	5.0
	2.1.1 Encouragement for the use of stored water	5.0	0.50	
	2.1.2 Water recirculation and use through a miscellaneous water system	5.0	0.50	
2.2 Reduction of rainwater discharge load		5.0	0.10	5.0
	2.2.1 Mitigation of surface water runoff using permeable paving & percolation trenches	5.0	0.50	
	2.2.2 Mitigation of rainwater outflow using retaining pond and flood control basins	5.0	0.50	
2.3 Reduction of the treatment load from sewage and greywater		4.0	0.10	4.0
	2.3.1 Load reduction using high-level treatment of sewage and greywater	5.0	0.50	
	2.3.2 Load leveling using water discharge balancing tanks etc.	3.0	0.50	
2.4 Reduction of garbage treatment load		3.3	0.20	3.3
	2.4.1 Reduction of collection load using centralized-storage facilities	3.0	0.33	
	2.4.2 Installation of facilities to reduce the volume and weight of garbage and employ composting	5.0	0.33	
	2.4.3 Classification, treatment, and disposal of waste	2.0	0.33	
2.5 Consideration for traffic load		3.5	0.15	3.5

	2.5.1 Reduction of the total traffic	4.0	0.50	
	2.5.2 Efficient traffic assignment on local road network	3.0	0.50	
2.6 Effective energy use for the entire designated area		4.6	0.30	4.6
	2.6.1 Area network of unused and renewable energy	5.0	0.33	
	2.6.2 Load leveling of electrical power and heat through area network	4.0	0.33	
	2.6.3 Area network of high-efficient energy system	5.0	0.33	
$LR_{UD}3$ Management of the local environment			0.25	3.7
3-1 Consideration of global warming		4.5	0.25	4.5
	3.1.1 Construction and materials, etc.	3.0	0.10	
	3.1.2 Energy	5.0	0.60	
	3.1.3 Transportation	4.0	0.30	
3.2 Environmentally responsible construction management		3.2	0.35	3.2
	3.2.1 Acquisition of ISO14001 certification	1.0	0.10	
	3.2.2 Reduction of by-products of construction	3.0	0.20	
	3.2.3 Energy-saving activity during construction	3.0	0.10	
	3.2.4 Reduction of construction-related impact affecting outside the designated area	3.0	0.20	
	3.2.5 Selection of materials with consideration of the global environment	3.0	0.20	
	3.2.6 Selection of materials with concern for impact on health	5.0	0.20	
3.3 Regional transportation planning		4.0	0.15	4.0
	3.3.1 Coordinating with the administrative master plans for transportation system	3.0	0.50	
	3.3.2 Measures for transportation demand management	5.0	0.50	
3.4 Monitoring and management system		3.5	0.25	3.5
	3.4.1 Monitoring and management system to reduce energy usage inside the designated area	5.0	0.50	
	3.4.2 Monitoring and management system to conserve the surrounding environment of the designated area	2.0	0.50	
BEE= 2.5 Rank A , Very Good				

This development also does not meet the requirements for light pollution reduction. The same is true when it is evaluated using LEED-ND.

In order to promote recycling, CASBEE-UD awards the highest score to those developments in which garbage is sorted into five or more types. According to garbage collection regulations of the City of Portland, waste must be sorted into four categories. Therefore, Hoyt Yards fails to satisfy the CASBEE-UD requirement (COP, 2012), and has a weak performance by Japanese standards.

In the paragraphs above the weaknesses of Hoyt Yards (when evaluated using CASBEE-UD) were showed. By contrast, the results show that Hoyt Yards meets the entire CASBEE-UD requirements in the following areas: transportation planning, universal design, pedestrian safety, public involvement, aesthetic design, human-scaled design, stormwater management, and energy efficiency. All these credits were also highly credited under LEED-ND.

The analysis also highlighted some of the significant issues that are not adequately included in the LEED-ND framework.

One such issue is hazard management. CASBEE-UD has strict regulations related to various types of hazards such as wind hazards, earthquakes, floods, landslides, and urban fires. Findings suggest that unlike CASBEE-UD, which has incorporated a wide array of criteria related to the understanding of natural and man-made hazards into the assessment framework, LEED-ND has reduced the issue to floodplain avoidance, and stormwater management. However, Hoyt Yards satisfies most of the CASBEE-UD criteria on hazard risk.

The development has avoided the floodplain; open space is available within 250 m of all the buildings, and can be used as shelter and evacuation area; and landslide issues have also been considered. One related point is that as shown in Figure 6-26. A large part of the neighborhood is located in high-risk earthquake zone meaning that Hoyt Yards would not receive the highest point on this criterion under CASBEE-UD.

Creation of ecosystem networks and continuity of green space is also not appropriately addressed in LEED-ND. The existing green space in the neighborhood has a "stepping stone" layout (existing green spaces are not appropriately connected) which is considered as normal practice in CASBEE-UD (IBEC, 2007, p.61). The best practice can be achieved if "green space in the designated area and its surroundings forms a network of corridors, and the movement of organisms has been fully considered" (IBEC, 2007, p.61).

Other criteria missed out in the LEED-ND framework include the earthquake resistance of the energy-related infrastructure (district heating and cooling facilities, pipes, etc.), and provision of excessive space for the potential future expansion of the facilities.

In the previous sections it was argued that performance of a given development under one assessment tool cannot always be used as a basis for predicting its performance under another assessment tool. The results of evaluating Hoyt Yards using CASBEE-UD corroborate that argument. Here two of the outstanding examples will be mentioned.

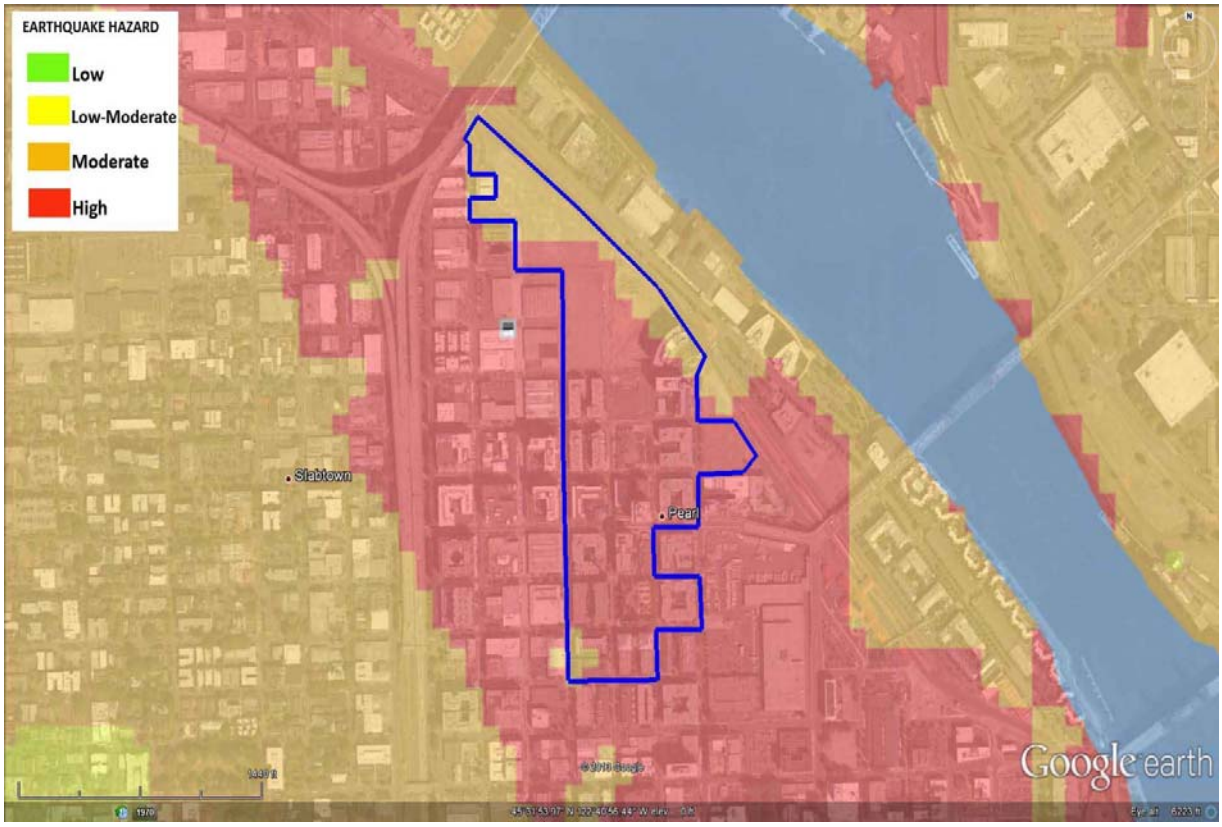


Figure 6-26. Earthquake hazard map for Hoyt Yards. Source: www.portlandmaps.com

LEED-ND and CASBEE-UD have different approaches towards crime prevention and this is reflected in the criteria they use to measure the degree of safety in the neighborhood. Whereas the former tries to enhance the safety through improving the walkability of the neighborhood and keeping the ground-level windows un-shuttered, the latter encourages the installation of surveillance cameras and guards, reducing the through-traffic and restricting the use of nearby roads by outsiders, and improving the visibility of the plazas and open spaces. Because of these differences, Hoyt Yards fails to acquire a high performance on this criterion under CASBEE-UD

Much the same as one of the examples shown when evaluating this development against BREEAM Communities, access to facilities is an issue that is addressed differently. As mentioned earlier, to achieve the related credit in LEED-ND facilities must be located within 400 m walk distance of fifty percent of all dwelling units (ninety percent in the case of access to parks). CASBEE-UD awards the highest score to developments in which all dwelling units are within 300 m walk distance of facilities. In addition, dwelling must also be

within the same distance of a local administrative office (which is required in neither LEED-ND nor BREEAM Communities).

There might also be a situation where the assessment tools use different criteria, but performance is judged at the same level. Take, for example, the case of encouraging energy efficiency through securing sunlight. LEED-ND pursues this aim by asking developers to design the layout such that "seventy five percent or more of the blocks have one axis within plus or minus fifteen degrees of the geographical east-west" (USGBC, 2011, p.96). CASBEE-UD uses a different measure and wants developers to ensure that at least four hours of sunlight are provided at winter solstice. Despite these variations in criteria, Hoyt Yards meets the requirements of both assessment tools.

The comparative performance of all the three case studies against CASBEE-UD is illustrated in Figure 6-27. Overall, the development can be awarded CASBEE-UD "Very Good" ranking.

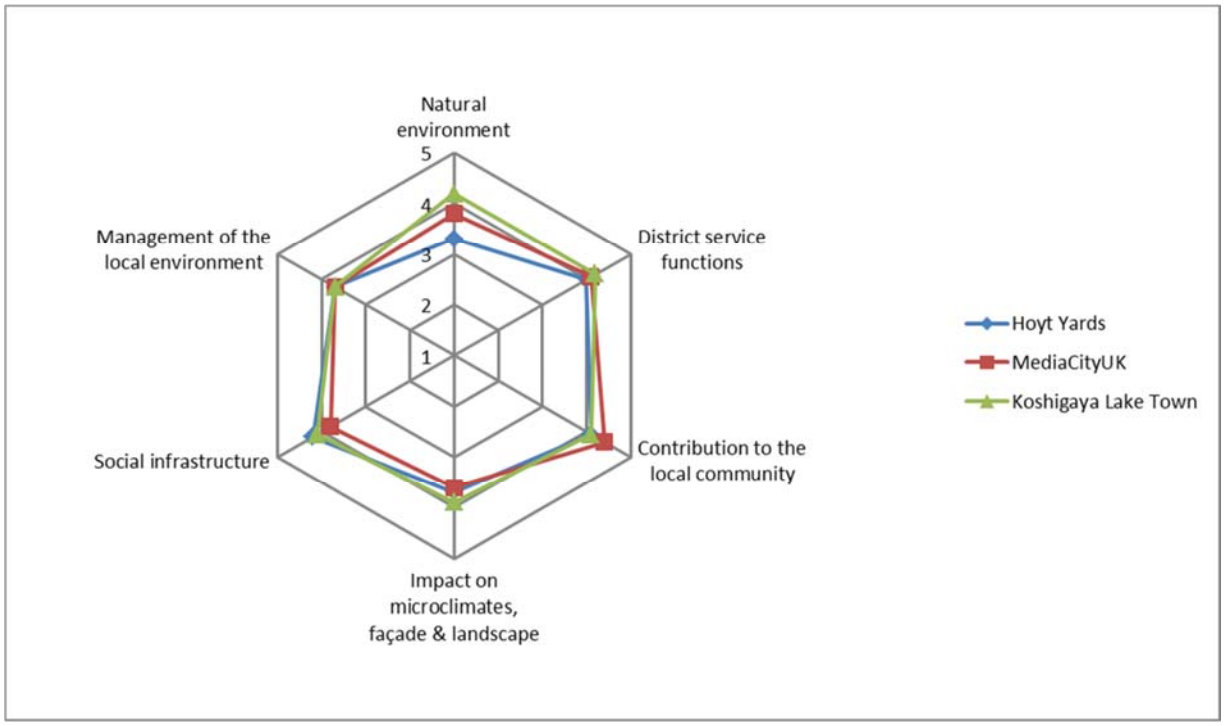


Figure 6-27. Performance of each case against the CASBEE-UD framework.

6.4.6. MediaCityUK performance against CASBEE-UD

This is the final part of a series of cross-evaluations conducted for the purpose of this research. As stated in Section 5.3.4, the assessment methodology used in CASBEE-UD is unique in the sense that it distinguishes between the environmental quality (QUD) within the site boundary and the environmental load (LUD) acting beyond the site boundary. As can be seen from the details of this assessment, available in Table 6-11, MediaCityUK's performance on QUD is considerably better than its performance on LUD. This means that the major achievements of this development should be in the areas related to interior environmental quality.

The criteria related to environmental quality that rank high include "consideration and conservation of terrain", "performance of information systems", "performance of transportation systems", "disaster and crime prevention performance", and " consideration for urban context and scenery".

Table 6-11. MediaCityUK performance against CASBEE-UD

Concerned Categories	Score	Weight	Overall
Q_{UD} Environmental Quality in Urban Development			4.1
$Q_{UD}1$ Natural Environment (microclimates & ecosystems)		0.25	3.8
1.1 Consideration and conservation of microclimates in pedestrian space in summer	3.4	0.35	3.4
1.1.1 Mitigation of the heat island effect with the passage of air	4.0	0.30	
1.1.2 Mitigation of heat island effect with shading	4.0	0.20	
1.1.3 Mitigation of heat island effect with green space and open water etc.	2.0	0.30	
1.1.4 Consideration for the positioning of heat exhaust	4.0	0.20	
1.2 Consideration and conservation of terrain	5.0	0.20	5.0
1.2.1 Building layout and shape design that consider existing topographic character	5.0	0.33	
1.2.2 Conservation of topsoil	5.0	0.33	
1.2.3 Consideration of soil contamination	5.0	0.33	
1.3 Consideration and conservation of water environment	3.0	0.15	3.0
1.3.1 Conservation of water bodies	5.0	0.33	
1.3.2 Conservation of aquifers	1.0	0.33	
1.3.3 Consideration of water quality	3.0	0.33	
1.4 Conservation and creation of habitat	3.2	0.10	3.2
1.4.1 Grasping the potential of the natural environment	5.0	0.25	
1.4.2 Conserving natural resources	4.0	0.25	
1.4.3 Creating ecosystem networks	2.0	0.25	
1.4.4 providing a suitable habitat for flora and fauna	2.0	0.25	
1.5 Other consideration for the environment inside the designated area	3.0	0.20	3.0
1.5.1 Ensuring good air quality, acoustic and vibration environments	1.0	0.33	
1.5.2 Improving the wind environment	3.0	0.33	
1.5.3 Securing sunlight	5.0	0.33	
$Q_{UD}2$ Service functions for the designated area		0.45	4.1
2.1 Performance of supply and treatment systems (mains water, sewerage, …)	3.5	0.20	3.5
2.1.1 Reliability of supply and treatment systems	3.0	0.50	
2.1.2 Flexibility to meet changing demand and technical innovation in supply and treatment systems	4.0	0.50	
2.2 Performance of information systems	4.3	0.15	4.3
2.2.1 Reliability of information systems	5.0	0.33	
2.2.2 Reliability to meet changing demand and technical innovation in information systems	3.0	0.33	
2.2.3 Usability	5.0	0.33	
2.3 Performance of transportation systems	5.0	0.15	5.0

	2.3.1 Sufficient capacity of transportation systems	5.0	0.50	
	2.3.2 Securing safety in pedestrian areas etc.	5.0	0.50	
2.4 Disaster and crime prevention performance		4.5	0.20	4.5
	2.4.1 Understanding the risk from natural hazards	5.0	0.25	
	2.4.2 Securing open space as wide area shelter	3.0	0.25	
	2.4.3 Providing proper evacuation routes	5.0	0.25	
	2.4.4 Crime prevention performance (surveillance and territoriality)	5.0	0.25	
2.5 Convenience of daily life		2.6	0.15	2.6
	2.5.1 Distance to daily-use stores and facilities	3.0	0.33	
	2.5.2 Distance to medical and welfare facilities	2.0	0.33	
	2.5.3 Distance to educational and cultural facilities	3.0	0.33	
2.6	Consideration of universal design	5.0	0.15	5.0
$Q_{UD}3$ Contribution to the local community (history, culture, scenery and revitalization)			0.30	4.4
3.1 Use of local resources		4.0	0.20	4.0
	3.1.1 Use of local industries, personnel, and skills	3.0	0.50	
	3.1.2 Conservation and use of historical, cultural and natural assets	5.0	0.50	
3.2 Contribution to the formation of social infrastructure		4.0	0.30	4.0
3.3 Consideration for nurturing a good community		4.5	0.20	4.5
	3.3.1 Formation of local centers and fostering of vitality and communication	5.0	0.50	
	3.3.2 Creation of various opportunities for public involvement	4.0	0.50	
3.4 Consideration for urban context and scenery		5.0	0.30	5.0
	3.4.1 Formation of urban context and scenery	5.0	0.50	
	3.4.2 Harmony with surroundings	5.0	0.50	
Concerned Categories		Score	Weight	
LR_{UD} Load reduction in urban development				3.7
$LR_{UD}1$ Environmental impact on microclimates, façade and landscape			0.30	3.6
1.1 Reduction of thermal impact on the environment outside the designated area in summer		3.8	0.30	3.8
	1.1.1 Planning of building group layout and forms to avoid blocking wind	3.0	0.20	
	1.1.2 Consideration for paving materials	3.0	0.20	
	1.1.3 Consideration for building cladding materials	3.0	0.20	
	1.1.4 Consideration for reduction of waste heat	5.0	0.40	
1.2 Mitigation of impact on geological features outside the designated area		4.4	0.15	4.4
	1.2.1 Prevention of soil contamination	5.0	0.70	
	1.2.2 Reduction of ground subsidence	3.0	0.30	
1.3 Prevention of air pollution affecting outside the designated area		3.0	0.10	3.0
	1.3.1 Source control measures	3.0	0.40	
	1.3.2 Measures concerning means of transport	3.0	0.20	
	1.3.3 Atmospheric purification measures	3.0	0.40	
1.4 Prevention of noise, vibration and odor affecting outside the designated area		5.0	0.10	5.0
	1.4.1 Reduction of the impact of noise	5.0	0.5	
	1.4.2 Reduction of the impact of vibration	-	-	
	1.4.3 Reduction of the impact of odor	5.0	0.5	
1.5 Mitigation of wind hazard and sunlight obstruction affecting outside the designated area		3.0	0.25	3.0
	1.5.1 Mitigation of wind hazard	3.0	0.50	
	1.5.2 Mitigation of sunlight obstruction	3.0	0.50	
1.6 Mitigation of light pollution affecting outside the designated area		3.0	0.10	3.0
	1.6.1 Mitigation of light pollution from lighting and advertising displays…	3.0	0.50	
	1.6.2 Mitigation of light reflection from building façade & landscape mat.	3.0	0.50	
$LR_{UD}2$ Social infrastructure			0.45	3.8
2.1 Reduction of mains water supply (load)		3.0	0.15	3.0
	2.1.1 Encouragement for the use of stored water	3.0	0.50	
	2.1.2 Water recirculation and use through a miscellaneous water system	3.0	0.50	
2.2 Reduction of rainwater discharge load		3.0	0.10	3.0
	2.2.1 Mitigation of surface water runoff using permeable paving & percolation trenches	3.0	0.50	
	2.2.2 Mitigation of rainwater outflow using retaining pond and flood control basins	-	-	
2.3 Reduction of the treatment load from sewage and greywater		3.0	0.10	3.0
	2.3.1 Load reduction using high-level treatment of sewage and greywater	3.0	0.50	
	2.3.2 Load leveling using water discharge balancing tanks etc.	3.0	0.50	
2.4 Reduction of garbage treatment load		3.3	0.20	3.3
	2.4.1 Reduction of collection load using centralized-storage facilities	5.0	0.33	
	2.4.2 Installation of facilities to reduce the volume and weight of garbage and employ composting	3.0	0.33	
	2.4.3 Classification, treatment, and disposal of garbage	2.0	0.33	
2.5 Consideration for traffic load		4.5	0.15	4.5
	2.5.1 Reduction of the total traffic	4.0	0.50	
	2.5.2 Efficient traffic assignment on local road network	5.0	0.50	
2.6 Effective energy use for the entire designated area		4.6	0.30	4.6

	2.6.1 Area network of unused and renewable energy	5.0	0.33	
	2.6.2 Load leveling of electrical power and heat through area network	4.0	0.33	
	2.6.3 Area network of high-efficient energy system	5.0	0.33	
$LR_{UD}3$ Management of the local environment			0.25	3.7
3-1 Consideration of global warming		4.2	0.25	4.2
	3.1.1 Construction and materials, etc.	3.0	0.10	
	3.1.2 Energy	5.0	0.60	
	3.1.3 Transportation	3.0	0.30	
3.2 Environmentally responsible construction management		3.9	0.35	3.9
	3.2.1 Acquisition of ISO14001 certification	4.0	0.10	
	3.2.2 Reduction of by-products of construction	5.0	0.20	
	3.2.3 Energy-saving activity during construction	3.0	0.10	
	3.2.4 Reduction of construction-related impact affecting outside the designated area	3.0	0.20	
	3.2.5 Selection of materials with consideration of the global environment	3.0	0.20	
	3.2.6 Selection of materials with concern for impact on health	5.0	0.20	
3.3 Regional transportation planning		3.0	0.15	3.0
	3.3.1 Coordinating with the administrative master plans for transportation system	3.0	0.50	
	3.3.2 Measures for transportation demand management	3.0	0.50	
3.4 Monitoring and management system		3.5	0.25	3.5
	3.4.1 Monitoring and management system to reduce energy usage inside the designated area	4.0	0.50	
	3.4.2 Monitoring and management system to conserve the surrounding environment of the designated area	3.0	0.50	
BEE= 2.4 Rank A, Very Good				

This does not mean, however, that all related criteria are appropriately satisfied. Apart from having normal level performance on several criteria, the following criteria are among those that rank low: “mitigation of heat island effect”, “conservation of aquifers”, “creating ecosystem networks”, “ providing suitable habitat for flora and fauna”, and “distance to facilities”.

Figure 6-28. Removal of the contaminated soil from the construction site. Source: http://www.skyscrapercity.com/

Let me first discuss strengths of the development in terms of environmental quality. The development satisfies the requirements of the “consideration and conservation of terrain” through a comprehensive set of measures taken to remove the soil contamination in the area.

This includes efforts taken to clean the contaminated topsoil and prevent the leakage of contaminants into the surrounding areas. Figure 6-28 shows a scene taken during the clean-up of the previously contaminated site.

Regarding the infrastructure for information systems, fiber connection is provided to all buildings and the future expansion needs are also considered. Moreover, site-wide high-speed wireless connection is available at MediaCityUK.

The development's achievements in providing appropriate transportation facilities are already discussed in Section 6.3.2. Receiving the maximum points on this criterion under CASBEE-UD is a further evidence for the strength of the transportation system.

As for disaster and crime prevention, evidence from the Salford City Council's strategic flood risk assessment (O'Callaghan, 2011) shows that the site is located in a low-risk area. Appropriate size of open space is provided that can be used as evacuation area in the case of disaster and the roads that lead to the evacuation area are designed so that the buildings can be easily evacuated. Crime prevention measures relate to the sufficient level of street lighting, installation of crime prevention facilities such as surveillance cameras, and provision of cultural facilities and community spaces to increase the presence of people in the environment.

Various efforts are taken to enhance the aesthetic qualities of the environment and create harmonious scenery. These include, but are not limited to, attention to wall positioning, appropriate use of colors for the facades and materials, beautiful landscape design, and provision of art and suitable street furniture.

It is now time to turn to the weaknesses in terms of environmental quality. The findings indicate that MediaCityUK does not satisfy the CASBEE-UD requirements for heat island mitigation. This can be explained by the fact that the strict CASBEE-UD specifications are designed for addressing the heat island effect during Japan's hot summers. Such strict regulations would probably be irrelevant for the mild climate of England.

Considering that no rainwater harvesting system and permeable paving is installed at MediaCityUK, the development cannot meet the requirements that are aimed at groundwater replenishment.

Concerning the ecosystem networks, MediaCityUK fails to receive the possible points. This is because there is no network of greenery to ensure the continuity of green space. Related to the ecosystem networks is the criterion for "providing suitable habitat for flora and fauna". Similar to what discussed when evaluating Hoyt Yards against CASBEE-UD, MediaCityUK does not meet the requirements because the green area is mixed with human-occupied areas, the organisms' need for food trees is not considered, and appropriate porous spaces that can be used as the habitat of organisms are not provided.

Regarding the distance to medical facilities, the development fails to get the highest points because there is no facility within 300 m walk distance of the development. Manchester Health Clinic is the closest medical center which is more than 600 m away.

Turning now to the issues associated with the environmental load (L_{UD}), the performance of MediaCityUK when evaluated using CASBEE-UD standards will be examined. In terms of the strong points, the results are consistent with those found when assessing the development using LEED-ND framework. Energy efficiency which is achieved through installation of the tri-generation CHP plant is the foremost example of efforts taken to reduce the adverse impacts of this development. The results indicate that for many of the criteria, performance is at level three. This suggests that although these criteria are considered, the performance is at the normal level. Likewise the Hoyt Yards, MediaCity fails to meet the rigorous CASBEE-UD regulations for waste management.

One particularly noticeable point about the above paragraphs is the absence of issues related to social, economic, and institutional aspects of sustainability. This, in part, reflects the lack of attention to these aspects in the CASBEE-UD framework. This is in good agreement with Sharifi & Murayama (2012), who criticize CASBEE-UD for its unbalanced structure in which more focus is on environmental aspects at the cost of socio-economic, and institutional ones.

Regarding the issues related to earthquake resilience, it is important to point out that since MediaCityUK is located in a low seismicity area, the rigorous earthquake-related criteria of CASBEE-UD were excluded from the assessment.

All the previous analyses revealed that benchmarks used for identical criteria are different across the selected NSA tools. Accordingly, it is perhaps not surprising that the same is true for this analysis. Again, this stems from the variations in the indicators and benchmarks used across the assessment tools.

The common criteria for which different benchmarks are used include, but are not limited to: passive solar design, groundwater replenishment, green networks, surrounding wind environment, transportation system, safety of the environment, soil contamination, energy and water efficiency, stormwater management, heat island, waste management, and distance to facilities. To find out if using different benchmarks for assessing identical criteria results in different scores, the performance of MediaCityUK under BREEAM Communities was compared with its performance under CASBEE-UD. Different scores for heat island, waste management, and distance to facilities were detected. Below details related to the performance of the heat island criterion will be explained.

In the BREEAM Communities framework it is specified that for achieving the highest score on heat island criterion five of the following seven indicators should be included: "provision of appropriate shaded green space and tree cover", "open water and fountains in public spaces", "shaded public spaces and footpaths", "design to enable air-flow throughout the development", "appropriate choice of external finishes that are designed to avoid heat absorption", "site layout / orientation to maximize microclimatic cooling", and "green roofs and vegetated walls" (BRE, 2011). MediaCityUK meets the requirements of all these indicators except the last one. Therefore the development achieves all the available points for heat island reduction. All these indicators and also indicators for the ratio of paved areas in the neighborhood, and the positioning of heat exhaust are available in the CASBEE-UD framework. Apart from these two additional indicators, what makes the difference is that unlike BREEAM Communities, CASBEE-UD defines specific benchmarks for each indicator. The green space ratio must be more than fifteen percent, which is roughly eight percent in MediaCityUK. Paved area must be less than ten percent, which is approximately thirty

percent in this development. Furthermore, there is no green roof open to public in the neighborhood. Therefore MediaCityUK does not receive CASBEE-UD's maximum credits for heat island.

Overall results of the assessment show that MediaCityUK would receive the CASBEE-UD Very Good certification. Figure 6-27 compares the scores for the main themes across the three selected cases.

In the light of these results, in the next section the promises and pitfalls of sustainability assessment at the neighborhood level; the major strengths and weaknesses of the selected NSA tools, and the way they can complement each other; and the viability of applying NSA tools in countries other than the origin will be discussed.

6.5. Discussion and conclusion

Before discussing the results, the reader is reminded of the main aims of this research. The research conducted in this chapter was initiated this research with the following objectives: first, to discuss the evolution and future of NSA; second, to provide better insight into NSA in action and determine whether NSA tools have been effective in enhancing sustainability of the developments (selected cases); third, to highlight the lessons that tools can learn from one another; and finally, to examine the feasibility of developing global standards.

In the light of the results obtained, it is now the right occasion to discuss how each of these objectives was addressed in this chapter.

6.5.1. The practice of NSA

The issue of the structure and theoretical robustness of NSA tools was extensively discussed in Chapter 5. To have a balanced account of both theoretical and practical issues, this research looks at the degree of success in implementing NSA tools and realizing their stipulations. This issue is discussed from two different perspectives: the extent of uptake of the NSA tools, and the extent of realization of the specifications of the selected NSA tools in certified projects.

With regard to the utilization of NSA tools by developers, this study revealed that there is a considerable variation across the tools. While LEED-ND has been applied to many developments in different countries, BREEAM Communities and CASBEE-UD have received very little attention from developers and planners. There are now more than 100 developments certified under either the pilot or the final version of LEED-ND. However, neither BREEAM Communities nor CASBEE-UD has been used to certify more than one development. A likely explanation for this overall low level of uptake is the voluntary nature of these certifications. Other possible explanations are the high cost of certification and the availability of numerous other certification schemes for sustainability. Table 6-12 compares the certification costs across the three selected tools.

Discussion about the viability of making NSA mandatory falls outside this study and requires further research. Here, only a recent move by the Bristol City Council to require BREEAM Communities assessment in the case of application for planning permission for "super-major" developments is mentioned (BCC, 2011). This can be helpful in both expediting the decision making process and ensuring that various sustainability concerns are considered at an early stage.

Table 6-12. Certification costs for the three selected assessment tools.

Assessment tool	LEED-ND		BREEAM Communities		CASBEE-UD	
Certification costs (USD)	Registration	1500	Registration	808	Registration	Included in the certification costs
	0-8 ha	18,000	All developments	7274	0-5 ha	30,000
	8-130 ha	18,000 + 700/ha			5-20 ha	36,000
	Over 130 ha	123,000			Over 20 ha	43,000

As was discussed in the last chapter, the comparatively better uptake of the LEED-ND assessment scheme can be explained by several factors such as collaboration between different parties involved in the urban development to encourage the use of LEED-ND; its use by local and state governments and federal agencies to promote green neighborhood development; and rewarding height and density bonuses and grants to certified projects. These are strategies worth considering by local authorities in other contexts. An alternative explanation would be the LEED-ND's simplicity of use and its less complicated framework for assessment. However, further research is needed to confirm this association.

It is now time to turn to discussion about the extent of compliance of the certified developments with the specifications of the selected NSA tools. Given the findings about the extent of the real world application of the selected tools described above, there is more room for discussion about the results related to the LEED-ND certified projects. However, it is interesting to note that the application patterns are significantly similar across the certified projects.

Generally, there was more focus on environmental issues at the expense of other important aspects. Affordability of the certified developments turned out to be a major challenge for achieving sustainability at the neighborhood level. None of the three cases studied here have addressed this issue appropriately. In the case of MediaCityUK, non-provision of affordable housing is despite the fact that it has been required by Salford City Council (SCC, 2007a). Developer has managed to approve the plan without providing affordable housing. Provision of affordable housing is important for meeting the intragenerational equity principle of sustainable development. Without paying due attention to this issue, development may result in an enclave of sustainable community surrounded by many other communities deprived of similar qualities and privileges. As a case in point, MediaCityUK is neighboring three wards namely Ordsall, Langworthy, and Weaste & Seedley. All these wards are suffering from "multi-faceted" deprivation (NeT-TOPIC, 2009, p.19). For sustainable development to be achieved, it is necessary to make sure that neighborhood development brings benefit to the surrounding communities. One way to achieve this goal is to embed the neighborhood development in a broader framework of urban development. This issue has received relatively high attention in Portland. Part of the success of Hoyt Yards can be attributed to the fact that it has been developed within the context of an integrated planning process for renewal of downtown Portland. The urban renewal area was created in 1998 and consists of several districts (PDC, 2012). Hoyt Yards is located in the River District shown in Figure 6-29.

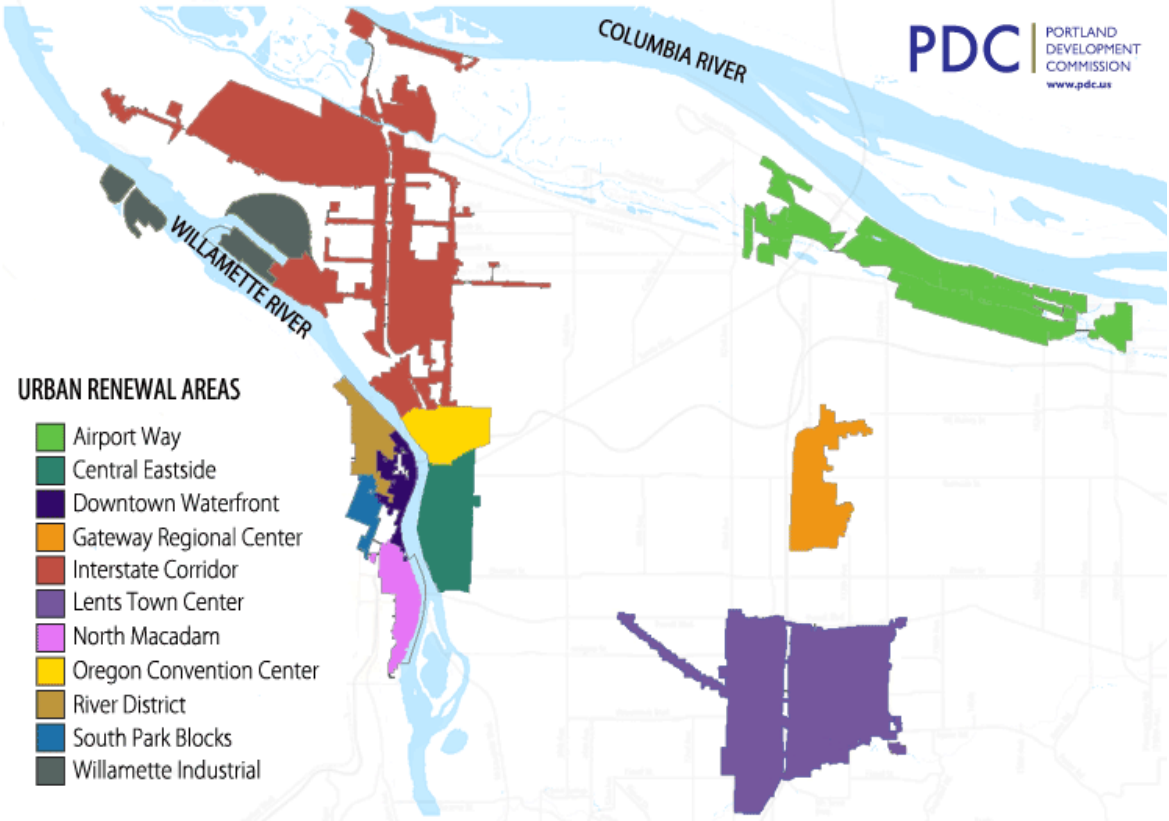


Figure 6-29. Urban Renewal Areas of Portland. Source: Portland Development Commission, http://www.pdc.us/our-work/urban-renewal-areas.aspx

The most notable difference between Koshigaya Lake Town and the other two cases is its location on a greenfield site. This is despite the fact that it is several times emphasized in the CASBEE-UD's technical manual that it is designed to enhance the situation of urban renewal projects (IBEC, 2007). Ironically, for its first and only real-world application, it has been used to evaluate a new greenfield development.

An interesting point that emerged from the analysis of the ninety seven LEED-ND certified projects was that most of the highly incorporated criteria are those that are highly weighted. The results of this analysis are hardly distinguishable from those of Garde (2009). He found that developers tend to comply with those highly weighted criteria which are also less costly. Earlier it was mentioned that market appeal has caused major challenges for achieving the goals of the Garden City movement (Grant, 2006). Results of this chapter show that this factor still remains to be challenging. Besides the necessity to make some important but less favorable criteria mandatory, planners and local authorities should work on strategies to increase the market appeal for sustainable development. Raising awareness about the long

term benefits of sustainable neighborhoods can be an effective way to increase the market appeal.

A research question related to the application of NSA tools was whether NSA tools have been effective in enhancing sustainability of the developments. The case study analyses of this chapter showed that in each case the majority of the specified criteria are met. The missing criteria often emerged when evaluating the case against other NSA tools. This implies that improving the assessment framework might lead to improvement of situations on the ground.

It should nevertheless be borne in mind that it will be too idealistic to think of a community that encompasses all the elements of sustainability. As Rydin (2007) argues, in many occasions trade-offs between different components are inevitable.

Using results of the cross-evaluations, in the following section the lessons that tools can learn from one another will be discussed.

6.5.2. Lessons that NSA tools can learn from one another

The results of this study suggest that there is no single, best method for assessing the sustainability of the neighborhood developments. Diverse types of criteria and methods were used for assessment across the selected NSA tools. Not surprisingly, there were some discrepancies between these tools in terms of their contents and also methodology used for assessment.

Regarding the criteria used for assessment, the cross-evaluations revealed that each NSA tool can be complemented by using important criteria available in other NSA tools. Table 6-13 highlights some major criteria missed out in each of the selected NSA tools. Each cell of the table contains those criteria that the NSA tool in the corresponding column can borrow from the NSA tool in the corresponding row.

It is worth noting, however, that this research does not suggest that all these criteria should be considered. As will be further discussed in the next section, any decision as to whether to use these criteria should be at the discretion of the relevant stakeholders.

Table 6-13. Major criteria missed out in each of the selected NSA tools. Each cell of the table contains those criteria that the NSA tool in the corresponding column can borrow from the NSA tool in the corresponding row.

	LEED-ND	BREEAM Communities	CASBEE-UD
LEED-ND	-	Local food production; Internal and external connectivity; Specified threshold size for the residential component	Smart location; Brownfield redevelopment; Walkability; Housing-job proximity; Internal and external connectivity; Compact development; Mixed-income diverse communities; Local food production; Certified green buildings
BREEAM Communities	Weather resilience; Smart-metering; Flexible parking; Electric vehicle charging points; Wildlife corridors; Inclusion of anchor businesses; Engagement of the local labor	-	Brownfield redevelopment; Green space within the development; Affordable housing; Active frontages; Car clubs; Flexible parking; Home zones; Housing-job proximity; Inclusion of anchor businesses; Green certified buildings
CASBEE-UD	The positioning of heat exhaust; Ecosystem networks; Wind resilience; Reliability of the communication infrastructure; Hazard and earthquake resilience; Waste sorting; Load leveling; Provision of excessive space for the potential future expansion of facilities; Inclusion of local administrative office in the neighborhood	The positioning of heat exhaust; Consideration of noise, odor, and vibration pollution; Hazard and earthquake resilience; Consideration for building cladding materials; Mitigation of sunlight obstruction; Load leveling; Inclusion of local administrative office in the neighborhood	-

With regard to the assessment methodology, some interesting points emerged from this research. One point is related to the different approaches taken for weighing the assessment criteria. Unlike BREEAM Communities and CASBEE-UD, in LEED-ND few criteria account for the bulk of possible points. As discussed earlier, this might lure the developers to acquire the certification by only complying with the highly weighted criteria. CASBEE-UD's approach of applying weights to nested categories of criteria can be helpful in alleviating this problem.

An important issue is related to the tool's capability of giving credit to all the efforts taken towards achieving sustainability. CASBEE-UD and, to some extent, BREEAM Communities have tried to take a cumulative approach so that all the efforts are scored. Under LEED-ND, however, a given development may fail to get the point (s) designated for a criterion, despite meeting the requirements of the majority of the sub-criteria. To avoid taking a black-and-white approach, this issue needs to be considered.

One lesson learned from the analysis of the Koshigaya Lake Town case was that failure to specifically defining the boundary requirements might lead to the acquisition of the targeted credit without appropriately addressing the true intention of the criteria. It was observed that despite being a single-used development, Koshigaya Lake Town would receive most of the LEED-ND and BREEAM Communities credits for mixed-use developments. More clarity regarding the boundaries of the development and other similar issues that may cause ambiguity can be helpful in addressing this issue. This can also be important for preventing "greenwashing" which is increasingly gaining strength (Mapes & Wolch, 2011, p.109; Stangl & Guinn, 2011, p.294).

To ensure the provision of some basic criteria, it is necessary to include some mandatory criteria in the assessment framework. This is considered for in LEED-ND and BREEAM Communities and needs to be considered in CASBEE-UD. Care should be taken, however, not to reduce the flexibility of the assessment tool by overusing mandatory criteria.

Regarding the community outreach, all the selected NSA tools have included one criterion for citizen involvement. However, only BREEAM Communities stipulates that this should involve the process of alternative making. Alternative making which is also

emphasized in other assessment tools such as SEA can facilitate a more effective way of citizen involvement. It can improve the transparency of the decision-making process through informing residents of the potential outcomes of each alternative and its ways of reducing the adverse impacts (Fischer, 2007).

In the next section the possibility of applying the NSA tools in contexts other than original is discussed.

6.5.3. The viability of developing global standards

To explore the possibility of developing global standards for NSA, a cross-evaluation approach was taken in this chapter. Cases from three different contexts were evaluated using three different NSA tools.

It was found that there are many similarities between the selected tools in terms of the criteria used for assessing the neighborhood development proposals. By contrast, clear evidence emerged from this research suggesting that varying degrees of adaptation to the local context are indispensable.

Table 6-14. The performance of each case under different NSA tools.

	LEED-ND	BREEAM Communities	CASBEE-UD
Hoyt Yards	Platinum	Very Good	Very Good
MediaCityUK	Gold	Excellent	Very Good
Koshigaya Lake Town	Silver	Good	Excellent

One significant finding of this study is that, as Table 6-14 indicates, assessing an identical case under different assessment tools resulted in different ratings. The analyses revealed that the main reason for this inconsistency is the difference in the benchmarks used by each NSA tool. These occasionally contradictory benchmarks (such as the case of connectivity) reflect the diversity of opinions about the appropriate way of addressing sustainability at the neighborhood level and make it difficult to achieve identical performance in different contexts. Vast variations in the definitions of benchmarks can be explained by the contested and pluralistic nature of sustainability (A. Bond & Morrison-Saunders, 2013), which was mentioned in the literature review. There is still no consensus on some basic sustainability related issues. As stated above, the concept of connectivity was interpreted

differently by each tool. Stangl and Guinn (2011, p.288) argue that planners have used other indicators such as "street density", "ratio of roadway to intersections", and "pedestrian route directness" to evaluate this criteria. Examining several urban blocks in Phoenix, Arizona, they suggest that "pedestrian route directness" is a better indicator for measuring connectivity. The use of intersection density is also criticized in a study by Bourdic, Salat and Nowacki (2012, p.599). They argue that maximizing the density "would turn the city into a maze, and increase the area occupied by streets at the expense of buildings, parks, and green spaces".

Relativity of some of the issues with regard to various sustainability dimensions is another point that needs to be considered. All the tools studied here have advocated for increasing the density of the development. However, there is still no consensus in the literature on whether increasing density would contribute to the sustainability of the development or not. In a study of several UK neighborhoods, Dempsey, et al., (2012, p.135) found that higher density neighborhoods are not necessarily more sustainable than their lower density counterparts. They argue that "less social interaction between residents takes place in high-density neighborhoods". On the other hand, an analysis of two case studies form the City of Toronto indicated that high-density neighborhoods make a significant contribution to energy conservation and greenhouse gas reduction, thereby contributing to overall sustainability (Norman, MacLean, & Kennedy, 2006).

Results of this study demonstrate that not all the criteria and indicators included in a given NSA tool would be relevant in a different context. This is because the environmental, social, and economic conditions in the target community might be starkly different. For example the earthquake resilience criteria of CASBEE-UD would be of a very little, if any, relevance in the English context. There are also issues that are acceptable norms in the three cases studied here, but are not necessarily appreciated in other cultures. As a case in point, the use of un-shuttered windows discussed in this study is against the residents' perception of privacy in Riyadh, where in some cases houses are surrounded by walls as high as 4 m (Choguill, 2008).

On the whole, based on the findings of this study developing a set of global standards for assessment of neighborhood sustainability appears not to be viable. These findings support existing research conducted by Cable (2008) and Saynajoki, et al., (2012) about the

applicability of tools developed for other contexts to local conditions in Germany and Finland respectively. Both studies emphasize the necessity of adaptation to the local context conditions. This research suggests that, instead of developing global standards, a database of all relevant criteria and indicators can be created. The final decision about the criteria, indicators, and benchmarks can be made by local planners in a process that involves input from various stakeholders. This may even be considered when applying national assessment tools in countries such as US where different climatic, social, etc. conditions exist and conditions vary greatly within the country.

Next chapter concludes this study by reflecting on the results obtained in the previous chapters.

Chapter 7 Conclusion

> The last step of every journey is the first of a new.
>
> *Unknown*

During the past several decades sustainability has gained a considerable recognition among various groups of the society, ranging from scholars to policy makers. It has evolved to be on the agenda of many meetings on various topics and plays an essential role in defining the goals and pathways for their achievement. Planning, as a discipline directly involved with the decision-making about the current and future conditions of the human settlements, has many goals in common with sustainability as a concept that emphasizes improving living conditions, both now and in the long term. Therefore, it is of no surprise that planning realm is replete with the term "sustainability".

Since its introduction in early 1990s, planners have increasingly used the concept of sustainability as a guiding framework for shaping their theories and practices. Given its massive use in the planning context, it would be no exaggeration to say that the emergence and diffusion of the sustainability concept has revolutionized the planning domain. This, of course, is a manifestation of the society's urgent need for wise, timely, and comprehensive measures in the wake of numerous economic, social, and environmental problems that have increasingly intensified within the past several decades.

Although urban areas constitute a very small proportion of the global land area, the majority of world population is now living in the cities and population projections indicate that urbanization is an irreversible trend. The ever increasing concentration of people and resources in the urban areas has massive consequences for both humans and the environment. Urban areas consume 60-80% of global energy and are among the main contributors to climate change and global warming (Frolking, Milliman, Seto, & Friedl; GEA, 2012). Unless appropriately managed, urban areas can cause problems that take many years to correct. In the meantime, concentration of people and resources in urban areas can be viewed as a window of opportunity that facilitates mobilization of efforts and resources for enhancing the quality of life and at the same time protecting the precious environmental assets.

Acknowledging the significance of cities and the built environment for achievement of sustainability goals, the bulk of sustainability efforts are concentrated in the urban areas. Around the world, many initiatives can be found in various levels from the metropolitan scale down to the scale of municipalities, neighborhoods, and single buildings.

In this thesis the main focus was on the sustainability at the intermediate level of urban neighborhood. As a major building block of each city, neighborhood has always been an object of interest to planners and urban thinkers. Descriptions of the major planning movements since the early years of the twentieth century (presented in Chapter 4 of this thesis), clearly show the central role that neighborhood, as an urban unit, has played in the development of planning ideas and practices.

The chronological analysis of neighborhood planning since the early twentieth century made it clear that all the major planning movements of the twentieth century have initiated with the aim of addressing various social and environmental problems dominant in the post-industrial cities. In particular, these movements have tried to find solutions for problems such as social exclusion and separation of human being and nature. Despite having similar roots, there are major differences between these movements in terms of their underlying principles and strategies they have followed to achieve their largely common objectives.

Introduction of the concept of sustainable development has made it possible for planners to unify various planning strategies under the umbrella of sustainability as a guiding framework. Despite the fact that sustainability is a value-laden concept and there are still major interpretations of its meanings and implications, it is increasingly gaining the status of a common language understood by different parties.

Perhaps it is because of these characteristics of the concept of sustainable development that there has been an increase in the number of tools available for evaluating the success of various plans and initiatives in the urban areas. Unlike tools available for assessing the performance of plans at other levels, NSA tools do not have a long history. They emerged in the beginning years of the new millennia, but have gained a considerably well recognition among the urban researchers and practitioners.

Since actions towards sustainability at the local level could contribute to the overall global sustainability, sustainable neighborhood development initiatives and NSA tools and their practice deserve further investigation. This investigation could lead to overall improvement of the whole system. It should be noted however that creating a group of sustainable local areas is not sufficient for achieving global sustainability. The interactions between various local areas and the way it affects sustainability should be considered as well.

This thesis was designed in response to this need, and with the overall aims of shedding more light on this newly emerged issue and finding ways for improving its performance both theoretically and practically. In addition, several specific aims were outlined at the beginning of this thesis. To conclude this study, the research aims will be repeated here and, in the light of findings of the study, try to specify how they have been addressed, and draw some conclusions. These issues have, to some extent, been discussed at the end of each respective section. In order to avoid repeating what have already been said, here a synthetic approach that tries to integrate results of different parts of the research is taken.

The specific aims of this study were:

a) to trace the evolution of impact assessment from traditional impact assessment tools to NSA,
b) to fill the gap in literature regarding research on evaluation of NSA tools,
c) to introduce a framework for evaluating the effectiveness of NSA tools,
d) to evaluate to which degree NSA tools are able to incorporate the different dimensions of sustainability,
e) to identify the differences, commonalities, strengths, weaknesses, successes, and failures of NSA tools through cross-comparison of them,
f) to understand various problems and challenges the NSA tools are grappling with,
g) to discuss some solutions to these problems and challenges, and refinements needed to enhance the efficiency of NSA tools,
h) to provide better insight into NSA in action,
i) to find out how the rhetoric is different from the reality through the analysis of the certified projects,

j) to highlight the lessons that tools can learn from one another,
k) and, to examine the feasibility of developing global standards.

After briefly describing how these aims have been achieved, the main implications of this research are discussed and a number of limitations that should be addressed in future work are highlighted.

7.1. Overall achievement of the research aims

7.1.1. Tracing the evolution of impact assessment theories

Since the shift in planning paradigm toward rational planning, planners and policy-makers have always relied on impact assessment to justify their plans either internally or in the eyes of the public. Environmental crises of the late 1960s and the subsequent rise in the public environmental awareness intensified the need for including assessment in the planning process.

During the first decades after the introduction of impact assessment, the main focus was on its institutionalization. Considerable efforts were taken (mainly in Europe and North America) to enhance communication between those active in the field, define a legal basis for impact assessment, and improve the public awareness of the significance of its undertaking. The literature review conducted in this study indicates that the introduction of the concept of sustainable development can be regarded as a turning point that has catapulted impact assessment into the forefront of planning issues.

It was after the emergence of the concept of sustainable development that planners paid enough attention to the nexus between various economic, social, environmental, and (recently) institutional dimensions of a proposed project. Before that, assessment approaches were largely focused on single sectors and disciplines. LCA and EIA were mainly targeting the environmental impacts. CBA was designed to consider the economic consequences. Social impacts were taken into consideration through the introduction of SIA, and HIA was designed in response to the argument that none of the other assessment tools take the health issues into account.

The first actions for integrating various dimensions into a single holistic tool were taken when SEA was introduced in the years following the rise and diffusion of the concept of sustainable development. However, its main concentration on the strategic level and its limitations with regard to addressing issues related to smaller scales, led to the birth of a new generation of assessment tools that complement SEA by developing assessment schemes for all different scales of development.

To put it in a nutshell, over the last several decades, three major shifts have occurred in the field of impact assessment. First is a major shift in the scope of assessment, in an effort to provide a more holistic image of the potential impacts of the proposed development. Second, a major progress toward providing a basis for undertaking "impact assessment" and implementing the results of the assessment report. This includes both legal and persuasive mechanisms. It is worth mentioning, however, that the legal provisions for undertaking sustainability assessment are still very limited. The main focus is still on persuasive measures such as conditioning grant of aid upon receiving a certain amount of score, giving density bonuses to those developers pursuing certification, and expediting the issuance of building permit and certificate of the completion of work for certified developments. The third major shift is related to the procedure of impact assessment. This is a two-pronged issue: firstly, there is a growing interest in alternative-making that can be regarded as an effective way of broadening the scope of assessment and involving more people in the process. Secondly, assessment tools are now available for various stages of development ranging from the pre-design through to post-occupation.

NSA tools as one of the newest generation of impact assessment tools have, more or less, most of these characteristics in their assessment framework. As stated in Chapter 3, there are also efforts in progress to extend the NSA practice to levels higher than the neighborhood.

7.1.2. The evolution and future of NSA

It was argued in Chapter 4 that NSA as a new paradigm for sustainability assessment can be described as a major product of the co-evolution of neighborhood planning and impact assessment as two well-established fields of research and practice. This co-evolution is also largely influenced by the sustainability concept.

The chronological analysis of neighborhood planning since the early years of the twentieth century, and analyses conducted in Chapters 5 and 6, revealed an important finding. Many of the principles that dominate the present day discourses on sustainable neighborhood development and constitute the theoretical basis of NSA tools, including those tools selected for this study, have been in place for a long time. These include, but are not limited to, principles such as energy efficiency, self-reliance, and affordability that were first proposed by Ebenezer Howard in his "Garden City" concept (Howard, 1985).

In addition, a closer look at the structure of the three NSA tools selected for this study (with the exception of CASBEE-UD) indicates that a large number of the criteria used by them are those first proposed by the various types of neo-traditional planning movements during the 1980's. These movements were concurrent with (or immediately followed by) the sustainability discourse that became widespread during the late 1980s and early 1990s. One reason for the comparatively weak performance of Koshigaya Lake Town against LEED-ND and BREEAM Communities can be the fact that neo-traditional planning has never caught on in Japan. Unlike the other two contexts, Japanese planners and architects have never gathered to develop urban visions comparable to those of neo-traditional planning. The findings of this analyses suggest that neo-traditional principles, especially those dealing with the social aspects, are not well addressed in CASBEE-UD and Koshigaya Lake Town.

Selected NSA tools are also influenced by the various assessment schemes available under the rubric of green building assessment. This is because these tools are spin offs of the more well-established tools available for assessing the sustainability at the building scale.

In addition to the evolutionary analysis of the neighborhood planning concept, the evolution of impact assessment tools from traditional impact assessment tools through to sustainability assessment was traced. Over time, impact assessment has shifted from reactive and mitigatory approaches to proactive and preventive ones. To be consistent with this new strategy, NSA tools are designed so that sustainability impacts are considered at the very early stages of design and planning process. The sustainability concept has also played a significant role in the development of tools for assessment of neighborhood plans. Inspired by the principles of sustainability assessment, tools designed for evaluating the performance of neighborhoods are increasingly becoming more holistic. What is meant here by the term

holistic is that they are trying to integrate various dimensions of sustainability into the assessment framework. Other sustainability related issues such as the issues of inter- and intragenerational equity and procedural equity are also getting more attention as the NSA tools continue to evolve. As was outlined in Chapter 5, these four characteristics, along with context-specificity, are essential for fulfilling the goals of sustainable development.

Regarding the inclusion of various dimensions of sustainability in the assessment framework, results indicate that further improvements are needed to achieve a more balanced assessment framework that provides the most exhaustive possible list of criteria for assessing the sustainability of neighborhood developments. Results show that by and large, across the tools studied here, environmental, and to some extent social, metrics dominate less tangible institutional and economic issues. The concern over unbalanced coverage is even more serious in the case of CASBEE-UD, which is mainly focused on environmental issues and has no specific criterion to account for the economic dimension of sustainability. Furthermore, it was found that these tools have no robust methodology to capture the interrelationships among different dimensions and indirect impacts that the available criteria might have on each other. This diminishes the integrity of assessment practice. These results generally agree with those obtained in previous studies by AlQahtany, et al. (2012) .

In relation to addressing the equity concerns, the selected tools have taken different approaches. Intergenerational equity can be accounted for through using benchmarks that are designed with thorough attention to the long-term impacts of the development. This issue has been addressed reasonably well by LEED-ND and BREEAM Communities that define benchmarks based on future needs and best achievable performance. CASBEE-UD however, evaluates the performance through comparison with the current normal conditions in Japan. For CASBEE-UD to have a more forward looking approach, it should set the reference points based on the long-term effects of today's decisions.

It was furthermore, stressed that intergenerational equity alone cannot bring about sustainable development and it should be complemented by intragenerational and procedural equities. Intragenerational equity can be broken down into two components: fair distribution of social, economic, and environmental conditions, and geographical equity. With respect to the earlier component, results of this analysis indicate that LEED-ND and BREEAM

Communities have criteria for evaluating the fair distribution of socio-economic and environmental resources across all the neighborhood residents. CASBEE-UD however, lacks criteria for measuring the fair distribution of socio-economic conditions. Regarding the geographical equity, tools have a poor performance and CASBEE-UD is the only tool that has some incomplete measures to account for trans-boundary effects. To be geographically equitable, a NSA tool must acknowledge the issue that neighborhoods and their surrounding areas mutually affect each other and sustainability assessment should not be just limited to some particular neighborhoods.

As for the procedural equity, tools are still far away from a state in which various stakeholders can participate in the process. Assessment tools should be created and used in cooperation with diverse stakeholder groups. This enhances the credibility of the assessment system, establishes a platform for mutual understanding, and provides a learning environment for all involved stakeholders.

Regarding the compliance with the context-specificity criterion, the analyses conducted in this study showed that these tools have employed very limited measures to account for the idiosyncrasies of different developments in different locations. LEED-ND has assigned four additional credits for regional priority credits, but this is not enough because the core indicators are stable and treated identically irrespective of context-specific requirements. BREEAM Communities has addressed this issue in a better way through applying regional weighting factors which are available for nine different regions. However for the local-specificity requirement to be met, the benchmarks should also be locally referenced. CASBEE-UD has not addressed this local-specificity requirement. Viability of global standards is a closely related issue that will be discussed later is this paper.

7.1.3. Contributing to the literature of NSA

One of the main aims of this research was to fill the lacuna in research on sustainability assessment at the neighborhood level. When this research was started in 2011, there was a very limited literature on NSA. Being in its preliminary stages of development, only some general and site-specific aspects of NSA were touched on by scholars. Over the last two years, some of the tools analyzed in this study have been updated and some other new

tools have also been developed. There has also been a relative increase in the number of studies delving into the issue of sustainability at the neighborhood level. In particular, LEED-ND has received a considerable attention from the researchers and since it is more widely practiced, it is expected to receive even more attention.

The literature review on sustainability assessment, impact assessment, and neighborhood sustainability has tried to explore the concerned issues from a different angle and discuss them with special attention to their nexus with NSA. In addition, this study has tried to fill three main niches in research on NSA: evaluation of the ability of the existing tools to contribute to the progress toward sustainability; investigation of the degree of success in applying NSA tools to developments in the real world; and finally, examining the possibility of developing universal standards for NSA.

In terms of covering various existing tools at the neighborhood level, this research has been successful in analyzing a larger number of assessment tools (both certificatory tools and plan-embedded tools). Specifically, this study has been effective in analyzing CASBEE-UD, for which a very limited work was available in the literature.

7.1.4. Introducing a framework for evaluating the effectiveness of NSA tools

Tools for assessment at the neighborhood level are not well-established. Therefore, it can be expected that work on evaluating their performance is also limited. On the contrary, assessment at the building level has received a considerable amount of attention from a number of researchers from various disciplines (Haapio & Viitaniemi, 2008; Retzlaff, 2008; Retzlaff, 2009; Sev, 2011).

To fill this gap and develop a similar evaluation framework for NSA tools, an extensive literature review on related subjects such as sustainability, neighborhood planning, and evaluation was conducted. In specific, the principles used in previous studies by Maclaren (1996) and Haughto & Hunter (2003) were found relevant to the aims of this study. One of the main concerns was to ensure that issues related to both the development phase and application phase of the NSA tools receive adequate attention.

The designed framework (presented in Chapter 5) can be used by the developers of NSA tools to examine the ability of their tools to contribute to the development of more sustainable communities. The main issues that this framework examines include: sustainability coverage, inclusion of pre-requisites, adaptation to locality, scoring and weighting, participation, reporting and presentation of results, and applicability of the NSA tool.

7.1.5. Evaluating the degree of incorporation of sustainability dimensions into NSA tools

Tools analyzed in this thesis have different approaches toward sustainability. They all have made considerable efforts to include a wide range of sustainability criteria in their assessment framework. Nevertheless, in reality there is still no single, best tool for comprehensive sustainability assessment at the neighborhood level.

As was emphasized in Chapter 2 of this study, comprehensive assessment of sustainability should involve all the four main pillars of sustainability (environmental, social, economic, and institutional) and also consider their nexus and direct and indirect relationships.

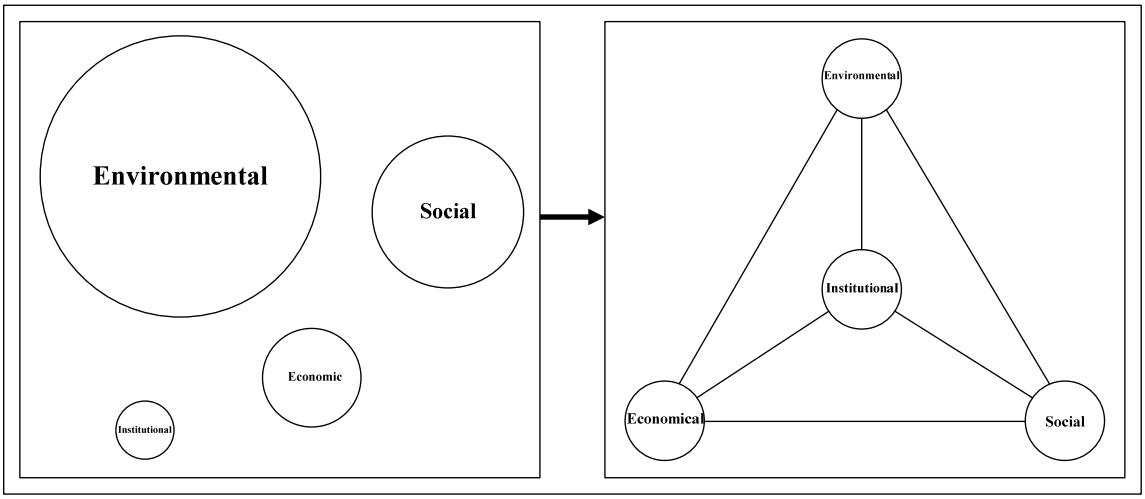


Figure 7-1. : Need for transformation from fragmented to integrated sustainability assessment (Right diagram adapted from Valentin and Spangenberg (2000))

Currently there is a lack of balance between these various pillars of sustainability in most of the NSA tools. More attention has been paid to environmental issues at the expense of

social, economic, and institutional dimensions. This lack of balance is especially evident in CASBEE-UD which does not have adequate criteria for assessing socio-economic situations. Moreover, all the tools studied here need to pay more attention to the institutional dimension which has received the least amount of consideration. The current situation is characterized by fragmentation and unbalanced account of the quadruple bottom lines of sustainability. As illustrated in Figure 7-1, a transformation to integrated sustainability assessment is necessary.

7.1.6. Identifying the differences, commonalities, successes, and failures of NSA tools

NSA tools are similar in the sense that they have all utilized a set of criteria and indicators for assessing the sustainability of the proposed developments. Another common feature of NSA tools is their emphasis on conducting the assessment early in the planning process.

This study revealed that the selected tool have major differences in terms of criteria used and methodology applied for assessment. Each tool has a major focus. This can be explained by the fact that different regions have various types of needs and priorities. NSA tools have been developed with special attention to the specific requirements of each context. For instance, because of the severity of the issue of sprawl in the American context, LEED-ND has prioritized the location related issues in its assessment framework.

The main success of NSA tools to be highlighted in this section is the significant diffusion of research and discussion about sustainability at the neighborhood level. Wherever practiced, they have also been, to some extent, capable of epitomizing sustainable development.

Inability to apply the assessment framework to a large number of real world projects can be considered as the major failure of NSA tools. Moreover, when applied (in many cases) NSA tools have adversely been influenced by market forces and therefore not all their aims have been achieved. The plan-embedded tools are, however, an exception in this regard. As they have been practiced as part of the development and as guiding frameworks, their success is more considerable.

7.1.7. Understanding various problems and challenges that NSA tools are grappling with

A full description of various problems associated with NSA tools is given in Chapters 5 and 6. Here, only the main problems that need to be addressed will be highlighted. One major problem is related to the generic nature of most of the analyzed NSA tools. Wide contextual variations within and between countries imply that the context-specific issues deserve more consideration.

The scoring and weighting process of NSA tools is involved with a large extent of ambiguity and subjectivity. This in part originates from the sustainability concept which itself is value laden. Related to the problem of scoring and weighting is the complexity of the assessment process which in some cases makes it difficult for NSA tools to be used by community groups interested in assessing the sustainability of their neighborhood.

The cost of using NSA tools is high which can be regarded as a discouraging factor adversely affecting their uptake. Except for LEED-ND which has received a relatively well reception, NSA tools have failed to persuade developers to pursue them. They have also failed to achieve their main aim which is guiding development early in the design and planning process. In many cases the assessment has been done after various reversible actions have been done. Therefore, instead of functioning as ex-ante assessment tools, NSA tools are mainly playing the role of ex-post assessment tools pursued by developers to enhance the market recognition of their projects.

Related to this issue is the fact that NSA tools have mainly been used to evaluate the sustainability of major greenfield and/or brownfield development, and little (if any) attention has been paid to projects targeting the incremental improvement of existing neighborhoods. As some cities (mainly in the developed world) have already started to shrink and are struggling to find optimum solutions for urban revitalization and management, it is of vital significance to benefit sustainability assessment for better decision-making throughout the process.

NSA tools lack a concrete mechanism for involving citizens and neighborhood residents in their development and practice. They are mainly developed and practiced by a group of experts who are not necessarily thoroughly aware of all the needs of the community.

The results of this study indicate that the practice of NSA is greatly influenced by market forces. Developers are inclined towards those criteria that impose fewer costs on the project and result in higher scoring.

7.1.8. Solutions to these problems and challenges

Regarding the context-specificity issue, this study argues that each assessment framework needs to be customized before being applied to a different context. One solution is to develop an assessment methodology and prepare a pool of criteria related to sustainability at the neighborhood level. When assessing the sustainability of a development proposal, relevant stakeholders could be asked to select the related criteria and decide about their relative importance. This can be helpful to consider the idiosyncrasies of each development and addressing the problem related to context-specificity.

To address the problems associated with scoring and weighting and enhance the rigor of the assessment process, this study suggests that weighting of the assessment criteria should be a more open process that involves a larger number of stakeholders. Moreover, in each target area, the specific priorities, goals, and planning strategies and the consistency between plans at all different levels of planning should be considered. Fuzzy techniques can be utilized to reduce the subjectivity of the process and provide a more realistic account of the sustainability conditions of the development. Care should be taken, however, not to make the assessment tools more complicated. Developing a simplified version of the assessment tool for self-assessment by the community members could be an effective way for enhancing the awareness of the local residents about the sustainability related issues, and encouraging them to contribute to the progress towards sustainability.

Raising public awareness of the significance of compliance with the sustainability criteria could also be helpful in increasing the demand for properties in the certified neighborhoods. This might be an effective strategy to address the developer's concern about the cost of certification and incorporation of costly criteria into the project. Ensuring them that

there will be adequate demand and willingness to pay for properties in the sustainable neighborhoods would make them less concerned about the return of their investment. Living in sustainable neighborhoods can also save residents a considerable amount of money in the long term. Therefore, it is a win-win situation for both developers and residents.

Applying NSA tools early in the planning process requires further actions by the local authorities. One possible solution is to condition the issuance of the building permit on submission of a certificate that demonstrates the achievement of a certain level of points. In addition, it might be possible to expedite the process of issuing building permit and certificate of completion of construction work for those developments that have achieved a certain level of performance. More institutional capacity building is necessary to use NSA certificate as a substitute for the building permit and certificate of completion of construction work.

And finally, to reduce the market-orientedness of NSA tools, it is necessary to have a more balanced distribution of weights and provide an institutional basis for NSA. Having significantly highly weighted criteria that account for chunk of the total score and require a relatively less cost lures the developers to comply with them and avoid criteria that require more cost and result in fewer points. Therefore, having a more balanced weighting can be helpful in reducing the problems related to the biased selection of the assessment criteria. Most of the tools examined in this study are market-based, and applied on a voluntary basis. Although trade-offs are inevitable, providing a legal basis for NSA in which acquisition of some minimum levels of performance are guaranteed can be an effective way for better uptake of NSA.

7.1.9. Providing better insight into NSA in action

In terms of being applied to the real world projects, this study revealed that NSA tools have not met the expectations. LEED-ND is the only tool that has received a reasonably good recognition among planners and developers. Other tools have only been applied to one (or a limited number) of developments.

This is in stark contrast with the conditions of tools available for assessment at the building scale, which are widely used by developers, and is an indication of the challenges associated with up-scaling assessment from building to neighborhood level.

Compared with assessment at the building level, more stakeholders are involved in the planning and practice of NSA which makes consensus building and decision-making a hard and time-consuming process. The overall costs of NSA are also higher and function as a discouraging factor. Given the economic difficulties that developers and local governments in many parts of the world are dealing with, it might not be possible to make NSA obligatory. Applying appropriate measures for stimulating the uptake of NSA tools (similar to those measures taken to promote the use of LEED-ND in US), and enhancing awareness of the significance of sustainable planning and design, seem to be the most viable strategies that can result in better uptake of NSA tools. It is also essential for the developers of NSA tools to acknowledge the necessity of institutional capacity building and take actions to improve the institutional basis of NSA. This should be undertaken along with efforts focused on improving the scientific robustness of NSA.

7.1.10. Finding out the difference between rhetoric and reality

Results of this study indicate that there is no direct relationship between the inclusion of sustainability criteria in the assessment framework and incorporating them into the real world project. However, the case study analysis showed that each certified case includes some sustainability measures, advocated by its corresponding NSA tool, which have not been incorporated into the other cases selected for this study. Take, for example, the case of Hoyt Yards. Unlike the other two cases, this neighborhood performs well in terms of connectivity which is the main focus of LEED-ND.

However, this cannot be used as an evident to conclude that NSA tools have been effective in guiding sustainable development. It should be kept in mind that there is a possibility that only those neighborhoods that are already in compliance with the specifications of a given NSA tool might apply for certification. In the recent case, developers might pursue certification as a means of market recognition.

Another point to be considered is that, because it is still the early years of NSA practice, the certified projects might have been used as pilot cases used for introduction and promotion of the respective NSA tool (as in the case of Koshigaya Lake Town).

Above, it was mentioned that criteria related to intra-generational equity, and procedural equity (institutional) have not been appropriately incorporated into the analyzed assessment tool. The case study analyses demonstrated that, in many cases, even the limited criteria that are available for addressing intra-generational equity and procedural equity have been ignored by developers.

One reason for this might be the cost of compliance with these principles. In order to address this issue, it might be necessary for the local governments to provide subsidy for incorporation of some criteria such as "affordable housing".

Good news about the practice of NSA is that, in the majority of cases it has been applied to existing and/or brownfield sites. Avoiding greenfields is essential for achieving sustainable neighborhood development (Wheeler, 2004), and should remain as a priority for developers and planners.

Needless to mention that in real world, trade-offs are inevitable and it is hard, if not impossible, to develop a neighborhood that features a whole set of sustainability criteria.

7.1.11. Highlighting the lessons that tools can learn from one another

Stressing that none of the analyzed tools possesses all the features required for having a comprehensive NSA tool, this study highlighted some major lessons that tools can learn from each other. These lessons can be divided into two main categories: lessons related to assessment criteria, and those associated with assessment methodology.

Concerning the assessment criteria, the cross-evaluation conducted in Chapter 6 indicated that NSA tools can complement each other by borrowing some important criteria that are missing in their own assessment framework.

With regard to the assessment methodology, this study emphasized the significance of having a balanced weighting system in order to avoid biased selection of criteria; including some mandatory criteria that guarantee the incorporation of the basic principles of neighborhood sustainability; clearly defining the boundaries of the development and ensuring the appropriate provision of sustainability measures within the boundary; and adopting an alternative making process that facilitates a more extensive involvement of various

stakeholders in the NSA process. Alternative-making is well practiced in SEA which is an institutionalized assessment system. Providing some institutional basis for NSA might be necessary to persuade developers to consider alternative-making, thereby enhancing the transparency of the process.

7.1.12. Examining the feasibility of developing global standards

In order to investigate the viability of developing a universal NSA tool, a cross-evaluation of three certified cases was conducted in this study. Results suggest that, because of various contextual differences, it is necessary to utilize customized benchmarks for NSA.

A comprehensive set of assessment criteria can be prepared to be used for assessment of neighborhood development proposals. Selection of the relevant criteria and assignment of weights to different sustainability criteria should be based on the local priorities and the opinions of the stakeholders of the development.

7.2. Limitation of the research

Given that the focus of this study was on sustainability, as a value-laden concept, there is some likelihood that some of the evaluations conducted in this study have involved a certain degree of subjectivity. As was discussed in detail in Chapter 2, the normative nature of the sustainability concept and the fact that there is still no consensus on its definition; makes dissimilarity in the judgments inevitable. To minimize the amount of subjectivity in the analyses, adequate care was taken to use definitions and principles for which a relatively strong consensus was available in the literature.

Regarding the literature review on impact assessment and neighborhood planning, the time limits of this study made it impossible to investigate all the related tools and theories. However, care was taken to scrutinize all major tools and neighborhood planning movements that have contributed to the evolution of sustainable neighborhood development and sustainability assessment at the neighborhood level.

Other downside of this study is that it was not possible to analyze all the tools available for sustainability assessment at the neighborhood level. Therefore, seven tools that fitted best appropriately with the needs of this study were selected.

As with all case study based research, there are also limitations to the case study analysis conducted for the purpose of this research. All the three case studies are among the best practice cases of sustainable neighborhood development. As Campbell (2003, p.16) argues, while exceptional case studies are more effective in "analytical generalization"; typical case studies are better for the purpose of "descriptive generalization". Since all the cases analyzed in this study are among the exceptional cases, it might be argued that this study does not represent the mainstream practice of sustainable neighborhood development. To lessen the impact of this limitation, an overall analysis of all other developments certified under these tools was conducted. Other issue is that there are some other neighborhood sustainability assessment tools, the certified cases of which were not analyzed in this study. Unfortunately, because of time and budgetary limits it was not possible to investigate all other NSA tools and their certified cases in this study.

7.3. Implications of the findings

The study presented in this thesis has gone some way towards enhancing the understanding of NSA (in theory and practice) and its promises and pitfalls. It has several implications for both research and practice.

The framework designed for evaluating the performance of NSA tools can be used by planners and local community groups to choose an assessment tool that fits their aims. It can also be used by the developers of the NSA tools to modify their shortcomings.

Analysis of the seven selected NSA tools showed that important principles such as intragenerational equity and procedural equity have not received due consideration. This should be appropriately considered when reviewing the NSA tools. Results indicate that better application of NSA tools requires joint efforts of various stakeholders. Institutional capacity building is necessary to facilitate a better uptake of NSA.

Cross-evaluation of several cases against different assessment frameworks proved to be a promising method for revealing the shortcomings of an assessment tool and its certified development, and providing ideas for future improvements. It also has the potential to be exploited for disclosing the idiosyncrasies of each context. This method could also be applied to other fields of research where multiple assessment schemes are available for assessment.

The findings about the methodological drawbacks of the selected NSA tools could be used for improving the assessment methodology during the revision process.

Results showed that because of differences in socio-economic and environmental conditions, developing global standards for assessment does not seem to be feasible. This has important implications for planners and local authorities and suggests that any adoption of assessment tools should involve major adaptations to the conditions of the local context. Given the pluralistic nature of the sustainability concept, planners and policy makers should give various stakeholders a greater role in the decision-making process.

7.4. Implications for future research

The limitations discussed in the previous section offer opportunities for further research. This should not only involve the various NSA tools and sustainable neighborhood practices in the developed countries, but also consider the cases in the developing world. In the coming decades nearly all the world population growth will take place in the urban areas of the developing countries (Cohen, 2006). The introduction of the NSA practices to the urban areas of the developing world could have significant impacts on the global sustainability. Future research should consider developing strategies for diffusion of NSA and sustainable neighborhood development in the developing countries as well.

This research showed that, in the context of cities in the developed world, incremental improvement of the existing neighborhoods has not received adequate consideration. Future studies should, therefore, examine this issue and find the best ways of development and application of NSA tools in such contexts.

Other vital issue for future research is to deal with the issue of using NSA as a tool for monitoring the neighborhood sustainability over time. Further studies are needed to clarify the role that NSA can play in this respect.

When introducing impact assessment tools in Chapter 3, it was stated that many assessment tools at different scales ranging from single building through to metropolitan are available to be used by decision makers. The interrelations between these tools and the way they can be used for developing an integrated assessment framework were not addressed in this study. More research is therefore required to explore this issue.

In the end, it should be reiterated that NSA is still in its formative period. Given this, the current achievements should be regarded as a relatively satisfactory initial step toward addressing sustainability concerns at the local level.

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Appendix

Glossary

Connectivity "the number of publicly accessible street intersections per square mile, including intersections of streets with dedicated alleys and transit rights-of-way, and intersections of streets with non-motorized rights of way. If one must both enter and exit an area through the same intersection, such an intersection and any intersections beyond that point are not counted; intersections leading only to culs-de-sac are also not counted. The calculation of square mileage excludes water bodies, parks larger than 1/2 acre, public facility campuses, airports, rail yards, slopes over 15%, and areas non-buildable under codified law or the rating system. Street rights-of-way may not be excluded" (USGBC, 2011, p.47).

Infill site "a site that meets any of the following four conditions:

a) At least 75% of its boundary borders parcels that individually are at least 50% previously developed, and that in aggregate are at least 75% previously developed.
b) The site, in combination with bordering parcels, forms an aggregate parcel whose boundary is 75% bounded by parcels that individually are at least 50% previously developed, and that in aggregate are at least 75% previously developed.
a) At least 75% of the land area, exclusive of rights-of-way, within a 1/2 mile distance from the project boundary is previously developed.
b) The lands within a 1/2 mile distance from the project boundary have a preproject connectivity of at least 140 intersections per square mile.

A street or other right-of-way does not constitute previously developed land; it is the status of property on the other side or right-of-way of the street that matters. For conditions (a) and (b) above, any fraction of the perimeter that borders waterfront other than a stream is excluded from the calculation" (USGBC, 2011, p.17).

Machizukuri "Machi literally means a local community and its physical setting, and zukuri means the act of making with care, as in the expression 'hand-made'. In contrast to the statutory city planning system (toshi keikaku), established in Japan in 1919, machizukuri has the positive connotation of residents building their own living environment, reflecting their own values and lifestyles, and is seen as a radical departure from the conventional centralized,

top–down, ‘civil engineering’ approach of Japanese urban planning, even playing an important role in the regeneration of Japanese civil society over this period” (Kusakabe, 2013, p.7).

Simpson Diversity Index “The Simpson Diversity Index calculates the probability that any two randomly selected dwelling units in a project will be of a different type.

$$Score = 1 - \sum (n / N)^2$$

Where n = the total number of dwelling units in a single category, and N = the total number of dwelling units in all categories”(USGBC, 2011, p.57).

Housing categories (As specified in USGBC (2011))

Type	Square feet
Detached residential, large	> 1,250
Detached residential, small	≤ 1,250
Duplex or townhouse, large	> 1,250
Duplex or townhouse, small	≤1,250
Dwelling unit in multiunit building with no elevator, large	> 1,250
Dwelling unit in multiunit building with no elevator, medium	> 750 to ≤ 1,250
Dwelling unit in multiunit building with no elevator, small	≤ 750
Dwelling unit in multiunit building with elevator, 4 stories or fewer, large	> 1,250
Dwelling unit in multiunit building with elevator, 4 stories or fewer, medium	> 750 to ≤ 1,250
Dwelling unit in multiunit building with elevator, 4 stories or fewer, small	≤ 1,250
Dwelling unit in multiunit building with elevator, 5 to 8 stories, large	> 1,250
Dwelling unit in multiunit building with elevator, 5 to 8 stories, medium	> 750 to ≤ 1,250
Dwelling unit in multiunit building with elevator, 5 to 8 stories, small	≤ 750
Dwelling unit in multiunit building with elevator, 9 stories or more, large	> 1,250
Dwelling unit in multiunit building with elevator, 9 stories or more, medium	> 750 to ≤ 1,250
Dwelling unit in multiunit building with elevator, 9 stories or more, small	≤ 750
Live-work space, large	> 1,250
Live-work space, small	≤ 1,250
Accessory dwelling unit, large	> 1,250
Accessory dwelling unit, small	≤ 1,250