The comparison of international and local sustainable assessment tools of landscape design for housing estate developments: Case of Bangkok Metropolitan Region, Thailand

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Abstract: Various countries have been introducing sustainable assessment tools for real estate design to produce integrated sustainability components not just for the building, but also the landscape component of the development. This paper aims to present the comparison between international and local assessment tools of landscape design for housing estate developments in Bangkok Metropolitan Region (BMR), Thailand. The methodologies used are to review, then compare and identify discrepancy indicators among the tools. This paper will examine four international tools; LEED for Neighbourhood Development (LEED – ND) of United State of America (USA), EnviroDevelopment standards of Australia, Residential Landscape Sustainability of United Kingdom (UK) and Green Mark for Infrastructure of Singapore; and three BMR's existing tools; Land Subdivision Act B.E. 2543, Environmental Impact Assessment Monitoring Awards (EIA-MA) and Thai's Rating for Energy and Environmental Sustainability of New construction and major renovation (TREES-NC). The findings show that there are twenty two elements of three categories which are neighbourhood design, community management, and environmental condition. Moreover, only one element in neighbourhood designs different between the international and local tools. The sustainable assessment tools have existed in BMR but they are not complete in only one assessment tool. Thus, the development of new comprehensive assessment tool will be necessary in BMR; however, it should meet the specific environment and climate condition for housing estate development at BMR.

Key words: Landscape, sustainability, assessment tools, housing estate development, Bangkok Metropolitan Region.

1. INTRODUCTION

Several landscape assessment tools categorise landscape elements into different systems. For example, LEED-ND divides the design elements into 5 categories of design activities: smart location and linkage, neighbourhood pattern and design, green infrastructure and buildings, innovation and design process, regional priority credits (USGBC, 2008). Chavachat (1986) divides landscape elements into 3 categories which are physical elements, public service, and environmental conditions. Savasdisara, Tips & Suwannodom (1989) places the landscape elements into 4 groups: neighbourhood aspects, location aspects, public facilities, and environmental condition. Furthermore, Askew (2002) presented only 2 groups of subjective elements such as general physical, urban park, recreation area; and objective elements such as view, neighbourhood support system, surround environment. Also, Kangwanpanich (2002) presented 3 groups of the landscape elements which are project physical environment, the public areas, and community management.

On the other hand, landscape design principles and various components of housing estate development have influenced the categorization of landscape elements. One example is the green spaces element in housing estates. The green spaces are firstly grouped into function aspect category, as they support social and recreation activities of the residents (Jim, 2004; Jim & Chen, 2006; John et al., 2001; Uy & Nakagoshi, 2008). In addition, green spaces will increase the aesthetic preference of residents, which means they can be placed in the aesthetic category (B. Chen et al., 2009; Thaiutsa et al., 2008). However, green spaces have disadvantages in housing estate development such as increasing the operation and maintenance (O&M) costs to the community management section (W. Y. Chen & Jim, 2008; Jim & Chen, 2007; Thaiutsa et al., 2008). Then, green spaces are grouped into O&M aspect. Moreover, use of fertiliser and water might create environmental problems in housing estate development (Helfand et al., 2006; Robinette & McClennon, 1983; Rodie & Streich, 2009; Vig, 2002). In this case, green spaces will group into environmental quality aspect.

The landscape elements can be grouped into many different systems, but they have some similar categories. Nevertheless, some elements can be placed into more than one category. Therefore, this paper categorises landscape elements into 3 categories of neighbourhood design, community management, and environmental condition. The aim of this paper is to present the comparison of landscape design elements from sustainable assessment tools between international and BMR levels. The comparison results will be useful to develop the new appropriate assessment tool of landscape design for housing estate developments in BMR.

2. OBJECTIVES AND METHODOLOGY

The objective of the study is to present the comparison between international and local assessment tools of landscape design for housing estate developments in BMR, Thailand. The methodology is to review, then compare and identify discrepancy indicators among the international and local tools. There are four international tools; LEED-ND (USA), EnviroDevelopment (Australia), Residential Landscape Sustainability (UK) and Green Mark for Infrastructure (Singapore). Three BMR's existing tools include of Land Subdivision Acts, EIA-MA and TREES-NC.

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3. STUDY AREA

3.1 Bangkok Metropolitan Region (BMR)

Bangkok Metropolitan Region (BMR) consists of the Bangkok Metropolitan Area (BMA), the capital city of Thailand, and its five adjacent provinces which are Nontha Buri, Pathum Thani, Samut Prakan, Nakhon Pathom and Samut Sakhon (REIC, 2009a; Yap Kioe, 2002). BMR locates in the central part of the country.

The present situation and trend of housing estate developments have been examined to establish a clearer understanding of the significance of housing estate developments business activities. The information shows a rising trend of housing estate in BMR with an annual increase of 3.69 %, with related evidence to population growth rate. In addition, the high price of land located in Bangkok inner city and expanding mass transit network from inner to urban and suburban of BMR are the driving factors for the increase trend of new housing estate projects in suburban and adjacent provinces of BMA.

In contrast, there are many environmental and social problems and complaints from the residents of the housing estate developments. However, while there are many sustainable design standards and assessment tools for buildings there is still a lack of appropriate sustainable assessment tool of landscape design for housing estate development in BMR. Therefore, the sustainable landscape design assessment tool is needed to develop and encourage developers and other landscape professionals to achieve best practice in housing estate development.

3.2 Current situation of sustainable assessment tools for housing estate developments in BMR

Various countries have been introducing design standards to produce integrated sustainability components of the housing estate project development, not just for the building, but also the landscape components of the development. However, the BMR still lack appropriate solutions to prevent negative environmental effects from housing estate development, because of the sustainable assessment tools still have two practical problems.

Firstly, the sustainable assessment tools do not cover all components of the development. Most of the sustainable tools focus on large scale buildings such as condominiums, office buildings, commercial buildings, hotels, industrial buildings, and does not include the landscaping and infrastructure features. Secondly, the current tools were created by government departments or government agencies from conservation viewpoints. They have not been accepted by developers who are concerned about their investment cost and economic returns. Many developers do not believe the existing tools will be useful to their firms or their projects. Some have attempted to avoid implementing sustainable standards through illegal methods or just complying with as little as possible.

Some government departments and agencies have tried to promote sustainable assessment tools to stimulate the high sustainability level of real estate development in Thailand. The examples of sustainable assessment tools are EIA-MA nominated by ONEP and TREES-NC nominated by Thai Green Building Institute (TGBI). However, most of the assessment tools still focus only on large scale buildings such as condominiums, office buildings, commercial buildings, hotels, industrial buildings, and do not for landscaping and infrastructure features. Only EIA monitoring award has more landscape and surrounding areas included in their assessment criteria, but only for large projects . The gap of sustainable assessment tools for housing developments in BMR is illustrated in Figure 1.

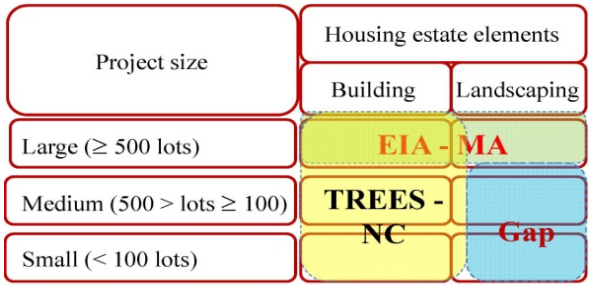

Figure 1: Gap of sustainable assessment tool of housing estate developments

4. THE SUSTAINABLE ASSESSMENT TOOLS OF LANDSCAPE DESIGN FOR HOUSING ESTATE DEVELOPMENTS

The sustainable assessment tools of landscape design for housing estate development applied to development of residential areas, where the houses are all planned and built at the same time and includes the elements of the visible or usable open spaces or outdoor environment; both of natural and human built activities which not just supports the economic needs, but also serve the social aspect and still maintain the environment. This section presents the current landscape assessment tools both of international and local levels. There are 4 international and 3 local tools will be reviewed.

4.1 The examinations of landscape design section on existing international sustainable real estate development assessment tools

There are 4 assessment tools from 4 continents which are examined in this section. The first tool is the LEED for Neighbourhood Development (LEED-ND) from Natural Resources Defence Council and U.S. Green Building Council, United State of America (USA). The second tool is the EnviroDevelopment standards version 2 from the Urban Development Institute of Australia (Queensland), Australia. The third tool is Residential landscape sustainability: A checklist tool from study of Department of Landscape: The University of Sheffield under the funding of Nation House-Building Council (NHBC), United Kingdom (UK). The final tool is Green mark for infrastructure Version 1.0 from Building and Construction Authority (BCA), Ministry of National Development, Singapore. This section presents their aims and objectives which relate to sustainable housing estate development.

4.1.1 LEED for Neighbourhood Development, USA

LEED for Neighbourhood Developments (LEED-ND) is one of the assessment tools of LEED (Leadership in Energy and Environmental Design System) founded by Natural Resources Defence Council (USGBC); U.S. Green Building Council, USA.

LEED-ND is the first international system for residential and community design and development. This rating system includes the principles of smart growth, urbanism and green building development. LEED-ND is divided into 5 sections, including of smart location and linkage, neighbourhood pattern and design, green infrastructure and buildings, innovation and design process, and regional priority credits. The total score of the system is 110 points and the result will be presented in 4 levels as being: Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points, Platinum: ≥ 80 points.

There have been more than 240 pilot projects started since year 2007. USGBC expected that the projects developed by direction of LEED - ND procedures will encourage healthy living for residents, reduce urban sprawl, protect threatened species in the community ecology, increase the alternative of transportation and reduce number of vehicles in the community, potentially reducing fees or waiting periods of approval, a good impression on the neighbourhood and change to higher tenancy rates of the properties (Travis, 2008; USGBC, 2008).

According to LEED-ND items, there are many items related to landscape design features such as imperiled species and ecological communities, wetland and water body conservation, farmland conservation, floodplain avoidance, bicycle network and storage, steep slope protection, site design for habitat or wetlands conservation, restoration of habitat or wetlands, conservation management of habitat or wetlands, walkable streets, connected and open community, reduced parking footprint, street network, tree-lined and shaded streets, water efficient landscaping, and wastewater management. However, this standard was developed under USA environmental conditions; it needs some adjustment before being applied to different locations.

4.1.2 EnviroDevelopment standards version 2, Queensland, Australia

The EnviroDevelopment is an accreditation system for real estate development. The EnviroDevelopment has been created by the Urban Development Institute of Australia, Queensland (UDIA (Qld)); Australia. The standard aims to increase the sustainability of real estate development including residential, retail, commercial and industrial. The standard was launched in October 2006. It consists of 6 elements which are ecosystems element, waste element, energy element, material element, water element, and community element. The system addresses reducing environmental impact, improving environmental performance and supporting the economics aspect of developers. However, the EnviroDevelopment standards are not specific to only landscape design, but there are many items related to landscape design elements in housing estate projects. The accredited projects will achieve the certification logo of EnviroDevelopment elements. The logo will generate positive impact to consumers' awareness and increase the marketing value to the current certified project and also to their further projects development (UDIA (Qld), 2009).

4.1.3 Residential landscape sustainability: A checklist tools, UK

The residential landscape sustainability is a checklist tool which has been developed by the Department of Landscape: The University of Sheffield under the funding of Nation House-Building Council (NHBC), United Kingdom (UK). The checklist is specific to landscape design elements in housing estate projects. The checklist comprises six categories of environmental concern which are energy, transport, pollution, material, water, and ecology and health. The sustainability rating score has been presented in percentages system; start from Fail (< 36%), Pass (38 – 47 %), Good (48 – 59 %), Very Good (60 – 69 %) and Excellent (70 – 100 %). However, this checklist was developed under UK environmental conditions, so it is more suitable for UK and other areas similar to the UK environment.

4.1.4 Green mark for infrastructure Version 1.0, Singapore

Singapore is a country located in the South East Asia region which emphasises green development both in building and landscape features (Wong & Chen, 2009). Green mark for infrastructure version 1.0 has been developed by the Building and Construction Authority (BCA), Ministry of National Development, Singapore. There are 6 categories of assessment criteria which are landscape, ecology and land efficiency; energy; water; project management; waste management; and environmental protection and innovation. However, only the category of landscape, ecology and land efficiency is related to landscape design features. This category consists of 7 items which are avoid use of land with high ecological, agricultural value; loss and mitigation of greenery area; conservation of matured trees and protected species; habitat creation and connectivity; use of brownfield sites/reclaimed land and cleanup of contaminated land; minimise the use of land through exploring alternative design layout; and provision of amenities for public usage and ease of accessibility (Building and Construction Authority (BCA)).

4.2 The examinations of landscape design section on existing sustainable real estate development assessment tools in BMR

This section will present the existing and ongoing of laws, regulations, standards and assessment tools with relevance to landscape features for housing estate development in BMR. Several laws, regulations and standards will be explored as follows.

4.2.1 Land Development Act, B.E. 2543 and the relative acts, Ministry of Interior, Thailand

Laws and regulations are the most important issue for the real estate development process (Kridakorn Na Ayutthaya & Tochaiwat, 2010; Piputsitee & Kittikunaporn, 2006). The Land Subdivision Act, B.E. 2543 is the most important laws for real estate development in Thailand, including BMR. In addition, BMR has several related acts used to mandate all projects in BMR. These are the Bangkok Metropolitan land usage plan Act B.E. 2549, provision of land subdivision for residential and commercial in Bangkok Metropolitans Area, B.E. 2550, provision of land subdivision in Nontha Buri Province, B.E. 2545, provision of land subdivision in Nakhon Pathom Province, B.E. 2545, provision of land subdivision for residential and commercial in Pathum Thani Province, B.E. 2552, provision of land subdivision in Samut Prakan Province, B.E. 2546, provision of land subdivision in Samut Sakhon Province, B.E. 2546.

According to details in the Acts, there are at least 15 major items related to landscape features for housing estate development such as the size of housing estate project, management of waste and municipal waste, water drainage design, wastewater management system, transportation system and safety design, parking area, footpath and walkway, street landscapes and trees, road design, traffic lights and signs, street lighting and fire protection, design of sanitary systems, community park areas, sports and children playgrounds and neighbourhood school areas (Royal Thai Government, 2002, 2003, 2006, 2007a, 2007b, 2009a, 2009b). Nevertheless, the elements in the acts are minimum requirements for all housing estate development in BMR and expect that will create the living sustainability for the residents.

4.2.2 Environmental impact assessment (EIA) and EIA monitoring award, Ministry of Natural Resources and Environment, Thailand

Environmental impact assessment (EIA) is one of the most essential regulations for control the environment quality of the project development. For Thailand, EIA has been established under National Environmental Quality Act, B.E. 2535, Office of Natural Resources and Environmental Policy and Planning (ONEP), Ministry of Natural Resources and Environment since 1992 (Tongcumpou & Harvey, 1994). Housing estate developments, with a development area larger than 100 Rai (160,000 m^2) or more than 499 lots, have to submit the EIA report for approval from the experts committee before start of their project development. There are 7 major items related to landscape features: water consumption system, wastewater treatment system, water drainage system, municipal waste management, transportation system, electrical system, and fire protection system. The EIA report presents details of project site, location and existing condition of landscape and community. In addition, the survey of people's opinions surrounding the project area are included into the report (ONEP, 1999; Royal Thai Government, 1992).

Moreover, ONEP has promoted the sustainable assessment tools to reward the top quality housing estate developments. There are two levels of the EIA monitoring award. Excellence award will be provided to the projects that total score is not less than 90 %, while the very good award will be provide for the project that total score is not less than 85 %. Moreover, the award follows the indicators in EIA report which focuses on natural conservation and environmental impacts for both buildings and landscape elements (ONEP, 2010). However, the EIA monitoring awards are limited to only projects under the EIA scope only.

4.2.3 Thai's Rating for Energy and Environmental Sustainability for new construction and major renovation (TREES-NC), Thai Green Building Institute (TGBI)

Thai's Rating for Energy and Environmental Sustainability for new construction and major renovation (TREES-NC) is the ongoing sustainable assessment tools for real estate development in Thailand under the development of the Thai Green Building Institute (TGBI). TGBI expected that TREES-NC will assist to develop more eco-friendly building in Thailand. TREES-NC is the rating tool for new real estate development projects for building and their surrounding area. There are 8 categories included in the TREES-NC. However, only one category relates to landscape, which is site and landscape. There are 7 items in category of site and landscape which are: project site and location, natural resource avoiding area, brownfield project development, distant to mass transportation, number of trees per project area, flood avoiding area, and green roof and location of trees (TGBI, 2009). The results of the rating will be presented into 4 levels as Certified (30-37 points), Silver (38-45 points), Gold (46-60 points), and Green (≥ 61 points).

5. THE COMPARISON OF LANDSCAPE DESIGN SECTION ON THE SUSTAINABLE ASSESSMENT TOOLS BETWEEN INTERNATIONAL AND BMR

The comparison in this paper categorizes landscape elements into 3 categories of neighbourhood design, community management, and environmental condition. The results of the comparison are presented as below.

5.1 The comparison of neighbourhood design category in landscape design

The comparison of neighbourhood design category in landscape design presents that there are 13 landscape design elements which are extracted from several international and local assessment tools. The results give an idea concerning a few different elements between international and BMR tools. The comparison results of neighbourhood design category in landscape design are presented in Table 1.

Table 1: The comparison of neighbourhood design category

Elements	International				BMR			Summary
	LEED-ND	EnviroDevelop	RLS –UK	GMI	LSA	EIA-MA	TREES-NC	
Project site planning	✓	✓	✓		✓	✓	✓	✓
Lot characteristics	✓		✓		✓		✓	✓
Road system and footpath design	✓	✓	✓		✓	✓		✓
Parking area	✓	✓	✓		✓			✓
Street trees, furniture & lighting	✓			✓	✓	✓	✓	✓
Water supply& drainage system	✓	✓	✓		✓	✓	✓	✓
Wetland conservation	✓		✓			✓		✓
Floodplain avoidance	✓		✓	✓		✓		✓
Park, green, lake & recreation area	✓	✓	✓	✓	✓	✓		✓
Mature trees & native plants	✓	✓	✓	✓			✓	✓
Community area	✓				✓	✓		✓
Neighbourhood Schools	✓				✓			✓
Neighbourhood Identity	✓							✗

Table 1 illustrates that most of the elements are presented in LEED-ND. Park, green and lake area, and mature trees and native plants are presented in all of 4 major international tools, while only LEED-ND supports the significance of neighbourhood schools. On the other hand, the neighbourhood

school is one of the important elements which is included in the Land Subdivision Acts of BMR, whereas TREES-NC present the essential of mature trees and native plants in housing estate design. The result shows the neighbourhood identity element is different between international and local tools. The element represents the visual aesthetic and social artistic of the community; therefore they are one of the important elements of landscape design principles for landscape design in housing estate developments.

5.2 The comparison of community management category in landscape design

The comparison of community management category shows that there are 4 landscape design elements, extracted from several international and local assessment tools. Thus, the result shows that there are no different elements between the international and local tools. Moreover, 3R (reduce reuse and recycle) systems and residents' encouragement exist in all major international tools, while the fire protection is in LEED-ND only. All of the design elements presented in this category will be included into landscape design in housing estate developments. The comparison results of community management category in landscape design are presented in Table 2.

Table 2: The comparison of community management category

Elements	International				BMR			Summary
	LEED-ND	EnviroDevelop	RLS –UK	GMI	LSA	EIA-MA	TREES-NC	
Fired protection	✓				✓	✓		✓
Security system	✓				✓			✓
Reduce, reuse and recycle system	✓	✓	✓	✓		✓		✓
Residents' encouragement	✓	✓		✓		✓		✓

5.3 The comparison of environmental condition category in landscape design

The comparison of environmental condition category shows that there are 5 landscape design elements, extracted from several international and local assessment tools. Thus, the result shows that there is no difference between international and local tools. The wastewater control element, water and energy efficiency element exist in all 4 major international tools. On the other hand, LSA and EIA focus on wastes control, while TREES-NC focuses on only the efficiency design on water and energy. The comparison results of environmental condition category in landscape design are presented in Table 3.

Table 3: The comparison of environmental condition category

Elements	International				BMR			Summary
	LEED-ND	EnviroDevelop	RLS –UK	GMI	LSA	EIA-MA	TREES-NC	
Municipal waste control		✓			✓	✓		✓
Wastewater control	✓	✓	✓	✓	✓	✓		✓
Water and energy efficiency	✓	✓	✓	✓			✓	✓
Noise pollution control		✓				✓		✓
Air pollution control	✓	✓	✓			✓		✓

6. CONCLUSIONS

This comparative study concludes that there are sustainable assessment tools in BMR but they are not complete in a single assessment tool. However, the existing sustainable assessment tools of housing estate developments in BMR only target large projects. here are no landscape standards for small and medium project in the existing tools.

The information from the literature presents the comparison of sustainable standards and assessment tools between international (LEED-ND, EnviroDevelopment, Residential Landscape Sustainability and Green Mark for Infrastructure) and BMR standards (Land Subdivision Acts, EIA-MA and TREES-NC) in items related to landscape design for housing estate development. Only neighbourhood identity element of neighbourhood design category different between the international and current BMR tools.

Integration of one sustainable assessment tool will be necessary for BMR; however, direct adoption from international tools will not be appropriate. The tool will need to be adjusted for specific environment and climate conditions for housing estate development in BMR.

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