CONCEPTUAL FRAMEWORK OF GREEN INFRASTRUCTURE PERFORMANCE EVALUATION FOR LOCAL AUTHORITY

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ABSTRACT

Green infrastructure planning has grown in prominence since it was first discussed in the late 1990's. Since the President's Council on Sustainable Development discussed the concept researchers and academics from across the globe, though predominantly the UK, Western Europe and North America, have won the process. Green infrastructure is an important trust in National Landscape Policy (NLP). Malaysia is moving towards to a developed nation by the year 2020. An environmental requirement should be take into accounts to emphasize to ensure the planned development. The government to intensify efforts to raise awareness and participation in issues of global warming carries out efforts extensively, green technology is the discourse is often featured. The preservation of green spaces in urban areas can function as recreational and social interaction areas in engaging the citizens who peaceful, harmonious, unified, and healthy. However, the approach to Green Infrastructure in Malaysia is still at an early stage, but these efforts have actually started to walk among scholars and researchers to disentangle the appropriate method with the situation in Malaysia. The purpose of this paper is to discuss a conceptual framework in order to bring the context of facility management. This is also the way to get the performance evaluation for green infrastructure criteria for local authorities in Malaysia.

Keywords: Conceptual framework, Green infrastructure, Facility management, Local authorities, Criteria, Performance evaluation.

Contribution/ Originality

This paper contributes an evaluation criteria and act as the fist logical analysis to produce green infrastructure framework. At the end of this research, it will produce an evidence base to help tackle the priority issues in the construction industry in Malaysia.

1. INTRODUCTION

The use of the term conceptual framework crosses both scale (large and small theories) (Ravitch and Riggan, 2012) and contexts social science, (Rodman, 1980) marketing, (Jaworski *et al.*, 1993) applied science, (Hobbs and Norton, 2006) art (Umberto, 1978) etc. Its definition and application can therefore vary. One set of scholars has applied the notion of conceptual framework to deductive, empirical, research at the micro- or individual study level (Shields, 1998; Baum, 2003; Shields and Hassan, 2006; Shields and Rangarjan, 2013). Shields and Rangarajan argue this tie to "purpose" that make American football game such a good metaphor. They define a conceptual framework as "the ways ideas are organized to achieve a research project's purpose." (Shields and Rangarjan, 2013). Explanation (Babbie, 2007) is the most common type of research purpose employed in empirical research. The hypothesis is the framework associated with explanation (Brains *et al.*, 2011). This paper will discuss about the conceptual framework based on the criteria of green infrastructure (GI) that can be adopted by the local authorities in Malaysia. The conceptual framework can be used to design a model of GI performance evaluation in Malaysia local authorities.

The GI framework can be created through the criteria and evaluation indicators of GI. This is to ensure the development more organize and systematic. This has been highlighted by the TEP (2008), in which many local authorities do not have the GI framework. According to TEP (2008), a GI framework needs to recognize that not all priorities can be represented on a set of key diagrams. For example, there may be compact pockets of significant deprivation or possible particular areas of high levels of multifunctionality interest that merit investment to meet City Regional goals. Green Infrastructure priorities can be identified using criteria of strategic importance. TEP (2008) noted that, the important of frameworks for GI as a healthy natural environment is a pre-requisite of growth the social and economic benefits that high environmental quality brings are well-documented. A strategy for growth requires a positive plan for GI. The TEP (2008) has designed to develop a GI framework and the functions are as follows:

(a) Managing surface waters and reducing flood risk;

(b) Adapting urban environments for climate change resilience;

(c) Inspiring inward investment and retention of high-value workers and entrepreneurs;

(d) Enabling healthy activity, recreation and social cohesion;

(e) Regenerating areas experiencing (actual or incipient) deprivation;

(f) Sustaining jobs in the natural economy;

(g) Maintaining and enhancing distinctive biodiversity, landscape and heritage; and

(h) Enabling sport and cultural excellence.

2. ISSUES

In the UK, organizations including Natural England, England's community Forests Partnerships and the Regional Development Agencies (RDAs) have all utilized GI and attempted to implement it within their development plans. These organizations are therefore at the forefront of the translation of GI ideas into landscape management practices. Likewise, a document including the Urban and Urban Fringe Policy Team (2007) in Countryside in and around Towns: A vision for connecting town and country in the pursuit of sustainable development' CA 207 is about sustainable communities. Planning for the future has also been at the fore of documents promoting GI in the UK (Mell, 2010). Although GI in the UK has developed rapidly over the last five years, North American research has been promoting its own growth since the late 1990s. Despite, or potentially because of, this is no longer timeframe, visible differences between UK and North American planning policy (at a local, regional and Federal level) can be seen. The development of GI thinking in North America has also been equally fragmented. In the England, GI thinking is been discussed in the latest rounds of Regional Spatial Strategy (RSS) developments. It been suggested that the GI process is, at present, being championed by a number of important landscape-orientated organizations throughout the UK with varying success. However, the development of a forum for debate between RDA's, researchers and delivery agents is only the first step towards a greater integration of the concept into planning policy. In Malaysia, GI was stated in any urban development involving various land uses such as residential, commercial, industrial and institutional and mix-development areas require at least 10% of open space and recreational areas (Town and Country Planning Department, 2006). Regarding with the National Landscape Department (2011), GI has existed and it is contained in the national policy landscape in the thrust 3. However, there are many problems in the implementation of GI. Up until now, it is still not fully implemented on several problems such as no comprehensive framework of GI. Evaluation of the performance is also the problems encountered by the implementer as to date there is no performance indicators used to measure the success of the implementation of GI at all levels, including local authorities level.

Lack of Availability of GI was caused by the provision and demand for green outdoor recreations is competing with other physical developments, thus they are constantly under threat of land acquisition, changes and modification. This issue was mentioned by Town and Country Planning Department (2005; 2006) which in their provision are usually either compromised for, largely being ignored or merely treated and included as leftover spaces (Mazlina *et al.*, 2010). Meanwhile, lack of connectivity caused by fragmentation of green spaces is another problem was lighted by Mazlina *et al.* (2010). For example, a big metropolitan city such as Kuala Lumpur does not have a proper GI network that links all the existing open spaces even though the planning of the network are proposed for implementation in the structure plan of the city (Streetheran *et al.*, 2004). The built forms and non-built spaces (greenery and open spaces) of an urban environment

are seen as a separate components instead of as a whole (Tibbalds, 2001; Carmona *et al.*, 2003). Therefore, the GI are treated as series of unrelated space with one another hence, facing lack of coherence including not being legible, accessible and confusing to urban residents to move around and orientate. The fragmentation of existing open spaces reduces the accessibility to places of recreational value. The results are lack of connectivity and continuity of residents' outdoor experience between and within towns and cities (Tibbalds, 2001; Benedict and McMohan, 2002).

In conjuction with, the effects may cause a social place such as a neighbourhood park to stand alone, disconnected from other parks by streets and buildings. Streets may separate community playgrounds from home gardens. Likewise, pocket spaces in between buildings are isolated, with no comfortable walkways to other green spaces. As a result, the opportunities for residents to engage in recreational activities, including socialising with friends and neighbours are therefore limited. The third issues which been highlighted by Mazlina (2011), is weak planning and management practices that affect uses of GI. The inadequate provision and fragmentation of the GI in green spaces in towns and cities in Malaysia are not well organised due to ineffective use of land (TCPD, 2005). This is firstly due to the poor quality of development plans (TCPD, 2005; Nor Akmar *et al.*, 2010). The planning of GI in Malaysia is heading in the right direction. However, it lack of proper planning, implementation and reinforcement (Cheang, 2010). For example, there are not enough tree-lined streets with shaded canopy for people to walk comfortably in the warm weather. As such, urban places may end up with sterile open spaces that are mostly empty or underused. These spaces may become impressive or monumental spaces that decline over time. The issues concerning management and implementation of urban GI include low standards of maintenance, lack of work force and budget, lack of skill, knowledge, expertise and interest, and lack of awareness and sense of civic mindedness (Adnan, 1998; TCPD, 2005). While in terms of reinforcement, there is still lack of monitoring by the local authority.

According to Maruani and Amit-Cohen (2007), one of the reasons that the green spaces are under threats is because developers and other businesses usually do not always care about green spaces. For example, a green recreational land of 6.07 hectares, which is provided under the draft Kuala Lumpur City Plan 2020 in the town of Bandar Tasik Selatan, Kuala Lumpur, has been redeveloped for private development of exclusive bungalow lots. Even though the town residents have made complaints to the Kuala Lumpur City Hall (DBKL) action has not been taken. Lack of awareness and sense of civic mindedness resulted in uncaring attitude that treats urban GI as a luxury instead of a necessary amenity. Urban GI is perceived as mainly associated with beautification of urban landscape, planting of trees and the addition of landscape features for aesthetic values (Streetheran *et al.*, 2004; Streetheran *et al.*, 2006). One of the reasons that many city governments all over the world have often cut expenditures for development and management of green spaces is to make ways for development that is seen as a financial priority (Nor Akmar *et al.*, 2010).

According to thrust 3 of the NLP, is to create landscape development programmes to provide functional and sustainable GI. Therefore, the performance indicators are necessary to measure the actual performance in implementing the GI. It acts as a measurement to ensure that this approach can assist and support the development of a local authority with focus on the environmental balance with the physical development of the urban area. Besides that, performance indicators also can monitor of implementation based on policy and guidelines.

3. CONCEPTUAL FRAMEWORK OF PERFORMANCE EVALUATION GREEN INFRASTRUCTURE FOR LOCAL AUTHORITY

The development of a GI strategies are influence by range of plans and to be supported by policies at the international, national and regional level and through guidance produced by Government, statutory bodies and NGOs. A GI strategy should therefore be utilised as part of the evidence base for the development of local strategies and policies. It should be planned for at a range of different scales Strategic Level, District Authority, Growth Area/ Point and Master Planning for individual sites and this will enable the identification of projects at a local level that can deliver local benefits whilst also contributing to targets at a sub-regional, regional and national level.
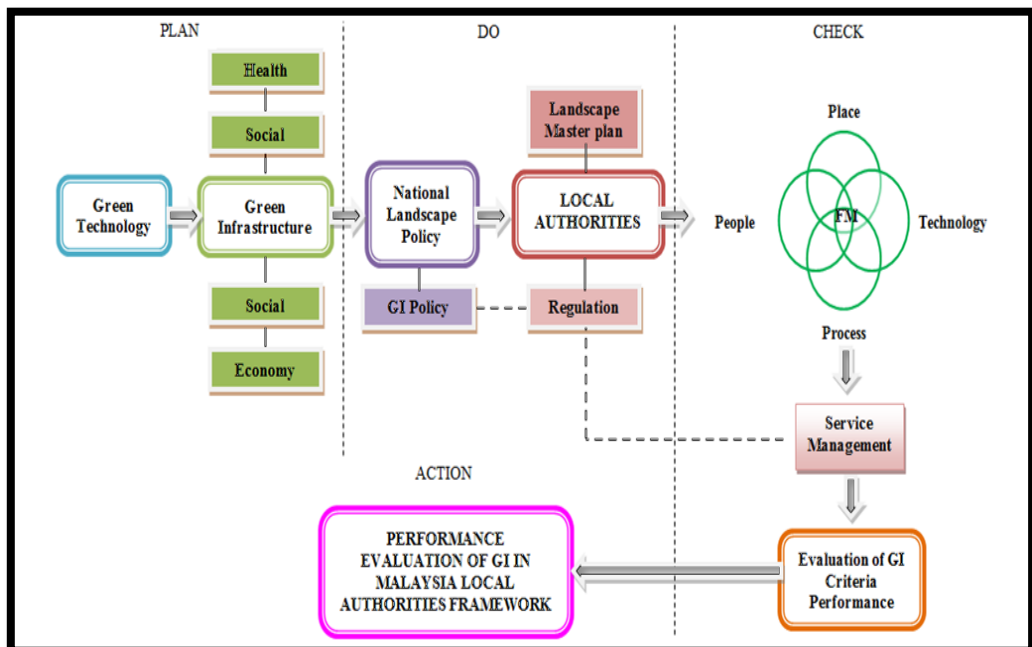
This will also include the need to work in partnership with neighbouring authorities to deliver connected and multifunctional landscapes. The GI strategies should not only identify physical linkages but also the linkages between dimensions of sustainability (as identified above with regard to climate change) and the potential benefits to quality of life, whilst also recognising and incorporating overlapping areas of policy. It should be a primary consideration in the

59

preparation of strategic plans right through to the master planning and design of new developments. The strategic planning of GI requires a co-coordinated approach from a multidisciplinary and cross-organisational team in order to create a successful GI strategy this will require local authorities, national agencies, landowners and to work together to implement the strategy.

Green technology covers a broad area of production and consumption technologies. The adoption and use of green technologies involves the use of environmental technologies for monitoring and assessment, pollution prevention and control, and remediation and restoration. Monitoring and assessment technologies are used to measure and track the condition of the environment, including the release of natural or anthropogenic materials of a harmful nature. Technologies prevention avoid the production of environmentally hazardous substances or alter human activities in ways to minimize damages to the environment; it encompasses product substitution or to redesign of an entire production process rather than using new pieces of equipment. Technologies control renders hazardous substances harmless before they enter the environment. Remediation and restoration technologies embody methods designed to improve the condition of ecosystems, degraded through naturally induced or anthropogenic effects.

According to Luken and Van Rompaey (2008), part of the strengths from adopting green technology were about the environmental image and ability to meet stricter environmental regulations in the future. This environment term related to the GI. By choosing not to develop on and thereby protecting these ecologically sensitive areas, communities can improve water quality while providing wildlife habitat and opportunities for outdoor recreation. Using land more efficiently and better manages stormwater runoff can reduce total impervious areas. Perhaps the single most effective strategy for efficient land use is redevelopment of already degraded sites, such as abandoned shopping centers or underused parking lots, rather than paving Greenfield sites. Open space or natural resource plans detail land parcels that are or will be set aside for recreation, habitat corridors, or preservation. These plans can help communities prioritize their conservation, parks, and recreation goals.

Early stages of GI planning should bring together as wide a partnership as possible in order to agree shared priorities, broker consensus and build a coalition for implementation. Importantly it should not just be environmental organizations, but it will bring together professionals involved in social and economic regeneration and growth. According to Mell (2010), GI will decreased stress and bring a quality of life adding the family enjoyment. Besides, increases interaction in the community can increasing social networks and improving confidence as outcome in community character.

The GI gives safer public spaces because of increased activity; evidence shows urban trees and green spaces decrease rates of violence and crime in urban areas and other neighborhoods. Good quality greenspace enhances property prices, and the value of the taxable urban asset base. Well-planned green space has also been shown to increase property values and decrease the costs

of public infrastructure and public services, including the costs for storm water management and water treatment systems (Benedict and McMohan, 2002).

This health benefit can also give a quality of life. The GI also absorbs air pollution and reduces urban core temperatures. It can clean the water before it is treated streams and aquifers filter. It will provide fresh, healthy food at low-costs at an ever-increasing number of farmer's markets & community gardens.   Furthermore, it can also increases physical activity and correlates to a decreased incidence of doctors' visits and depression, reduces obesity and maintains opportunities for children to experience and explore nature. It is a nation's natural life support system and also an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for communities and people.

The concept of GI at the early stage in Malaysia compared with developed countries in United States, UK and some European countries. There are several approaches that have been adopted in practice, such as the Urban Storm Water Management Manual for Malaysia that has been adopted by the Department of Irrigation and Drainage Malaysia. It provided 10% open space in development areas approval under the Town and Country Planning Act 1976 (Act 172) and some policies and guidelines issued by several agencies and departments that are directly involved in the planning and development of the area.

MacDonald *et al.* (2005) proposed guidelines or checklists of best practices for developing and evaluating GI plans. They highlight the multi functionality of GI, stressing what defines GI is its inclusion of goals for protecting ecological functions along with goals for providing benefits to humans, in terms of land use, such as agriculture, forestry and green urban space.

According to Mazlina *et al.* (2010), GI networks are an attempt to overcome the negative effects of the built environment of cities and towns. MacMohan (2000) stated GI has been discussed as enabling planners to develop multi-functional, innovative and sustainable places. It is associated with a variety of environmental, economic, and human health benefits, many of which go hand-in-hand with one another. The benefits of GI are particularly accentuated in urban and suburban areas where green space is limited and environmental damage is more extensive. It can be determined to reduce stormwater runoff volumes, enhanced groundwater recharge, storm water pollutant reductions, reduced sewer overflow events, increased carbon sequestration, urban heat island mitigation and reduced energy demands, improved air quality, additional wildlife habitat and recreational space, improved human health and increased land values.

There is no performance indicators and methods used to measure performance towards program, coordination and cooperation of local authorities and related agencies to implement the program and provide data and information required in the evaluation of the program is still not

comprehensive. This is due to constraints of power allocation which is there is no specific act in the development of the landscape and the lack of staff to monitor the implementation of local level authorities and supporter from the Central Agency that the program has been planned. The jurisdiction of functions and responsibilities of implementation has been enhanced and mentioned in National Landscape Policy.

The local authorities were given wide powers under the Local Government Act 1976 (Act 171). The role and functions mandated to it not only covers the tasks required and it could carry out their own discretion.   Mandatory tasks that include garbage collection, streetlights maintenance and activities related to public health.   Their discretionary functions include development of roles such as providing public facilities, recreational parks, residential and commercial activities. According to the Act 171, local authorities handed the role of following tasks:

In general, local authorities can act their roles and can be categorized into environmental, public, social and development. The local jurisdiction are covered in licenses issuing, impose certain taxes, relate to the building, housing and commercial units (market stalls, etc.) and exercise the functions of planning and managing urban. Besides, they are also managed and control the traffic (including managing the municipal public transport system) and authority to plan and provide public facilities.

The environment task is the maintenance and improvement of the environment under their jurisdiction. It includes services such as cleaning, collection and disposal of solid waste, drainage and sewerage perfect addition environment.

Public services role includes an abattoir services, veterinary services, transportation, burial areas and cremation places. Local authorities are also responsible for managing solid waste and sanitation systems, clean drains and roads, and maintaining the overall environment in the area. Licensing sales stalls, the traders on a small scale, retailers and business operators who are outward can interfere with public order are also accountable to local authorities.

There are eight roles and responsibilities of local authorities such as planning, development, infrastructure, maintenance, taxation, execution, social and regulation. Local authority is an organization that is engaged in asset management to cater needs of the urban community. Among the duties and responsibilities of local authorities are planning a development plan for a specific period in accordance with the rules and requirements of the act and the guidelines provided by the central government. Next, to control and approved the development by private sector or individuals who are in the local authority area or infrastructure development undertaken by the local authorities themselves. Local authority is also responsible for maintaining all the assets under the supervision and ensures that all assets are properly managed and always performed with and safely to the urban population.

By the FM approaches, it can help in organizing and managing the assets of the local authorities. Through this role, it is closely related to facility management that combines the four

key components of place, people, technology and process. According to Atkin (2003) facilities management is the process of delivering effective and responsive services, allowing changes in the applied area in the future, make asset as a cost-effective, creating competitive to the organization's core business, and enhance the culture and image of the organization.

In this study, in the form of service management, GI such as open space, playgrounds, parks and green networks available in the area and the responsibility of local authorities should be maintained as far as possible to be effective. This sector is closely related to green and asset management requires technology that green technology is more suitable to be applied in the management of GI. To ensure that the implementation of GI management is effective, approach and facility management practices such as performance evaluation can be applied in this sector. Therefore, it will help assess the effectiveness of the implementation of GI by providing GI requirements major criteria in the form of environment, economy, social and health. By assessing the implementation of the GI performance, it will help the local government to monitor the implementation of more efficient and effective.

Component of technology in facility management plays an important role in producing green technology in this study to producing GI. Thus, there are four important components of GI such as environment, economy, social and health. The components need to be analyzed to produce GI criteria and to measure performances to indicate and to target are being met holistically by local authorities.

4. DISCUSSION

In summary, the research issues that are addressed in this study are the important evaluation aspects. Performance criteria of GI require inputs from policy maker (National Landscape Department) and action (local authorities) and the key activities of performance criteria to develop the indicators of GI evaluation need to be clearly identified and understood. Based on the issues identified in this study, a number of things that need to be analysed deeply first are to measure to what extent the achievement of the implementation of GI in local authorities and how to measure the performance of the GI in Malaysia. Further, the important thing is to determine what the appropriate measure or criteria used to measure the performance of GI in Malaysia.

However, the approach to GI in Malaysia is still at an early stage, but these efforts have actually started to walk among scholars and researchers to disentangle the appropriate method with the situation in Malaysia. In this study, it is more focused on performance evaluation method of GI practices among practitioners is dedicated to the many local authorities play a role in controlling the development of policy development by providing development and enforcement of existing development.

Therefore, the GI plan actually is depends on the Malaysia government systems that consist of local government or state government represented the third level. It is empowered to impose such a limited tax assessment. Besides these government agencies it can enforce by-laws to

people who are in their administrative areas. Local government system in Malaysia carried out based on the principle of ultra vires (Latin for beyond the power) and the general efficiency (English: general competence). To implement the policy of this thrust in National Landscape Policy 2011, the coherent frameworks which are:

(a) Systematically and efficiently plan, implement, and manage GI to address the issues of global warming and climate change; and

(b) Encourage manageable and sustainable landscape development programmes to achieve beautiful garden nation.

Thus, local authorities are discretion to this role and play as an important tool in the local socio-economic modernization, lack of financial resources and physical ability to restrain the extent and functions they can provide. In this case, local councils often face the problems. A requirement of this rapid development has seen several new areas were explored. The result of this development and GI needs have begun to increase dramatically. Users of modern technology and development facility to meet the needs of the community resulted in the development carried out by so fast. The development has been the practice now and equilibrium aspects come not given serious attention. Neglect in this aspect causes local authorities sensitive to the impact of development for a long time.

A model then can be developed as mechanism of evaluation (tools) to measure performance of the implementation of the GI across local authorities in Malaysia. This model can be used to build a GI plan since it is not implement yet so far. The implementation of the GI plan will bring about maximum benefits in the Government efforts to establish a well-balanced and harmonious development that can be enjoyed by every level of society.

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