A Conceptual Study of Connectivity Elements towards Successful Green Network

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Abstract

Rapid urbanization has resulted in the loss of natural setting of urban spaces. Fusing the gap between nature and the city development can generate both common cause and conflict. Green network is a significant shift in linking urban green spaces that will lay out over the coming decades. At present, this green network is not successfully applied due to many open spaces that are not well connected. Hence, connectivity elements provided by the green network plays an important role in helping to conserve urban sustainability. Furthermore, green network is recognized as an effective urban conservation strategy to mitigate the effects of urbanization while maintaining healthy living and sustainability for urban area. However, the opportunity for green network to function as a linkage has not been optimized. Therefore, this research investigates on visitors' responses to different dimension of their needs for natural connectivity in the context of sustainable living. Data were collected using interviews and surveys on the scope of connectivity elements towards successful green network. This research offers input on green network by addressing visitors strong preferences towards natural connectivity elements compared to man-made landscape elements.

Keywords: Green network, connectivity elements, visitor preferences

1.0 Introduction

Cities have the capability of providing network of interactions with great human and technological potential. However, it is well known that urbanisation is taking place and hard to find a land hot shaped by human. Despite the fact that cities are in desperate need of their integration within the surrounding natural areas and open spaces in terms of increasing their ecological status. Yet, green networks (GN) are known to be a favourable tool in order to achive sustainable future of mankind. Therefore, there is a growing need to prevent the existing spaces being fragmented through development proposals in identifying ways to create and link formal open spaces as appropriate intention of new GN. GNs can be viewed as a strategically identified system of publicly accessible green spaces and linkages allowing movement around the network for people and providing habitat for wildlife (Forest Research, 2011). Importantly, there is a range of evidence that suggests its significance in providing physical, psychological and physiological benefits (Mitchell and Popham, 2008; Morris, 2003; Tzoulas et al., 2007; Croucher et al., 2007; Bell et al., 2008; O'Brien et al., 2010). Dandy (2010) as well as Stewart et al. (2010) claimed that one of the key benefits associated with green networks is the ability to generate social interactions, outdoor activities and events. GN is argued to derive primarily from the greater used f public areas by community members when 'green' including trees are present. Protection and management aspect are regarded as vital components of a more sustainable urban environment. The pressure on GN in urban area is an opportunity for active travel, health initiatives and range of ecosystem services which need to be planned in a long term run through a GN approach (Van Herzele et al.,2003).

Therefore, a number of research papers explored on how GNs can be assessed and managed to meet societal requirement. For example, a research conducted by Flink and Searns (1993) claimed that GNs have been designed for wildlife and human movement in American cities. GNs are manifested from well-planned, well-designed and managed land which comprises linear elements for multiple purposes including ecological, recreational, cultural, and aesthetic or others compatible with the concept of sustainable land use, people-oriented city of 21st century (Ahern, 2004; Platt, 1999). While, Foo (2001) stated that GNs in Singapore were recognised at the neighbourhood scale through parks and community garden. Moreover, it is vary depending on the community preferences and landscape resources that might connect to be GNs as such urban areas, business park, community centre, suburban housing, and urban park, through the connecting elements including sidewalks, bicycle and hiking trails, streams

and rivers, abandoned railroads, utility , scenic roads and scenic easements(Benedict and McMahon, 2006). Admittedly, research in GNs had been widely exposed. However, it is lack of spatially referenced social data on what are connectivity elements and preferences on the types of connectivity element used by visitors which only study had been carried in urban areas in Malaysia. In parallel with the never ending issue related to literature review in GN in Malaysia, it is found that only little effort was done to document a detailed research with clear understanding on identifications GN pertaining to its types of connectivity elements such as soft-traffic corridors for pedestrians, river corridor for off-street GN, linear green spaces and reserves. Likewise, there was also a lack of empirical evidences in Malaysia that determine the visitors' preference regarding connectivity elements in GN as such what types of connectivity element they prefer and to whom they may offer the most easy access to green spaces such as civic spaces, parks, playground and natural open space. The purpose of this paper is to identify connectivity elements in GN. This paper had also sought to evaluate the visitors' preferences regarding connectivity elements in GN. The attitudes of visitors are essential to understand the elements of GN, in order to properly succeed in the implementation of urban green networking initiative in general.

2.0 Literature Review

The term of GN is often replaceable with the aim to focus on social, biological and physical environment functions. It is a relatively recent and widely used term, which meaning and definition can vary according to the context. Generally, the definition of GN is an area comprises the continuity of green spaces within and around towns and cities, linking out into the wider countryside, which underpins the region's quality of life and sense of place, and provides the setting within which high quality, sustainable growth can occur. On the other hand, according to Tzoulas et al. (2007), GNs are all natural, semi-natural and artificial networks of multifunctional ecological systems with, around and between urban areas, at all spatial scales. Later, Tzoulas and James (2010) pointed out the GNs are more functionally or physically integrated, and, therefore may provide more recreational opportunities. Moreover, GN can be made up of woodlands, natural and semi-natural habitats, watercourses, and wetlands, formal and informal greenspace in and around settlement; and active travel routes which aim to promote green linkages and also to safeguard and enhance wildlife corridors in and around new and existing developments (Natural England, 2008). In addition, GNs vary depending on the landscape and visitor preferences. For example in American cities, GNs have been designed for wildlife and human movement (Flink and Searns, 1993). Similarly, GNs for parks and community gardens at the neighbourhood scale have been realised in Singapore (Foo, 2001). The current development of GNs is partially showing improvement after the continuous idea of GN protruded since Kuala Lumpur Structured Plan 1984; whereby to link major spaces together need a network of smaller open spaces along with rivers and drain reserves. Therefore, GN should be designed and managed for multiple concepts including ecological, recreational, cultural, aesthetic, or sustainable land use.

Connectivity can be broken down into structural connectivity and functional connectivity. Structural connectivity refers to the physical relationship between landscape elements,whereas functional connectivity describes the degree to which landscapes actually facilitate or impede the movement of organisms and processes. Functional connectivity is a product of both landscape structure and the response of organisms and processes to this structure. Distinguishing between these two types of connectivity is important because structural connectivity does not imply functional connectivity. In general when the term connectivity is used, it is usually related to the functional definition (Meiklejohn et al., 2014). This connectivity can enhance public engagement with the natural environment and encourage sustainable form of travel. However, according to the Landscape Institute(2013) physical connections make the most impact. The connectivity plans define core areas connected by connectivity elements such as landscape corridors, stepping stone corridors, linear corridors and buffer zones Latimer and Peatt (2014). Interestingly, Baguette et al.,(2007) suggest that various landscape connectivity within ecological network could be designed by setting up well provided linkages or several species living in different ecosystem. Generally, according to Kuala Lumpur City Hall (2008) in Draft Kuala Lumpur City Plan 2020: Towards a world class city, GNs consist of road reserve, utilities reserve, river and drainage reserve and railway reserve. An interconnected network of green spaces will be created by linking major parks and forest reserves with rivers, roads and utility reserves. This approach is chosen by the authority to re-introduce and promote the GN into conception of community. Although there are many researches related to GN, however, it is lack of spatially referenced social data on what are connectivity elements and preferences on the types of connectivity element used by communities. Thus, limited study has been carried in urban areas in tropical countries including those in Malaysia. In other words, there is always an issue related to GN connectivity, which were up until now there are open spaces where the linkage to the network is incomplete (Sreetheran and Adnan, 2009; Mazlina, 2011; Noraini, 2010). According to Thorne (1993), connectivity can be distracted by the breakage occurred along the route or corridor which resulted to lack of connectivity and suffering from fragmentation. In relation to that, fragmentation is defined as the landscape's lack of connectivity which caused by the mechanism and the subsequent alteration of ecological process. As a result of the lack of connectivity elements, it may lead towards difficulties of user's accessibility and

turning some spaces to be neglected or confused (Shuhana et al.,2007; Quayle, 1995).

Relationship between GN and connectivity is a vital element to consider in order to preserve ecosystem services, maintain and enhance biodiversity, improve the perceived quality, identity and connectivity places, provide recreational opportunities and human movement across the landscape and sustains natural areas. Each of connectivity elements have their own benefits. Similar to the designed transportation networks that provide efficient travel options for traveling, connectivity in GN are designed to provide efficient movement of social activities, improve health and well-being, enhance biodiversity, encourage tourism and promote sustainability on the use of scarce land resources. As development proceeds, there is an increasing lack of connectivity in using natural elements and associated impacts to ecosystem services. To avoid this problem, planning for a better connectivity elements must occur in both places where natural areas are common, and in places that intensively used by people. Therefore, designing good connectivity elements of GN are not an isolated or solely an environmental concern but can create more sustainable places and address the core purpose of development planning.

3.0 Research Methodology

The data for this research have been collected through a survey conducted among visitors at Taman TasikPerdana. This is due to greater significant impact of urban park experienced in Klang Valley compared to other urban park in the country. A random sample within the case study area was interviewed using a structured questionnaire. The total number of questionnaire form distributed was 75 with the response rate of 56%, the total number of respondent was 42 persons. The composition of the respondents who participated in the survey is presented in the Table 1

Table 1: Category of Respondents

Category of Respondents	No. of Responses	Percentage
18 - 29	6	14
30 - 44	15	36
45 - 59	12	29
60 above	9	21
Total	42	100

A face-to-face administration of the survey was done and every visitor approached was first informed about the survey's objectives. Participant who are willing to participate will be regarded as respondents for the study. The objectives constructed based on the following criteria (Section A) Demographic background question, (Section B) Reasons for visiting the study area, (Section C) Linkages within and outside of urban park areas (Section D) Preference towards connectivity elements in meeting their current and future needs. Field study observations were used to record every element or structure which exists as connector along the GN. It was done to understand the physical characteristic of existing connectivity elements in the study area. The variables used for this study are connectivity, naturalness and variety of features (Untermann, 1984; Dober, 2000; Strange and Banning, 2001; Tan, 2006; Toccolini et al., 2006). The degree of connectivity is a prime variable in order to measure because designing routes for movement which allow visitors to move from one space to another, besides providing transition from one type of landscape element to another form of landscape structures. According to Untermann (1984), an adequate provision of these features will contribute to a good pedestrian environment. Meanwhile, a pilot test was conducted to obtain information to improve the questionnaire. . In order to obtain a better understanding of GN and to answer the first objective, documentation was collected and analysed based on connectivity elements such as natural and man-made. In addition, structured interview session were conducted with Physical Planning officer who in charge in GN.

4.0 Limitations of the study

There are several limitations of this study that the researcher believe have had some impact on the overall outcome. Firstly, the researcher is aware that the nature of the samples for the connectivity elements survey is one of the limitations in this study. It is noted, that if more time and budget were available, the researcher would have richer data, both in the quantitative sense of having more observations and more variation within the data, and in the qualitative sense that it would be feasible to conduct focus group discussions from visitors of the case study area. Furthermore, the researcher would also gain more information if the scope of the study covered a wider range of locations and types of area. Another issue is the fact the data only collected at one single time point, which may not be fully represented and will not reveal changes over time. Given these limitations, the findings and implications of the study need to be interpreted with caution and the results may not represent other GN in city

centre.

5.0 Result and Discussion

Based on the observation and clear definition of connectivity, it is informed that consideration of structural and functional are important in understanding the effects of development as well as how present connectivity can be managed to meet the ongoing and future challenges of sustainability. Some parts of natural elements are loss due to the development of these elements. This phenomenon provides an opportunity for conservation, although time for action is finite. Therefore, it is important to improve GN connectivity to avoid the looming threat of extinction.

Referring to the figure below, the result indicates the mean of trees and shrubs value is 7.89. Thus, trees and shrubs value is the highest preference among visitors within connectivity elements in GN. Next, the mean of forest reserves values is 7.87, thus, it is the second highest preference among visitors. Followed by natural habitat, 6.33; river reserves, 6.13; land form, 5.8; jogging tracks 5.57; walkways, 5.56; cycle ways, 4.67. Utility and road reserves respectively recorded as the lowest preference choices of 2.77 and 2.35. The important of well-planned and successful GNs depending on visitors' preference on connectivity elements for a frequent and maximum use. It can create attractive settings for daily life, distinctive local identities for places, sense of place, sense of belonging and can help guiding future settlement growth without having to sacrifice the nature for development.

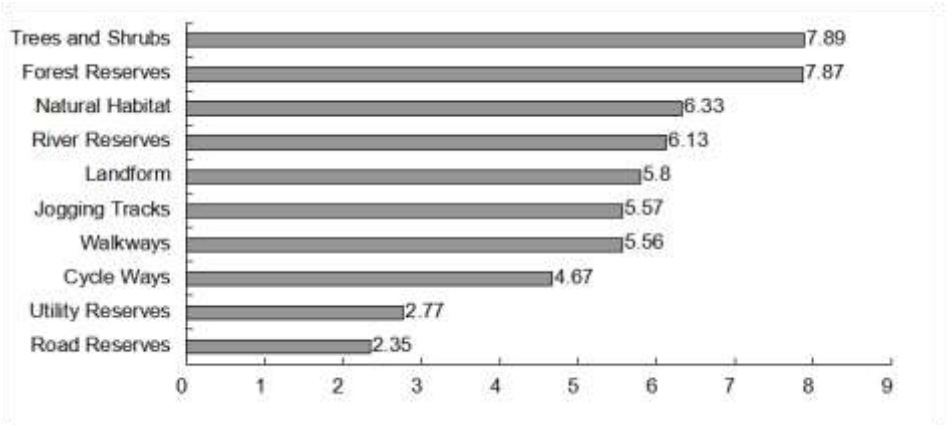

Figure 1: Visitors' preferences on connectivity green network

The survey in 2011 found that 39% of the respondents used green spaces at least once a week, followed by twice per week (35%), 17% respondents that come once fortnightly, over 8% visit their local green spaces at least once a month and followed by others (1%). Visitors show that that GN is used for a range of different activities such as to spend time with the family (35%), to socialize with friends (31%), to exercise (16%), to relax (13%), to pass through (4%) and to have contact with other visitors (1%). The repeat survey in 2015 found that 67% of the sample reported that they used their green space at least once a week with 80% visiting their local green space at least once a month. Comparatively, from this survey it shows that urban dwellers are concerned with the sustainable and healthy living. The primary uses of green space remain spending time with family (43%) and to socialize with friends (27%). The aim of this survey is to gain a better understanding of how the public use GN as well as their preferences and expectations. The research objectives are worth repeating as they may provide a useful framework towards successful GN that could be collected around Klang Valley. This criterion will make designing and planning for the purpose of connectivity become clearer.

The research identified positive preferences of visitors on connectivity elements of GN especially with natural elements. The results indicate that the visitors displayed strong preferences towards naturalistic elements for the linkages comprising trees and shrubs, forest reserves, natural habitat, river reserves and landform, compared to man-made elements such as jogging tracks, walkways, cycle ways, utility reserves and road reserves. Their preferences may be attributed to their appreciation of the psychological and social needs of living with nature. The research discovered that visitors looked forward to seeing an increase in the selective elements as linkages in GN. An overwhelming portion of respondents who commented on aspects of creating natural linkages that must be integrated as part of design consideration for GN to function effectively as pocket park, where visitor can easily accessed, and offer opportunities for interaction, relaxation and give recreational value. It is hoped that the implementation of GN will provide benefits in many aspects such as enjoyment to visitors, recreation benefits and reduction in forgotten space that act as white elephant. Nevertheless, the idea of introducing GN poses few challenges, which require careful close consideration before implementation in year 2020.

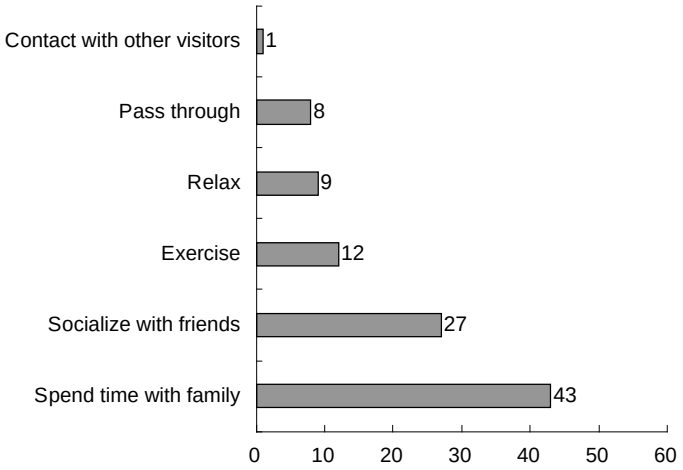

Figure 2: Percentage of visitors' activity in green space

6.0 Conclusion

This research examined visitors' preferences towards connectivity elements in GN and conclude that connectivity elements that based on natural elements are the best compared to man-made elements. In this perspective, both manmade and natural connectivity need to be considered in understanding and managing sustainability in the face of changes in structural connectivity through land use change and fragmentation. However, in order to motivate visitors to use GN, these connectivity elements are needed to encourage people to keep active in the areas. Specifically, the different aspects of connectivity should receive more attention for their role in the GN. The result however revealed the positive feedback from the findings that the visitors can distinguish between natural and man-made connectivity element. This research has made a significant contribution to the research on connectivity element in GN. Actively planning green space as a GN will help to reserve the effect of fragmentation and is likely to increase opportunities for the everyday engagement of people with GN and promote active travel. Despite the fact that have been learnt from this research, there is undoubtedly more scope for continuous discovery and expansion on the knowledge that can explain about an expansion to the GN circumstances in Malaysia. For that reason, new direction for further research is to identify the importance of GN as well as their losses due to the rapid urban growth and factors of to motivate people to move through and use connectivity element. The importance of ecosystem services provided by GN for human well-being is rapidly gaining recognition. Thus, it will discuss the emerging trends of GN research and its implications for safeguarding biodiversity.

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"Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the Ministry of Education Malaysia."

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