Research Proposal

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Research Topic

Green Infrastructure as Network of Social Spaces for Health and Well-being of Urban Residents in Towns of Malaysia.

Research Aims

The aim of the research is to determine the properties and attributes of green infrastructure and its land use components as social networks of spaces in towns of Malaysia through preference and experience of urban residents. This would reveal the qualities of green infrastructure that enhances the community's physical, social health and cognitive functioning and well being, hence, forming the sense of attachment and belonging towards their places.

Research Objectives

To achieve the aim, the following research objectives are formulated:

1) To identify the land use components of green infrastructure as networks of social spaces that knit a town's fabric.
2) To examine the existing green infrastructure components of the sites studied.
3) To investigate people's behavioural preferences towards their urban greenery and spaces as infrastructure in a town.

4) To determine the properties and attributes of green infrastructure that enhances physical, social and cognitive functioning and residents' well-being, hence, reveal the attachment of urban residents towards their town.
5) To formulate a model that emphasizes and enhances the qualities of urban green infrastructure components which are vital for town, so that, people can appreciate its contributions to health and well being of urban community.

Assumptions

Properties and attributes of green infrastructure and its networks determine people's progressive responses from physical, social and cognitive functioning and well-being, hence, enhancing the sense of attachment and belonging for their towns.

Research Questions

Research questions are divided according to green infrastructure and its components and people's responses towards it.

A. Green Infrastructure and its Land-use Components:

1) What is green infrastructure and how many types of green infrastructure and its land use components can be found in Malaysia's towns?
2) What are the green infrastructure's components exist in the studied areas? (town park, community park, padang, pocket spaces, loose-fit spaces, square, halaman/courtyard, active frontage, five foot corridor/arcaded walkway, tree-lined streets, alleyways, school open spaces and residential open spaces)?
3) What are the spatial arrangement and compositions of the land use components of green infrastructure?
4) What are the properties and attributes of these green infrastructure components?
5) How do these components link with each other and to other land uses?

B. Behavioural Responses of People towards Green Infrastructure and its components:

1) How the open spaces and green infrastructure networks are used by urban residents?
2) What are the social interactional and transactional activities of users in urban green spaces?

3) Why people experience these spaces?
4) What are the properties and attributes of the green infrastructure contributing to progressive behavioural response of people?
5) What are the positive behavioural responses and progressive outcomes after experiencing green infrastructure and its spaces in terms of physical, social and cognitive functioning and residents' well-being?
6) Why people indicate that some places are their places?
7) Is there any relationship with the amount of greenery with the number and frequency of people who used it?
8) What is the pattern of social interaction favourable to urban residents in experiencing these land use components of green infrastructure?

Problem Statement

In the last few hundreds years, there has been an extraordinary disengagement of humans from the natural environment (Katcher and Beck, 1987; Axelrod and Suedfeld, 1995). Movement from rural to urban environments has facilitated in this detachment, therefore, diminishing our regular contact with nature. The modern society has also insulated people from outdoor environmental stimuli (Stilgoe, 2001) and regular contact with nature (Katcher and Beck, 1987). The implication is that, being in urban environment exposes its inhabitants to too much artificial stimulation. It is indicated that an existence spent in purely human environments may cause exhaustion and produce a loss of vitality and health (Katcher and Beck, 1987; Stilgoe, 2001). In addition, the protective factors of nature for health improvement and sustainability have been reduced (Katcher and Beck, 1987; Axelrod and Suedfeld, 1995) by being in urban environments, and as a consequence, human, community and cultural well-being have suffered from these industrialization and urbanization (Maller et al., 2005, p.46).

In an urban environment, parks and public nature reserves are considered as the only means of accessing nature (Maller et al, 2005). Based from this realization, efforts were made to stress on the importance of parks and open spaces for health functioning of urban inhabitants. For instance, health justification was used for provision of parks and other natural areas and for preserving the wilderness areas outside of cities for public use (Parsons,

1991; Ulrich, 1993). In the 19th century, parks were designed in strong belief of its possible health advantage gained from these open spaces (Hamilton-Smith and Mercer, 1991; Rohde and Kendle, 1997) which were hoped to reduce disease, crime and social unrest and provide 'green lungs' for city, and areas for recreation (Rohde and Kendle, 1997). Even now, urban spaces are expected to function not as an isolated unit but as a vital part of urban landscape with its own specific set of functions (Urban Task Force, 1999). It is to be used as an outdoor room to relax and enjoy the urban experience, a venue for different activities such as outdoor eating, street entertainment, sport and play areas, a venue for civic or political functions and most importantly a place for walking and sitting-out (Ward Thompson, 2002).

Similarly, open spaces in urban areas of Malaysia are expected to function effectively for its users. With the acceptance that open spaces can provide 'green lung' for a city, serve as focal points that can break monotony of concrete jungle, promote healthy society by providing spaces for recreational, social and leisure activities and also counterbalance the harsh reality of a hectic urban life, encouraged the government to formulate planning standards for open spaces and recreation. This planning standard requires 10 percent of open space and recreation to be provided for all types of housing, commerce, industry, mixed, tourism and institution development (Federal Department of Town and Country Planning, 2005). The requirement forms the basis of most of heritage town, royal town, special role town, special industry town and any modern township in Malaysia today.

Yet still, it is implied that the existing open spaces are not valued as the city's heritage; therefore, the spaces are constantly under threat of land acquisition, changes and modification (Federal Department of Town and Country Planning, 2005). In addition to the matter, the open spaces have also loss their importance to physical development in which, their provision in many developments are usually either compromised for, largely being ignored or merely treated and included as 'leftover spaces'.

A well-distributed open space can influence the quality of life of people in a congested urban area (Federal Department of Town and Country Planning, 2005). Nonetheless, green infrastructure and open spaces in Malaysia's cities and towns are not well organized. A study on open spaces in seven major cities in Peninsular Malaysia based on assessment of their respective local plans highlighted that there was an inadequacy in provision of open spaces, thus, concluded that it was not the shortage of land that contributed

to the lack of open spaces in urban areas, but rather the ineffective use and organization of land (Federal Department of Town and Country Planning, 2005). This issue needs attention because, these green areas contribute to the quality of life in cities (Bonaiuto et al, 2003; Chiesura, 2004) and local people consider urban nature and daily outdoor recreation opportunities to be the main factors enhancing their everyday well-being (Eronen et al., 2002). Their benefits are primarily determined by the quantity and quality of these areas as well as their accessibility (Tyrväinen et al. 2005; Tyrväinen et al. 2007). The major concerns can be detected the area of planning and design of Malaysia's urban spaces such as accessibility and openness (Federal Department of Town and Country Planning, 2005). To allow for accessibility and openness, and hence improve the quality of spaces, these spaces must have connectivity. One of the examples is through a network or matrix of patches and corridors as posited by Forman (1996) on his conceptual approach to spatial arrangement of space which matter most for social integrity (Tan, 2006). He suggested that the optimum spatial arrangement must consist of three fundamental structures called patches-corridors-matrices (Thwaites et al., 2005).

Research in open spaces are various, however, less research is explored on the value of these non-parks places (Ward Thompson, 2002). Nonetheless, it is important to recognize the value of these non-park places, waste lots or 'loose-fit places' (Dovey et al. 2000). Federal Department of Town and Country Planning (2005, p.8) defined open space as "whichever land that is enclosed or open that is specified wholly or in part as a public botanical park, public park, public sports and recreational field, pedestrian walkway or as a public area". However, green infrastructure in urban spaces constitutes more than just open space and incidental open spaces as defined by the Federal Department of Town and Country Planning (2005). As a whole, green infrastructure comprises of all natural, semi-natural and artificial networks of multifunctional ecological systems within, around and between urban areas, at all spatial scales (Tzoulas et al., 2007), which is introduced to upgrade urban green space systems as a coherent planning entity (Sandström, 2002). It is a term that described the abundance and distribution of natural features in the landscapes like forests, wetlands, and streams which provide the ecosystem services that are equally necessary for well-being (Weber et al., 2006). And as an interconnected network of green open space consists of woodlands, wildlife habitat, parks and other natural areas that conserves natural ecosystem

values and functions and provides associated benefits to human population, sustains clean air, water and natural resources and enriches quality of life (Benedict and McMahon, 2002). Besides the identified open spaces, it also includes the informal spaces termed as the "loose-fit" (Dovey et al., 2000). Loose-fit places are environments that allow for a variety of functions and which are often un-designed, unregulated, spaces (Dovey et al., 2000), residual spaces (Davidson, 1999) and a wilder side of urban green space, unmanaged and awaiting redevelopment lands (Ward Thompson, 2002) such as the informal, waste lots, the derelict, gap sites, messy places and non-parks places (old railways sidings, gap sites, cemeteries, etc.). These spaces are important to be considered in development as elements that knit an urban fabric into a network of open spaces (Refer Table 1 Green Infrastructure and Its Land-use Components in Appendix A).

Street is also an important part of green infrastructure land use components. It is indicated that there are many opportunities to engage with people in streets rather than in parks or plazas. Therefore, the street is actually the truly representative of public open space, the one which the whole population may be comfortable in using (Ward Thompson, 2002). Thus, it is vital to explore the responses of urban residents through their experience and preferences in using these social spaces. Therefore, to understand green infrastructure networks, the research must not only cover the experiences of using parks and open spaces, but must also include streets and 'loose-fit' places as important parts of green infrastructure components. These places are expected to be additions to formal parks rather than a substitute to them which can be a contemporary reinterpretation of the ideas of green network (Ward Thompson, 2002) or as park connectors (Tan, 2006). In addition, there is a need to look at network, mosaic or systems of linked spaces that are woven into the fabric of urban areas since those green infrastructure components can have already existed either by incidence or planned (Thwaites, 2005).

The relation between green area qualities and experiences, perceptions and activities across landscapes have received relatively little attention (Dwyer and Childs, 2004; Balram and Dragicevic, 2005). This is important to find the social and cognitive functioning and well-being of urban residents. The majority of studies on place attachment have attempted to understand people's feelings for residential settings (Ryan, 2005) such as home (Cooper-Marcus, 1995) and neighbourhood (Ahlbrandt, 1984; Rivlin, 1987; Lalli, 1992; Brown et al.,

2003), rather than for natural settings. In addition, the effects of environmental change and development on people and on their attachment to natural areas have gone relatively unstudied (Ryan, 2005). Therefore, this study would reveal and see how changes in environmental aspect and development can affect urban residents' sense of attachment to their places and whether the sense of attachment of people to their places is still intact even though some developments might over the years changed the existing green infrastructure components of the places. Experiences are the most crucial part of how people perceive, utilize or *live* their green areas (Relph, 1976). Therefore, personal meanings are the important characteristics of a place for local people either it is based on aesthetic, social characteristics and cultural values and meanings (Tyrväinen et al. 2007). There is a need also to look at the way social use of space interacts with the need for "natural" spaces (Ward Thompson, 2002). This study intends to fill the gap to reveal the characteristics of green infrastructure and its land use components as networks of social spaces that can meet physical, social and cognitive health functining and residents' well-being. Thus, meanings and social values need to be examined through behavioural responses of urban residents using preferences in their environment which hence will reveal the attachment of people towards their towns. Findings from this research would generate evidence on the qualities of green infrastructure in towns and help to improve the planning and design of green infrastructure in towns of Malaysia.

Theoretical Framework

Various research in traditional disciplines such as psychology and biology, recent studies in the field of recreation and leisure and wilderness therapy (St Leger, 2003) and new disciplines such as ecopsychology (nature-guided therapy), wilderness experiences, horticulture therapy and animal assisted therapy (Maller et al, 2005) have shown that nature provides many benefits to human functioning and well-being. Positive relationship can be found between well-being, health and nature and green space (de Vries et al., 2003; Takano et al., 2002; Tanaka et al., 1996). It is suggested that human needs nature for psychological, emotional and spiritual needs (Wilson, 1984; Katcher and Beck, 1987; Friedman and Thomas, 1995; Roszak et al., 1995; Frumkin, 2001; Wilson, 2001). Therefore, viewing nature, contact with nature or participating in nature imply benefits to physical, psychological and social health of people and community (St Leger, 2003; Maller et al, 2005). Among the

studies on the positive effects of either viewing, contact and participating in nature and their contribution to various health benefits (physical, social and cognitive) were carried out by various researchers such as Ulrich et al (1991b) in healthcare, Parsons et al. (1998) for drivers on roads and highway, Kaplan and Kaplan (1989), Lewis (1996), Leather et al (1998), Randall et al. (1992), Larsen et al. (1998) in work environment, Tennensen and Cimprich (1995) for university students, Ulrich, et al. (1984) and Moore (1981) in prison environment and Wong (1997) for new immigrants. For examples, studies on psychological health confirmed that nature increases positive mood affect (Ulrich 1979; 1982), feelings of pleasure, sustained attention or interest, 'relaxed wakefulness' and diminution of negative emotions, such as anger and anxiety (Rohde and Kendle, 1994) provide restorative environments that can help strengthen the activities of the right hemisphere of the brain and restore harmony to the functions of the brain as a whole (Furnas, 1979). Kaplan and Kaplan (1981) suggested that parks are ideal for restorative environment because that foster recovery from mental fatigue. People who have access to nearby natural settings have been found to be healthier overall than other individuals (Kaplan and Kaplan, 1989).

Green infrastructure and its components represents social network to people. Urban Task Force (1999) implied that public spaces work best when they establish direct relationship between space and people who live and work around it. Land use components of green infrastructure present variety of landscape experience to people and such experience goes deeper than visual aesthetics. Studies suggested that different landscapes influence emotional states of people (Parry-Jones, 1990). Urban parks and trees hold a special meaning for urban residents (Dwyer et al. 1996). Trees and vegetation also influence urban inhabitants and they can have a strong, relaxing effect to people. Users of green infrastructure in urban spaces described their favourite settings as serene, peaceful and restful (Schroeder, 1988; Dwyer et al., 1991). People have the ability and even need to form emotional attachments to other people (Levitt, 1991; Weiss, 1991) and, so are the attachments that people form to the environments around them. This emotional bond between people and places has been termed place attachment (Shumaker and Taylor, 1983). However, environmental change and development can have sad consequences for those who have an attachment to natural areas (Ryan, 2005). For instance, the early seminal work of Marc Fried (1963) showed that some urban residents who had the strongest attachment to their former neighbourhood experienced

intense grief and depression when forced to relocate for urban renewal. These include the grief for their close-knit social network and the physical places that were their favourite areas. People may also form attachments to places which satisfy particular motivational needs and desires, or which exhibit fine design and distinctive environmental quality, or which are meaningful in terms of events (Thwaites, 2001, p.247). Place is significant when they have physical or social value, are able to satisfy specific needs, and are regularly visited (Bonnes and Secchiaroli, 1995). Thus, green infrastructure represents 'social imageability' to a place. Imageability means qualities of a landscape present in totality or through elements; landmarks and special features; both natural and cultural making the landscape create strong visual image in the observer, and making landscape distinguishable and memorable (Tveit and Fry, 2006).

The benefits and significances of green infrastructure as a network of social space in urban areas are summarized in Table 2. All of the studies with the exception of Tan (2006) examine the green infrastructure and its benefits to human well-being in Western cities. Thus no study has been carried in small towns in tropical countries including those in Malaysia. This exploratory study is designed to fill the gap.

Table 2: Studies on green infrastructure as open space network and people's preferences

Green Infrastructure and Open Spaces in Urban		
Authors	*Problems or concerns of research*	*Parameter measured*
Tzoulas (2007), Ward Thompson (2002), Dovey et al. (2000), Malaysia Federal Dept of Town and Country Planning (2005), Thwaites (2001), Thwaites et al. (2005), Tan (2006), Tveit and Fry, 2006, Alexander et al. (1977),	• Significance of network of open space to ecosystem and human health and well-being • Network of linked open spaces that are woven into the fabric of urban areas • Link between ecological and social systems • Link between spatial arrangement of open space and social benefits • Values of small and loose-fit spaces in urban planning	• Accessibility and connectivity • Openness • Heterogeneity • Naturalness • Coherence • Wayfinding
Personal meaning and social value of green spaces		
Authors	*Problems or concerns of research*	*Parameter measured*
Ryan (2005), Brown et al. (2003), Cooper-Marcus (1995), Lalli (1992), Rivlin (1987), Ahlbrandt (1984), Tyrväinen et al (2005), Tyrväinen et al (2007), Takano et al. (2002), Tanaka et al. (1996).	• Social values of green spaces to urban dwellers • Personal meaning and cultural values linking to restoration and psychological well-being • Residents' preferences and emotional feelings to greenery • Enhance sense of community	• Sense of place • Place attachment • Aesthetic • Social Imageability • Comfort and being relaxed
Physiological effects of encountering greenery		
Authors	*Problems or concerns of research*	*Parameter measured*
De Vries et al. (2003), Payne et al. (1998), Hartig et al. (1991, 2003), Kaplan et al. (1998), Ulrich et al.	• Public attachment to urban parks and natural areas • Natural views restore attention fatigue and recovery	• Cognitive performances

(1991), Kuo (2001), Kuo and Sullivan (2001), Korpela et al. (2001), Newell (1997), Frumkin (2001), Kendle (1994), Beck and Katcher (1996), Russell et al. (1999), Lewis (1996), Herzog et al. (2000), Tennessen and Cimprich (1995), Weiss (1991)	from stress and increase cognitive performances, and relaxation • Favourite place often relate to natural settings	• Preference • Place attachment • Self-regulation • Comfort

Underpinnings

Theories that underpinned this studies can be divided into two categories; (1) Theories on spatial structures that may be beneficial to human well being physically and psychologically and (2) Perceptual theories that relates to humans' perceptions and preferences.

Concept on spatial structures namely, by Richard Forman (1996) is a conceptual approach on spatial arrangement. Effective use of green infrastructure components depends on organization of land, which, resulted in a well-distributed open space, hence, influence the quality of life of urban residents. Networks of social spaces allow connectivity and optimum spatial arrangement as suggested by Forman (1996). The optimum spatial arrangement must consist of three fundamental structures called patches-corridors-matrices (Thwaites et al., 2005). These spatial arrangements are not just important to biodiversity and environmental sustainability but may equally be applied to achieve human needs (Thwaites et al, 2005; Tan, 2006). Patches are relatively homogeneous non-linear areas that differ from the surroundings; corridors are strips of particular types that differ from the adjacent land on both sides, and matrices are the background ecosystem or land-use type. Land mosaics are patterns of patches, corridors and matrices (Forman, 1996). The spatial concept is similar to the ideas by Christian Norberg-Schulz (1971) on phenomenological approach to the built environment that is tripartite spatial structure that integrates sensations of proximity, continuity and change into a collective sense of place (Thwaites et al, 2005). Christopher Alexander's theory of centres (Alexander et al., 1977) also relates to these concepts, which concerns on the principles of locational, directional and transitional and how these spatial concepts can be manifested in urban settings that emphasize restorative qualities (Thwaites et al, 2005). The spatial concept based on linkages of locational, directional and transitional experience is explained in clarity by Gordon Cullen's ideas of serial vision (1971) in which he believed that transitional experience is important for the ability to sustain psychological engagement to surroundings.

The perceptual theories are (a) Landscape Preference Theory by Kaplan (1986); (b) Prospect and Refuge Theory by Appleton (1975) and; (c) Topophilia by Tuan (1974). Landscape Preference and Aesthetic Responses to Nature suggests that respond of people are in favour of natural settings than that urban or man-made. These responses enhance the

ability to direct attention and also mitigation to psychophysiological stress (Kaplan, 1986; Zeller, 2006). Explorations of the work of various researchers (Kaplan and Kaplan, 1989; Ulrich, 1993) reveal the reasons for this response such as human beings prefer natural scenes, open savannah-like setting because these settings are the easiest to extract in terms of information needed to function. For instance, in spatially defined areas and in open forests, by contrast, it is far easier to judge where one can venture safely and what to expect and these categories tend to be highly favoured (Kaplan and Kaplan, 1989). Further support for this evolutionary understanding of landscape preference comes from Heerwagen and Orians (1993), who hypothesized that aesthetic preference is tied to such factors as habitability, resource availability, potential for shelter and wayfinding and movement (Zeller, 2006).

Prospect and Refuge theory identified human as predator and prey results in a preference for landscape offering both prospect and refuge, that is the possibility to 'see without being seen'. The ability to see without being seen is as indicator of environmental conditions favourable to biological survival. Landscapes offering this feature provide a source of aesthetic pleasure (Appleton, 1975).

Topophilia hypothesis (Tuan, 1974) focuses on personal attributes, for examples, age, gender, occupation, hobbies, academic background and familiarity as being important for the forming of landscape preference. Specific domains underlying topophilia hypothesis are cognitive challenge (e.g., complexity and coherence), synesthetic tendency (e.g., colors and sounds), ecodiversity (e.g., water bodies and trees), and familiarity (e.g., identifiability and privacy) (Ogunseitan, 2005).

In summary, urban residents' health and well-being that can be obtained from green infrastructure components and network may include physical functioning of urban residents that is active living, dexterity and mobility, social and cognitive functioning that is attention capacity, place attachment (Fried, 1963; Tuan, 1974; Ryan, 2005), sense of place and belonging (Norberg-Schulz, 1971), favourite places (Schroeder, 1988; Dwyer et al., 1991), personal meaning (Dwyer et al. 1996), relaxation and positive emotions and social functioning and community well-being that is community empowerment, sense of harmony, sense of community integrity, community place attachment, bonding, participation, social territoriality (Kuo, 2003) and social imageability (Thwaites, 2001). These are the domains that will be measured during field investigation on urban residents.

Scope of Study and Variables

The study explores the responses of urban residents based on their preferences and experiences in urban environments especially their relationship with the green infrastructure and its land use components as networks of social spaces. Green infrastructure is seen as a significant public health factor (St Leger, 2003; Stokols et al., 2003), therefore, green infrastructure in this study is expected to enhance the physical, social and cognitive functioning and well-being of urban residents. It will measure the physical and emotional functioning of urban residents and the value of green infrastructure through their sensual responses. Hence, the study will be using questionnaires survey and interview to explore urban residents' preferences and experience as dependent variables and their relationships with green infrastructure components as independent variable. The unit of analysis is the urban residents from various age groups in small towns of Malaysia. The reasons for selecting residents of small towns are because these residents have been in their towns for some time and have long experience and might have sense of attachment to their places. Study on place attachment reveals that people attached many meanings to the places they valued such as specific personal place memories of childhood and the development of personal identities through long term connection and experiences of a place (O'Brien, 2006). Furthermore, understanding of the attachment of local residents to urban natural areas may be the first step in learning more about management and use (Ryan, 2005). The sites for the study are towns in Peninsular Malaysia namely, Taiping, Kuala Kangsar and Kuala Lipis. The reasons for choosing the towns are firstly, based on their appropriate population size. According to urban hierarchy of Peninsular Malaysia (National Urbanization Policy, 2006), the expected population range of the year of 2006-2020 for Taiping is 30,001 – 100,000 and for Kuala Kangsar and Kuala Lipis are 10,001-30,000 people. Secondly, these towns are in the category of towns with special functions (National Urbanization Policy, 2006), that is, Taiping as heritage town, Kuala Kangsar and Kuala Lipis as royal towns. This means that, the green infrastructure networks are already established in these towns due to their existence since colonial time. Furthermore, the local people in the towns have been residing there for some time to really know well their places and to experience the spaces inside the towns. Hence, the towns are appropriate for investigating the behavioural responses of their residents towards the green infrastructure networks that are already established.

Significances of Study

This study will add to the body of knowledge that green infrastructure and its land use components can enhance the health functioning of urban residents physically, cognitively and socially and contribute to well-being of the community. In the aspects of design and planning, it would reveal the properties, attributes and key dimensions of green infrastructure components and networks that would be appreciated and valued by users and the organization of spaces in towns would be improved. From the urban residents' responses, a model of analysis of favourable green infrastructure networks for towns of Malaysia that relate to humans' preferences could be formulated. This model will emphasize the importance of quality green infrastructure and its land use components and make people appreciate the contribution of green infrastructure components to health and well-being, hence, quality of life of urban community. Thus, the model can be proposed to authority and help to improve the conditions of green infrastructure networks of towns in Malaysia.

Research Design

The aim of the research is to determine the properties and attributes of green infrastructure and its land use components as social networks of spaces through preference and experiences of urban residents. Therefore, it will investigate the impacts of green infrastructure (independent variable) towards community's physical, cognitive and social health and well-being (dependent variable). The responses of urban community will be obtained through questionnaires survey and interview. Then, the social values analysis and result of green infrastructure will be mapped to reveal and clarify the quality of green infrastructure networks in towns and to see areas for improvement. The planning for this research has several stages; namely,

1) Definition, background and theories and concepts of green infrastructure, community preference study and towns and their existing green infrastructure network.

2) Synthesis on criteria for quality green infrastructure for community health and well-being.

3) Field surveys and data collection.

4) Descriptive and inferential statistic analyses on urban community's responses towards green infrastructure.

5) Mapping of findings on social values of urban residents.

6) Documentation of findings of the green infrastructure attributes and design values for enhancing community's health and well-being and conclusion and implication of study.
(Refer Figure 1 Research Operational Framework in Appendix B)

Expected Findings

This research anticipates that the experiences of users in their urban environments would indicate their preferences for types of green infrastructure in urban settings, reveal the qualities of green infrastructure networks that are most favourable for community. The enhancements from green infrastructure networks can be obtained through physical functioning of urban residents (active living, dexterity and mobility), cognitive functioning (attention capacity, place attachment, sense of place, favourite places, personal meaning, relaxation and positive emotions) and social functioning and community well-being (community empowerment, sense of harmony, sense of community integrity, community place attachment, bonding and participation). The physical characteristics of each land use components of green infrastructure (parks and recreation, open space, natural areas, incidental spaces and loose-fit places) includes among others heterogeneity, diversity, usability, coherence, connectivity, proximity, orientation and way finding (Thwaites, 2001; Ward Thompson, 2002; Thwaites, 2005; Tveit and Fry, 2006) would contribute to the enhancement of preference and progressive response of users toward the green infrastructure networks. (Refer Figure 1 Research Variables and Outcomes in Appendix C).

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Proposed Research Schedule

	Year 1				Year 2				Year 3			
	Sem 1		Sem 2		Sem 1		Sem 2		Sem 1		Sem 2	
Stages of Study	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Thesis Proposal Stage												
L. Review & formulation of research model												
Goal and objectives formulation												
Methodology development												
Pilot study												
Data collection												
Data input and analysis												
Findings												
Write-up												
Drafts and submission												

Table 1: Green Infrastructure and Its Land Use Components

GREEN INFRASTRUCTURE

OPEN SPACE & RECREATION

Open space is defined as 'whichever land that is enclosed or open that is specified wholly or in part as a public botanical park, public park, public sports and recreational field, pedestrian walkway or as a public area' (Federal Department of Town and Country Planning, 2005).

Types of Green	Functions	Definition of Space
National Park (Forest)	Conserving the natural environment is prioritized.	Unique from the aspect of landscape beauty, presence of wildlife and material for scientific and geological research and no distance limit from the population – (FDTCP, 2005).
Regional Park (Forest)	For structured sports events, seasonal sports or to enjoy natural environment. Site with natural environment and tourist attractions.	100 ha site of focal point for urban, rural and district residents within radius of not more than 1 hour's journey by vehicle. with facilities such as camp site, camping, fishing, boating, hiking, jogging, jungle tracking, scenic drives.
Urban Parks	Interactive centres for recreational and seasonal sports.	Distance between 5-10 km from residential areas, 100-250 acres with playing fields for structured sports activities, games courts, sports building or hall, tennis, badminton complex, swimming pool, etc.
Local Parks (Community Park)	Activities of physical, social and cultural for local residents.	3km distance from residential areas and size of 20-100 acres.
Neighbourhood Parks/Open Spaces	For recreation and gives a community an identity unique to the residents within the neighbourhood.	Demonstrate the very basic need of a community, namely, sense of belonging.
Playground	For formal games/informal activities for children.	1.5 acres-5 acres and location with radius not exceeding 1.5km from residential areas.
Play Lot	For pre-school children.	0.5-1.5 acres and less than 0.5km from users.

OTHER OPEN SPACES as identified by Federal Department of Town and Country Planning (2005)

Types of Green	Functions	Definition of Space
Civic Open spaces & The 'Padang'	Stages to cultural events, formal civic functions and national festivities or spaces for memorial and contemplation.	The representation of nation's civic pride and dignity and reflect the local community they represent.
Lake Gardens & City Parks	Amplify the idea of open spaces dedicated totally for leisure and enjoyment of scenic beauty.	Scenic beauty parks with balanced ecosystem.
Open spaces of Public Institutions: Masjid, Church, Hospital, School, University, Museum, Theatre.	Place for religious, administrative, educational and communal gatherings, recovery, contemplation and appreciation of art and beauty.	Form part of religious complex as forecourts, lawns and gardens

OTHER OPEN SPACES as defined by various authors

Greenways Park connector (Concept Plan Review, Singapore, 1988/89; Tan, 2006)	Could serve to connect parks, nature reserves, cultural and historical sites and other protected lands (Arslan et al., 2001).	**Greenway:** Linear open spaces established along either a natural corridor such as riverfront, stream valley or ridgeline, or overland along a canal, a scenic road or a disused railway line (Little, 1990). Corridors of various widths, linked together in a networks of highways and railroads, in much the same way as networks of highways and railroads have been linked (Fabos, 1995).
Stream/River Corridor (Gobster, 2004)		
Residential Garden (Loram, 2007 ; Fraser, 2000)		

GREEN INFRASTRUCTURE	**INCIDENTAL OPEN SPACES as defined by Federal Department of Town and Country Planning (2005).**		
	Incidental Open spaces: • Road reserves • Plinths areas of a built up area • River corridors • Setbacks between buildings. • Pocket parks & spaces. • Pedestrian malls. • Smaller urban parks • Secluded flower garden.	The purpose is to establish character for a place or street as memorable landmarks.	A supplementary urban open spaces created through the use of non-planned open spaces as ways to alleviate urban congestion and fatigue.
	OTHER INCIDENTAL OPEN SPACES		
	• Tree-lined street (Takano & Watanabe, 2002) • Alleyway (Gearin and Kahl, 2006). • Active frontage • Five foot corridor.		
	LOOSE-FIT PLACES CATEGORIES		
	• "Loose-fit" spaces (Dovey et al., 2002) • Residual spaces (Davidson, 1999) • Waste lots • Messy places • The derelict • Gap sites • Non-parks places (old railways sidings, gap sites, cemeteries, etc.) (Ward Thompson, 2002)		"Environments that allow for a variety of functions and which are often un-designed, unregulated, spaces" (Dovey et al. 2000).

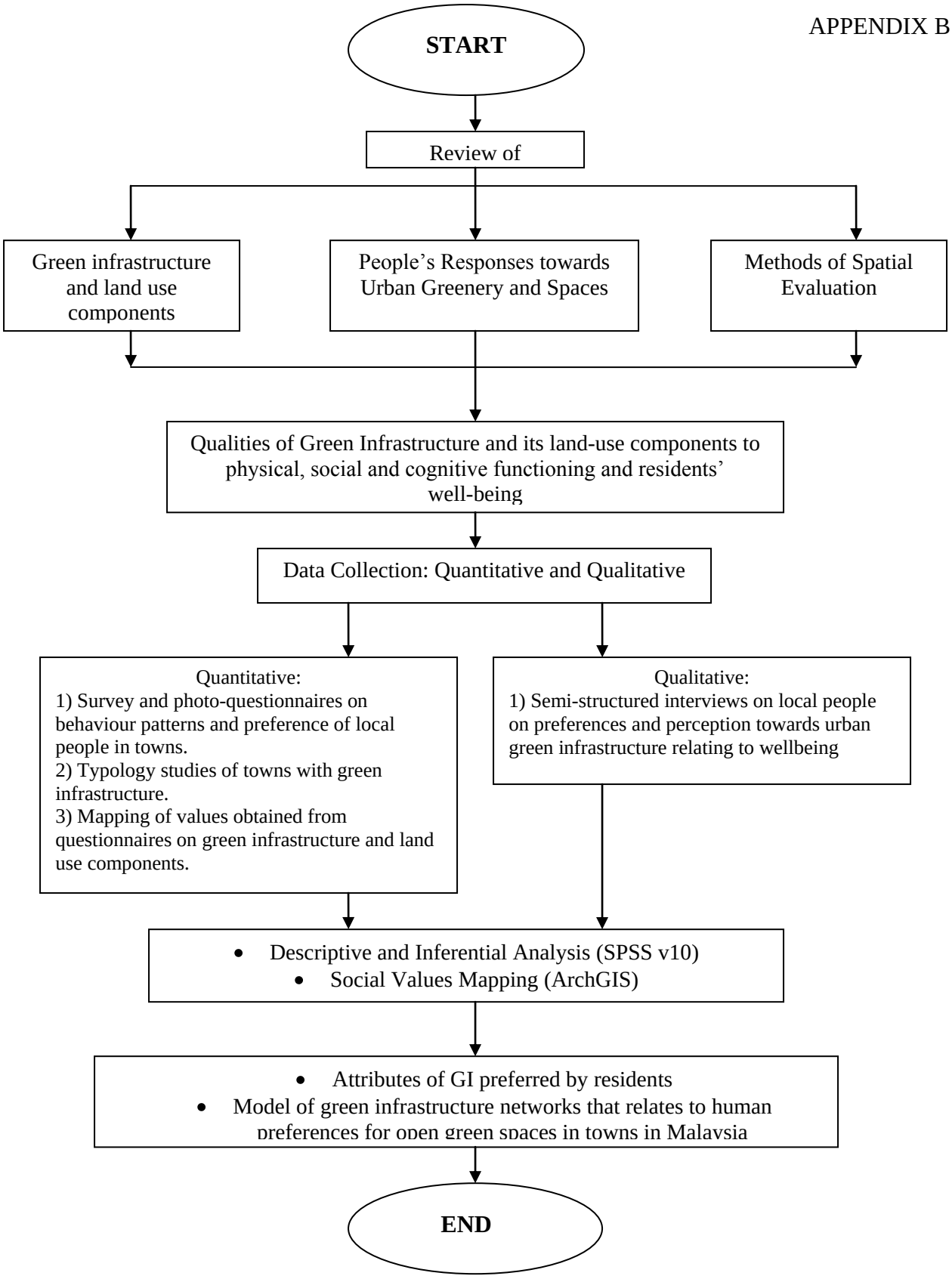

Figure 1: Research Operational Framework

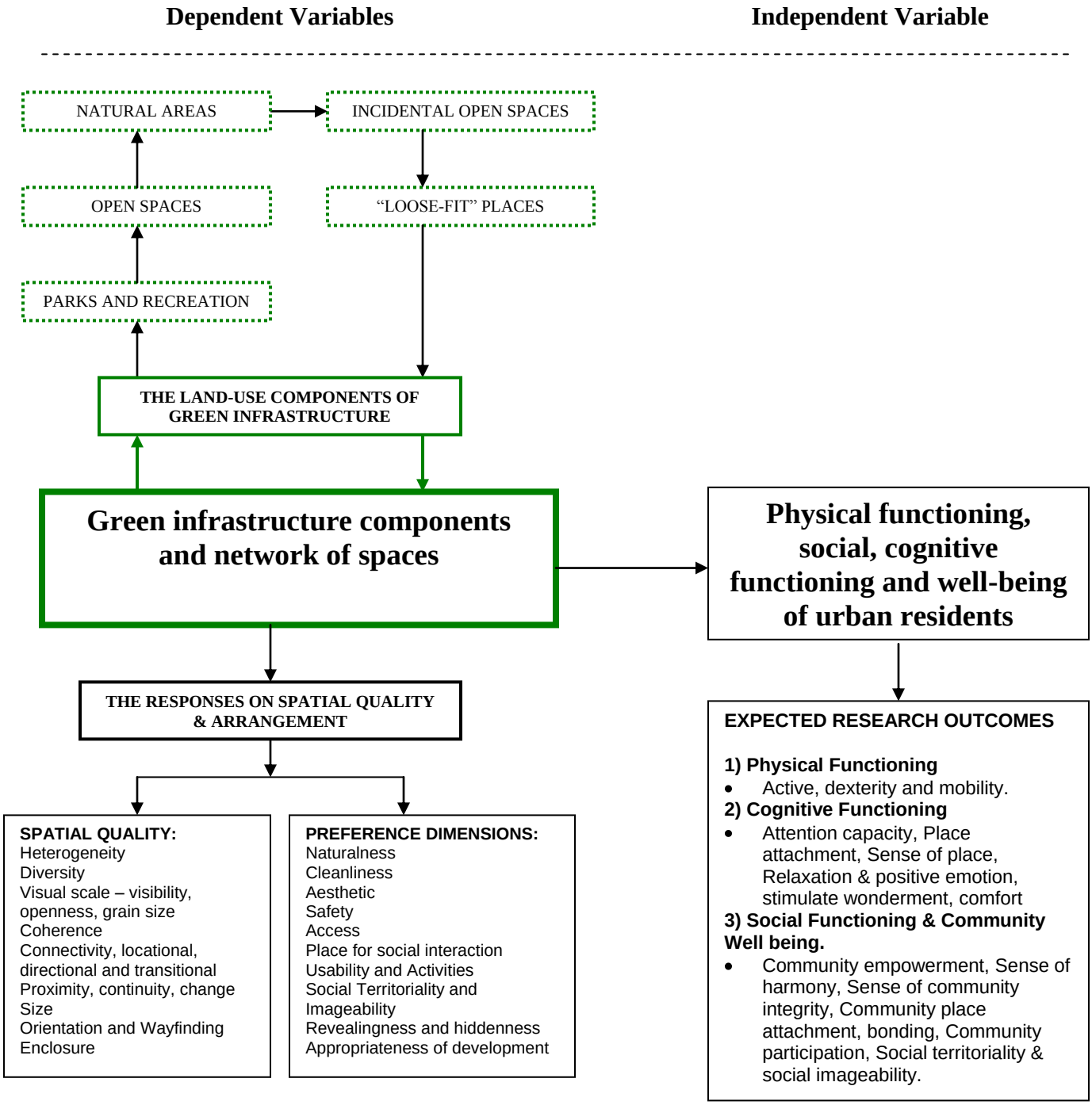

Figure 2: Research Variables and Outcomes