Factors that Contribute to Green Neighbourhood: A Review

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ABSTRACT

Human activities such as deforestation, urbanisation and industrialisation have contributed to the increasing amount of carbon dioxide (CO_2) deposited in the atmosphere which has become a major issue in this century. CO_2 gives a huge impact on greenhouse gasses that lead to climate change, global warming and other environmental disaster. These impacts are very severe, and need to be properly examined in designing a city. A city should move towards a comprehensive green and sustainable development. For the past 10 years, various studies emphasising on green neighbourhood have been published in urban planning research. This paper presents a review of literature prior to 2014 and its current issues based on factors that contribute to green neighbourhood. The review highlighted that green infrastructure, walkability and connectivity, mixed use development and safe neighbourhood as the most prominent factors in a green neighbourhood planning concept. It is also found that these factors contribute towards a more liveable city.

Keywords: green, neighbourhood, elements, climate change, planning

1.0 INTRODUCTION

Majority of the population around the world today choose to live in a city (Luederitz et al., 2013). Madlener and Sunak (2011) argued that industrialisation is seen as a key for the rural-urban migration as it provides a wide range of needs and opportunities for better living and employment (Ajaero & Onokala, 2013). In tandem with the increasing number of the urban population is the increasing demand for housing which subsequently results in urban sprawl (Ng et al., 2012). The uncontrolled urban sprawl contributes to the increasing number of new highways and motorised vehicle ownership (Handy, 2005). Motor vehicles contribute up to 70% of carbon emission to the atmosphere, especially during the rush hours (Kueh & Lim, 1999).

Goh (2012) argued that a city needs to adopt a more compact urban form in providing a more liveable city environment. However, the main impact of urbanisation is the decline in our ecological footprint (McPherson et al., 2013), whereby a vast amount of tree species has been chopped down for such projects. Moreover, this has inevitably increased CO_2 and greenhouse gas emissions that caused disturbances to the carbon cycle (Ewing et al., 2008).

Since the 1950s, carbon cycle has been disrupted (Folger, 2009). According to Dilling (2007), carbon cycle is defined as a process of carbon movement from the environment and organism. This cycle consists of respiration, combustion and photosynthesis process. Carbon transfers from the atmosphere and later being absorbed by plants. Once plants die and decompose, carbon is then transferred to the ocean and accumulated at the bottom of the sea until it becomes saturated, while some of them remain on land. Marine plants use carbon for photosynthesis process, which releases oxygen for living organism. Carbon is then transferred to the atmosphere again through respiration and other process such as combustion (Folger, 2009).

The increasing number of buildings and high gas emission has caused global warming (Nowak & Crane, 2002). Moreover, it contributes to greenhouse gases, air pollution (Sandhya Kiran & Kinnary, 2011), and affects the earth ecosystem (Muhamad, 2012). Studies have shown that urban development has a direct impact on climate change (Ewing et al., 2007; Hamin & Gurran, 2009; Handy, 2005). The rising concerns on the global climate change issue serve as a wakeup call to all nations that urban development should move towards sustainable development. Therefore, urban dwellers, developers and policy-makers need to consider the importance of tree for green sustainable city (Kueh & Lim, 1999).

Trees are highly essential in fixing carbon problem. They are good absorbers of CO_2 as they need it to produce food for growth through the process of photosynthesis (Korner, 2006; Sandhya Kiran & Kinnary, 2011). In urban planning, trees are important to circulate fresh air and reduce pollution (Sandhya Kiran & Kinnary, 2011) and sequester carbon from the atmosphere (Muhamad, 2012). Therefore, it is timely for cities to start thinking of developing new strategies and alternatives to reduce the use of motorised vehicles and promote more walkable and pedestrian friendly cities. Studies have shown that traditionally designed neighbourhoods which allow children to play and cycle, promote active elderly and preserve green spaces are now preferred by many people (Handy 2005; Sallis et al., 2008). These neighbourhoods not only provide healthy living and safe environment, but also help to safeguard our scarce energy and environment from further deterioration.

This paper, firstly, covers the introduction and background of study. It is then followed by research method and material. Discussions on green neighbourhood are presented in the third section. Overview of factors that contribute to a green neighbourhood - specifically the green infrastructures, walkability and connectivity, mixed use development, safe neighbourhood and green network - are discussed in the fourth section, while the conclusion is in the final section of the paper.

2.0 PREVIOUS RESEARCH ON GREEN NEIGHBOURHOOD

There are many definitions of neighbourhood. It can be defined as a place or geographic position for living people who live in close proximity in one residence. As a result, these conditions cause interactions or bonds between them in terms of social and economic, for instance (Lebel et al., 2007). In Islamic terminology, neighbours means people who live near our house either right, left, front, back, top or bottom 40 scale of houses from every corner of the house (Syaza, 2012).

Arshad (2012) defined green neighbourhood as a planned neighbourhood integrated to mainly focus on the protection and use of natural resources, green technology, and green practices that aim to preserve the environment, safety and general welfare of the population. This definition is supported by Ho (2011) who defined green neighbourhood as a design that considers the rate of harm and hazard reduction to environment, such as global warming and pollution, because of high gas emission in order to preserve the ecological environment and provide healthier lifestyle.

With the implementation of green neighbourhood, concept plan and design are more structured, organised and manageable as they help to reduce the complexity into a less complex part (Luederitz et al., 2013). Green neighbourhood concept includes the facilitation of accessibility, green network connectivity, green neighbourhood buildings, neighbourhood safety, highly-mixed use buildings, medium density, healthy neighbourhood, suitability of design concept, time saving and the shortening of distance to the nearest facility and public transport (Rosly, 2010). Thus, people can save travelling time from one place to another, especially when commuting to work. Besides shortening travelling time, this concept also helps to improve social interaction among people and to satisfy people's needs (Qureshi & Ho, 2011).

Studies on green neighbourhood planning, action and conversion of land revealed that there have been a lot of green spaces developed since the 1970s. However, most of them were not properly organised (Berry, 1981; Francis et al., 1984). The biggest challenge faced by researchers during the 1980s was the limited research materials on impact of green spaces towards neighbourhood (Francis et al., 1984).

Publications on the impact of green neighbourhood started in early 1990 with the impact on the environment, followed by social studies among people of various age groups (Givoni, 1991; Phillipson et al., 1999; Taylor et al., 1998) and property value (Bolitzer & Netusil, 2000; Hobden et al., 2004). Results indicated that children and adult tend to spend more time i.e. two times higher, carrying out activities in a green space compared to a less green space. However, children need adult supervision in some of the activities (Taylor et al., 1998). Studies on green impact on property value were carried out by various scholars, which show the positive impact of green neighbourhood. Table 1 depicts the summary of literatures on the impact of green neighbourhood.

Table 1: Summary of literatures on the impact of green neighbourhood

Year of publication	Author(s)	Focus
2004	Hobden et al.	Property value
2000	Bolitzer & Netusil	Property value
1999	Phillipson et al.	Order people's experiences of community life
1998	Taylor et al.	The spending of more time in green spaces among adults and children
1991	Givoni	The impact of urban planted areas: public parks and private planting around individual buildings

In terms of technology, remote sensing technology was used to differentiate green space. Results show hyperspectral airborne data are able to detect green space in large area coverage (Roessner et al., 2001). Green neighbourhood index is important to measure the greenness of a neighbourhood. Gupta et al. (2012) have conducted a study in Delhi to measure green space by using Normalized Difference Vegetation Index (NDVI), which was derived from the Indian remote sensing satellite image, to identify green area. Near infrared and red band is needed to accomplish the study. It is found that in order to obtain more accurate results, NDVI can be used to validate the GIS measures since there is an error of misclassification in GIS (Rhew et al., 2011).

Green neighbourhood index is produced by measuring biomass using allometric equation and from the carbon stock. According to Vashum and Jayakumar (2012), various types of equation have been developed based on the types of forest and species of trees. Meanwhile, in order to measure biomass, there are two ways, namely destructive and non-destructive methods. Destructive method is more accurate compared to non-destructive method. Nevertheless, this method is applicable for small areas and sample size only (Ketterings et al., 2001). For tropical rainforest, many researchers prefer to use biomass estimation (Kueh & Lim, 1999). Basuki equation, for example, has been used in Kalimantan, Indonesia (Vashum & Jayakumar, 2012).With remote sensing technology, carbon sequestration can be estimated effectively (Muhamad, 2012).

In the 21st century, many researches on sustainable green neighbourhood have been published. For example, sustainable neighbourhood development by Choguill (2008) showed that sustainable concept for modern Arab neighbourhood has failed due to rapid urbanisation. Sharifi and Murayama (2013) compared sustainable tools in Asian and Western countries, such as the United States, United Kingdom, Malaysia, and Singapore, and found that sustainable tools were difficult to compare because each tool was suitable for a specific area only.

Green neighbourhood is also being developed in Asian countries such as China. Chen et al. (2008) investigated the compact city concept. For the past 20 years China has experienced rapid growth of industrialisation which has caused loss of green area, natural resources and land use. Results indicated after all factors have been examined, no confirmed solution for the implementation of compact city concept in China has been established.

Burton (2000) discovered that urban planning in China can be implemented since the number of population is still below the critical density level that may decrease urban quality. However, the study is quite complex. In Korea, Park et al. (2013) studied perceptions on the safety of walkability in Korean neighbourhoods in order to improve walkability design elements.

2.1 Sustainable Planning Concept

Sustainability refers to the ability to preserve and retain. According to Luederitz et al. (2013), sustainable planning is urgently needed due to deficits in environmental quality, loss of plant and animal species, and climate change. Zone of sustainability is the union of economic, environment and social factors (Salonena & Åhlberg, 2013).

From global perspectives, Chiesura (2004) discovers that green space, which is one of the main keys in sustainability concept, can develop positive emotion among human beings. Other benefits for people in Amsterdam, in terms of sociology and psychology, include the ability to reduce stress. Mahmoud and El-Sayed (2011) state that in Egypt, there are many developments of green spaces and network improvement to connect people that focus on promoting economic and the value of land towards improving quality of life.

In Malaysia, planning guidelines focus more on sustainable development for green urbanism. The Government's efforts have helped ensure that such development is carried out in an environmentally friendly condition. In addition, the entire urban community also implemented green practices that are supported by green technology towards addressing issues of global climate change (Ministry of Housing and Local Government, 2011). The main purpose of these guidelines is to preserve the environment and reduce ecological footprints and carbon emissions.

Nevertheless, effective sustainability is very much dependent on the readiness of the public to accept and work together to achieve this goal. This is indicated by Banister (2008) in the sustainable research on transportation.

3.0   RESEARCH METHOD AND MATERIALS

The materials for this paper are sourced from the Web of Science (WoS) core database that is more extensive to the Scopus database (Salisbury, 2009). WoS is widely known among researchers as an effective tool for journal search as it offers an easy way of exporting references to EndNote (Mikki, 2009; Salisbury, 2009). Each journal published in WoS is carefully vetted based on accepted publication standards, approval by experts, and quality of citations (Garfield, 1990).

The scope of this study is restricted to factors that contribute to green neighbourhood. Overview of the study is made based on gaps in research findings derived from past and current research. This method is one of the most effective ways to prepare for a review paper. Three keywords used in the WoS search are "green", "neighbourhood" and "factors" to search for relevant articles. Articles are sorted from oldest to newest publication and highest to lowest time cited. The search made in 2014 generates 114 articles. Relevant articles are selected to enhance the review quality. The results are analysed to determine the development of green neighbourhood and its contributing factors. Hence, new ideas are developed and improved to achieve the goal of greener neighbourhood.

4.0   FACTORS THAT CONTRIBUTE TO GREEN NEIGHBOURHOOD

A neighbourhood can be a high polluted area, a nest of crime and a failure for a community or, the safest and successful place for people (Gifford & Sussman, 2012). Therefore, in the planning of green city, factors such as walkability, connectivity, safety zone, green infrastructures and mixed use development, are important (Rosly, 2010). The following sections describe these factors.

4.1   Walkability and Connectivity

Green walkable zone designs are necessary (Park et al., 2013) to preserve greenery and reduce carbon emission. According to Krambeck (2006), the main factors to be taken into account in green walkable zone designs are safety and conduciveness of walkable zone surroundings for pedestrians.

Many metropolitan cities such as Paris and New York have set up thoroughfares and streets to public spaces to encourage people to walk (Ng et al., 2012). This is because when people walk, the use of motor vehicles is less, thus reducing carbon emissions. Furthermore, walking is healthy and it fosters social interactions among residents. Hence, green walkable zone networks should be easy to access, creating a comfortable walking experience when people move around especially to public amenities, infrastructure and services (Mohd. Khir, 2012). In addition, the networks should not have any malfunction and should provide high connectivity. This will help ensure the availability of various types of transportation. Pedestrians can select the most direct route to the desired location; they can easily switch transportation modes such as from private vehicles to public transportations (Bochner et al., 2010).

McNally (2010) states that the most preferred radius for walking is five (5) minutes. Otherwise, the green walkable zone is considered as an unsuccessful design. On the contrary, in Malaysia, the walking radius in green townships is at least ten (10) minutes (Rosly & Hashim, 2011). However, in order to maintain good health, people are encouraged to walk longer distance. Forsyth and Southworth (2008) have proven that walking is good for both mental and physical fitness.

In Portland, United States, the green network has been found to be very helpful in order to sustain and protect natural resources aside from linking the area to the green space (Rhew et al., 2011). Trees along streets and sidewalks are important in green connectivity design. City of Dawson Creek (2008) argues that trees should be planted at least on one side of the street to protect people from sunlight so that they feel more comfortable when walking. Table 2 depicts a summary of works carried out on walkability and connectivity.

Table 2 Summary of works on walkability and connectivity

Year of publication	Author(s)	Focus
2013	Park et al.	Green walkable designs
2012	Mohd Khir	Green neighbourhood planning guidelines
2011	Rosly & Hashim	Guidelines and framework for green township
2011	Rhew et al.	Tools for measuring neighbourhood greenness
2010	Bochner et al.	Enhancing walkable community
2010	McNally	Design guidelines for walkable communities
2009	Lo	Walkability
2008	City of Dawson Creek	Walkable design
2006	Krambeck	Global walkability index

4.2 Safety Zone

Safety is defined as being safe from any danger, harm or risk that can be prevented from happening (Ding et al., 2014). In a neighbourhood, security is important to improve social life (Annerstedt et al., 2012). Cochrane et al. (2009) highlighted factors such as road, traffic condition and the influence of illegal activities on community activities.

According to Park et al. (2013), Koreans usually feel insecure due to various factors such as difficulties faced in walking areas, cars, and crosswalks. Slippery sidewalks and dark walking areas are very dangerous especially during rainy and snowy days. Besides, parking of vehicles near sidewalks is also dangerous. This problem can be resolved by parking vehicles away from the sidewalk. Therefore, neighbourhood environment should be friendly to people of all ages including those with disabilities (Zaharin, 2013).

The speed of vehicles has high relationship with visual clearness of drivers on highways and road junctions (Thompson, 2002). To create a safer environment, speed limits should be reduced. Drunks need to be banned from driving as they are dangerous to other road users (Leather et al., 2011). Leather et al. (2011) highlighted the absence of neighbourhood security or police personnel in Jakarta as one of the reasons people feel insecure and unprotected from crimes such as pick-pocketing and other illegal activities. Csefalvay (2009) found that people preferred to live in a guarded neighbourhood.

In Asian countries, the main issue is the increasing amount of CO_2 that pollutes the air. People in Hanoi tend to be exposed to such pollution that, in the long term, may ruin their health (Saksena et al., 2008). Therefore, in urban planning, plants are very essential for human health (Mitchell & Popham, 2008). Kowarik et al. (2011) suggested that small plants be planted at roadsides because it is not only cheap, but also effective in improving air quality. Table 3 depicts a summary of works on pedestrian safety.

Table 3: Summary of works on pedestrian safety

Year of publication	Author(s)	Focus
2014	Ding et al.	Safety concept
2013	Zaharin	Friendly neighbourhood environment
2013	Park et al.	Safety factors
2012	Annerstedt et al.	Security for improving social life in neighbourhoods
2011	Leather et al.	Safety from drunk drivers; absence of law enforcement
2011	Kowarik et al.	Improving air quality
2009	Cochrane et al.	Factors influencing neighbourhood safety
2009	Csefalvay	Gated and guarded community
2008	Mitchell & Popham	The importance of plants
2008	Saksena et al.	Pollution in relation to motorised vehicles
2002	Thompson	Speed of vehicles

4.3   Green Infrastructure

People's perception of a green neighbourhood is dependent on the quality of its infrastructure. A park is a recreation place for people and a habitat for wildlife (Solecki & Welch, 1995). Park et al. (2013) highlighted infrastructure elements which include sidewalks, shops, kiosks, sidewalk furniture, trees, electric wires, street lighting and parking spaces.

Leather et al. (2011) studied 13 Asian countries and found inadequate facilities such as uncovered drainage along sidewalks, signage problems, and problems of crosswalk connecting to buildings. Greenways play an important role for a green city to connect people and places (Walmsley, 1995). Signage should be clear because it plays an important role to help people find their way around (Ng et al., 2012). Ismail (2013) argued that street art and cultural events will not only attract tourists but also pedestrians. This will help make a city become more livable.

Meanwhile, Sugiyama et al. (2013) discovered that people who live in a neighbourhood with many green spaces tend to walk more at the recreation park and maintain their fitness compared to those living in an area without green space. In New York, the mayor has redesigned the roads and closed some roads to make public space more livable and safe (Ng et al., 2012). For example, Times Square is now known as one of the busiest public spaces in New York (Ng et al., 2012). Green infrastructure helps promote healthier lifestyle (Tzoulas et al., 2007).

4.4   Mixed Use Development

Mixed use development is a mixture of land uses with many different functions of buildings. Figure 1 shows mixed use development of residential, work place, shopping mall, recreation place and education facility in one neighbourhood, and mono use. With the implementation of mixed use development, the city will be more livable and is able to sustain the environment (Teriman, 2012).
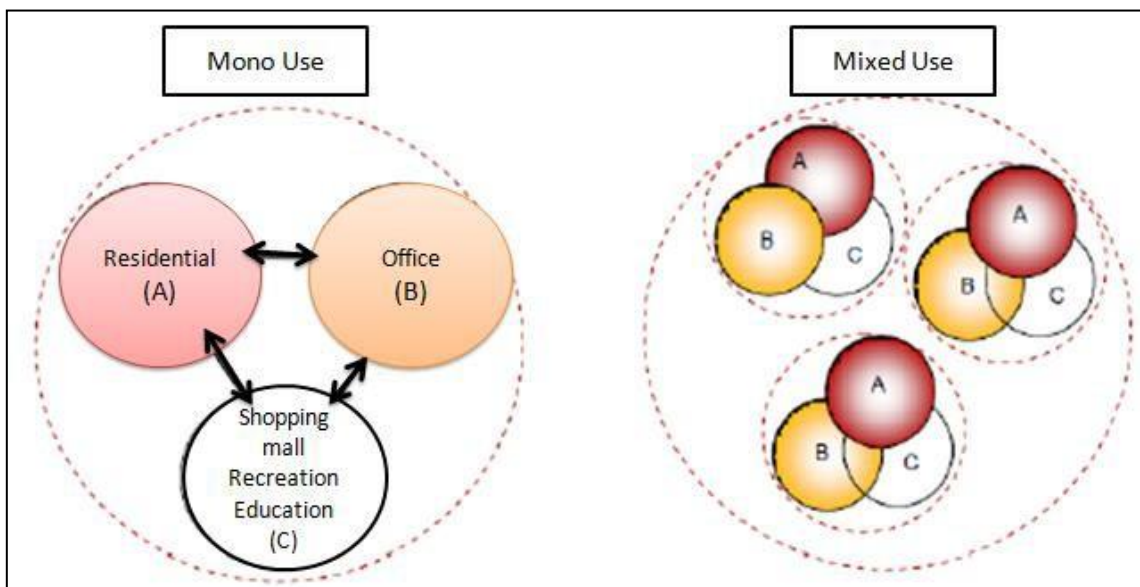

Figure 1: Mixed use and mono use neighbourhood development
Source: Arshad (2012)

Arshad (2012) proposed vertical mixed development where the ground floor is for retail, the middle floor is for office space, and the upper part is for residence. Rosly and Hashim (2011) stated that one floor area should fill-up at least 15 percent of a building for business purpose. On the other hand, education facility should be located at the corner of the neighbourhood so that everyone can have equal access to the facility.

Mixed use and density have a strong relationship. In a recent study, designers always consider types of housing. Vertical apartments are more commonly found in high density areas, while detached houses in low density areas such as in Gahoe and Sungsan, Korea. Mixed use buildings in Haengdang are equipped with various amenities (Park et al., 2013).

High density development in Singapore signifies the nation as a compact city. People in Singapore mostly live in apartments or condominiums equipped with basic amenities especially for leisure activities such as gym, swimming pool, and tennis court.

Examples of mixed use buildings in Singapore include Roxy Square and Burlington Square which consist of shops, residences, and offices (Building and Construction Authority, 2005). However, the green aspect is always considered in its development. Therefore, proper planned development should not be neglected by developers (Bulkeley & Betsill, 2005).

5.0   CONCLUSION

In conclusion, green neighbourhood is popular as shown in recent publications. People have started to realise the importance of green neighbourhood since 1990s. Green neighbourhood is one of the important elements in sustainable city to increase economic, environment and social quality in the area. In designing green sustainable city, proper planning and implementation are required. Proper consideration of all the above factors for a future greener environment needs to be prioritised. Studies have been carried out to show the importance of green neighbourhood in achieving sustainable development.

6.0   ACKNOWLEDGEMENT

7.0   REFERENCES

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