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Assessment of Residents' Socio-demographic Factors Associated with Visit to Green Infrastructure Facilities in Lagos Metropolis, Nigeria

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ABSTRACT

Despite global efforts at promoting environmental sustainability through development of Green Infrastructure (GI) facilities at urban centres; social menaces, depletion and wrong use of green spaces still persists in many developing nations. Indeed, attitude of residents towards the use of these facilities have not been commensurate to the reasons why the GI facilities were created. This study therefore examines the socio-demographic factors associated with visiting GI sites among residents of Lagos Metropolis, Nigeria. Multi-stage sampling technique was used to select 1560 participants in a questionnaire survey. Descriptive statistics was used to explore data distributions while Chi-square test was used to investigate residents' socio-demographic characteristics associated with visit to green infrastructure sites in the study area. Participants were mostly men (58.6%) and younger than 50 years old (85.8%). Percentages of residents visiting GI facilities for either spiritual exercises (male=26.4%, female=23.8%) or joblessness (male=48.9%, female=52.1%) is higher than percentages of residents visiting GI facilities for recreation/relaxation (male=24.7%, female=24.1%) activities in Lagos Metropolis. The study suggests among others that, the Lagos State government should develop GI facilities to enhance more opportunity for job generation, while more public orientation on positive attitude toward use of GI facilities should be emphasized.

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1. Introduction

Rapid and uncontrolled urbanization is greatly altering the spatial pattern of urban land use worldwide. The phenomenon is particularly recognised as one of the biggest environmental problems confronting many cities worldwide (Graham, Gurian, Corella-Barud & Avitia-Diaz 2004; Balogun, Adeyewa, Balogun, & Morakinyo, 2011; UN-Habitat, 2015; Popoola *et al.,* 2016). Presently, urbanization is rapid worldwide and is expected to continue in the coming decades, especially in the developing world where studies by the United Nations Population Fund (UNPF-2007) projected that 80% of the world's urban communities will be found by 2030 (Beardsley *et al.,* 2009). Consequently, the resulting depletion of urban natural environment to cater for the increase in population at local to global level are continuously altering urban ecosystems. Recent researches on this aspect (Ward Thompson, Aspinall & Roe, 2014, Adegun, 2018, 2019) has emphasised the importance of

urban Green Infrastructure (GI) as well as their rapid losses due to geometric progression in urban growth as GI form an essential component of urban spatial elements. Urban GI helps provide a framework on which sustainable environment and development lies. The aesthetic, air quality maintenance, sense of community and therapeutic benefits that these facilities provide cannot be over-emphasized (Popoola *et al.,* 2016).

More importantly, the positive health effects of green environments have been described across different field of study including landscape architecture, descriptive epidemiology, environmental psychology, public health, ecology and behavioural studies (Hartig *et al.,* 2003; Takano *et al.,* 2002; Maas *et al.,* 2006; Bonnes, Passafaro & Carrus, 2011). Proximity to green environments has been found to be associated with a number of health benefits (De Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Morita *et al.,* 2007; Nielsen and Hansen, 2007). Residents in greener areas report their physical, mental and overall health status to be better than those living in less green areas (De Vries *et al.,* 2003; Bell *et al.,* 2008). It is pertinent to note that the developed and developing world is facing a health crisis of alarming proportions as physical inactivity, obesity, mental and emotional illness increase. Creating awareness that green environment might play a role in enhancing health, and perhaps prevent illness as well the high cost that would be needed for medical intervention, has attracted attention from policy makers and researchers (Morris *et al.,* 2006; Ward Thompson *et al.,* 2014). Neighbourhood GI facilities like green gardens, urban parks, street trees, urban forests, fountains, urban agriculture, public open space, sports facilities and other green spaces contribute to individual well-being, and through their social, economic and environmental attributes contribute to more liveable and attractive towns and cities (Bell *et al.,* 2008) and as well have a role to play in promoting residents' health and well-being (Bedimo-Rung, Mowen, & Cohen, 2005). Some of the many other benefits of urban GI are; improved air and water quality, mitigation of the impact of environmental pollution, carbon sequestration, regulation of microclimate, habitat for urban wildlife, recreational, spiritual and therapeutic value as well as social integration (Schipperijn *et al.,* 2010; Jahdi & Khanmohamadi, 2013; Nurul Nazyddah, Othman, & Nawawi, 2014; Wolch *et al*., 2014; Liu *et al*., 2015).

Despite the well-established benefits of urban GI facilities, residents' attitudes toward the use of GI facilities still remain not commensurable to the reasons why these facilities were provided and this has attracted attention of researchers recently. Although there is an increase in frequency of studies on benefits of urban GI (Bedimo-Rung *et al.,* 2005; Benedict & McMahon 2006; Bell *et al.,* 2008; Baycan-Levent & Nijkamp, 2009; Dipeolu, 2015; Mexia *et al*., 2018), there is still not a clear and consistent understanding of the factors motivating users and other practitioners towards the use of GI facilities in developing nations like Nigeria. Only a limited number of studies (Otegbulu, 2011; Popoola *et al.,* 2016) investigated and began to systematically consider questions related to this idea. This paper attempts to fill this gap by identifying the socio-demographic factors associated with visiting GI sites among residents of Lagos Metropolis, Nigeria.

1.1 Concept of Green Infrastructure

Green infrastructure includes strategically planned and delivered networks of high-quality green facilities that contribute to the protection of natural habitats, species diversity and other environmental features designed and managed with the aim of delivering ecological services and quality of life benefits to people in communities (Natural England, 2009). The concept originated in the United States in the mid-1990s with emphasis on the significance of the natural environment and its life support functions in handling land use planning issues. Sandstrom (2002) noted that the concept of GI promotes the quality as well as quantity of urban and sub-urban green areas, their multifunctional role with emphasis on interactions between habitats. Benedict and McMahon (2002) submitted that GI is an interconnected network of water features, wetlands, streams, woodlands, wildlife habitats, and other natural areas; greenways, parks, gardens, and various conservation lands; farms and forests; and other open spaces that support various native species and contribute to quality human life. It comprises all environmental resources which makes GI approaches to contribute towards sustainable planning and management.

These assertions are broadly on two aspects namely; terrestrial habitat connectivity and aquatic habitat connectivity. from the definitions, the following elements has been frequently mentioned as constituting green infrastructure strategies: ecological processes, waterways, multi-functionality, access, connectivity, human benefits, spatial variance, biodiversity and sustainability.

Green infrastructure concept took different styles and focus in its evolution in many developed nations. Beatley (2009) described these differences in evolution style as being a function of planning orientations and styles commonly practiced in those nations. In the UK for example, Howard (1985) concepts of garden cities and the special attractions of green areas at major cities gave birth to GI planning and management. Howard's attempts at creating spaces that promote recreation and quality of life for urban dwellers through major green facilities became very prominent in these cities (Williamson, 2003). According to Beatley (2009), the development of GI in Europe could be traced to the evolution of green plantings cohesively integrated within high density landscapes in major towns. However, the North American GI evolution could be traced to early developments in landscape conservation to enhance balanced ecology in the city (Benedict & McMahon, 2002; 2006).

Generally, GI has its origin in two fundamental principles: connecting parks and other green areas for the benefit of people, and conserving and connecting natural areas to benefit biodiversity and counter habitat fragmentation. These two fulcrums enhance the multifunctional capacity of GI facilities (Pakzada & Osmonda, 2016). The concept of GI emphasizes the value of functionally and spatially connected, healthy ecosystems and the importance of ensuring that they keep providing their goods and services. GI has a vital role to play in the conservation of the Nigeria's biodiversity and in tackling fragmentation. This implies that the role of GI in achieving environmental

sustainability cannot not be overemphasized, especially in rapidly growing cities in the Global south.

1.2 Types of Green Infrastructure And Their Importance In The Built Environment

Green infrastructure are of different types as found in the review of literature. Generally, they can be categorized into four different groups namely; a green feature GI (e.g green roofs, green parks, gardens, sport fields), tree feature GI (e.g street trees, woodlands, community forests), water feature GI (e.g streams, fountains, rivers, flood plains) and other spaces GI that cannot fit into those earlier mentioned (e.g open spaces, Permeable pavement, cemetery, wildlife habitats) (Wolch et al., 2014; Mullaney, Lucke & Trueman 2015; Adegun, 2018). The connectivity between the different types of GI are important strategies through which GI perform their functions in ecosystem services. GI systems functions by restoring natural ecosystems thereby creating opportunity for sustainable growth and development in cities (Benedict & McMahon, 2006). In doing so, they provide a diversity of ecological, social, and economic functions and benefits, like enriched habitat and biodiversity; improved health; maintenance of natural landscape processes; provide cleaner air and water and increased recreational opportunities.

GI facilities have been reported to have the capacity to provide various environment-related benefits such as carbon sequestration, improved air and water quality, control of air pollution and urban heat island effect (Whitford, Ennos & Handley, 2001; Gómez-Munoza et al., 2010). GI provision contributes to energy conservation initiatives by insulating buildings, shading building envelopes and ameliorating the urban heat island effect. In addition to the direct energy saving benefits, they can also be built as a complement to sustainable energy generation practices. Furthermore, developments that incorporate GI practices into the initial planning and design phase are better able to take advantage on the cost-saving, climate change resilience and other benefits GI provides (Naumann et al., 2011). Nigeria and other developing world are faced with a multiplicity of challenges in addressing sustainable development but GI strategies can provide perfect solution to tackle these challenges.

Empirical evidences have also evaluated the roles of various types of GI on storm water management as well as carbon emission control (Liu, Chen & Peng, 2014; Liu et al., 2015; Pugh, MacKenzie, Whyatt & Hewitt, 2012). The roots of some trees serve as filters for underground water and thus highly improve quality of drinking water (Dong, Guo & Zeng, 2017). Well planned green space has also been shown to increase property values and decrease the costs of grey infrastructure and services, including the costs for stormwater management and water services (Benedict & McMahon, 2006; Poudyal et al., 2009; Otegbulu, 2010; Tan, 2011). The concept of GI promotes the value of functionally and spatially connected, healthy ecosystems and the importance of ensuring that they keep providing their goods and services. Therefore, residents must be aware of the concept and make use of GI sites in more positive ways that nature provides.

2. Methodology

2.1 Description of Study Area

Lagos state lies in the South-western area of the Federal Republic of Nigeria within the longitude 2° 42'E and 3° 42'E and latitude 6° 22'N and 6° 52'N (Figure 1). The Metropolitan part of the state is on low land, with about 20000 hectares of built-up area (Oduwaye, 2009). Administratively, Lagos is made up of twenty (20) Local Government Areas with sixteen (16) of these LGAs statistically classified as Lagos Metropolis (Ajose, 2010) while the remaining four (4) LGAs (Ikorodu, Epe, Badagry and Ibeju/Lekki) are in the sub-urban area of Lagos state (Figure 2).
With the high urbanization and industrial growth rate, Lagos is one of the most densely populated regions on earth with a population of about 9.3 million recorded in the 2006 Census (Adesuyi, Njoku & Akinola, 2015). This figure was further estimated to have grown to about 21 million people in 2016, surpassing Cairo to become the largest city in Africa and one of the fastest growing urban centre the world over. Lagos is the centre of business and economic development in Nigeria, hosting about 70 percent of the country's industrial establishments, 60 percent of Nigeria's non-oil economy and more than 65 per cent of all commercial activities (Adelekan, 2010).

The rapid physical development going on in Lagos have among other things intensified the depletion of initial greens areas of the state. Various community forests, open and green spaces have been depleted in lieu of massive grey infrastructure. This has consequently increased adverse effects of various environmental sustainability challenges in the state. Thus, the need to develop strategy that can re-invent green spaces in this city. In attempt to provide solution to this, Lagos State Government established the Lagos State Parks and Gardens Agency (LASPARK) in 2011 as a parastatal under the State Ministry of Environment for the purpose of improving the quality of the environment through tree planting and maintenance of open spaces, design and beautification of open spaces and monitoring, and enforcement of compliance to protection of the existing stock of GI in the State (Dipeolu, 2017).

Consequently, the efforts of LASPARK have brought about the availability of all the four categories of GI (green, tree, water and other spaces GI) in the study area. Green spaces GI are basically of green features and mostly plant materials (such as grasses, gardens, parks, city farms and sports fields), tree GI are mostly of tree features and their assemblage (such as street trees, community forest, woodlands and horticultures). Water GI are those of water/aquatic ecosystems (such as streams, rivers, lake, floodplains and fountains), other spaces GI are those GI cannot be categorized into any of the earlier mentioned group (such as open spaces, permeable pavement, school yards and cemetery). Presently, it is not uncommon to notice street trees on major high ways in Lagos Metropolis (Figure 3) creating rhythm and serenity to observers. Also, initial slum areas in Lagos have been planted

with green plants to create parks and gardens for recreation and public gathering (Figure 4). Most of these gardens are well maintained with green grasses, trees and water bodies thus creating environment that is cool, aesthetically pleasing and habitable.

Figure 1: Map of Nigeria showing the location of Lagos in south-western Nigeria
Source: Federal Ministry of Environment, Maps Department, Abuja.

Figure 2: Map of Metropolitan Lagos State Showing the 16 Local Government Areas.
Source: Lagos State Ministry of Environment

Figure 3: Pictorial view of street trees along Ikoyi road, Victoria Island, Lagos State.

Figure 4: Pictorial view of a green garden at Ojota, Kosofe LGA, Lagos State.

2.2 Data Collection

The data presented in this paper were sourced from authors field-work in a survey conducted between the months of March and July 2017. Totally, 1560 residents participated in the study. Participants were household heads or adult representative who can and were willing to provide the needed information.

To ensure the validity of findings of this study, the questionnaire instrument used was pre-tested in an unselected Local Government area of Lagos Metropolis and feedback incorporated into the final version of the questionnaire administered to the residents. Multi-stage sampling techniques were used in the administration of the questionnaire. First, a random sampling technique was used in selecting 4 LGAs (25%) from the 16 LGAs in the sampling frame, which was followed by another random sampling of Enumeration Areas (EAs) in the four sampled LGAs. This was achieved through the collection of list and maps of Enumeration Areas in Lagos Metropolis from the Lagos State National Population Commission (NPC). At the second stage, in each EA, households were systematically sampled from the list of numbered houses (households) until the required number allocated to the EAs was reached. For the third stage, a questionnaire was given to every consenting household head to fill. A total of 1620 questionnaires were administered from which 1560 (96.3%) were retrieved. Questions were structured to elicit responses on socio-demographic characteristics of participants such as age, marital status, household size, highest education qualifications among others and issues relating to availability of green infrastructure in their neighbourhood such as type of GI present in their neighbourhood, the location of the GI facility, reasons why they visit GI facilities/sites, distance of GI facilities to their place of residence, evaluation of government supports for GI development in their neighbourhood and the type of support they expected from the government. Others questions were on the type of housing and the type of residential neighbourhood of

respondents. The data were analyzed using both descriptive and inferential statistics and findings are presented in the subsequent section of the paper.

2.3 Data Analysis

2.3.1 Socio-demographic characteristics of the respondents

Nearly half of the participants (48.2%) were aged 30-49 years old while only 12.1% of the participants were 50 years or older. Participants were mostly male (58.6%) living in household comprising of two-four (46.9%) and more than four (41.9%) persons per household. Also, 54.7% were currently married at the time of the study, whereas 37.9% were not yet married and 4.0% were previously married but now separated or divorced. More than half of the participants (62.1%) had tertiary education while only few (5.4%) have no formal education. Some participants (31.0%) were management staff/business owners, while 26.3% were junior staff and 14.3% were senior staff in either civil services or private companies (Table 1).

2.3.2 Socio-demographic factors associated with visit to GI facilities

To further investigate other issues related to the objective of this study, chi-square test was carried out to assess participants' socio-demographic characteristics in relation to their reasons for visiting the available GI facilities in Lagos Metropolis. Chi-square test was employed based on the nature of data generated by the study and to also be able to select among others, those factors that motivate the residents toward the use of GI facilities in Lagos Metropolis.

In Table 2, compared with any other household size, the proportion of participants visiting GI for spiritual exercise was significantly higher among those with only one person (29.5%; p=0.020) in the household while the proportion visiting GI due to joblessness was significantly higher among participants with two-four persons in the household (53.8%; p=0.020). Similarly, the proportion visiting GI sites for relaxation was significantly higher among respondents with more than four persons in the household (27.9%; p=0.020).On the other hand, among participants with only one person in the household, proportion visiting GI due to joblessness (50.0%) was significantly higher than any other reasons for visiting GI facilities. Actually, joblessness accounted for the major reasons why people visit GI facilities in the study area (Table 2).

Also, results from the rank in occupation/income level shows that the proportion of participants visiting GI for spiritual exercise was significantly higher among management staff/business owners (30.2%; p=0.007) while the proportion visiting GI due to joblessness was significantly higher among the junior staff participants (54.9%; p=0.007). Similarly, the proportion visiting GI sites for relaxation was significantly higher among respondents who are senior staff in their various organisations (28.6%; p=0.007). Proportion of participants visiting GI due to joblessness continued to be significantly higher (54.9%) than any other reasons for visiting GI facilities. So, joblessness can be confirmed to be the major reasons why people visit GI facilities in the study area.

Table 1: Socio-demographics Characteristics of Respondents N=1560

Variables		Frequency	Percentage (%)
Sex			
Male		914	58.6
Female		646	41.4
Current age			
	<30	587	37.6
	30-49	752	48.2
	>=50	189	12.1
	Not Reported	32	2.1
Marital Status			
	Never Married (Single)	592	37.9
	Married	896	57.4
	Previously Married	62	4.0
	Not Reported	10	0.6
Household Size			
	One person	166	10.6
	Two-four Persons	731	46.9
	More than Four Person	654	41.9
	Not Reported	9	0.6
Religious Affiliations			
	Christianity	1004	64.4
	Islam	471	30.2
	Others	80	5.1
	Not Reported	5	0.3
Ethnic group			
	Yoruba	1102	70.6
	Others	457	29.3
	Not Reported	1	0.1
Highest Educational Qualification			
	No Formal Education	84	5.4
	Primary Education	108	6.9
	Secondary / Technical Education	395	25.3
	Tertiary Education	968	62.1
	Not Reported	5	0.3
Profession			
	Unemployed	173	11.1
	Self employed	704	45.1
	Private/Public employee	439	28.1
	Students and Others	244	15.6
Rank in Occupation / Income level			
	Junior Staff	410	26.3
	Senior Staff	223	14.3
	Management staff/ Business owners	483	31.0
	Not Reported	444	28.5

Source: Authors' field work, 2017

Table 2: Socio-demographic factors associated with visit to GI facilities

	Reasons for visiting Green Infrastructure sites				
Socio-demographic Characteristics	**For Relaxatn/Rec. Purpose**	**Because I am Jobless**	**For Spiritual Exercises**	**Chi-square**	**P value**
Sex				1.92	0.384
Male	239(24.7)	474(48.9)	256(26.4)		
Female	161(24.1)	348(52.1)	159(23.8)		
Age				2.51	0.643
<30	142(23.8)	312(52.3)	142(23.8)		
30-49	201(24.9)	395(49.0)	210(26.1)		
>=50	47(23.3)	98(48.5)	57(28.2)		
Marital Status				8.39	0.780
Never married (Single)	139(23.0)	325(53.7)	141(23.3)		
Married	237(24.7)	470(49.0)	252(26.3)		
Formally married	19(30.2)	23(36.5)	21(33.3)		
Household size				11.66	0.020*
One person	34(20.5)	83(50.0)	49(29.5)		
2-4 persons	168(22.0)	411(53.8)	185(24.2)		
>4 persons	194(27.9)	324(46.6)	178(25.6)		
Religious Affiliations				6.35	0.175
Christianity	241(22.8)	550(52.1)	265(25.1)		
Islam	137(27.7)	233(47.2)	124(25.1)		
Others	19(23.5)	37(45.7)	25(30.9)		
Ethnic group				2.16	0.340
Yoruba	294(25.3)	582(50.1)	285(24.5)		
Others	106(22.4)	239(50.4)	129(27.2)		
Highest educational qualifications				7.45	0.281
No Formal Education	19(22.9)	40(48.2)	24(28.9)		
Primary Education	35(32.4)	45(41.7)	28(25.9)		
Secondary/Tech. Education	105(26.6)	198(50.1)	92(23.3)		
Tertiary Education	241(23.0)	535(51.1)	270(25.8)		
Profession				3.64	0.934
Unemployed	42(24.0)	86(49.1)	46(26.3)		
Self employed	174(24.8)	353(50.2)	172(24.5)		
Private/Public employees	132(25.5)	249(48.1)	135(26.1)		
Students and Others	52(20.8)	134(53.6)	62(24.8)		
Rank in occupation				17.83	0.007*
Junior staff	103(23.7)	239(54.9)	89(20.5)		
Senior staff	71(28.6)	121(48.8)	56(22.6)		
Management staff/ business owners	115(22.7)	235(46.4)	153(30.2)		

Source: Author's field survey, 2017

2.3.3 Evaluation of Government Supports for the Development of GI in the Study Area

Figures 5 and 6 are the result of the residents' evaluation of government supports for the development of GI in Lagos Metropolis. Specifically, majority (34%) of the residents rated present supports for GI facilities by the government to be average. While 26% of the residents rated government support to be low and only 14% rated government supports for GI in Lagos Metropolis to be high. Also, despite the high reported score of 28% for technical supports, the residents highly reported (39%) that they expect more financial commitments from the government than provision of free seeds (15%) and free lands (12%) respectively.

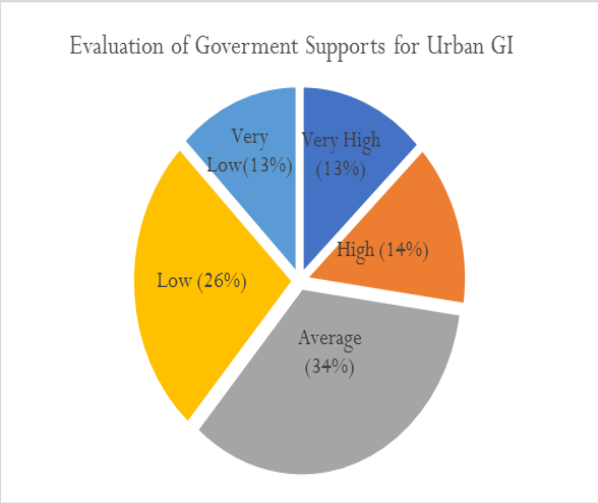

Figure 5: Government Supports for Urban GI in Lagos Metropolis.

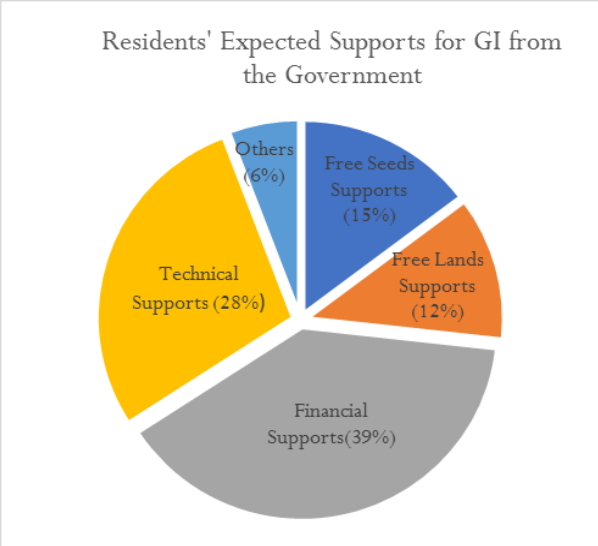

Figure 6: Expected Government Supports by Lagos Metropolis

3. Discussion

This study is an attempt at assessing the socio-demographic factors associated with visit to GI facilities/sites in Lagos Metropolis. Previous study like that of Riaz, Batool, Younas and Abid (2002), emphasized that socio-economic characteristics such as gender, age, education and occupation of the respondents play very important role in the determination of human attitude towards the use of green spaces and realities of life. However, findings from the present study indicated that *household size* and *rank in occupation* are the two major socio-demographic factor associated with visit to GI facilities in the study area. This suggests that diversified recreational facilities that can be more useful for households or family recreation should be set up, and that a multifunctional facility should be developed, such as the provision of more stone or wooden seats

and tables for playing board games, reading, meeting friends, family discussions among others (De Vries *et al.,* 2003; Zhang, Chen, Sun & Bao, 2013). It also suggests that these facilities should be provided at different levels of operations so that all categories of residents (irrespective of their economic strength and rank in occupation) will find the facilities affordable and be very enthusiastic to pay and make use of the GI facilities at different levels. To achieve this, thoughtful designs fortified with adequate facilities are required to attract residents, encourage active participation and multiple users (Giles-Corti *et al.,* 2005).

In contrast to the evidence from previous studies, highest education attained did not emerge as a socio-demographic factor associated with visit to GI facilities in the survey. Whereas, education has been previously identified to be one of the most consistent predictors of positive environmental attitude. In fact, studies of Wall (1995), Ewert and Baker (2001) indicate that individuals with high levels of education tend to appreciate, visit and care more about green spaces in the environment than the less educated people. However, to a certain extent, the result of this study which shows that highest educational attained did not account for reasons why users visit GI facility sites, is consistent with the study by Maas et al. (2009) who concluded that the amount of available green space in the neighbourhood was less important for social contacts of high income people; residents with low income or low level of education benefit most from green space in their living environment.

This study also discovered that men visited and participated in the activities around GI facilities more than women. This result is in agreement with previous findings that differences exist with respect to the gender around green spaces: men shows different sensibility and expectations with respect to urban GI and the younger men are mostly driven by the wish to seek to escape from children interference in their busy schedules and therefore showing preference for the use of parks to meet friends and to rejuvenate from everyday stress. Women on the other hand, are more sensitive to safety and children facilities and will prefer to play with the children especially around the home compared to their male counterparts (Jahdi & Khanmohamadi, 2013; Conedera, 2015). In all, the findings show that environmental approaches to restore natural space in developing nations can have a positive impact on levels of use of the green space and on stewardship to the environment.

On government supports for green infrastructure development in Lagos Metropolis, the residents perceived that government supports for development of GI is still on the average. This may be due to the fact that while government is concentrating on provision of technical supports, tree seeds for planting, land provision and preparation; the public have not felt the impact of government supports or official development assistant by the government adequately in their neighbourhoods. They therefore perceived that if government make more funds available for the development of GI, the facilities will be more available and spread throughout Lagos Metropolis.

4. Conclusion and Recommendations

Green infrastructure has many roles and capacity to provide diverse benefits for cities and their residents (Venn & Niemelä, 2004). A number of empirical studies have indicated that urban residents, values urban green space as place to recuperate from physical, emotional and psychological illness, as well as overcoming stress (Takano *et al.,* 2002; Bonnes, *et al.,* 2011). Overall, the results in the present study indicate that the degree of use of GI site in Lagos Metropolis is still very far from the purpose for which the facilities are provided. Although, some of the participants still visit GI facilities for the purpose of relaxation and recreation, a large majority of the respondents mentioned that they visit due to joblessness and for spiritual exercises. However, a correct use of the facilities would yield health benefits such as feeling of freshness, mental relaxation, and opportunity for body exercises, early recovery from illness, quality air and control of micro-climate (Benedict & McMahon 2006; Jahdi & Khanmohamadi, 2013; Dipeolu, 2015). Green infrastructure within residential neighbourhoods provides a place of contact between people and nature, increases the potential of meeting neighbours, developing sense of community and enables social well-being and social inclusion, among various categories of users (Germann-Chiari & Seeland, 2004; Seeland *et al.,* 2009; Conedera et al., 2015). It is concluded that GI makes the quality of life better by improving health and creating functional environment through environmental, social and economic impacts. So, a correct use and attitude toward the facilities should be encouraged among residents. The study however makes the following recommendations:

(1) That, the Lagos State government should allow GI facilities to enhance more opportunity for job generation. This could be achieved from the planning stages of implementing GI projects. The project should be planned to generate jobs for residents especially those in the field of built environment. Workers in horticulture, plant scientist, landscape architects and artisans in carpentry, masons, and iron benders can also be employed to carve appropriate shapes and implement professional designs on GI sites. Others that can also benefit from establishment of GI facilities are the tax officers, administrative staff, security and guards that manage the affairs and security of the facilities.

(2) More public orientation on attitude toward use of GI facilities should be emphasized by the government. This could be achieved through various media organisations and public lectures regularly organised for the citizens so that they can be well equipped with needed information and understanding of the benefits and usefulness of GI facilities. This understanding will have capacity to develop in resident's correct and positive environmental attitude in citizens which gradually affect their use and care for GI facilities in their neighbourhood.

(3) There is need for more financial commitment by the government to environmental greening projects in Nigeria. This will allow every department related to environmental designs to have more resources to implement green infrastructure projects and consequently spread GI sites across the nation. As environmental greening is encouraged in the nation through

these recommendations, challenges related to environmental sustainability can be sufficiently tackled.

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References

Adegun, O. B. (2018) Residents' Relationship with Green Infrastructure in Cosmo City, Johannesburg. *Journal of Urbanism.* 11(3): 329-346.

Adegun, O. B. (2019). Green Infrastructure in Informal Unplanned Settlements: The case of Kya Sands, Johannesburg. *International Journal of Urban Sustainable Development.* 11(1):1-12. DOI: https://doi.org/10.1080/19463138.2019.1565412.

Adelekan, I. O. (2010). Vulnerability of poor urban coastal communities to flooding in Lagos, Nigeria. *Journal of Environment and Urbanization.* 22(2): 433-450. Retrieved 22 June 2018 from http://eau.sagepub.com/content/22/2/433.

Adesuyi, A.A., Njoku, K.L., & Akinola, M.O. (2015). Assessment of Heavy Metals Pollution in Soils and Vegetation around Selected Industries in Lagos State, Nigeria. *Journal of Geoscience and Environment Protection.* 3: 11-19.

Ajose, S. A. (2010). The Evolution And Development Of Lagos State Administration In Lagos State: A Sociological Approach. Retrieved 15 April 2018 from http://www.cefolassaocoed.net/index.php.

Balogun, I. A., Adeyewa, D. Z., Balogun, A. A. & Morakinyo, T. E. (2011). Analysis Of Urban Expansion And Land Use Changes In Akure, Nigeria, Using Remote Sensing And Geographic Information System (GIS) Techniques. *Journal of Geography and Regional Planning.* 4(9): 533-54. Available online at http://www.academicjournals.org/JGRP.

Baycan-Levent, T., & Nijkamp, P. (2009). Planning and Management Of Urban Green Spaces In Europe: Comparative Analysis. *Journal of Urban Planning and Development.* 135(1): 1-12.

Beardsley, K., Thorne, J. H., Roth, N. E., Gao, S. & McCoy, M. C. (2009). Assessing The Influence Of Rapid Urban Growth And Regional Policies On Biological Resources. *Journal of Landscape and Urban Planning.* 93: 172-183.

Beatley, T. (2009) *Green Urbanism Down Under: Learning From Sustainable Communities In Australia.* Washington D.C: Island Press.

Bedimo-Rung, A. L., Mowen, A. J. & Cohen, D. A. (2005). The Significance Of Parks To Physical Activity And Public Health. A Conceptual Model. *American Journal of Preventive Medicine.* 28(2S2): 159–168.

Bell, S., Hamilton, V., Montarzino, A., Rothnie, H., Travlou, P. & Alves, S. (2008). *Greenspace And Quality Of Life: A Critical Literature Review.* Green space Scotland, Stirling press.

Benedict, M. A., & McMahon, E. T. (2002) Green Infrastructure: Smart Conservation For The 21st Century. *Renewable Resources Journal,* 20(3): 12-17.

Benedict, M. & McMahon, E. D. (2006). *Green Infrastructure: Linking Landscapes And Communities.* Washington, DC: Island Press.

Bonnes, M. Passafaro, P. & Carrus, G. (2010). The Ambivalence Of Attitudes Toward Urban Green Areas: Between Proenvironmental Worldviews And Daily Residential Experience. *Journal of Environment and Behaviour.* 43(2): 207-232. DOI: 10.1177/0013916509354699.

Conedera, M., Del Biaggio, A Seeland, K., Morettia, M. & Home, R. (2015). Residents' Preferences And Use Of Urban And Peri-Urban Green Spaces In A Swiss Mountainous Region Of The Southern Alps. *Journal of Urban Forestry & Urban Greening.* 14: 139–147.

Davies, C. (2011). *Stockton Trees Green Infrastructure Strategy* Retrieved May 4 2018 from http://www.stockton.gov.uk/greeninfrastructure.

De Vries, S., Verheij, R.A., Groenewegen, P.P., Spreeuwenberg, P. & (2003). Natural Environments—Healthy Environments? An Exploratory Analysis Of The Relationship Between Greenspace And Health. *Environment & Planning.* 35: 1717–1731.

Dipeolu, A. A. (2015). Influence of Urban Environmental Greening On Climate Change Challenges in Nigeria. *Journal of Sustainable Development.* 8(6): 304-310.

Dipeolu, A. A. (2017). Impact of Green Infrastructure on Environmental Sustainability in Selected Neighbourhoods of Lagos Metropolis, Nigeria. An unpublished PhD Thesis in the Department of Architecture, Federal University of Tech., Akure, Nigeria.

Dong, X., Guo, H., & Zeng, S. (2017). Enhancing Future Resilience In Urban Drainage System: Green Versus Grey Infrastructure, Water Research. 4(7): 12-33, doi: 10.1016/j.watres.2017.07.038.

Ewert, A. & Baker, D. (2001). Standing For Where You Sit: An Exploratory Analysis Of The Relationship Between Academic Major And Environment Beliefs. *Environment and Behaviour.* 33(5): 687–707.

Germann-Chiari, C. & Seeland, K. (2004). Are Urban Green Spaces Optimally Distributed To Act As Places For Social Integration? Results Of A Geographical Information System (GIS) Approach For Urban Forestry Research. *Forest Policy and Economics.* 6: 3–13.

Giles-Corti, B., Broomhall, M. H., Knuiman, M., Collins, C., Douglas, K., Ng, K., Lange, A., Donovan, R.J., (2005). Increasing Walking: How Important Is Distance To, Attractiveness, And Size Of Public Open Space? *American Journal of Preventive Medicine.* 28(2): 169–176.

Gómez-Mu˜noza, V. M., Porta-Gándarab, M. A., & Fernándezc, J. L. (2010). Effect of Tree Shades In Urban Planning In Hot-Arid Climatic Regions. *Landscape and Urban Planning*. 94: 149–157.

Graham, J. Gurian, P. Corella-Barud V. & Avitia-Diaz, R. (2004). Peri-Urbanization And In Home Environmental Health Risks: The Side Effects Of Planned And Unplanned Growth, *International Journal of Hygiene and Environmental Health.* 207: 447–454.

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking Restoration In Natural And Urban Field Settings. *Journal of Environmental Psychology*. 23(2): 109-123.

Howard, E. (1985). *Garden Cities Of Tomorrow*. Eastbourne: Attic Books.

Jahdi, R. & Khanmohamadi, M. (2013). Residents and Urban Green Spaces: A Case Study in Rasht (North of Iran). *African Journal of Agricultural Research*. 8(23): 2918-2923.

Liu, W., Chen, W., & Peng, C. (2014). Assessing The Effectiveness Of Green Infrastructures On Urban Flooding Reduction: A Community Scale Study. *Ecological Modelling*. 291: 6-14.

Liu, W. Chen, W. Peng, C. (2015). Influences of Setting Sizes And Combination Of Green Infrastructures On Community's Storm Water Runoff Reduction. *Ecological Modelling*. 318: 236-244.

Maas, J., Verheij, R.A., Groenewegen, P.P., de Vries, S. & Spreeuwenberg, P. (2006). Green space, urbanity, and health: how strong is the relation? *Journal of Epidemiology and Commununity Health.* 60: 587–592.

Maas, J., van Dillen, S.M.E., Verheij, R. A., Groenewegen, P. P. (2009). Social contacts as a possible mechanism behind the relation between green space and health. *Health & Place.* 15: 586–595.

Mexia T, Vieira J, Príncipe A, Anjosa A, Silva P, Lopes N, Freitas C. Santos-Reis M, Correia O, Branquinho C, et al. 2018. Ecosystem Services: Urban Parks Under A Magnifying Glass. *Journal of Environmental Research.* 160: 469–478.

Morita, E., Fukuda, S., Nagano, J., Hamajima, N., Yamamoto, H., Iwai, Y., et al. (2007). Psychological Effects Of Forest Environments On Healthy Adults: Shinrin-Yoku (Forest-Air Bathing, Walking) As A Possible Method Of Stress Reduction. *Public Health.* 121(1): 54–63.

Morris, G., Beck, S. A., Hanlon, P. & Robertson, R. (2006). Getting Strategic About The Environment And Health. *Journal of Public Health.* 120: 889-903.

Mullaney, J., Lucke, T., & Trueman, S. J. (2015). A Review Of Benefits And Challenges In Growing Street Trees In Paved Urban Environments. *Landscape and Urban Planning.* 134: 157–166.

Natural England, (2009). Green Infrastructure Guidance. Natural England 2009 Catalogue Code: NE176. Accessed on 13 May 2018: (7 p.) www.naturalengland.org.uk.

Naumann, S., McKenna D., Kaphengst, T. Anzaldua, G., & Berry, P. (2011). *Design, Implementation And Cost Elements Of Green Infrastructure Projects.* Final report. Brussels: European Commission.

Nielsen, T.S., & Hansen, K.B. (2007). Do Green Areas Affect Health? Results From A Danish Survey On The Use Of Green Areas And Health Indicators. *Health Place.* 13: 839–850.

Nurul Nazyddah, M. N., Othman, N & Nawawi, A. H. (2014). Green Infrastructure And Its Roles In Enhancing Quality Of Life. *Procedia - Social and Behavioural Sciences.* 153: 384–394.

Oduwaye, L. (2009). Spatial Variations Of Values Of Residential Land Use in Lagos Metropolis. *Journal of African Research Review. An International Multi-Disciplinary Journal, Ethiopia*, *3*(2): 381-403. Retrieved from http://www.academicjournals.org/JGRP

Otegbulu, A. C. (2011). Economics of Green Design And Environmental Sustainability. *Journal of Sustainable Development.* 4(2): 12-19. Available at www.ccsenet.org/jsd Doi:10.5539/jsd.v4n2p240.

Pakzada, P. & Osmonda, P. (2016). Developing a Sustainability Indicator Set For Measuring Green Infrastructure Performance. *Procedia - Social and Behavioural Sciences,* 216: 68–79.

Popoola, A. A., Medayese, S. O., Olaniyan, O. M, Onyemenam, P. I. & Adeleye, B. M. (2016). Users' Perception Of Urban Parks And Green Networks in Ibadan. *Singaporean Journal of Business Economics, And Management Studies.* 4(10): 16-30.

Poudyal, N. C., Poudyal, D. G., Hodges, B. T. & Cho, S. H. (2009). Valuing Diversity And Spatial Pattern Of Open Space Plots In Urban Neighborhoods. *Journal of Forest Policy and Economics.* 11(3): 194–201.

Pugh, T. A., MacKenzie, A. R., Whyatt, J. D. & Hewitt, C. N. (2012). Effectiveness of Green Infrastructure For Improvement Of Air Quality In Urban Street Canyons. *Journal of Environment Science and Technology.* 46(14): 7692-7699.

Riaz, A., Batool Z., Younas A. & Abid L. (2002). Green Areas: A Source of Healthy Environment for People and Value Addition to Property. *International Journal of Agriculture and Biology.* 4(4): 478-481.

Roy, S. Byrne, J. Pickering, C. (2012). A Systematic Quantitative Review Of Urban Tree Benefits, Costs, And Assessment Methods Across Cities In Different Climatic Zones. *Urban Forestry and Urban Greening.* 4(11): 351–363.

Sandstrom, U. F. (2002) Green Infrastructure planning in urban Sweden. *Journal Planning Practice Research.* 17(4): 373–385.

Schipperijn, J., Stigsdotter, U., Randrup, T.B., & Troelsen, J. (2010). Influences on the Use Of Urban Green Space – A Case Study in Odense, Denmark. *Journal of Urban Forestry and Urban Greening.* 9: 25-32.

Seeland, K., Dübendorfer, S. & Hansmann, R., (2009). Making friends in Zurich's Urban Forests And Parks: The Role Of Public Green Space For Social Inclusion Of Youths From Different Cultures. *Forest Policy and Economics.* 11: 10–17.

Takano, T., Nakamura, K., & Watanabe, M. (2002). Urban Residential Environments And Senior Citizens' Longevity In Megacity Areas: The Importance Of Walkable Green Spaces. *Journal of Epidemiology and Communality Health.* 56(12): 913–918.

Tan, T. H. (2011). Neighborhood Preferences Of House Buyers: The Case Of Klang Valley, Malaysia International. *Journal of Housing Markets and Analysis*. 4(1): 58-69.

Turner AG. 2003. Sampling Strategies- Expert Group Meeting To Review The Draft Handbook On Designing Of Household Sample Surveys. Secretariat, Statistics Division. ESA/STAT/AC.93/2. Accessed on 16 July 2016. 14-16

UN-Habitat. (2015). *A Practical Guide To Designing, Planning, And Executing Citywide Slum Upgrading Programmes*. Nairobi: UN-Habitat.

United Nations Population Fund (UNPF, 2007). State of World Population: Unleashing The Potential Of Urban Growth. From http://www.unfpa.org/swp/.

Venn, S, & Niemelä, J. K. (2004). Ecology in a Multidisciplinary Study Of Urban Green Space: The URGE Project. *Boreal Environment Research*, Helsinki 14 December 9, 479-489.

Wall, G. (1995). General Versus Specific Environmental Concern: A Western Canadian Case. *Environment and Behaviour.* 27: 294–316.

Ward Thompson, C., Aspinall, P. & Roe, J. (2014). Access to Green Space in Disadvantaged Urban Communities: Evidence of salutogenic effects based on biomarker and self-report measures of wellbeing. *Procedia - Social and Behavioral Sciences.* 153: 10 – 22.

Williamson, K. S. (2003) *Growing with Green Infrastructure.* Heritage Conservancy, Doylestown, P. A.

Whitford, V., Ennos, A. R., & Handley, J. F. (2001). City Form And Natural Processes: Indicators For The Ecological Performance Of Urban Areas And Their Application to Merseyside, UK. *Landscape and Urban Planning.* 20(2): 91–103.

Wolch, J, R., Byrne, J. & Newell, J. P. (2014) Urban Green Space, Public Health, And Environmental Justice: The Challenge Of Making Cities 'Just Green Enough'. *Journal Landscape and Urban Planning.* 125: 234–244.

Zhang, H., Chen, B., Sun, Z. & Bao, Z. (2013). Landscape Perception And Recreation Needs In Urban Green Space in Fuyang, Hangzhou, China. *Journal of Urban Forestry & Urban Greening.* 12: 44– 52.