# PROCEEDINGS OF THE CHINA-AFRICA URBAN DEVELOPMENT FORUM 2019

## 2019年中非城市发展论坛论文集

# Towards Building Resilient Cities:

## Opportunities, Challenges and Innovation

## 构建弹性城市：机遇、挑战、与创新


**Edited By**

Ishmael Mensah

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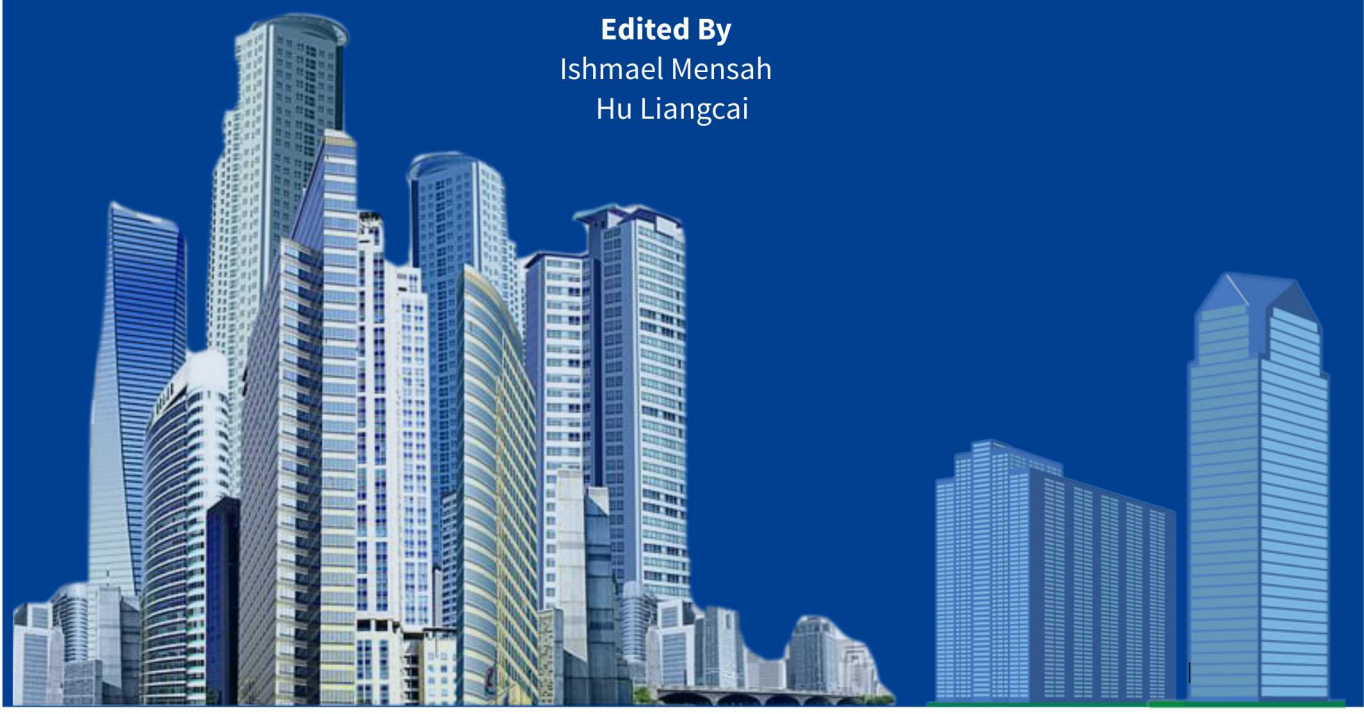


UNIVERSITY OF CAPE COAST, CAPE COAST, GHANA

3RD- 4TH OCTOBER, 2019

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# PREFACE

The Confucius Institute, University of Cape Coast (UCC) in collaboration with the Department of Geography and Regional Planning, UCC, and with sponsorship from the Confucius Institute Headquarters (China Hanban) organized the second edition of the China-African Urban Development Forum from 2019 from the 3rd to 4th October 2019. The conference also had support from Cape Coast Technical University, Hunan City University, Aussie-Sino Studies and Journal of Urban Studies. During the conference, a number of papers were presented, based on the theme "Towards Building Resilient Cities: Opportunities, Challenges and Innovation". Papers presented during the conference were grouped under four thematic areas, namely:

1. Climate Change mitigation and renewable energy;
2. Urban Transport, leisure and recreation;
3. Urban culture and livelihoods; and
4. Environment and Health.

Presenters were of the view that addressing environmental challenges such as climate change, improving transport systems, providing sustainable sources of livelihoods and improving healthcare were critical to building resilient cities. Building urban resilience has become very imperative in the face of global environmental challenges like climate change, depletion of natural resources coupled and overpopulation. Cities have to be equipped to face future shocks and stresses in fulfilment of Sustainable Development Goal 11. Though factors such as technological advancements present opportunities for building resilient cities, there are also a number of challenges to building urban resilience. This book is a compendium of papers presented at the conference. We believe this would not only add to the existing stock of knowledge on the subjects but it should also stimulate debate and engender deep reflection on the opportunities and challenges to building resilient cities.

Ishmael Mensah
Hu Liangcai

# ACKNOWLEDEMENTS

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# EFFECT OF JOB SATISFACTION ON TURNOVER INTENTION OF HOTEL EMPLOYEES IN THE WESTERN NORTH REGION OF GHANA

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**Abstract:** This study examined the effect of hotel employees' job satisfaction on turnover intentions in hotels in the Sefwi Wiawso and Bibiani Ahwianso Bekwai Municipals of the Western Region, Ghana, using the Herzberg two-factor theory of motivation. Out of a population of 385 hotel managers from four hotel categories (two-star, one-star, budget, and guest houses), 140 respondents were involved in the study, using the multi-stage sampling technique. Data for the study was obtained using a self-administered questionnaire. Findings of the study revealed that the presence of pay, supervision, working conditions, and nature of work takes away dissatisfaction. However, what was found to motivate hotel employees not to exit their current jobs was promotion. This finding, therefore, affirms the Herzberg two-factor theory The study, therefore, recommends that, for employees to remain with a particular hotel, issues of promotion should be given priority. Promotional opportunities should be given to deserving employees if hotels are to encourage continuity and reduce employee turnover.

**Key words:** job satisfaction, turnover intention, hotel, employee

## Introduction

Information on job satisfaction is valuable to every organisation, as satisfied employees experience physical and psychological well-being, while dissatisfied employees are more likely to be associated with absenteeism, psychological withdrawal, and employee turnover (Rothman & Coetzer, 2002). Employees are highly motivated, have good morale at work, work more effectively and efficiently (Eskildsen & Dahlgaard, 2000), and are not likely to leave one organisation for another. One sector that requires highly motivated and morale staff to succeed is the hospitality sector. As stated in the study of Zeithaml, Barry, and Parasuranman (as cited in Owusu, 2018), the nature of work in the hotel sector is labour-intensive and, therefore, requires highly motivated and committed staff to work and remain with the hotel.

The hotel industry as a service-oriented industry relies heavily on the behaviour and attitudes of employees to provide friendly and courteous services to customers (Amissah, Gamor, Deri, & Amissah, 2016). Institutional memory is key to the delivery of quality service to customers. Investing in employees to remain with the firm is, therefore, key for the achievement of

organisational goals. As established in the study of Kammeyer-Mueller and Wanberg (2003), turnover diminishes hotels' returns on investment, and efforts are required to ensure that employees do not leave the firm.

Further, failure to ensure that employees remain with the firm could also result in loss of highly skilled employees, with its attendant cost hiring and training new hotel employees (Bothma & Roodt, 2013). Although no official statistics on employee turnover is readily available, there is anecdotal evidence that officials of the Ghana Tourism Authority and Ghana Hotels Association in the Western Region complain of perceived high employee turnover intentions. To achieve the industry projections and for the sustenance of the hotel industry in the region and Ghana at large, attention must be given to job satisfaction and the perceived employee turnover intentions so that the industry can retain qualified number of employees.

Although studies have established relationship between job satisfaction and turnover intention, most of these studies ignored the job satisfaction dimension that greatly predicts turnover intentions. For example, a study by Medina (2013) established that job satisfaction is inversely related to turnover intentions. However, the study failed to indicate the component of job satisfaction that is responsible for the inverse nature of the relationship between job satisfaction and turnover intentions. Similarly, a study by Alam and Asim (2019) on the relationship between job satisfaction and turnover intentions found overall satisfaction to has a negative effect on turnover intentions. Against this background, the present study investigates the factors that contribute to job satisfaction among hotel employees and also determines the dimensions of job satisfaction that greatly predict turnover intentions of hotel employees working in the Western North Region of Ghana. Findings of the study will provide hotel managers with the specific dimension of job satisfaction that requires attention in order to reduce employee turnover in the hotel sector.

## Literature Review

This section reviews literature related to job satisfaction and turnover intentions. The section begins with a theoretical review that focuses on the main theory that underpins the study. Next, job satisfaction and employee turnover intentions are explained as the key concepts of the study. The section further provides a review on the relationship between job satisfaction and employee turnover intentions.

### Theoretical review

The Herzberg's (1959) two-factor theory is the theory that underpins the study. According to Herzberg (1959), it sought to look at the correlation between employee attitude and workplace interaction. These two were put into two groups and named hygiene factors and motivators. The hygiene factors, according to Kumchala (2017), cause dissatisfaction. These factors, according to the proponent of the theory, must be present to take away dissatisfaction but do not in themselves lead to motivation. The theory postulates that what motivates arises from intrinsic motivation such as recognition, achievement, opportunities for growth, and advancement. This study looks at job satisfaction and turnover intentions. The study, therefore, assumes that for employees to attain a certain level of satisfaction, certain factors must be present. However, not all these factors are said to motivate. The key issue that provides focus for the study is to

identify those factors that motivate employees not to quit their present job. This the study termed as motivators. Despite the widely accepted use of the two-factor theory of motivation, it has received several criticisms. For example, Yew and Manap (2012) criticized the theory on the ground that the conclusions drawn are questionable, as the study failed to recognize the existence of substantial individual differences. Others have also criticized the theory on methodological grounds, as critics indicate that the study did not take into account the various job factors that might cause satisfaction or dissatisfaction.

**Job satisfaction**

Alarcon and Edwards (2011) conceptualised job satisfaction as an appraisal of one's job, an affective reaction to one's job, or an attitude towards one's job. Job satisfaction is a generalised affective work attitude towards one's present job and employer (Martin & Roodt, 2008), resulting from cognitive processes, and is an embodiment of employees' perception of how well their jobs provide for their hierarchy of needs, values, and expectations (Luthans, 2008). According to Luthans (2008), there are three general dimensions to job satisfaction: First, it is an emotional response to a job situation; second, it is determined by the extent to which expectations are met; and third, job satisfaction represents several related attitudes such as work itself, pay, promotion opportunities, supervision, and co-workers which are important characteristics of a job. The focus of this study is on hotel employees' general job satisfaction and turnover intentions of which Luthans (2008) highlighted key of the attributes in his study.

McShane and Von Glinow (2005), in their study, suggested that job satisfaction is a multi-faceted concept consisting of past and present-oriented pleasurable feelings that result when individuals evaluate their work roles. Thus, decisions of employees may depend on how they are affected by the factors of job satisfaction (McShane & Von Glinow, 2005). Lumley, Coetzee, Tladinyane, and Ferreira (2011) also indicated that there are many facets of a job to which employees have affective responses, including the work itself, pay and promotion opportunities, leadership, and co-workers.

**Turnover intention**

Employee turnover is the series of actions that it takes from the employee leaving, to his or her being replaced, and it is often utilised as an indicator of company performance and can easily be observed negatively towards the organisation's efficiency and effectiveness (Glebbeek & Bax, 2004). Employee turnover has significant costs and negative consequences for any organisation (Du Plooy & Roodt, 2013; Takawira, Coetzee, & Schreuder, 2014). These consequences provide a sound rationale for the study of turnover intention.

Morrell, Loan-Clarke, and Wilkinson (2001) conceptualised turnover intention as employees' voluntary cessation of membership of organisation and their freedom that they can leave the organisation for any reason such as work environmental factors, career issues, or may be influenced by external opportunities. In another vein, turnover intention is the extent to which an employee plans to leave or stay with the organisation (Bothma & Roodt, 2013). Sousa-Poza and Henneberger (2002) also define turnover intention as the manifestation of the subjective probability that an individual will change his or her job within a certain period. Takase's (2009) study of turnover

intentions explained the concept of turnover intentions to include three main components which are psychological, cognitive, and behavioural.

**Job satisfaction and turnover intentions**

Mahdi, Zin, Nor, Sakat, and Naim (2012) studied the relationship between job satisfaction and turnover intention among employees in XYZ facility in Malaysia. The study showed that both forms of job satisfaction (intrinsic and extrinsic satisfaction) have an inverse relationship on employees' turnover intentions. The researchers concluded that, even though intrinsic job satisfaction has a stronger influence on turnover intention, existence of extrinsic job satisfaction also must be considered in measuring the turnover intention of employees.

In Turkey, Mete and Sökmen (2017) explored the relationship between job satisfaction and turnover intentions among employees in the hospitality industry. The findings indicated a significant and negative relationship between job satisfaction and turnover intention. As a result of the correlation coefficient significance test, it was concluded that the relationship between job satisfaction and turnover intention was significant.

Lee, Huang, and Zhao's (2012) study in the Taiwan hostel industry showed that more harmonious co-worker relationships between hotel employees and a higher level of satisfaction regarding their work environment have a significantly positive effect on job satisfaction. Also, the findings suggest that a higher level of organisational commitment among hotel employees has a significantly negative effect on turnover intention; the direct effect of employee job satisfaction and salary level on turnover intention has not reached a significant level.

In Malaysia, Sangaran and Jeetesh (2015) worked on the effects of job satisfaction towards employee turnover in the hotel industry, with a case study of hotels in Kuala Lumpur city centre. The findings revealed that job performance influenced turnover whereas choice of work did not, and the main factors of job satisfaction that lead to turnover were wages/ salary and opportunity for advancement/career progression.

**Research Methodology**

The study adopted **a** quantitative research approach that enabled the researcher to generate data through standardised collection procedures based on a highly structured research instrument.

**Sampling procedure**

A multi-stage sampling technique was used for the study. The sampling was done at two levels to select the hotels and the employees. First, there was a division of the hotel population into strata, using the Ghana Tourism Authority (GTA) classifications of hotels obtained by the hospitality facilities within the study area. The classifications included budget, 1-star, 2-star, and guest houses. A total of 20 hotels were randomly selected from the 35 licensed hotels in the Sefwi Wiawso and Bibiani Ahwianso Bekwai Municipals, which comprised two 2-star hotels, eight 1-star hotels, two guest houses, and nine budget hotels. Secondly, convenience sampling was used by the researcher to select employees from the various divisions of hotels due to their convenient accessibility and proximity to the researcher or because of the accessibility to the data collection tool concerning potential

participants (Uprichard, 2013). Table 1 presents how the sampling was done for the

**Table 1: Distribution of Hotels Sample**

| Hotel category | Number of hotels | Sampled Hotels |
|---|---|---|
| Two stars | 2 | 2 |
| One star | 12 | 8 |
| Budget Hotel | 19 | 9 |
| Guest Houses | 2 | 2 |
| Total | 35 | 20 |

hotels in the Sefwi Wiawso and Bibiani Ahwianso Bekwai Municipals. Welch and Comer's (2006) formula n = 385 ÷ {(1+ (385/N)**}** was used to determine the sample size of 152 from the total population of 250 hotel employees in the study.

Questionnaire was the instrument used to obtain data from the population of the study. The study adapted and modified job satisfaction scale by Agho, Price, and Muller (1992) and Minnesota job satisfaction questionnaire by Weiss, Dawis, England, and Lofquist (as cited by Gunlu, Aksarayli, & Percin, 2010) to measure job satisfaction. The factors and number of statements were pay (5), promotions (5), and nature of work (5), supervision (5), and working conditions (5). In a similar vein, turnover intention scale by Boshoff and Allen (as cited by Khan & Du, 2014) was adapted for the study. The criteria for adapting these tools for the study include their validity and reliability qualities, as well as their prior utilisation in hospitality-related studies on job satisfaction and turnover intentions.

The questionnaires for the study were self-administered to the respondents sampled to participate in the study within the period of 4th February and 11th March, 2019. The self-administered questionnaires yielded relative high response rates. Personal phone calls and visits were made to the sampled hotel employees. The purpose of the study was then explained to hotel managers. Managers who agreed to allow their hotels partake in the study were asked to inform staff of the impending data collection for the study. Data was collected from hotel managers/account officers, receptionists, waiters/waitresses, chefs/cooks, housekeepers, and security persons. Some respondents completed the questionnaires instantly while others asked the researchers to collect the completed questionnaires later in sealed envelopes. 140 out of 152 hotel employees sampled participated in the study, indicating a response rate of 92.11%.

The questionnaires that were collected from the field survey were sorted out to find out those that were not answered and to check for consistency, clarity, and accuracy of recordings. Each of the questionnaires was labelled to avoid double entry or data loss. Data from the field was coded and processed using Statistical Package for Service Solution (SPSS) version 20 template, and both descriptive and regression analysis were used to analyse the data.

**Results and Discussion**

This section presents the findings of the study. First, descriptive statistics on the background characteristics of respondents are

provided. Next, factors influencing job satisfaction of hotel employees are presented. Description of the responses on the two key concepts of the study are also presented.

**Demographic profile of Hotel employees**

**Table 2: Socio-Demographic Characteristics of Respondents**

| Variables | Sub-scale | N | % |
|---|---|---|---|
| Sex | Male | 68 | 48.57 |
| | Female | 72 | 51.43 |
| Age range | 20 and below | 28 | 20.0 |
| | 21-30 | 65 | 46.4 |
| | 31- 40 | 20 | 14.3 |
| | 41-50 | 18 | 12.9 |
| | 51 and above | 9 | 6.4 |
| Level of education | | 14 | 10.0 |
| | Master's degree | 13 | 9.3 |
| | Undergraduate degree | 17 | 12.1 |
| | HND | 28 | 20.0 |
| | Diploma | 43 | 30.7 |
| | SHS | 25 | 17.9 |
| | JHS | | |
| Income Level | | 70 | 50.0 |
| | Below 400 | 44 | 31.4 |
| | 400- 700 | 26 | 18.6 |
| | 700 and above | | |
| Years of service | | 41 | 29.3 |
| | Less than 1 year | 51 | 36.4 |
| | 1-3 years | 30 | 21.4 |
| | 4-6 years | 18 | 12.8 |
| | 7years and above | | |
| Job position | | 25 | 17.80 |
| | Hotel manager/Account officer | 32 | 22.9 |
| | Receptionist | 17 | 12.1 |
| | Waiter/waitress | 20 | 14.3 |
| | Chef/Cook | 35 | 25.0 |
| | Housekeeper | 11 | 7.9 |
| | Security person | | |
| Total | | 140 | 100 |

Additionally, regression analysis on the effect of job satisfaction and employee turnover intentions are presented. From Table 2, the gender distribution of the hotel employees indicated that, of the 140 respondents, 48.57% were males while the remaining 51.43 were females. It was evident that 46.4%, which was the highest proportion of respondents, were within the ages of 21 – 30 years, 20% were of the ages of 20 years and below, while 14.3% of the respondents were between the ages of 31 – 40 years. With the educational levels of the respondents, 30.7% had education up to the senior high school level, 20% of the respondents were at the diploma level, 17.9% of the respondents had junior high school education level while 10% had masters' degree qualification. Among the respondents, the majority (50%) were paid below Gh¢ 400, about 31.4% of them were paid between Gh¢ 400 – Gh¢ 700, and the least (18.6%) were paid Gh¢ 700 and above. The results show that 36.4% have worked with their employers between 1- 3 years, while 21.4% of the respondents have worked in their hotels between 4 - 6 years. Out of the job positions classified, 25% were housekeepers, 22.9% of the respondents work at the front desk as receptionists, while 17.8% of the respondents held the hotel manager and/or account officer position.

**Factors that influence the job satisfaction of hotel employees**

Twenty-five statements were related to the factors of pay, promotions, nature of work, supervision, and working conditions which affect job satisfaction of hotel employees.

**Table 3: Factors Influencing Job Satisfaction of Hotel Employees**

| Item | Frequency | | | | | Percentages % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SA | A | N | D | SD | SA | A | N | D | SD |
| I feel I am being paid a fair amount for the work I do | 30 | 37 | 30 | 33 | 10 | 21.4 | 26.4 | 21.4 | 23.6 | 7.1 |
| I am paid according to my years of working experience | 17 | 40 | 32 | 38 | 10 | 12.1 | 28.6 | 22.9 | 27.1 | 7.1 |
| I am paid according to my educational qualification | 22 | 42 | 36 | 32 | 8 | 15.7 | 30.0 | 25.7 | 22.9 | 5.7 |
| I am paid more than what I do | 14 | 16 | 29 | 51 | 30 | 10.0 | 11.4 | 20.7 | 36.4 | 21.4 |
| The pay policy is fair to all employees in the facility | 17 | 34 | 52 | 28 | 9 | 12.1 | 24.3 | 37.1 | 20.0 | 6.4 |
| There are chances of being promoted in this facility | 21 | 56 | 32 | 25 | 6 | 15 | 40.0 | 22.9 | 17.9 | 4.3 |
| Promotion policy exists and is fair | 23 | 32 | 51 | 24 | 10 | 16.4 | 22.9 | 36.4 | 17.1 | 7.1 |
| Promotion is done regularly and fairly in this facility | 11 | 35 | 45 | 39 | 9 | 7.9 | 25.0 | 32.1 | 27.9 | 6.4 |
| Facility has a good career prospect for its employees | 22 | 35 | 48 | 27 | 6 | 15.7 | 25.0 | 34.3 | 19.3 | 4.3 |
| I am being rewarded for the quality of my efforts | 31 | 44 | 34 | 21 | 7 | 22.1 | 31.4 | 24.3 | 15.0 | 5.0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Am very proud when performing my duties | 54 | 60 | 17 | 6 | 2 | 38.6 | 42.9 | 12.1 | 4.3 | 1.4 |
| This work am doing is tiring and challenging | 29 | 65 | 23 | 16 | 7 | 20.7 | 46.4 | 16.4 | 11.4 | 5.0 |
| The job am presently doing is comfortable | 25 | 51 | 35 | 23 | 6 | 17.9 | 36.4 | 25.0 | 16.4 | 4.3 |
| I have too much to do at work | 26 | 57 | 38 | 14 | 5 | 18.6 | 40.7 | 27.1 | 10.0 | 3.6 |
| My work is enjoyable | 28 | 53 | 41 | 12 | 6 | 20.0 | 37.9 | 29.3 | 8.6 | 4.2 |
| My supervisor treats me fairly | 27 | 73 | 32 | 4 | 4 | 19.3 | 52.2 | 22.9 | 2.9 | 2.9 |
| My supervisor provides assistance all the time | 25 | 73 | 30 | 9 | 3 | 17.9 | 52.1 | 21.4 | 6.4 | 2.1 |
| My supervisor relates well with me | 40 | 70 | 25 | 3 | 2 | 28.6 | 50.0 | 17.9 | 2.1 | 1.4 |
| My supervisor commends me for good work done | 30 | 67 | 34 | 5 | 4 | 21.4 | 47.9 | 24.3 | 3.6 | 2.9 |
| My supervisor is competent in doing his/her job | 50 | 78 | | 11 | 1 | 35.7 | 55.7 | | 7.9 | 0.7 |
| Employees have the necessary authority to perform their job | 26 | 61 | 35 | 14 | 4 | 18.6 | 43.6 | 25.0 | 10.0 | 2.9 |
| The facility acknowledges and recognises my work | 24 | 90 | | 16 | 10 | 17.1 | 64.28 | | 11.4 | 7.1 |
| The working hours are conducive | 53 | 68 | | 15 | 4 | 37.9 | 48.6 | | 10.7 | 2.9 |
| The physical environment is conducive to work | 32 | 61 | | 31 | 16 | 22.9 | 43.6 | | 22.1 | 11.4 |
| The benefits we receive are as good as most other hotels offer | 26 | 82 | | 21 | 11 | 18.6 | 58.6 | | 15.0 | 7.9 |

Pay is a major factor in job satisfaction because the benefits individuals earn afford them the opportunity to satisfy both their basic and higher-level needs (Amissah et al., 2016; Lee, Yang, & Li, 2017). Out of the 140 total respondents, most of them (26.4%) agreed that they are being paid fairly for the work they do. 21.4% strongly agreed that they are being paid fairly. However, 23.6% of the respondents, which happens to be the second-highest, disagreed It was captured that, out of the 140 respondents, most (30%) of them agreed that they are being paid according to the educational qualification they hold. 22.9% of the respondents disagreed that they are being paid based on their educational qualification that they are being paid fairly in respect to the work they do, and 7.1% also strongly disagreed that they are paid fairly. 28.6 % were in consensus and agreed that the payment system in their working place are subject to the number of years an employee has worked and the experience he or she accumulated over the years. On the contrary, the second-highest of the respondents (27.1 %) contended that they are not paid per the number of years they have worked.

while 15.7% of the respondents strongly agreed that they are paid per their educational qualification. Most of the respondents (36.4%) disagreed that they are paid more than the work they do. 20.7% of the respondents were indifferent and did not

know if they are paid more than the work they do or paid less for the work they do, while 11.4% of the respondents agreed that they are paid more than what they do. Interestingly, most of the respondents (37.1%) shared the view that they do not know whether the payment policy in the hotels is fair to all employees or not. 24.3% of the respondents responded positively that they agree that the pay policy is fair to all employees in the facility.

Respondents were further asked whether promotion is significant to employees being satisfied with the work that they do. This was necessary because scholars like Chen, Liu, Si, Liu, and Dong (2013), Cao, Chen, and Song (2013), and Lumley, Coetzee, Tladinyane, and Ferreira (2011) found that job satisfaction of employee is affected by the existence of promotion opportunities in the organisation. The results indicate that most of the respondents (40%) agreed that there are chances of being promoted in their facilities whilst 17.9% of the respondents disagreed that there are no chances of them being promoted in their facility. Most of the respondents (36.4%) specified that they have limited knowledge about the promotion policy in their hotels; hence, they lack judgement and are neutral as to whether the promotion policy exists in the organisation and is fair to employees or not. Further, 22.9% of the respondents agreed that there are promotion policies in their hotels which are fair to all employees. Inversely, 17.1% of the respondents disagreed that promotion policy exists in their hotels while 7.1% of the respondents strongly agreed by affirming that there is no promotion policy in their hotel facilities.

Respondents were further asked how frequently or regularly are promotion done fairly in their facility. Most of the respondents (32.1%) neither agreed nor disagreed that promotion in their facility is regularly and/or fairly done in their workplace and were neutral with their responses. On the other hand, 25% of the respondents agreed that promotion is done regularly and fairly and 7.9% strongly agreed that promotion is done regularly and fairly. Respondents were further asked if their hotel facilities have a good career prospect for them. Out of the 140 respondents, most (34.3%) shared the view that they do not know whether their facility has a good career prospect for them or not; hence, they were neutral about their responses. Nonetheless, 25% of the respondents agreed that their facility has a good career prospect for them and 15.7% of the respondent seconded by strongly agreeing that their facility has a good career prospect for them.

Employees were asked if they are being rewarded for the quality of their effort. Most of the respondents (31.4%) agreed that they are being rewarded for the quality of their efforts. However, 15% of them disagreed that they are being rewarded for the quality of their efforts and this was strongly seconded by 5% of the respondents. Respondents were asked if they are very proud when performing their duties as hotel employee as a result of the nature of hotel work and incentives received. Out of the 140 respondents, most (42.9%) agreed that they are very proud when performing their duties as hotel employee. This was seconded by 38.6% of the respondents who strongly agreed that they are very proud when performing their duties as hotel employee. On the other hand, 4.3% of the respondents disagreed that they are very proud when performing their duties as hotel employee and 1.4% also strongly disagreed that they are

very proud when performing their duties as hotel employee.

However, when respondents were asked if their work is tiring and challenging, most of the respondents (46.4%) agreed that the work that they are doing is tiring and challenging. Further, 20.7% of the respondents strongly agreed that their work is tiring and challenging. Nevertheless, 11.4% disagreed that their work is tiring and challenging, and 5.0% of the respondents strongly alluded to this assertion. Table 3 indicates that most of the respondents (36.4%) agreed that they are comfortable with their present job that they are doing. However, 25.0% of the respondents were not sure whether they are comfortable with their current job or not and, therefore, were indecisive and neutral with choice. 16.4% of the respondents disagreed and shared their view that they are not comfortable with their current job, whilst 4.3% of the respondents also strongly disagreed that they are comfortable with the hotel job that they are doing currently.

Although the respondents earlier indicated that they are comfortable with their current job, most of the respondents (40.7%) shared the view that there is too much work for them to do at their workplaces. Also, 18.6% of the respondents strongly agreed that there is too much work for them to do. However, 10% of the respondents indicated that they do not have much work to do and 3.6% also strongly disagreed that they have too much to do at work. Interestingly, although respondents indicated they have too much work to do at their workplace, most of the respondents (37.9%) indicated their work is enjoyable. Further, 20% strongly agreed that the works they do at their hotels are enjoyable. On the other hand, 8.6% had no pleasure doing their work and they disagreed that their work is enjoyable and very few respondents (4.2%) strongly disagreed that their work is enjoyable.

Respondents were further asked if their supervisor treats them fairly, assist all the time, relates well with workers, commend workers for good work done, and are competent in doing their job. From Table 3, the majority (52.5%) agreed that their supervisors treat them fairly and 19.3% of the respondents seconded and strongly agreed that their supervisors treat them fairly. 2.9% disagreed and also 2.9% strongly disagreed that their supervisors treat them fairly. Further, the majority (52.1%) of the respondents indicated that their supervisors provide them with all the necessary assistance. However, few people disagreed that they are attended to all the time by their supervisors, and this was seconded by 2.1% of the respondents who strongly disagreed that they receive assistance all the time from their supervisors.

From Table 3, out of the 140 respondents, half (50%) indicated that their supervisors relate very well with them and very few (2.1%) disagreed. 1.4% strongly disagreed that their supervisors relate with them very well at their workplace. However, 17.9% of the respondent were not sure whether their superiors relate with them well or not; hence, they were neutral with their responses. Since the superiors or supervisors relate well, it was not surprising that most of the respondents (47.9%) indicated that their supervisors commend them for a good work done. Nonetheless, 3.6% of the respondents did not see their superiors encouraging them in the good works they do and did not agree to that statement.

More than half of the 140 respondents (55.7%) agreed that their supervisors are competent in doing their

work. The second highest of the respondents (35.71%) strongly agreed that their supervisors are competent in doing their work. very few of the respondents (0.7%) strongly disagreed and also 7.9% strongly disagreed that their supervisors are competent in doing their work. Respondents were asked if they have all the necessary authority or the freedom to perform their job effectively and efficiently. From Table 3, most of the respondents (43.6%) indicated that they have the necessary authority to perform their duties irrespective of their supervisors being around or not. Nonetheless, 10.0% of the respondents disagreed and had a different opinion. 25.0% of the respondents did not know whether they have the authority to perform their job or not, and they were in between, neutral.

From Table 3, the majority (64.28%) of the respondents agreed that their facility acknowledges and recognizes their good work done. Very few of the respondents alerted that their good work is not acknowledged or recognized in their workplace; hence, 11.4% of the respondent disagreed while 7.1% strongly disagreed. Out of the 140 respondents, 48.6% agreed that their working hours are conducive and this was seconded by 37.9% of the respondents who strongly agreed that the working hours in their working place is conducive. However, some of the respondents had an opposing view. To them, the working hours may not always be conducive as others may anticipate. 10.7% of the respondents agreed to this fact while 2.9% strongly disagreed to that fact that working hours are conducive in their working places. It was also evident in the responses that the respondents also have a conducive physical environment to work. From the 140 respondents, most of them (43.6%) agreed that their physical environment in their working place is conducive, only few (10.7%) disagreed, and 2.9% strongly disagreed.

Respondents were asked if the benefits they receive are as good as most other hotels offer elsewhere. Statistically, the majority (58.6%) of the respondents agreed to the fact that the benefits they receive are as good as most other hotel offers. Nonetheless, 15% of the respondents disagreed to this allusion and 7.9% also strongly disagreed.

**Effect of employees' job satisfaction and turnover intentions**

To examine the effects of job satisfaction on turnover intentions, descriptive statistics of the dimensions of job satisfaction and employee turnover intentions are presented. Four dimensions were used to measure job satisfaction, which included pay, promotion, nature of work, supervision and working conditions. Simple linear regression analysis was found to be more appropriate. Findings of the descriptive analysis are presented in Tables 4 and 5 before proceeding to present the regression results on the effect of job satisfaction on turnover.

From Table 4, very few of the respondents (5.7%) indicated that they are extremely dissatisfied with their salary and 17.1% also established that they are dissatisfied with the salaries that they receive. Irrespective of this, most of the respondents (33.6%) were satisfied with their salary, 32.9% were somehow satisfied, and 10.7% were extremely satisfied with the salaries that they receive from their employees. Also, most of the respondents (37.1%) indicated that they are satisfied with their job because they feel they stand the chance of advancing on the job. However, 11.4% were dissatisfied with their chances of advancement on the job and only 3.6% of the respondents were extremely dissatisfied with their job.

**Table 4: Level of Job Satisfaction of Hotel Employees**

| Item | Frequency | | | | | Percentages % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ES | S | SS | D | ED | ES | S | SS | D | ED |
| I am very satisfied with my salary | 15 | 47 | 46 | 24 | 8 | 10.7 | 33.6 | 32.9 | 17.1 | 5.7 |
| There are chances for advancement on this job | 14 | 52 | 47 | 16 | 5 | 10.0 | 37.1 | 33.6 | 11.4 | 3.6 |
| My supervisor handles his/her workers well | 30 | 55 | 43 | 3 | 3 | 21.4 | 39.3 | 30.7 | 2.1 | 2.1 |
| Working here gives me the chance to be somebody in the community | 33 | 52 | 43 | 6 | 3 | 23.6 | 37.1 | 30.7 | 4.3 | 2.1 |
| I get high self-esteem for working in a hotel | 30 | 68 | 34 | 4 | 4 | 21.4 | 48.6 | 24.3 | 2.9 | 2.9 |
| I enjoy working on shifts in the hotel | 34 | 48 | 44 | 7 | 3 | 24.3 | 34.3 | 31.4 | 5.0 | 2.1 |
| In general, I like working in this department of the hotel | 42 | 53 | 36 | 5 | 2 | 30.0 | 37.9 | 25.7 | 3.6 | 1.4 |
| In general, I like my job | 51 | 80 | 0 | 8 | 1 | 36.4 | 57.1 | 0.0 | 5.7 | 0.7 |

From Table 4, 39.3% of the respondents were satisfied with the way the supervisors handle workers. 30.7% of the respondents were somehow satisfied, and 21.4 were extremely satisfied with their supervisors' handling cases at the workplace. Enormously few respondents (2.1%) were dissatisfied and 2.1% were extremely dissatisfied with how the supervisors handle workers.

More so, the workers were satisfied working in their various hotels because they anticipated working in such institution raises the status quo and makes them important personalities in their localities. Because of this, most respondents (37.1%) indicated that they are satisfied with the work that they do because their status among colleagues would rise, 30.7% were somehow satisfied, and 23.6% were extremely satisfied with the work they are doing. However, 2.1% were extremely dissatisfied, and 4.3% were dissatisfied.

Most of the respondents (48.6%) attested that they get high self-esteem and are satisfied for working in a hotel, and 21.4% were also extremely satisfied whilst 2.9% of the respondents were dissatisfied with their work and do not have any high self-esteem for working for the hotel and another 2.9% were extremely dissatisfied. The respondents pointed out that, in general, they like working in their various departments (see Table 4). Most of the respondents (37.9%) responded that they are satisfied and like working in their department. On the other hand, 3.6% were dissatisfied and 1.4% were extremely dissatisfied and didn't like working in their department.

Not only do the respondents like working in the department of the hotel, as explained by Table 4, the respondents

(workers) like the work that they do in general. Majority of the respondents (57.1%) like the various determinants of satisfaction and are satisfied with the job they do in the hotel. Contrarily, 5.7% of the respondents were dissatisfied, and 0.7% were extremely dissatisfied with whatever they do in their hotel and thus do not like what they do in general. These findings are consistent with that of Lee, Huang, and Zhao (2012), and Raddaha, Alasad, and Albikawi (2012), who found that employees in the hospitality industry that are laden with high level of better working conditions have higher levels of job satisfaction.

**Table 5: Level of Employee Turnover Intentions in Hotels**

| Item | Frequency | | | | | Percentages % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SA | A | N | D | SD | SA | A | N | D | SD |
| I often seriously consider leaving my current job | 15 | 36 | 0 | 72 | 17 | 10.7 | 25.7 | 0.0 | 51.4 | 12.2 |
| I intend to quit my current job | 15 | 31 | 0 | 72 | 22 | 10.7 | 22.1 | 0.0 | 51.4 | 15.8 |
| I have started to look for other jobs | 16 | 30 | 0 | 33 | 61 | 11.4 | 21.4 | 0.0 | 23.6 | 43.6 |
| I would recommend this facility to a relative or a close friend | 43 | 49 | 27 | 17 | 4 | 30.8 | 35.0 | 19.3 | 12.1 | 2.9 |

The researcher asked the respondents four important questions which had to do with how often workers consider leaving their current job, how they intend to quit their current job if workers have started looking for other jobs, and if workers would recommend their working place to a relative or a close friend. The responses are presented in Table 5. When the respondents were asked if they often consider leaving their current job, majority (51.4%) disagreed with often seriously considering leaving their current job. However, 25.7% of the respondents considered leaving their current job whilst 10.7% also strongly agreed often seeing themselves leaving their current job.

From Table 5, the majority of respondents (51.4%) indicated that they do not intend to quit their current jobs and strongly disagree with this assertion. On the other hand, 22.1% of the respondent indicated that they have the intention of quitting their current job. Also, most of the respondents (43.6%) contended that they strongly disagreed that they have started looking for a new or another job. Similarly, 23.6% of the respondents disagreed to this contention. Nonetheless, 21.4% of the respondents agreed to this statement and said they have started looking for other jobs and 11.4% strongly agreed and said they have started looking for other jobs.

Out of the total 140 respondents, most (35%) indicated that they agree to recommend their facility to a relative or close friend. Consistently, 30.8% of the respondents strongly agreed to this testimonial. Yet, 12.1% disagreed to recommending the facility and indicated that they would not recommend the facility to any known person and this was seconded by 2.9% of the respondents who strongly disagreed.

**Table 6: Linear Regression of Job Satisfaction and Turnover intentions**

| Dimensions of satisfaction | Coef | SE | t | P |
|---|---|---|---|---|
| Pay | 0.178 | 0.157 | 1.13 | 0.259 |
| Promotion | -0.329 | 0.163 | -2.02 | 0.046* |
| Nature of work | 0.339 | 0.261 | 1.30 | 0.196 |
| Supervision | 0.166 | 0.170 | 0.68 | 0.497 |
| Working condition | -0.086 | 0.140 | -0.62 | 0.539 |
| Constant | 2.018 | 0.623 | 3.24 | 0.002 |

R-Square =0.07 (7%); p=0.15;
Scale; 1 = SD, 2 = D, 3 = N, 4=A, 5= SA

The results in Table 6 show that among the four job satisfaction dimensions, only promotion was found to be a significant predictor of turnover intentions of hotel employees. The more hotel employees agreed that they were satisfied with their promotion, the lesser the likelihood that they wanted to quit their jobs (b=-0.329; $p<0.05$). This implies that increasing satisfaction with job promotions reduces turnover intentions. The findings are consistent with Ellickson and Logsdon's (2002) finding that promotional opportunities of job satisfaction significantly affect turnover intentions. This finding also confirms that of Median (2013) that also established an inverse relationship between job satisfaction and employee turnover in general.

It was, however, observed that working condition, pay, nature of work, and supervision are not significant predictors of turnover intentions. The presence of these factors is said to prevent dissatisfaction, as explained in Herzberg's two-factor theory. The findings contradict the findings of Lee, Huang, and Zhao (2017), who found a direct effect of job satisfaction pay level on turnover intention and indicated that higher pay levels can facilitate harmonious employees-supervisors relationship, employees's job satisfaction can be effectively improved, and will lead to lower employee turnover intentions.

**Conclusion and Implications**

For an employee of a hotel to be satisfied with the job, certain factors come together to influence the satisfaction. Though the findings of the study establish that well-paid salary, promotion, nature of work, supervisions at work, and better working conditions are the main factors that make employees satisfied in the hospitality industries, particularly, in the hotel sector, promotion was found to highly predict employee turnover intentions. The study

establishes that, when promotional opportunities are given to employees, the likelihood of such employees leaving is reduced, thereby reducing turnover intentions. This has implication for the management of hotels. Hotel managers and owners of hotels in the Sefwi Wiawso and Bibiani Ahwianso Bekwai of the Western Region of Ghana need to prioritize the promotion of staff and offer staff that have acquired the needed skills and qualifications to work an opportunity for them to be promoted.

**Limitations and future research**

The focus of the study on only four hotel categories which are within the lower scale categories could have influenced the responses. Future studies could also focus on upscale hotels such as the 3-star, 4-star, and 5-star hotels. The motivational needs of employees within the upscale hotels might also be different or same; hence, the same or different outcome may be expected.

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# LEISURE PREFERENCES AND CONSTRAINTS OF URBAN DWELLERS OF HO, GHANA

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**Abstract**: Leisure choices and constraints among university students and visually impaired in Ghana have been examined, with less attention paid to urban dwellers in the country. Consequently, the leisure behaviours and patterns of urban dwellers in Ho are unknown. To fill this gap in knowledge, this study investigated leisure choices and constraints amongst the residents of Ho Municipality. Using a cross-sectional research design, self-administered questionnaires were used to solicit data from a convenience sample of 900 residents. Data was analysed using descriptive statistics and independent sample t-test to summarize and explore relationships between demographic characteristics of respondents and leisure preferences and constraints. Listening to music, chatting with friends, walking, and using social media were the most preferred leisure pursuits. Generally, residents of Ho were prevented from engaging in leisure by work/studies, busy life, no time, and unavailability of recreational/leisure facilities. Gendered patterns of leisure preferences were observed in the study. Female residents were more inclined to dancing, listening to music, watching television, and reading storybooks than males. However, male residents exhibited proclivity towards aerobics, basketball, running and jogging, and playing of computer games than females. Lack of physical abilities, fear of injuries, and house chores were more likely to impede female leisure participation compared to male residents.

**Key words:** Leisure preferences; constraints; gender; urban; Ho, Ghana.

## Introduction

Leisure embraces a set of experiences gained by people in the domain of free time or free-will activities (Granger, 2014; Honer & Swarbrooke, 2005; Torkildsen, 2011) comprising socializing, sedentary, creative, and leisure-time physical activity (LTPA) (Adam, 2014; Scott & Willits, 1998). Leisure in itself is not a necessity for survival (Przepiorka & Blanchnio, 2017) but influences an individual's psychological state (Sandoval, 2017) through various degrees of satisfying levels (Stebbins, 2007). LTPA is associated with higher ratings of general and mental health (Mock et al., 2013), and a source of happiness (Lu & Hu, 2015) and enhancing the quality of life (Haworth, 2014). Within the work context, leisure promotes autonomy and enhancement of decision-making skills (Garst et al., 2001), generates positive feelings (Gilbert & Adbullah, 2004; Godbey, 2003; Lloyd & Little, 2010), moderates the impact of work strains (Lewis, 2003), and satisfies employees' emotional needs, which in turn affects their physical and mental health, and enhances job satisfaction and employee job

performance, while serving as a break from work (Joudrey & Wallace, 2009).

These leisure outcomes are attainable contingent on leisure involvement, which is inhibited by constraints that influence leisure choices and frequency of participation (Ragheb & Griffith, 1982). These constraints have been categorized into three: intrapersonal, interpersonal, and structural (Crawford & Godbey, 1987). Intrapersonal constraints highlight the psychological and attitudinal factors that inhibit leisure behaviour. Interpersonal barriers deal with limitations resulting from social relationships while structural constraints to leisure participation relate to systemic factors such as lack of facilities and money, and geographic distance. These constraints inhibit people's ability to participate in leisure activities either in time spent or taking advantage of leisure services to achieve desired levels of satisfaction in construct or motive (Haung & Lin, 2011; Liang, 2017).

Generally, limited studies have been conducted on leisure participation and constraints in Ghana, as compared to other parts of the world (Adam, 2014; Adam et al., 2015; Yankholmes & Lin, 2012). In the Ghanaian context, the scanty studies on the subject have focused on leisure patterns and constraints of students (Adam, 2014; Adam, Hiamey, & Afenyo, 2015; Yankholmes & Lin, 2012) and people with physical and visual impairment (Adam, 2017; Adam, 2018; Adam, Boakye, & Kumi-Kyereme, 2017). Geographically, such studies have focused on Kumasi and the University of Cape Coast. However, leisure constraints and preferences are contextual and less generalizable. It is on the premise of the foregoing that this study explores the leisure preferences and constraints of residents of Ho. Individual urban areas present diverse opportunities and constraints; hence, the perspectives of Ho would form the basis for the design of specific policies with implication for land use and planning within the regional capital.

## Literature Review

### The concept of leisure

Leisure is conceptualized in diverse perspectives, including leisure as a time, an activity, a state of being, leisure as an all-pervading 'holistic' concept, and leisure as a way of life (Torkildsen, 2011). Conservatively, leisure has been defined as the period of time that is not attached to paid work or other obligatory activities (Parker, 1971). Relatedly, Przepiorka and Blanchnio (2017) conceptualize leisure as the time beyond what is compulsory and beyond what we have to do to live. It is the set of activities that a person voluntarily pursues when that person is free from work, familial, or social responsibilities. According to Sandoval (2017), leisure is the consequence of class differences, as an activity, as an inner experience, or as a combination of activities and psychological states. Leisure activities usually occur in discretionary time in which individuals have the freedom to choose activities that provide intrinsically satisfying experiences pleasurable and pursued for their own rewards (Lobo, 2006). According to Honer and Swarbrooke (2005), leisure is a term that has been used to include a whole set of experiences that people undertake during their free time.

Leisure activities are varied, and scholars have developed taxonomies of leisure. A distinction is made between passive and active leisure. Passive leisure constitutes restful, static, and quiet time-out activities in which participants do not engage in physical

exertion, with examples including the reading of books or newspapers, watching shows on television, and listening to music (Joudrey & Wallace, 2009). However, active leisure highlights activities that involve some form of physical exertion such as running, walking, swimming, trekking, and playing sports (Joudrey & Wallace, 2009). Passmore and French (2001) classified leisure into three: achievement leisure that involves playing sports, hobbies, creative and performance arts; social leisure consisting of activities for the purpose of being in the company of others; and lastly, time-out leisure that includes listening to music and watching television. Based on the works of Scott and Willits (1989, 1998), leisure activities are divided into four groups: socializing, creative/artistic, sedentary/solitary, and physical/sports. Socializing leisure involves chatting with friends, going to movies, and visiting friends whereas creative/artistic leisure includes playing of musical instruments, singing, and painting. Sedentary/solitary leisure is made up of activities such as playing video games, watching television, and crafting. Lastly, physical/sports consist of leisure-time physical activities such as football, basketball, mountaineering, among many others. The classification scheme of Scott and Willits (1989, 1998) is adopted to explore the leisure preferences of residents of Ho Municipality.

Adam et al. (2015) investigated leisure preferences of 1160 university students in Cape Coast, Ghana and concluded that the most popular leisure activities among the students were listening to music, followed by sleeping, while playing of musical instruments was least reported activity. Among people with physical disability in Kumasi, Ghana, the most frequently undertaken leisure activities were chatting, listening to music, watching television, and listening to the radio (Adam, 2017) while amongst visually impaired people, the most commonly reported leisure activities were chatting and listening to music, with the least leisure activity being reading (Adam, 2018). Another study investigating the leisure lifestyles of 200 students from the University of Cape Coast found sedentary activities, such as chatting on mobile phone with friends/family, and visiting family and friends common among the research participants (Yankholmes & Lin, 2012). Home-based leisure activities such as watching TV, videos, DVDs, listening to radio, and computer gaming were popular among university students in Greece whereas university college staff in Poland frequently undertake cycling, swimming, skiing, and tennis (Biernat & Roguski, 2009). Conversations with family and watching of TV were common leisure pursuits among the elderly in Selangor, Malaysia (Amin, 2014).

The driving factors behind peoples' leisure choices and behaviours have attracted the attention of leisure researchers for more than four decades. Beard and Ragheb (1983) classified leisure motivations into the following: stimulus-avoidance, competence-mastery, intellectual, and social. Based on Beard and Ragheb's (1983) leisure motivation classification, Adam et al. (2017) found competence-mastery, social, intellectual, and stimulus avoidance to be the main leisure motivations among people with physical and visual impairment in Kumasi, Ghana. Within a sample of higher education institution employees in Ondo State, Nigeria, the desire to attain physical fitness, longevity, and stress reduction were the main leisure motivators (Alayode, Babalola, & Oyesegun, 2014). Dillard and Bates (2011) proposed

four core motivators for leisure participation: escape, enhancing relationships, personal mastery, and winning.

**Gender and leisure preferences**

Gendered leisure choices and participation have received empirical attention among leisure researchers. Results of several studies confirm gender differences in leisure pursuits across diverse populations. Female university students in Ghana are predisposed to sedentary/solitary activities while the male students partake in socializing activities (Adam, 2014). Among older adults in Shanghai, China, males were more likely to engage in detachment-recovery and aesthetic activities, whereas females were more likely to participate in social and performing-arts activities (Zhang, Feng, Lacanienta, & Zhen, 2017). Among university students in Athens and Larissa in Greece, computer gaming seems to be an activity for males, while telephone calls of longer than 15 minutes were trendy amongst females (Sirakoulis & Deffner, 2002). Similarly, female students reported greater cell phone use than males in a study involving 268 students of Midwestern USA (Barkley & Lepp, 2016). In another USA study, female students reported significantly higher participation in 'art /cultural' activities whereas male students were more inclined to participate in 'indoor/outdoor sports' (Lehto, Park, Fu, & Lee, 2014). Among Japanese adults, men were found to significantly indicate higher total physical activity than women (Matsushita, Harada, & Arao, 2015). A study of high school students in Brazil revealed that young males engaged more in active leisure than young females (Ricardo, Rombaldi, Otte, Perez, & Azevedo, 2013). Similarly, males reported spending significantly more time in activities by themselves and in physical past-times such as skating, bowling, and riding a scooter while the females spent more time than the males reading, writing, and listening to music (Trainor, Delfabbro, Anderson, & Winefield, 2010).

**Theoretical Framework**

The theoretical framework underlying this study is based on the leisure constraint model (Crawford & Godbey, 1987). According to Jackson (1988), leisure constraints are things or circumstances "that inhibit people's ability to participate in leisure activities, to spend more time doing so, to take advantage of leisure services or to achieve a desired level of satisfaction" (p. 203). Leisure constraints can also be defined as factors that inhibit an individual from participating in any leisure/physical activity or event (Crawford & Godbey, 1987; Godbey, Crawford, & Shen, 2010; Jackson, 2000). Leisure constraint factors are divided into three broad categories: intrapersonal, interpersonal, and structural constraints. Intrapersonal constraints relate to factors such as lack of confidence and skills, or unavailability of social support, while interpersonal constraints focus more on the lack of social relationship factors such as reference groups, influence from peers, cultural and social norms, values, expectation, stress, depression, and anxiety. Structural constraints are characterized as external factors that prevent individuals from participating in leisure activities, such as lack of facilities, time, money, etc. (Godbey & Crawford, 1987).

Masmanidis, Tsigilis, and Kotsa (2015) examined the leisure constraints factors of students selected from two universities in Greece, indicating that students were constrained first by

interpersonal factors, followed by intrapersonal and structural barriers. Specifically, the authors identified accessibility, lack of information, and facilities/services as the leading barriers to participation in leisure activities. Among college students in the US, the most highly perceived constraint indicated by the students was lack of time (Young, Ross, & Barcelona, 2003). Results of studies conducted in Ghana indicate that university students are highly constrained by academic workload and financial conditions (Adam, 2014; Adam et al., 2015; Yankholmes & Lin, 2012), with reported gender differences. Female students were highly constrained by lack of skills and social support, compared to their male counterparts. Female students were constrained by both intrapersonal and interpersonal barriers while their male colleagues were not constrained by any of the three constraints (Adam, 2014).

**Methodology**

The study population included all residents of Ho aged 18 years and above. Ho serves as the administrative and commercial capital for the Volta Region and Ho municipal district. Ho covers an area of 11.65 square kilometres (UN-HABITAT, 2009). The total population of Ho is estimated at 104,532, with those aged 18 years or more constituting 68,604 (Population and Housing Census, 2010). Using a 5% margin of error and 99% confidence level, the sample was determined to be 658. However, 1,000 paper-and-pencil questionnaires were distributed to residents who were selected using convenience sampling technique in May 2019. Respondents were intercepted in the streets, stores, and shopping centres in the town, ensuring that all suburbs are represented in the sample. After retrieving the questionnaires, 900 were considered to contain sufficient data for analysis, resulting in a response rate of 90%. The research instrument was divided into two sections. The first section collected information on residents' demographic characteristics such as, gender, age, marital status, among others. The second section measured leisure activities and constraints that were adapted from previous studies (Adam et al., 2014; Crawford et al., 1991; Scott & Willits, 1998). Respondents' participation in leisure activities was measured on a five-point Likert type scale anchored on 1=never to 5=many times. In the case of leisure constraint factors, respondents were requested to use five-point Likert-type scale ranging from 1=strongly disagree to 5 strongly agree. Data analysis was conducted using IBM SPSS version 25, with descriptive statistics utilized to describe the profile of respondents while independent sample t-test was used to explore gender differences in respondents' leisure preferences across activity and leisure domains.

**Results**

**Profile of respondents**

The profile of the respondents is presented in Table 1. A greater proportion of the respondents were male (60.7%), largely to be aged 29 years or less (65.7%), and married (70.7%). In respect of education, the sample was marginally dominated by respondents with secondary educational attainment (37%), followed by those with a university degree (32.8%).

**Table 1: Demographic Profile of Respondents**

| Demographic Factors | Attributes | N | (%) |
|---|---|---|---|
| Sex | Male | 546 | 60.7 |
| | Female | 354 | 39.3 |
| | Total | 900 | 100 |
| Age | 29 years or below | 591 | 65.7 |
| | 30-39 | 195 | 21.7 |
| | 40-49 | 72 | 8.0 |
| | 50+ | 42 | 4.7 |
| | Total | 900 | 100 |
| Marital Status | Unmarried | 264 | 29.3 |
| | Married | 636 | 70.7 |
| | Total | 900 | 100 |
| Education level | Basic | 75 | 8.7 |
| | Secondary | 321 | 37.0 |
| | Diploma | 63 | 7.3 |
| | HND | 99 | 11.4 |
| | Degree | 284 | 32.8 |
| | Post-graduate | 25 | 2.9 |
| | Total | 867 | 100 |

**Leisure preferences**

Table 2 presents results relating to respondents' leisure preferences. As indicated in the table, 'Listening to music' was the most frequently pursued leisure activity (M=4.27), followed by 'Chatting with friends' (M=4.25) and 'Walking' (M=4.15). The least patronized leisure activities were 'Playing golf' (M=1.45), 'Hockey' (M=1.48), and 'Lawn tennis' (M=1.62).

**Table 2: Table Leisure Preferences of Residents**

| Activity domain/activity type | Mean | Standard Dev. |
|---|---|---|
| *Sedentary* | *3.83* | *.84* |
| Listening to music | 4.27 | 1.11 |
| Watching television | 3.88 | 1.19 |
| Reading novels/storybooks | 3.34 | 1.29 |
| *Socialising* | *3.31* | *.82* |
| Chatting with friends | 4.25 | 1.09 |
| Walking | 4.15 | 1.28 |
| Social media-Facebook, WhatsApp | 3.92 | 1.30 |
| Going to parties | 2.61 | 1.33 |
| Old school activities | 2.50 | 1.33 |
| *Creative/Arts* | *2.78* | *.96* |
| Dancing | 3.04 | 1.39 |

| | | |
|---|---|---|
| Playing computer games | 2.88 | 1.42 |
| Playing musical instrument | 2.41 | 1.44 |
| *LTPA* | *2.01* | *.64* |
| Running and jogging | 3.03 | 1.43 |
| Football | 2.52 | 1.42 |
| Cycling (for health and recreation) | 2.49 | 1.36 |
| Mountaineering and climbing | 2.17 | 1.30 |
| Swimming | 2.17 | 1.36 |
| Table tennis | 2.09 | 1.36 |
| Volleyball | 2.08 | 1.25 |
| Basketball | 2.01 | 1.25 |
| Handball | 1.70 | 1.08 |
| Aerobics/gym | 1.70 | 1.07 |
| Badminton | 1.64 | 1.06 |
| Lawn tennis | 1.62 | 1.10 |
| Hockey | 1.48 | .96 |
| Golf | 1.45 | .94 |

*Scale: 1=never; 2=once/twice; 3=sometimes; 4=often; 5=many times*

In the case of the domains of leisure, sedentary leisure activities were found to be common pursuits, compared to socialising (M=3.31), creative/arts (M=2.78), and leisure-time physical activity (M=2.01).

**Gender and leisure preferences**

Independent sample T-test was conducted to find out whether leisure choices will vary by gender, and the results are presented in Table 3.

**Table 3: Gender and Leisure Preferences**

| Activity | Male | Female | P-Value |
|---|---|---|---|
| Aerobics/gym | 1.76 | 1.60 | .036* |
| Badminton | 1.68 | 1.59 | .223 |
| Basketball | 2.08 | 1.91 | .045* |
| Cycling (for health and recreation) | 2.55 | 2.40 | .090 |
| Dancing | 2.95 | 3.19 | .009* |
| Football | 2.83 | 2.03 | .000* |
| Golf | 1.45 | 1.44 | .781 |
| Handball | 1.66 | 1.78 | .091 |
| Hockey | 1.50 | 1.45 | .481 |
| Mountaineering and climbing | 2.27 | 2.02 | .005* |
| Running and jogging | 3.12 | 2.89 | .016* |
| Swimming | 2.22 | 2.08 | .153 |
| Lawn tennis | 1.64 | 1.59 | .532 |
| Volleyball | 2.17 | 1.95 | .009* |
| Table tennis | 2.24 | 1.86 | .000* |
| Walking | 4.14 | 4.17 | .802 |

| | | | |
|---|---|---|---|
| Listening to music | 4.22 | 4.36 | .049* |
| Chatting with friends | 4.24 | 4.27 | .732 |
| Watching television | 3.80 | 4.00 | .013* |
| Playing Computer Games | 2.99 | 2.71 | .005* |
| Reading Novels/storybooks | 3.23 | 3.50 | .002* |
| Playing musical instrument | 2.56 | 2.18 | .000* |
| Social media-Facebook, WhatsApp | 3.91 | 3.93 | .846 |
| Going to Parties | 2.59 | 2.64 | .607 |
| Old school activities | 2.56 | 2.40 | .084 |

As shown in Table 3, it is evident that preferences for leisure activities are segregated by gender. Male residents reported higher frequency of aerobics/gym participation than their female counterparts. Similarly, the male respondents reported a higher frequency of participation in 'playing musical instrument', 'playing computer games', 'playing table tennis', 'volleyball', 'running and jogging', 'football' and 'basketball'. Interestingly, the female respondents reported higher indulgence in 'listening to music', 'dancing', 'watching television', and reading novels/story books' than their male counterparts (Table 4).

Clearly, female residents were predisposed to participating in sedentary leisure activities, compared to their male counterparts. On the other hand, the male residents reported higher interest leisure-time physical activities more than the female respondents. Further, male residents were more likely to indicate the patronage of creative/arts-related leisure activities than the females.

**Table 4: Gender and Participation in Leisure Activity Domain**

| Leisure Activity Domain | Gender | Mean | P-Value |
|---|---|---|---|
| | Male | 3.74 | |
| Sedentary | Female | 3.95 | .000 |
| | Male | 3.32 | |
| Socialising | Female | 3.30 | .763 |
| | Male | 2.83 | |
| Creative/Arts | Female | 2.69 | .041 |
| | Male | 2.08 | |
| LTPA | Female | 1.89 | .000 |

**Leisure constraints**

Results relating to the factors that constraint residents' participation in leisure activities are presented in Table 5. Evidently, respondents appeared constrained structurally from participating in leisure, with specific factors including 'work/study', 'busy life', 'lack of time', and 'unavailability of leisure facilities'. Intrapersonal factors identified include 'lack of interest', 'fear of injuries', 'lack of participation skills', and 'fear of losing focus'. Interpersonal constraints were least influential in leisure participation decisions of residents.

**Table 5: Constraints to Leisure Participation**

| Constraints | % in Agreement | Mean | Std. Deviation |
|---|---|---|---|
| *Structural constraints* | | *3.01* | *0.74* |
| Work/study to do | 51.4 | 3.36 | 1.29 |
| Busy life | 48.1 | 3.27 | 1.31 |
| No time | 43.7 | 3.15 | 1.31 |
| Unavailability of leisure/recreational facilities | 44.8 | 3.15 | 1.37 |
| Self-commitment | 38.0 | 3.01 | 1.26 |
| Distance to facility | 40.5 | 2.94 | 1.38 |
| Social commitment | 33.2 | 2.93 | 1.19 |
| Family commitment | 34.0 | 2.92 | 1.26 |
| Life pressures | 33.0 | 2.86 | 1.23 |
| Too many house chores | 26.2 | 2.59 | 1.31 |
| *Intrapersonal constraints* | | *2.40* | *0.84* |
| Lack of interest | 31.6 | 2.75 | 1.35 |
| Fear of injuries | 30.2 | 2.63 | 1.39 |
| Lack of participation skills | 23.5 | 2.42 | 1.30 |
| Fear of losing focus | 21.4 | 2.41 | 1.27 |
| No physical abilities | 24.7 | 2.41 | 1.36 |
| Health-related problems | 23.0 | 2.32 | 1.35 |
| *Interpersonal constraints* | | *2.10* | *0.84* |
| Low levels of interest by other colleagues | 22.3 | 2.41 | 1.29 |
| The activity is looked down upon | 19.7 | 2.35 | 1.28 |
| Leisure is not too important in my culture | 18.9 | 2.32 | 1.26 |
| Other colleagues will make fun of me | 17.1 | 2.19 | 1.26 |
| Fear of being rejected by friends | 17.4 | 2.13 | 1.28 |
| Not be allowed to participate | 16.2 | 2.11 | 1.25 |
| People will not respect me | 13.7 | 2.04 | 1.21 |
| Society do not expect me to participate | 14.5 | 2.03 | 1.26 |
| Society will mock me | 14.5 | 2.02 | 1.23 |

*Scale: 1.0 = strongly agree, 2.0 = agree, 3.0 = neutral, 4.0 = disagree, 5.0 = strongly disagree*

**Discussion and Conclusions**

Leisure preferences and constraints of students and people with disabilities have been investigated in Ghana but not among residents of urban areas in the country. This study, therefore, sought to investigate the leisure choices and constraints of urban residents of Ho, Ghana. Specifically, the factors that constrain leisure participation of the respondents were explored as well as gender differences in leisure preferences. Similar to the results of previous studies (Adam et al., 2015; Yankholms & Lin, 2012; Adam, 2018; Amin, 2012), sedentary leisure activities were most preferred by residents of Ho, compared to socialising, creative arts,

and leisure-time physical activities (LTPA), confirming the proverbial over dominance of sedentary leisure pursuits among citizens of developing countries. This result seems to suggest that leisure patterns of people in developing countries have undergone limited transformation over several decades. Clearly, the results of the study indicate that the residents of Ho spend their leisure time listening to music, watching TV, and reading storybooks. A multiplicity of factors might explain leisure-time sedentary behaviour among the residents of Ho. Within the socio-ecological model (Bronfenbrenner, 1989), issues such as environmental support, parental modelling and encouragement, as well as physical and mental health could explain the excessive pursuit of leisure time sedentary activities among the studied population in the current study. The dominance of leisure-time sedentary activity has health implications for the residents of Ho. Sedentary activities have been found to be related to cardiovascular diseases (Jakes et al., 2003), type 2 diabetes (Hu et al., 2003), obesity (Banks et al., 2011), and metabolic syndrome (Chang et al., 2008). High levels of sedentary leisure behaviour are associated with poor cardiometabolic health of males and females (Pitanga et al., 2019).

Similar to the findings of some previous works (Adam, 2014; Barkley & Lepp, 2016; Delfabbro et al., 2010), the results of the study indicate gender differences in leisure choices and behaviour among the residents of Ho. Female residents are predisposed to pursuing leisure activities relating to listening to music, reading novels/storybooks, dancing, and watching television more than their male counterparts, who indicated a preference for playing football, mountaineering, and climbing, table tennis, among other activities related to LTPA. The observed gendered leisure preferences reported among the residents of Ho are not different from what has been reported among other populations across different countries. Several explanations have been put forward to explain differences in leisure preferences between males and females. Gender role socialization provides a schema within which gendered leisure choices and behaviours are explained. Femininity and masculinity have been emphasized through societal and familial socialization processes to the extent that females and males choose leisure activities that reflect their gender role-identity (Leversen, Torsheim, & Samdal, 2012). The manliness in males drives them into pursuing active leisure activities such as running and jogging, playing volleyball, mountaineering, and climbing while females undertake sedentary leisure pursuits such as watching television and reading storybooks.

**Practical implications**

The results of the study have significant practical implications for leisure interventions in urban areas in Ghana and elsewhere. Given the dominance of sedentary leisure activities among the respondents, there is a need to formulate intervention policies and strategies to address the issue of sedentarism among the residents of Ho. Public campaigns and awareness creation programmes are urgently required in order to encourage residents to improve participation in leisure-time physical activity levels. Educational publications aimed at highlighting the benefits of LTPA need to be printed and distributed to the residents of Ho in order to draw their attention to the negative consequences of low levels of leisure-time physical activity pursuits. It is equally important that people are made aware of the health consequences of over-indulgence in

sedentary leisure activities while advocating for a balance in leisure patterns. Institutional reforms are needed to bring leisure participation needs of urban residents of Ho to the forefront. There is a critical need to provide an institutional framework for leisure interventions in Ghana. Ghana's Ministry of Sport, Health and Education should collaborate to design and implement gender-sensitive interventions aimed at increasing female participation in LTPA. It is equally important that both central and local government commit funds towards the construction of recreational facilities in all the suburbs of Ho.

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# URBAN HOUSEHOLD SOLID WASTE MANAGEMENT: LIVELIHOOD IMPLICATIONS OF REUSE IN THE WA MUNICIPALITY

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**Abstract**: In the present state of population growth and urbanization, local government authorities have the daunting challenge of effective management of solid waste in the 21st century, because of its slow rate of degeneration. However, the practice and research into the area of waste management mostly focus on the provision of the necessary infrastructure, promoting access to services, and waste disposal. This study argues that solid waste contributes to the livelihoods of urban households through reuse and that some efforts in the disposal of waste are needless. We developed a model to simulate the relationship between solid waste reuse and livelihoods of households. The paper concludes that various household occupations are linked to various sources and types of solid waste that are reused, and this reduces material costs, provides employment, income, and the abilities to cater for other basic needs of urban households whose members engage in solid waste reuse as occupations. It was recommended that stakeholders should facilitate more awareness creation programs on the benefits of solid waste reuse by households, while formal sector operations should also shift away from waste collection and disposal, to waste recycling, energy recovery, and waste reuse.

**Key words**: Solid waste, urban households, waste reuse, livelihoods

## Introduction

Solid waste is any material which comes from domestic, agricultural, commercial, and industrial sources arising from human activities, and considered to have no value and so discarded by people who possess it (Bukari et al., 2017). Vergara and Tchobanoglous (2012) also consider household solid waste as discarded items that are no longer useful to households. Household acquisition and consumption of food, processing of agricultural produce, and domestic animal keeping, packaged goods, and equipment, lead to food wastes, yard waste, paper waste, metal waste, wood waste, textile waste, plastic waste, and glass wastes (Gettis et al., 2006).

Household solid waste is a problem because it does not easily degenerate, as it litters the environment by polluting air, land, and water resources. This is because it becomes smelly, unsightly, and toxic, as it finds its way into such media (Tonjes & Greene, 2013; Toxics Action Center, 2012). Diseases such as diarrhoea, dysentery, typhoid, intestinal parasites, and cholera are said to occur due to environmental pollution and poor solid and liquid waste management

(Centre for Indigenous Knowledge and Organisational Development, 2017).

Waste generation and management are becoming problematic, with the rise of towns and cities as urban areas. According to Mondal (2015), urban areas are towns and cities with concentrated and heterogeneous populations (5,000 people or more). They also serve as political and administrative centres; provide higher-order services in water, sanitation, and hygiene; education; health; banking; transportation; manufacturing industries; large markets; with diminished agricultural participation (Bukari, 2017). The associated activities meet population demands in terms of consumables. At the same time, the productive, service delivery, and consumption processes constitute the sources and types of waste identified by Getitis et al. (2006).

The greater populations and higher consumption levels of urban areas account for higher levels of solid waste generation in urban towns and constrain waste management efforts. For example, Bukari et al. (2017) report that Nadowli, the capital town of the Nadowli-Kaleo District, generates about 120m3 of waste per month, but only 40m3, representing 33.3%, is collected and disposed. Miezah et al. (2015) also ranked settlements by population sizes and their corresponding average household waste generation rates. From the highest to the lowest, they had metropolitan cities (0.72 kg/person/day), municipalities (0.40 kg/person/day), and districts (0.28 kg/person/day). These are evidences that highly populated areas generate more waste.

With the increasing pattern of urban waste generation, one daunting challenge of governments and city authorities is finding sustainable ways of meeting waste management objectives. For example, the common approaches used in Ghana for addressing Millennium Development Goal (MDG) 7, which sought to reduce the proportion of people without basic sanitation, including water (United Nations Development Programme [UNDP], 2012), and Sustainable Development Goal 6, which emphasises Clean Water and Sanitation (United Nations [UN], 2015) have been by the provision of waste collection and disposal infrastructure. However, a look at the hierarchy of waste management offers better options. According to Ewijk and Stegemann (2014), the hierarchy of waste management model was postulated by Ad Lansink in Dutch Parliament in 1979. Preferentially, the basic methods of waste management in the hierarchy include avoidance, reduction, reuse, recycling, energy recovery, and disposal of waste (Zeng et al., 2010). We find some aspects of the hierarchy to be beneficial to households to venture into alternative uses of solid waste, such as livelihood activities involving waste reuse, recycling, and energy recovery. Examples are the reuse of durable plastic and glass bottles for packaging of local beverages and vegetable oils for sale, recycling of scrap metal for moulding iron pots, and use of domestic livestock droppings as farm manure. This conception also draws on the relevance of the livelihood framework, which is about how households earn a living by developing strategies involving the use of assets (in this particular case, solid waste) with their capabilities for a range of activities for their livelihoods (United Nations Development Programme, 2017).

A lot of the research works on waste management have not departed from the general perception that waste is a pollutant, unwanted, and so should be managed by getting rid of it through safe disposal at landfills sites, burying, incineration, and

deep-sea dumping. Examples of such studies were done by Ali et al. (2016), Bukari et al. (2017), Chang and Davila (2008), and Chukwudi and Oluwafemi (2014). On the opposite side of the coin, other writers such as Adu and Lohmueller (2012), Baum Post and Furedy (2004), are of the view that waste could be reused through recycling. The research niche is that all these studies have not identified the specific aspects of household livelihoods dependent on identified types of solid waste and the associated impacts on household livelihoods. In other words, very little effort has been made in research to examine solid waste reuse as a household occupation and its effects on livelihoods.

The population of Wa Municipal, according to the 2010 Population and Housing Census, is 107,214. This represents 15.3% of the population of the Upper West Region (Ghana Statistical Service [GSS], 2014). As an urban area, the Wa Township alone generates about 1820 tonnes of solid waste per month. Given that the poverty incidence is equally highest in the Upper West Region, where 70.9% of the population is considered poor (GSS, 2018), how could vulnerability to poverty and the consequent lack of financial capital for business be a driving force for solid waste reuse? How do the sources and types of solid as livelihood assets inform household livelihood strategies? What specific household occupations dependent on solid waste reuse emerge from the strategies? How does the nature of such occupations based on solid waste reuse contribute to sustainable waste management? And how do all the above contribute to the livelihood outcomes of households dependent on solid waste reuse? Such are the questions generated from the gaps in theory and empirical literature. This study adopted the Wa Municipality as a case study in the examination of how reuse of solid waste contributes to effective waste management and also improves household livelihood. The specific objectives derived from the identified gaps are the following:

1. To ascertain the state of household solid waste generation
2. To identify the household occupations dependent on reuse of solid waste
3. To assess the effects of solid waste reuse on household livelihoods.

To address these objectives, the paper began with an introduction, in which the historical perspectives, key concepts, theoretical and empirical backgrounds were expressed. Separate sections were then created for literature on concepts and theories and methodology.

**Theoretical and Conceptual Foundations**

This section focuses on the theoretical and conceptual underpinnings of this study. It presents a conceptual framework anchored on the livelihood sustainability framework and the hierarchy of waste management as the theoretical lenses. According to the United Nations Development Programme (UNDP, 2017), the livelihoods framework explains how strategies involving the use of skills and assets by individuals and communities could support their survival, and is often expressed graphically (see also Department for International Development [DFID], 1999). Sustainability here implies the abilities of individuals and communities to develop skills and assets to overcome livelihood challenges without the exploitation of their natural resources but continue to meet their needs even in the future. On the other hand, the hierarchy of waste management model

prioritises waste management methods hierarchically, from the most effective to the least effective, thus waste avoidance, reduction, reuse, recycle, energy recovery from waste, and waste disposal (Ewijk & Stegemann, 2014). To establish integration between the livelihoods sustainability framework and the hierarchy of waste management, in order to describe how the reuse of solid waste by households contributes to their livelihoods, we developed Figure 1 as a modified framework for the two theoretical basis of this study.

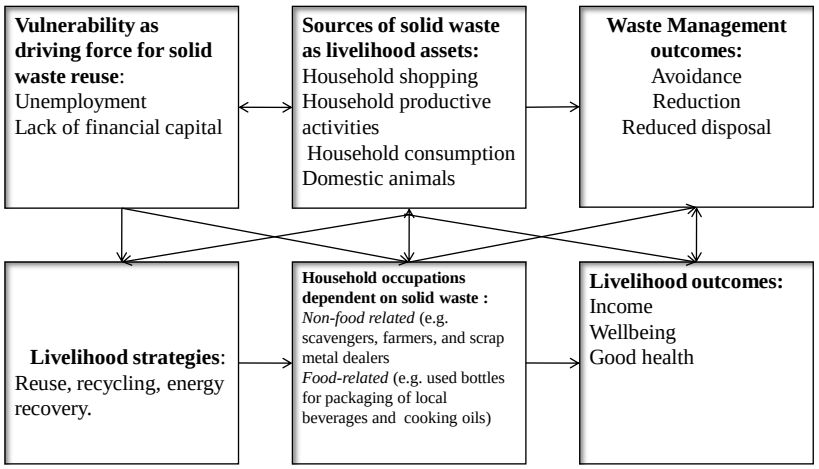


*Figure 1.* Conceptual Framework on Household Livelihood Implications of Solid Waste Reuse

Based on Sustainable Livelihoods Framework and Hierarchy of Waste Management (Ewijk & Stegemann, 2014; Majale, 2001)

Figure 1 illustrates that unemployment and lack of financial capital are aspects of vulnerability to poverty, which drive affected households to reuse of solid waste as alternative assets without the exploitation of natural resources for investments in various occupations (UNDP, 2017). Because of the availability of various sources of solid waste, households develop strategies on what occupations or livelihood activities that could take advantage of such wastes. In Figure 1, the second box at the top row shows the sources of household solid waste. Detailed inquiries into the sources, types, and prevalence of such wastes provided data for addressing Research Objective 1, which was about the state of household solid waste generation. On the other hand, the second box at the bottom row shows the classification of occupations that household solid waste could be used for. Data on this aspect also helped to address Research Objective 2.

Unlike the hierarchy of waste management in which all the methods of waste management are arranged in order of preference (Ewijk & Stegemann, 2014), in Figure 1, reuse, recycling, and energy recovery have been treated as strategies by households in the first box of the second row as a feature of the sustainable livelihood framework (DFID, 1999). Such strategies and the associated occupations contribute to the

other aspects of waste management in the hierarchy, indicated in the third box of the top row of Figure 1. These are waste avoidance, reduction, and disposal. Here again, waste disposal changed to "reduced waste disposal" because the reuse of solid waste reduces the quantity and frequency of waste disposal (Ogunmakinde et al., 2019).

Apart from the positive effects of waste reuse on waste management, the third box to the extreme right of the bottom row of Figure 1 shows that it also contributes to household livelihoods, as the basis of Research Objective 3. As households strategise to reuse waste for various occupations, it saves them of investment capital, as the waste becomes assets, provides income as they engage in various trades, and prevents diseases that could have occurred as a result of poor sanitation due to poor waste management. For instance, Bukari et al. (2017) identified malaria, cholera, typhoid fever, diarrhoea, and tetanus as being related to poor sanitation and cause poor households to spend their limited financial resources on treatment of such diseases. The situation does not only reduce the capital accumulation but also disrupts productive activities due to sickness absenteeism (Aronsson & Gustafsson, 2005).

From the theoretical underpinning, we hypothesise that household occupations dependent on solid waste reuse (L) for better livelihood is a function of low-income status or vulnerability (V), availability of reusable household solid waste (S), and to avoid and reduce household waste (R). From these variables, we developed a function for L as below:

$$L=f(V, S, R) \quad \text{eq.1}$$

This function was used to develop a model for hypothesis testing in the methodology section.

**Methodology**

The study adopted a mixed research design involving qualitative and quantitative approaches. Quantitative data were collected using a structured household interview guide with close-ended questions. Questions were framed under themes related to the research objectives of this study. Table 1 shows the specific settlement areas that were selected for the study.

**Table 1: Distribution of Sample Size by Study Communities**

| Community | Number of houses | Sample size |
|---|---|---|
| Kompala | 24 | 19 |
| Dondoli | 36 | 29 |
| Kpaguri | 40 | 32 |
| Total | 100 | 80 |

Source: Bukari, Annan-Prah, Abdul (2019)

The settlement areas under Wa Municipality were selected purposively. Initially, there was a community walk in the most populous settlement areas of Wa Township, to identify areas where household occupations related to solid waste reuse were prevalent. Dondoli and Kpaguri were prioritised as urbanised settlements with the desired characteristics. On the other hand, Kompala is rural and was added for comparison, since the Wa Municipality also has rural areas including Kompala.

The community walk further enabled the researchers to identify specific locations within the selected study communities for the study, based on the desired phenomenon stated earlier. Such locations constituted the cross-sections. Houses, workshops, and shops/kiosks that had solid waste reuse related occupations or trading activities were enumerated to give the number of houses per cross-section per community in the second column of Table 1. The total number of houses counted for the selected cross-sections amounted to 100, which represented the sample frame. Yamane's (1967) formula was used to calculate the sample size, stated as: Sample size (n) = $\frac{N}{1+N(e)^2}$.

where N = the population (100) and $e^2$ = margin of error (5% or 0.05). The computation gave us a sample size (n) of 80. To obtain the number of respondents per community, the sample frame for that community was divided by 100 (total sample frame) and multiplied by the sample size. This gave the results in the "sample size" column of Table 1.

The sample units were members of the households engaged in solid waste-related occupations. Participants who were seen at work in such occupations were selected purposively to answer questions on the instrument. If researchers had to enter into a house, we asked for a member of any household who was 15 years or above, engaged in the occupations of interest. Once a respondent was selected, other members of his/her household could participate in the responses. Observation was also done using an observation guide, sometimes with an informal conversation with persons engaged in the solid waste reuse activity being observed. Responses on completed interview guides were coded and entered into the Statistical Package for Social Sciences (SPSS) version 20. The data was then analysed quantitatively, using frequency distribution tables and graphs. Chi-Square test was also done to test the hypotheses of the study. The model developed for the Chi-Square is presented below.

**Model specification**

We used 2 x 2 Chi-Square tables for the models derived from eq.1. The Chi-Square formulas for testing the relationships between household livelihood and solid waste reuse based on the dependent variables V, S, E, and R use the frequencies of the responses. Thus, we began with a typical question such as "Does the reuse of solid waste in your occupation improve your livelihood?" This was assigned two response values: No and Yes, with frequencies $L_1$ and $L_2$ respectively. This was used as the dependent variable. We asked similar questions for the independent variables V, S, R, and cross-tabulated with the dependent variable L. Thus, we enquired whether a respondent's solid waste-related occupation due to low-income (V, with frequencies $V_1$ for 'No' and $V_2$ for 'Yes') affects his/her livelihood; whether a respondent's solid waste-related occupation due to availability of solid waste as an asset (S, with frequencies $S_1$ and $S_2$ for 'No' and 'Yes' respectively) affects his/her livelihood; whether a respondent's use of solid waste for the purpose of reducing waste (R, with frequencies $R_1$ and $R_2$ for 'No' and 'Yes' respectively) affects his/her livelihood.

Because 2 x 2 Chi-Square ($\chi 2$) tables were used, the Yate's Continuity Correction was introduced into the Chi-Square equations to offset overstatement. This was by subtracting 0.5 of the number of units studied or sample size 'N' (i.e. 0.5N) from delta ($\Delta$). We, therefore, expressed the relationship

between L and the frequencies of each of the dependent variables as below:

When L = $f$ (V),

$$\Rightarrow \chi^2 = \frac{N(|L_1V_2 - L_2V_1| - 0.5N)^2}{(L_1 + V)(L_2 + V_2)(L_1 + L_2)(V_1 + V_2)} = \frac{N(|\Delta^2| - 0.5N)}{N_1N_2N_LN_V}$$

where $\Delta = L_1V_2 - L_2V_1$; $N = L_1 + L_2 + V_1 + V_2$; $N_1 = L_1 + V_1$, $N_2 = L_2 + V_2$, $N_L = L_1 + L_2$, and $N_V = V_1 + V_2$.

When L = $f$ (S),

$$\Rightarrow \chi^2 = \frac{N(|L_1S_2 - L_2S_1| - 0.5N)^2}{(L_1 + S_1)(L_2 + S_2)(L_1 + L_2)(S_1 + S_2)} = \frac{N(|\Delta^2| - 0.5N)}{N_1N_2N_LN_S}$$

Where $\Delta = L_1S_2 - L_2S_1$, $N = L_1 + L_2 + S_1 + S_2$, $N_1 = L_1 + S_1$, $N_2 = L_2 + S_2$, $N_L = L_1 + L_2$, and $N_S = S_1 + S_2$.

When L = $f$ (R),

$$\Rightarrow \chi^2 = \frac{N(|L_1R_2 - L_2R_1| - 0.5N)^2}{(L_1 + R_1)(L_2 + R_2)(L_1 + L_2)(R_1 + R_2)} = \frac{N(|\Delta^2| - 0.5N)}{N_1N_2N_LN_R}$$

Where $\Delta = L_1R_2 - L_2R_1$, $N = L_1 + L_2 + R_1 + R_2$, $N_1 = L_1 + R_1$, $N_2 = L_2 + R_2$, $N_L = L_1 + L_2$, and $N_R = R_1 + R_2$.

Chi-Square model developed above is based on Spiegel and Stephens's (2008) formula.

The results were then tabulated as test results for the following null hypotheses:

$H0_1$: There is no significant difference between solid waste reuse due to vulnerability to low-income and household engagement in solid waste-related occupations for improvement in household livelihoods among respondents;

$H0_2$ There is no significant difference between solid waste reuse due to availability of solid waste as an asset and household engagement in solid waste-related occupations for improvement in household livelihoods among respondents; and

$H0_3$: There is no significant difference between solid waste reuse for waste reduction and household engagement in solid waste-related occupations for improvement in household livelihoods among respondents.

For the qualitative approach, observation guide was used to observe household occupational activities involving solid waste reuse. Photographs were taken with permission to serve as evidences, and informal conversations were sometimes used to clarify issues. Questionnaires were also administered to waste management institutions such as Zoomlion Ghana Ltd. on the contribution of household solid waste reuse to effective and sustainable waste management. The Environmental Health Department also responded to a questionnaire on the positive and negative sanitation and health effects of solid waste reuse. The responses from qualitative data sources were presented by narrations and direct quotations. Numerical data were also collected from the instructional respondents, such as the quantity of waste generated by households per month and waste collection bills.

The strength of the mixed research method used was that it encouraged triangulation of findings by comparing responses of households to those of experts in the field. It also enabled us to find answers to

questions that could not be answered by either the household respondents or institutional respondents. However, combining quantitative and qualitative approached was expensive and required more advanced analytical abilities to be able to apply both approaches concurrently in the analysis. Response errors and question format biases were also adequately controlled by making questions simple, self-explanatory, and unambiguous. Questions that could lead respondents to the answers of interest to researchers were also avoided.

**Data Presentation and Analysis**

Here, we progressed to address the thematic issues based on the research objectives and also tested the hypotheses. Focal issues include the background characteristics of respondents, the state of household solid waste generation, household occupations dependent on reuse of solid waste, and the effects of solid waste reuse on household livelihoods.

**Background characteristics of respondents**

Table 2 is a summary of the relevant background of the household respondents. It shows, among others, that 74% of the household respondents earned below the national monthly average per capita income of about GH¢461 (based on the annual per capita income of GH¢5, 540). Comparing the occupational status of the households studied to the Ghana Statistical Service (2018) living standards report (GLSS7) that 70.9% of the population of the Upper West Region is considered poor, the finding is not far from being accurate. Table 2 further shows that, although the study targeted solid waste users, 68% of them depended entirely on it as a major occupation for livelihood.

**Table 2: Characteristics of Respondents**

| Characteristic | Frequency | Percent |
|---|---|---|
| *Location* | | |
| Kompala | 17 | 21 |
| Dondoli | 29 | 36 |
| Kpaguri | 34 | 43 |
| Total | 80 | 100.0 |
| *Sex* | | |
| Male | 30 | 37.5 |
| Female | 50 | 62.5 |
| Total | 80 | 100.0 |
| *Age Group* | | |
| 15-60 | 72 | 90 |
| 61+ | 8 | 10 |
| Total | 80 | 100.0 |
| *Literacy Status* | | |
| Literate | 50 | 63 |
| Illiterate | 30 | 37 |
| Total | 80 | 100.0 |

| | | |
|---|---|---|
| *Household Sizes* | | |
| 1-3 | 16 | 20 |
| 4-6 | 59 | 74 |
| 7+ | 5 | 6 |
| Total | 80 | 100.0 |
| *Monthly Income* | | |
| GH¢460 or less | 59 | 74 |
| GH¢461 or more | 21 | 26 |
| Total | 80 | 100 |
| *Major Occupation* | | |
| Farming | 13 | 16 |
| Non-farm | 13 | 16 |
| Solid waste-related | 54 | 68 |
| Total | 80 | 100 |
| Total | 80 | 100.0 |

Source: Source: Bukari, Annan-Prah, Abdul (2019)

The finding also supports the aspect of the conceptual framework in Figure 1 (first box on the top row at extreme left) that low-income, expressed as lack of financial capital, is a condition of vulnerability, which could lead to alternative strategies involving the reuse of solid waste for livelihood-related occupations. Thus, solid waste is seen as an asset, and this corroborates the exposition of Majale (2001) and UNDP (2017) in the livelihoods sustainability framework.

**State of solid waste generation**

This section addresses the first research objective on the state of household solid waste generation. It was informed by the second box on the top row of the conceptual framework in Figure 1, which is about the sources of household solid waste. Table 3 indicates that the most dominant source of household solid waste identified by respondents was household consumption, with 76.3% response rate, followed by

**Table 3: Sources of solid waste in the communities**

| Sources | Frequency | Percent |
|---|---|---|
| Household consumption | 61 | 76.2 |
| Household shopping | 6 | 7.5 |
| Household productive activities | 2 | 2.5 |
| Domestic animals | 11 | 13.8 |
| Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

domestic animal droppings (13.8%). Others were household shopping and household productive activities. Household consumption here refers to the acts of using

up acquired resources for enjoyment and survival (Guo, 2009). As households earn income, it is spent on food, leading to food waste; communication, leading to discarded credit unit scratch cards; educational materials such as books, leading to paper waste; cooking utensils, furniture, and electronic appliances, leading to metal, wood, plastic, and electronic wastes among others. It was also found that some livestock such as poultry, goats, and sheep are reared under semi-intensive system, in which the animals dwell in the compounds of the households at night and move in and out of the compounds in the day. In the process, they litter the compounds and surroundings with their droppings which dry into solid waste. Household shopping entails buying of consumables from the market, which are often packaged in tins, polythene bags, or sachets, paper or plastic boxes, which end up in the homes of households as waste, once their contents are used up. Some households were also observed to carry out productive activities such as removal of harvested maize husks, plucking harvested groundnuts, undertaking carpentry works, and food vending in front of the houses. These lead to agricultural wastes, sawdust, and waste foods and packaging materials in the home environments.

The various sources of household solid waste lead to the types of waste. Table 4 reveals that the commonest type was plastic waste, with a 40% response rate. In line with this, Akurugu et al. (2018), in their study of a section of the Wa Municipality, also found that plastic waste prevailed over other types of waste by 82%. The authors elaborated that polythene waste is prevalent because the products are affordable, portable, have multiple uses, and are easily blown away by the wind. Food, paper, animal, and textile wastes, in order of magnitude, were other types of waste identified by the respondents. Officials of Zoomlion Gh. Ltd. in an interview in the Wa Municipality, also disclosed that the major types of solid waste generated in the municipality during this study include plastic, paper, glass, textiles, electronic waste, inorganic (ashes, debris from collapsed buildings and constructions), and organic waste (food waste, kitchen waste, agric waste).

**Table 4: Types of solid waste**

| Types | Frequency | Percent |
|---|---|---|
| Food waste | 28 | 35.0 |
| Paper | 11 | 13.8 |
| Textile waste | 1 | 1.3 |
| Plastic waste | 32 | 40.0 |
| Animal droppings | 8 | 10.0 |
| Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

Respondents considered solid waste to be a sanitation problem by expressing their knowledge of the distinguishing characteristics of the waste, as presented in Table 5. The data in Table 5 shows that respondents were concerned that solid waste causes bad smell, with a response rate of 41.2%. Another 22.5% expressed concern that solid waste affects the aesthetic beauty of the environment because it makes their environments unsightly, while 13.8% said it occupies space. In an informal conversation

with an 18-year-old female household respondent on her interpretation of solid waste "occupying space," she commented:

> Look at the old bicycles, motorbikes, and their parts over there (pointing to a corner of the compound and continued). Ever since I was a child they were there. I don't see these types of motorbikes around in town now. So I believe their spare parts are not available, and I don't know why they still keep them there. That place could have been converted into a kitchen. As you moved around, I know you saw several solid waste dump sites. People want land to build, and when they see the hips of rubbish, I am not sure they would want the land.

**Table 5: Distinguished Characteristics of Solid Waste**

| Characteristic | Frequency | Percentage |
|---|---|---|
| Do not degenerate easily | 2 | 2.5 |
| Can negatively affect the beauty of the environment | 18 | 22.5 |
| Can cause bad smell | 33 | 41.2 |
| Can attract rodents and snakes | 1 | 1.2 |
| Can cause diseases | 7 | 8.8 |
| Occupy space | 11 | 13.8 |
| Pollute the environment | 8 | 10.0 |
| Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

Respondents also said that solid waste pollutes the environment, causes disease and attracts rodents and snakes. Interview with Zoomlion Gh. Ltd. officials also indicated that solid wastes are distinguished by their physical composition, moisture content, and high calorific value. The above characteristics are similar to those identified by Gettis et al. (2006). The association of solid waste with the disease by the respondents also supports the other response that it is a pollutant, and several authors had similar results. For instance, Bukari et al. (2017) asserted that poor sanitation through indiscriminate disposal of solid waste is the cause of some diseases, as presented in Table 6. The data in Table 6 establish the relationship between dirty environment due to poor solid waste management, and the contamination of food and water sources through the breeding of disease-causing organism.

**Table 6: Diseases Related to Poor Sanitation**

| Disease | Causal organism | Associated poor sanitary condition |
|---|---|---|
| Cholera | *vibrio cholera* | Contaminated food and water due to dirty environment |
| Diarrhoea | Cryptosporidium bacterium | Contaminated food and water due to dirty environment |
| Typhoid fever | *Salmonella typhi* bacterium | Contaminated food and water due to dirty environment |
| Malaria | *Plasmodium* through female anopheles mosquito bite | Landfills, dump sites and stagnant water |
| Tetanus | *Clostridium tetani* bacterium | Street dirt and scrap rusty metals |

Source: Bukari *et al*. (2017, p. 203)

Despite the problems associated with solid wastes, their existence is a potential asset for households that could venture into occupations related to waste reuse, as contended by the livelihoods sustainability framework (UNDP, 2017). This leads us to a further inquiry into how solid waste is useful to household occupations and livelihoods in the Wa Municipality.

**Household occupations dependent on reuse of solid waste**

This section addresses the second research objective of the study. It is also informed by the second top row of the conceptual framework in Figure 1, which elaborates the alternative uses of household solid waste. The focus is on major livelihood activities and the types of solid waste they depend on, through reuse. Table 7 presents findings on household occupations based on food products that depend on solid waste reuse in the study communities. Local oil sellers take the largest percentage of 28.8%, followed by bissap (sobolo)/ice kenkey sellers, with 20%, and also kenkey sellers (20%). Tables 8 and 9 also present the types

**Table 7: Occupations Dependent on Solid Waste Reuse**

| Occupations | Frequency | Percent |
|---|---|---|
| Bissap (sobolo)/ice kenkey makers | 16 | 20.0 |
| Local oil sellers | 23 | 28.8 |
| Scrap metal plastic buyers | 3 | 3.8 |
| Scavengers | 2 | 2.5 |
| Kenkey sellers | 16 | 20.0 |
| Mechanics | 7 | 8.8 |
| Farmers | 4 | 5.0 |
| Roasted yam/roasted plantain sellers | 4 | 5.0 |
| Smoked fish sellers | 5 | 6.3 |
| Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

of solid wastes which food-related products and occupations depend on as raw materials or for packaging. Table 8 reveals that products such as bissap, locally known as sobolo (a local non-alcoholic drink made of ginger juice, sugar, and bouye), ice kenkey (mashed and refrigerated kenkey drink), and local cooking oils such as palm and groundnut oils make use of used plastic bottles and gallons as packaging materials. On the other hand, non-liquid food products such as roasted yam, plantain, and smoked fish or meat make use of waste paper from books and newspapers as packaging materials. In an informal conversation with a missap seller, she responded to a question on the used plastic bottles for her business by stating this:

> I usually move round to register with kiosk operators and drinking bars where customers sit to drink plastic bottled soft drinks such as '5 Star', fanta and coca-cola. Then I leave a container there for them to sort the bottles and store. Each day I go to empty the containers, return home to wash them neatly with soap and water for reuse in the bottling of sobolo. Sometimes I sell surplus bottles to other acquaintances who sell sobolo, fura, engine oil and petrol. The use of the plastic bottles helps a lot. If you can move around to gather them you don't spend to have some for your business. So with some little money, you can start a business. If you are lucky, some of your customers will give the bottles back to you after drinking the sobolo. So you can use them over and over again instead of throwing them away to make the surrounding filthy.

**Table 8: Food Products/Occupations and Type of Solid Waste Reused**

| Product/occupation | Solid waste used | Frequency | Percent |
|---|---|---|---|
| Bissap (Sobolo)/ice kenkey | Waste plastic bottles | 80 | 100 |
| | Total | 80 | 100 |
| Local oils (palm and groundnuts) | Used plastic gallons | 43 | 53.8 |
| | Used plastic bottles | 37 | 46.2 |
| | Total | 80 | 100.0 |
| Kenkey sellers | Maize husks found in the houses of farmers | 74 | 92.5 |
| | Ash for galvanizing cooking pots | 6 | 7.5 |
| | Total | 80 | 100.0 |
| Roasted yam./ plantain/ smoked fish/smoked meat | Damaged books | 23 | 28.8 |
| | Old newspapers | 55 | 68.8 |
| | Others | 2 | 2.4 |
| | Total | 80 | 100 |

Source: Bukari, Annan-Prah, Abdul (2019)

Kenkey, also indicated in Table 8 above, is a typical Ghanaian staple dish made of fermented corn and usually shelled with maize husks before boiling. Responding to

the same question answered by the bissap seller, a kenkey seller's position was very similar. She said this:

> When my husband harvests maize and brings them home, after removing the husks I select some and store in sacks, which I use for my business throughout the year. Kenkey sellers who do not cultivate maize have to go to the houses or farms after harvest to get the husks or buy from the market. I also use firewood, which generates a lot of ash. Before putting the kenkey on fire, I use water to mix with the previous day's ashes to form a semi-liquid. This is used to smear around the iron pots to coat them from direct smoke, to make washing easier and keep them shining. When we do this, we save the husks from being thrown around or burnt to produce a lot of smoke to disturb neighbours. We also control the volume of ash to be disposed of. Once washed from the pots, you don't see the ash as waste again because we wash it directly onto the soil as wastewater and does not gather.

The response above shows how awareness of the availability of solid waste leads to their adoption as assets. It also shows that such strategies are made by people who are mostly financially vulnerable in terms of investment capital acquisition. These findings are also consistent with interview results with the Environmental Health and Sanitation Department officials, that some petty trading activities involve the sorting of bottles and other solid materials to be reused in various ways e.g., bottling of bissap or sobolo and locally made liquid washing soap.

Table 9 also shows other non-food occupations and the type of waste materials reused. It shows that blacksmiths, mechanics, metal works men, and farmers depend on metallic and organic waste materials for their occupations. Blacksmiths use scrap metals from the various sources specified in the "solid waste used" column. Common products observed include hoe blades, animal traction equipment, local buckets, and metal saving boxes. Closely related to blacksmithing are the activities of aluminium pot moulders. These meltdown to recycle waste aluminium products such as mineral drink cans, aluminium basins, source pans, scrap aluminium roofing sheets. Table 9 further shows that mechanics find alternative uses of damaged products such as refrigerators for the storage of tools, while metal works men engaging in welding broken metal parts of buildings, such as metal gates as well as broken vehicle and other machine parts for reuse. They also cut off rusting components of metal parts of buildings and vehicles and rejoin with fresh metal components to enhance and continue their usefulness. The scrap metal resulting from their activities are gathered and sold to scrap metal dealers for recycling.

Table 9 illustrates further that farming is another occupation dependent on solid waste reuse. It shows that 76.25% of respondents said that animal droppings from their compounds are used as farmyard manure. These are often used in combination with crop residue and ashes from household kitchens. The use of such materials for compost making and application on cultivated lands is known as energy recovery, which is a component of the hierarchy of waste management. Apart from the non-food occupations listed in Table 9, retail sale of engine oil and petrol was also observed to be

dependent on used plastic bottles and gallons. For example, Figure 2 shows a small-scale female retailer in the fuel business. When asked how useful the used plastic drink bottles were to her business in an informal conversation, she said this:

> I cannot afford to build a fuel station with huge underground tanks and dispensers. But with these bottles, I just move around and gather them free of charge. I find it very easy and feel like a fuel station owner because the price of the fuel in a bottle is the same as the price of the drink if bought new from a drinking spot or shop.

**Table 9: Non-food Products and Occupations and the Type of Solid Waste Reused**

| Product/occupation | Solid waste used | Frequency | Percent |
|---|---|---|---|
| Blacksmith | Scrap metals from damaged vehicles for hoe blade, buckets, saving boxes, local knives, etc. | 5 | 6.3 |
| | | 74 | 92.5 |
| | Scrap metal from household utensils for local, by maintaining damaged ones for reuse | | |
| | Scrap metal from damaged home appliances, by maintaining damaged ones for reuse | 1 | 1.3 |
| | Total | 80 | 100.0 |
| Mechanics | Damaged refrigerators as tool boxes | 51 | 63.8 |
| | Abandoned vehicle parts as support systems | 11 | 13.8 |
| | Abandoned roofing sheets for construction of workshops | 18 | 22.5 |
| | | 80 | 100.0 |
| Metalworks men | Scrap vehicle metal parts | 79 | 98.8 |
| | Damage metal products of the metalwork industry | 1 | 1.3 |
| | Total | 80 | 100.0 |
| Farmers | Waste of harvested crops as organic manure | 18 | 22.5 |

| | | | |
|---|---|---|---|
| | Domestic animal droppings as organic manure | 61 | 76.25 |
| | Ash for composting | 1 | 1.25 |
| | Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

To illustrate the fuel retailer's comparison of her business to fuel station standards, she explained that the plastic bottles are 0.5L bottles. If one buys the real drink of the particular brands of the bottles being used (e.g. 5 Star), it costs about GH¢2 in the retail market (as of September 2019). Therefore, she sells her fuel at that same price but with slightly reduced quantity

**Figure 2: Used plastic soft drink bottles for retail sale of petrol in Wa**
Source: Bukari, Annan-Prah, Abdul (2019)

Each of the respondents above, in response to further questions on sanitation management, agreed that, without their activities, the waste materials they reuse would have been left littering the environment or ending up in the landfill or dumpsites. These are all confirming the applications of the livelihood sustainability framework and the reuse and waste reduction aspects of the hierarchy of waste

management, which are expressed in the conceptual framework of this study (Figure 1). However, waste disposal has been deemphasised and is seemingly needless.

**Effects of solid waste reuse on household livelihoods**

This part of the paper addresses the third research objective, which is about the effects of solid waste reuse on household livelihoods. It shows the transition from livelihood strategies, through household livelihood occupations dependent on solid waste reuse, to livelihood outcomes, as illustrated by the last row of boxes in the conceptual framework in Figure 1. Under the appropriate theme, respondents were first asked whether the reuse of solid waste was useful to the livelihoods of their households. The results indicated that 82.5% answered "Yes" while the remaining 17.5% said "No." This was followed by another question on the implications of solid waste reuse on their household livelihoods. The responses are presented in Table 10. It shows that income generation was ranked highest as the implication of solid waste reuse on household livelihoods, with a 64% response rate, followed by provision of employment opportunities, with 36%. These responses are evidenced by the data in Tables 8 and 9, which show the food and non-food occupations based on identified types of solid waste.

**Table 10: Implications of Solid Waste Reuse on Household Livelihoods**

| Implication | Frequency | Percent |
|---|---|---|
| Creates employment | 29 | 36 |
| Generates income | 51 | 64 |
| Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

During an informal conversation with an iron pot moulder, he responded to the question of how solid reuse in his business affects his household livelihood by saying this:

> When I completed junior high school in 2011, I couldn't continue schooling again because of no money. So I decided to learn iron pot moulding from my uncle. Today I am now a master on my own with trainees under me and I don't feel jobless. If the market is good, I make up to GHc100 a day. From my income, I have been able to provide my wife with capital for cooking and selling rice and beans. I have two children now and they are all schooling. I am also able to pay the school fees and other needs of my younger brother in the university.

Figure 3 shows a picture of waste assorted soft drink cans and damaged head pans made of aluminium, being recycled by melting them on fire, to be used for aluminium pot moulding by one of the trainees of the aluminium pot moulder. Also in the picture is a collection of some of the new aluminium pots produced and ready for sale.

Figure 3. Aluminium pots produced by recycling of aluminium waste materials in Wa
Source: Bukari, Annan-Prah, Abdul (2019)

Interview with the Environmental Health and Sanitation Department officer in Wa also indicated that, apart from promoting good sanitation management, solid waste reuse helps people to also save because it reduces the cost of investment in the small-scale businesses in terms of input acquisition. These responses are similar to the findings of Njoroge, Wokabi et al. (2013) that urban waste collectors in the Nakuru of Kenya can turn waste into wealth by generating income from it.

Further inquiries into the implications of solid waste reuse on household livelihoods generated the data in Table 11, which is about other benefits of household solid waste reuse. Table 11 shows that the highest-ranking benefit of solid waste reuse identified by respondents with 58.8% response rate was improved household sanitation, which tends to minimise waste-related diseases. Other benefits include a reduction in household waste and cost of household waste management, by reducing the need for waste collection services that attract bills. Some respondents also identified that solid waste reuse reduces the risk of household exposure to poor sanitation-related diseases, such as those listed earlier in Table 6.

It is acknowledged that solid waste reuse is not without negative health and other environmental effects. As a result, the interview with the Environmental Health official was extended into inquiries on the risks of solid waste reuse. The results are shown in Table 12. It shows both the sanitation effects and risks of waste reuse, as well as suggested ways of ensuring safe reuse of solid waste.

**Table 11: Other Benefits of Household Solid Waste Reuse**

| Benefits | Frequency | Percent |
|---|---|---|
| Household waste reduction | 28 | 35.0 |
| Reduction in the cost of household waste management | 1 | 1.2 |
| Improves household sanitation | 47 | 58.8 |
| Reduces household disease risk | 4 | 5.0 |
| Total | 80 | 100.0 |

Source: Bukari, Annan-Prah, Abdul (2019)

**Table 12: Other Effects of Solid Waste Reuse on Households**

| Type of solid waste | Sanitation effect of reuse | Risk from reuse | Suggested remedy for safe solid waste reuse |
|---|---|---|---|
| Plastic/polythene | To reduce the amount of plastic waste generated. | Risk of contamination | Should be washed thoroughly before reuse |
| Metal | To reduce metal waste in the environment | Risk of contracting tetanus | Only metals that are safe to handle should be reused |
| Agricultural | Agric waste are usually good for recycling into compost | Breeding of pest and vectors | Composting should be the way forward other than reuse |
| Textile | To reduce textile waste finding its way to the soil | Transmission of diseases | Textiles should be washed and disinfected before reuse |
| Paper | To reduce forest degradation | There is no much risk in paper reuse | The way forward is to recycle back into paper |
| Glass | Avoid glass mixing with soil | Risk of contamination | Should be thoroughly washed before reuse |

Source: Interview with the Environmental Health Department, Wa (2019)

The findings above show that some households use solid waste in various occupations for their livelihoods. However, for objective measurement of the relationships between solid waste reuse and the various theoretical provisions, we revisit the hypotheses to present the test results. Table 13 satisfies this purpose. It shows hypotheses 1 to 3 and the associated functions used for the models developed in the methodology section, as well as the Chi-Square test results. The results show that there were significant relationships between the reuse of solid waste for improvement in

household livelihood and the reuse of solid waste based on vulnerability to low-income, availability of solid waste, and the intention to reduce the amount of household solid waste.

**Table 13: Chi-Square Test Results on Effects of Solid Waste Reuse on Livelihoods**

| Hypotheses | Function | $\chi 2$ | Degree of freedom | Asymptotic significance | Remarks |
|---|---|---|---|---|---|
| **$H0_1$**: There is no significant difference between engagement in solid waste-related occupations for improvement in household livelihoods among respondents and solid waste reuse due to vulnerability to low-income by household; | L = *f* (V), | 5.620 | 1 | 0.018 | There were significant differences in responses. Null hypothesis is rejected. |
| **$H0_2$**: There is no significant difference between engagement in solid waste-related occupations for improvement in household livelihoods among respondents and solid waste reuse | L = *f* (S) | 4.399 | 1 | 0.036 | There were significant differences in responses. Null hypothesis is rejected |

| | | | | | |
|---|---|---|---|---|---|
| due to the availability of solid waste as an asset by household | | | | | |
| **$H0_3$**: There is no significant difference between engagement in solid waste-related occupations for improvement in household livelihoods among respondents and solid waste reuse for waste reduction by household | L = *f* (R) | 4.788 | 1 | 0.029 | There were significant differences in responses. Null hypothesis is rejected. |

Source: Bukari, Annan-Prah, Abdul (2019)

Put differently, an asymptotic significance of 0.018 in a Chi-Square test for hypothesis $H0_1$ means that the willingness of households to reuse solid waste for occupations that improve their livelihoods is related to their willingness to reuse solid waste in their occupations because they are financially vulnerable (the probability that they would not be the same is only 0.018 or 1.8%). In other words, the p values (asymp. Sig.) in the fifth column of Table 13 are all significant (less than 0.05). Furthermore, the significance and Chi-Square values ($\chi 2$ in column 3 of Table 13) show that the relationship is strongest for the function on financial vulnerability, i.e. L = *f* (V), followed by the need for household waste reduction, i.e. L = *f* (R), and then the availability of solid waste as an asset, i.e. L = *f* (S). The acceptable significance levels imply that any policy to control waste management or improve livelihoods through the reuse of solid waste would have either less than 5% chances of failure or more than 95% chances of success in the communities studied.

**Conclusions**

From the conceptual and theoretical perspectives, the findings showed that vulnerability to financial capital for investment, due to evidences of the low-income status of the studied households, was a driving force for re-using solid waste. Respondents being aware of the availability

of solid waste makes strategies to reuse them for various occupational activities based on the types of solid wastes available to them. The specific types of solid waste identified for various uses included plastic, metal, paper, animal droppings, ash, and agricultural wastes (maize husks). The occupations dependent on solid wastes were classified under food (e.g. bissap and kenkey production for sale) and non-food (e.g. aluminium pot moulding and fuel retail business) occupations.

The reuse of waste in the various occupations took the forms of direct reuse, recycling, and energy recovery and so constituted a method of household waste management. The combined effects of waste reuse and waste reduction were found to be an improvement in household livelihoods through employment opportunities and income generation. These were found to be contributing to waste avoidance and reduction by households in the study area. It was also found that there were strong statistical relationships between solid waste reuse for livelihoods and low-income status of households, the need to reduce waste, and the availability of solid waste as an asset.

Despite the numerous benefits of waste reuse, their acquisition and use lead to threats of contamination (e.g. of food and water sources), diseases such as tetanus, and breeding grounds for pests and vectors. These could, however, be avoided by effective washing or cleaning to disinfect the waste before reuse.

**Recommendations**

Based on the findings, since low-income was a major determinant of household willingness to reuse waste, the Ministry of Sanitation and Water Resources, in partnership with Ministry of Local Government and Rural Development, through the Metropolitan/Municipal/District Assemblies, should encourage more low-income households to participate in occupations involving solid-waste reuse. This could be by providing incentives such as micro-financing with lower interest rates. Such interventions could focus on the dominant types of waste such as polythene and plastic wastes. The partnership could be extended to include Non-Governmental Organisations in the area of Water, Sanitation and Hygiene to build the capacities of households participating in the occupations.

Tax-free policies should be introduced to encourage the development of warehouses for buying and keeping buffer stocks of useful wastes. In this way, another group of people would be motivated to participate as waste collectors. The stock of the waste warehouse is sold to operators who reuse them as raw materials at relatively lower prices through government direct subsidies.

As part of its youth employment strategy, through the Nation Builders' Cop policy (NABCO), the Government of Ghana should promote research into, and come out with more innovative and technological ways of, waste reuse in the other types of waste that household participants do not use much. Examples are glass waste, textile waste and wood waste. The emphasis should be on waste reuse, recycling, and energy recovery, instead of the present trend of waste collection and disposal.

Promotion of the waste reuse industry should be emphasised as an indigenization policy through advertisements at ethnic and religious festivals, the various news media such as radio, television and newspapers, and also mainstreaming waste reuse into the basic educational curriculum as a subject. The implementation of these

recommendations would reduce the financial burdens of local government authorities for waste management. It would also improve environmental sanitation and serve as a major step in preventive health management.

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# THE INTERACTION BETWEEN HUMAN BEINGS AND URBAN CULTURE SPACE: ONE OF THE MOTIVATIONS FOR HIGHER EDUCATION INTERNATIONALIZATION

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**Abstract:** Current researches on the motivation for the internationalization of higher education don't pay enough attention to its interrelationship with that of the city. Besides the economic and political incentives, modern urban culture, against the background of globalization, also plays an important role in motivating higher education internationalization. The separation which human beings are confronted with and the appeal for the self-assurance of the citizens become an important motivation for higher education internationalization during the process of the mutual construction of human beings and urban cultural space.

**Key words**: urban culture space, higher education, internationalization, self-assurance

## Introduction

The internationalization of higher education is based upon that of the modern city. Researches upon it have neglected this point. Therefore, against the background of the city internationalization and from the perspective of the interaction between human beings and urban culture space in the culture domain, exploring its cultural motivation is an effective way of approaching this issue and also an efficacious method for promoting human being's development and the construction of urban culture space.

## The Interaction Between Human Beings and Urban Culture Space: A New Perspective for Researches on Higher Education Internationalization

At present, with the increasing pace of economic globalization and the practice of higher education internationalization, researches on its theory are also drawn attention to. The achievements of these researches mainly focus upon the significance of internalization, the developing trend of internationalization, roles of politics and economy in accelerating the progress of internationalization, the introduction of experiences from western developed countries, China's position and policies, international students, the impact of World Trade Organization (WTO), international education cooperation, the relationship between nationalization and internationalization and so on. The great majority of them are about the introduction of strategies and experiences in the western developed countries, and those about its relationship with WTO are surging. Besides, heated discussions are provoked by its speeding growth in China, about the issues of the relationship between internationalization and localization, internationalization and nationalization, and the strong and weak cultures.

Though the researches on such theories did have a series of achievements and promoted the progress of its practice to a certain extent, the exploration of the motivation behind it is scarce. The researches done on this issue mainly pivot around the political and economic incentives.

As an unchangeable trend in the present world, globalization has given impetus to internalization of higher education, made higher education as an important part of international free trade, and promoted the extension of the influence of for-profit sector of higher education (Altbach & Knight, 2007, p. 1).

There some other scholars who even more point out that the dynamic for higher education internationalization is mainly represented by aspects like economic interests, social environment, demand for international communication and cooperation, and the need for the development of higher education internationalization itself (Lu, 2008).

There is no doubt that all the factors referred to in the researches done in this field play a very important role in higher education internationalization. However, in actuality, several aspects are neglected: the first one is the carrier (the city); the second one is an important aspect of its simulations (culture); the third one is the interrelationship between the former two through the mediation of citizens. Mutual promotion of economic internationalization and urbanization, culture and the city, and the interaction between higher education and various factors accelerate its progress.

The intrinsic dynamism of a city's development is education. When people are well-educated (including social education, school education, family education, and so on), they strive to change their social status, improve their living standards, and fight for a better future. They make efforts in pursuit of distinction in different fields such as politics, economics, military and culture, considering the need of the era and their dispositions. During this process, they need to cooperate and, thus, gather together, and build together, and all these lead to the formation of the city (Fu, n.d.)

In return, urbanization, especially the internationalization of cities and development of urban culture, prompt new demands for higher education, namely, its internationalization. And during this process, the interaction between human beings and urban culture plays a crucial role. Thus, to explore higher education internationalization from this perspective has great significance.

## The Dynamic Relationship Between Human Beings and Urban Culture Space, and its Inspiring Significance

As is known to all, social life exists and distributes in space, and the whole society operates through space. The formation of urban culture and its historical development, to a certain extent, is inlaid in space. Harvey has claimed, to question 'what is space?' is, therefore, replaced by the question 'how is it that different human practices create and make use of distinctive conceptualizations of space?'…relational space comes into its own as an important aspect of human social practice. An understanding of urbanism and the social-process-spatial-form theme requires that we understand how human activity creates the need for specific spatial concepts and how daily social practice solves with consummate ease seemingly deep philosophical mysteries concerning the nature of space and the relationships between social processes and spatial forms (Harvey, 1973, pp.13-14).

Various kinds of spatial metaphors all show the relationship of mutual construction between human beings and society, and it is the same case with urban culture space. The dynamic relationship between human beings and urban culture space is one of the motivations for the internationalization of higher education.

Just as Harvey believed, the dynamic relationship of space is effectuated by human beings and their social practice. The internationalization of modern cities, to a large extent, depends upon the extension of other geographical spaces, and this process mainly relies on the mobility of human beings in the city.

This is related to human beings' way of existence and its real significance in the context of modern urban culture. Just as the distribution of social life in society, human beings exist in time and space.

Human beings' materiality necessarily has a spatial and temporal position. To ensure the existence of them, that of the "I" should first be guaranteed, and the precondition is that the subject becomes conscious of the body's state of existence. The skin which separates him from the outside world produces the distance between inside and outside, the interaction between "here" and "there," and this is the spatiality of existence; the body feels the change of the outside world and this is the temporality of existence (Wang, 1998, p. 237).

From this point of view, human beings' existence depends upon that of space and human being's self-assurance is the precondition for the latter.

From the perspective of the interaction between urban space and human being, the construction of human beings and that of urban space always exists in contradiction. On the one hand, human beings construct urban space and cannot be separated from it. In other words, the geographical extension of urban space relies upon human beings' existence and practice as the basis and precondition. It is because urban space is the result of the interaction between human beings and their man-made environment, and its structure as a whole is the place for human beings' life. As the place where people gather, it is through living together in the city that people know each other. This shows the relationship between human beings. Therefore, urban space is a social and public space shared by residents (Yu, 1998, p.18).

On the other hand, with the extension of urban geographical space, human beings and the urban space are sure to be distanced from each other. Many scholars have explored this issue from the perspective of "Flâneur." The appearance of "Flâneur" is related to the researches upon the French poet Charles Pierre Baudelaire, designating those people who can wander, observe, and experience life in every corner of the modern prosperous city. This concept is widely applied in sociology, anthropology, and other domains. It is highly applicable in the researches on urban experience and urban space.

With the ongoing industrialization and the development of social economy and culture, people, in the cities, start to be aware of the new social phenomena and relationships and the residents' familiar urban space experienced great change. In such circumstance, Harvey stated, Baudelaire would be torn for the rest of his life between the stances of flâneur and dandy, a disengaged and cynical voyeur on the one hand, and man of the people who enters into the life of his subjects with passion on the other (Harvey, 2003, p.15).

In other words, in Baudelaire's time, the urban space was experiencing great change and the modern city started to take shape.

With the example of the city arcades in the streets of Paris, Benjamin explored this issue. Designed for modern cities, the commercial arcade is a building and urban space which is constructed through modern high technology with materials like glass and steel. It is from the aspect of its space significance that Benjamin analyzed its cultural connotation as a part of the urban spatial structure. According to him, the arcade is the best symbol for Paris in the 19th Century. It enables the flâneurs to wander and loiter, and they had enough time and space there to languidly appreciate the commodity and visualize the dreams etched upon it. The streets form a huge space of imagination and culture, encompassing various kinds of connotations, like the intuitive, experiential, social, and cultural. At the same time, during the city's modernization, as have stated above, the space formed by these commercial arcades enabled the urban culture to be immensely tolerant and considerably egalitarian. In such urban space, everyone could roam the streets at any time yet each with their secret. Evidently, Benjamin has long since been aware of it, and as Harvey's claim about Baudelaire, the connotation of urban culture space has already experienced profound change especially in terms of its influence upon "human beings." The urban space and culture created by the arcades become thoroughly a space where modern urban culture and its significance appear. This is not that kind of group formed by the gathering of friends, relatives, and acquaintances in the pre-modern society but the group composed by people who are strange to each other and suddenly cram into such a small space in modern society (Benjamin, 1989, p. 25).

The commercial arcade is only an example, and with the ongoing urbanization, the relationship between human beings and urban culture starts to be very complex.

A conspicuous representation is that the city road becomes broader, providing a more convenient space for the people (or their means of transportation). More people move into the city, and at the same time, they become more mobile. The city residents have to adapt the rapid-paced life in which the interaction between people and space, and the communication among people become frequent but instant. It is since then that the transformation of urban culture space started to be closely related to human beings' development. In other words, people start to consider how to solve the problems which are brought by the construction and transformation of urban culture space with the ongoing modernization of the city.

The background of the problem mentioned above is limited to the inception of modernity. With the maturity of urbanization, urban space starts to mature and extend on its basis, namely, the speeding city internationalization. Against such a background, theoretical research becomes indispensable when people are confronted with separation and indecision during the initial stage of the modern city.

**Human Being's Need for Self-assurance in Modern Urban Culture Space**

The modernization of urban space goes hand-in-hand with that of culture, and during this process, people are confronted with the crisis of separation, as mentioned above. During the initial stage of modern society, people are aware of such crisis but can do nothing about it. However, with the

internationalization of the city, higher education, against the background of urban culture space diversification, becomes an effective strategy to solve the problem of human beings' separation through keen attention and intervention. Furthermore, the rapid development of modern city increases the pace of higher education internationalization.

Baudelaire's separation described by Harvey, to a certain degree, is the common status of modern citizens' existence. Just as Guo Jun described, since such a flâneur is purposeless, and his observation on the street landscape, including the crowd, ancient building, and the store, is more like the scrutiny and appreciation of a connoisseur, his relationship with the environment forms a sharp contrast with the masses' utilitarian attitude toward everything in the era of commercial capitalism. At the same time, it is because such a person seems weirder and weirder in the rapid-paced modern city. Among the masses, his image represents the residue of tradition which is evicted from social space by modernity. Thus, he is always arousing people's nostalgia (Guo, 2006, p.56).

The flâneur is a reflection of the status of the modern citizens' spiritual culture. On the one hand, the city is an imaged and egalitarian social space; on the other hand, people are reminiscent of the old cultural value system, lost in the dilapidation and transformation of the old environment. The urban space people are familiar with is ephemeral and ungraspable, which, to a certain degree, evokes a sense of alienation. In modern cities, human beings need self-assurance.

This feature becomes even more prominent with the ongoing internationalization of the city. Zygmunt Bauman, a famous sociologist, has stated, "It represents the world as fragments and episodes, with one image chasing away and replacing the one before, only to be replaced itself the next moment" (1995, p. 260). In modern society, human beings' way of living has fundamentally changed and their experience and ability become fragmented, increasingly shrivelled, and even dysfunctional. Modern education, on the one hand, is the product of modern culture and acts as stimulation for the development of modern cities. On the other hand, the separation confronting human beings during urbanization and internationalization helps to produce modern higher education and its internationalization. It is represented in the following aspects:

Firstly, the appearance of higher education internationalization is mediated by the alteration of the existing environment of urban culture space against the background of city internationalization.

The internationalization of a modern city has brought great change to the existing environment of urban culture space, and it is first represented by the speed of urban culture space's replacement. The features of modern urban space shown through the material environment of modern urban space are newness, fluidity, and fastness, and urban culture constructed on such basis is hardly comprehensible let alone congenial with people. Education is the best way of attaining constant culture identification and significance.

The appearance of boulevards greatly increased the speed. Modern people have experienced unprecedented high speed, though their emotion may range from the excitement of the car swooshing on the strait lane and the anxiety of its higher speed. With the increase in speed and the overlapping of

spaces, people more often sit in the cars and observe without moving their bodies to interact with the environment or having any bodily touch with passers-by. Therefore, vision becomes the main sense people rely upon to acquire information, and as a result, other senses are dulled and deteriorated. People's sensory experience is reduced (Wang, 2003, p. 109).

Benjamin's (1983) statement on the same issue is even more accessible and profound:

> Someone who sees without hearing is much more uneasy than someone who hears without seeing. In this, there is something characteristic of the sociology of the big city. Interpersonal relationships in big cities are distinguished by a marked preponderance of visual activity over aural activities. The main reason for this is the public means of transportation. Before the development of buses, railroads, and trams in the nineteenth century, people had never been in situations where they had to look at one another for long minutes or even hours without speaking to one another (p. 69).

The fast speed breaks the urban culture space into pieces, and we can't equate even those things which are accessible to human vision with the urban culture. Thus, the construction of urban culture space is the combination of individual experience, historical experience, and city environment.

For modern internationalized cities, the existing environment of urban space is imbued even more with the modern citizens' anxiety about their understanding of culture. On the one hand, the internationalization of the city has changed the material environment where people live and can have a better understanding of urban culture and, to a certain degree, people have lost the basis for such an understanding; on the other hand, the internationalized city, with its new landscape, inundates people with many unknown things and their cultural connotations. In order to solve the first problem, higher education should always be relied upon, and education should be developed upon the basis of urban life. To solve the second problem, human beings need to have a cultural psychology of stable structure, encourage the development of the city, and promote that of their own. And higher education internationalization is an effective strategy to achieve this purpose.

Secondly, human beings' need for self-assurance in urban culture space helps to stimulate the internationalization of higher education. Human beings promote the development of modern culture space and their separation in urban culture space accelerates the development of higher education. The problem of modern life stems from this:

> The deepest problems of modern life derive from the claims of the individual to preserve the autonomy and individuality of his existence in the face of overwhelming social forces, of historical heritage, of external culture, and the technique of life…. The nineteenth-century demanded the functional specialization of man and his work; this specialization makes one individual incomparable to another, and each of them indispensable to the highest possible extent. However, this specialization makes each man the more directly dependent upon the supplementary activities of all others… An inquiry into the inner meaning of specifically modern life and its products, into the soul of the cultural body, so to speak, must seek to solve the equation which structures like the metropolis set up between the individual and the super-individual contents of life (Simmel, 1950, p. 409).

With the ongoing internationalization, the equilibrium between

the personal and the transpersonal is given more and more attention. The most prominent problem in the extension of urban culture space is how human beings find and assert themselves in the neon light of the city. In other words, human beings need to construct new ways of culture experience and then promote their own development and extend modern urban culture space through higher education internationalization when the old urban culture space lost its significance for human beings' self-development.

Human beings always wish to know their position and assure themselves in the environment at the same time. In other words, stable position is the necessary condition for human life. The environment is ever-changing, even if it can't resonate with human beings and build cognitive mode for their survival (Wang, 2003, p.109).

In internationalized cities, the environment is changing even faster. The need for building up self-assurance, sense of identification and cognitive mode, and so on appeals for the accelerating pace of higher education internationalization, which cultivates the subject of the city's construction, bridging the gaps between human beings and urban space in terms of its cultural significance.

Thirdly, the interaction between human beings and urban culture space guarantees the dynamism of higher education internationalization.

The relationship between human beings and urban culture space has various possibilities and modes.

The city exists as a series of doubles. It has official and hidden cultures; it is a real place and a site of imagination. Its elaborate network of streets, housing, public buildings, transport systems, parks, and shops is paralleled by a complex of attitudes, habits, customs, expectancies, and hopes that reside in us as urban subjects. We discover that urban "reality" is not single but multiple, and that inside the city, there is always another city (Chambers, 1986, p.183).

Streets, houses, public buildings, and traffic systems and other material contents of the city change with a stunning speed, and the ideas reflected by them alter correspondingly. And, obviously, the latter lags behind the former, which, to a certain extent, confuses the people. However, the positive significance of such change is apparent, namely, "There always exists in a city another city", which means it harbours another possibility of cultural significance, and the need to realize and fathom this kind of possibility is the very dynamic, which fuels the development of higher education. Thus, urban space is：

No longer an artefact to be analyzed and becomes a kind of basis for experience and projection of consciousness. It invites the participants to play the game of signifier and signified (there is the possibility of new spatial forms and significances hidden in the game) (Wang, 2003, p.110).

Urban culture space has the streets, houses, public buildings and traffic systems and so on as its signifiers, and to understand the corresponding signified, people should know the signifiers' form of spatial significance. From the urbanization of the countryside to the internationalization of the city, the development of such a movement is always promoted, providing the constant and strong stimulation for higher education internationalization.

From the urbanization of the countryside to the internationalization of the city, the development of such a movement is always promoted, providing the constant and

strong dynamism for higher education internationalization.

The interaction between human beings and urban culture space and its motivation for higher education internationalization have great practical significance. From the perspective of higher education internationalization, to sort out the cultural motivation for higher education and find its suitable form for the city's internationalization (or whether the internationalization of higher education is suitable in terms of the city's level of development) is crucial for adjusting the orientation and guaranteeing the efficacy of higher education internationalization. From the aspect of human beings' development, as stated above, the separation between urban space and human beings caused by the city's ongoing internationalization is an urgent problem to be solved. From the aspect of the construction of urban culture space, as an important means to retain human beings' equilibrium, urban culture promotes the internationalization of higher education. The construction and development of these three aspects are closely related, and they all focus upon the wholesome and free development of human beings, which is just the purpose of higher education internationalization and the construction of modern urban culture in this internationalized world.

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# INVESTIGATION OF THE IMPACT OF VEGETATION COVERAGE RATE ON URBAN THERMAL ENVIRONMENT：A CASE STUDY OF SHAOSHAN CITY, CHINA

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**Abstract**：This paper aims to propose a new simplified method of calculation based on a simplified vegetation model, and study the relationship between vegetation coverage rate and urban thermal environment. The simplified vegetation model, namely temperature compensation model of vegetation surface source, is established. Shaoshan City, a typical city in the development of urbanization in China, is taken as a research object. The thermal environment of Shaoshan City under different vegetation coverage rates is analyzed by CFD method. The results show that the temperature compensation model of vegetation surface source can be applied to the numerical simulation of the city in the meso-scale. With the increase of the vegetation coverage rate in Shaoshan City, the wind speed near the ground will decrease. When the vegetation coverage rate changes from 0% to 99%, the average surface temperature decreases by 1.74℃ for every 10% increase in vegetation coverage rate. The findings can provide some guidance for the construction of Shaoshan City and other cities. The new simplified method of calculation is helpful to the numerical simulation of urban thermal environment in the meso-scale.

**Keywords:** Numerical simulation, Thermal environment, Vegetation coverage rate, Vegetation simplified model, Temperature compensation model

## Introduction

Human health, social-economic development, and climate change are affected by urban thermal environment. For the regulation of urban thermal environment, domestic and foreign scholars have done a lot of research on numerical simulation of urban thermal environment. At present, most foreign research focus on the cities in the micro-scale. In this scale, scholars have studied the thermal environment of an area within a city (Hedquist & Brazel, 2014; Huang et al., 2005; Kakon et al., 2009). It provides precedent for CFD applications in urban microclimates and guides future urban planning. Scholars have also analyzed various factors influencing urban thermal environment, such as architectural layout, building materials, etc. (Grignaffini & Vallati, 2007; Yumino et al., 2015). Additionally, scholars have discussed ways to alleviate urban heat island (Fintikakis et al., 2011; Okeil, 2010). The domestic studies of urban thermal environment by numerical calculation mainly focus on the analysis of residential thermal environment, temperature field, wind field in street canyons, and urban areas (Li et al., 2004; Tang et al., 2003). Many researches have analyzed the impact of pollutants on urban thermal environments (Jiang et al., 2006). Some scholars have discussed the thermal environment in the

meso-scale, but they mainly focused on the wind environment of the mountain (Cheng & Hu, 2006; Gao et al., 2008). A large number of studies have been conducted on the numerical simulation of urban thermal environment, but studies on the impact of vegetation coverage rates on urban thermal environment in the meso-scale are few.

In this paper, a new simplified method of calculation based on a simplified vegetation model suitable for urban thermal environment in the meso-scale is proposed. A typical representative of Shaoshan City, China is taken as a research object, and the thermal environment of Shaoshan City is studied. A simplified vegetation model is established, namely temperature compensation model of vegetation surface source. The wind and temperature fields of Shaoshan City under different typical vegetation coverage rates are analyzed by the model and CFD method.

**Case interpretation**

Shaoshan City is located in Hunan Province, south-central China. Shaoshan City is a famous cultural tourism city in China. Buildings are mainly distributed in Qingxi town and Shaoshan town. The highest peak is named ShaoFeng (Fig.1).

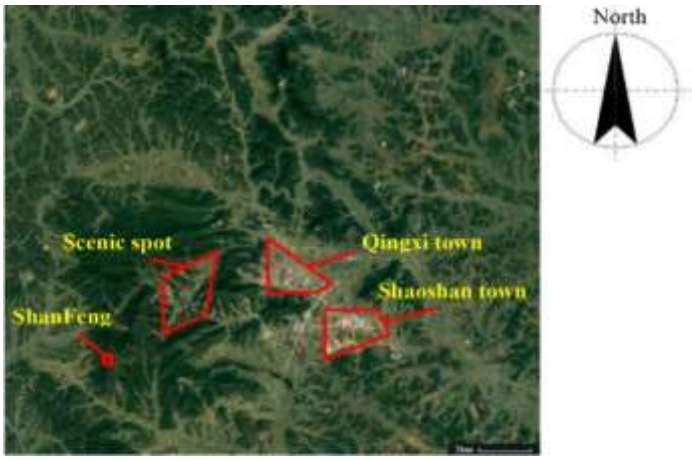



**Figure: 1 Schematic diagram of Shaoshan City**

**Methodology**

**The temperature compensation model of vegetation surface source**

The porous medium model is commonly used in calculating vegetation, but it is mainly applied to the micro-scale range. The small-sized mesh in the micro-scale cannot be used in the meso-scale. If a large-sized mesh is used, the height of the first layer of the mesh near the surface may be higher than the height of the vegetation and buildings in the city (Fig. 2). Therefore, a simplified calculation model of vegetation, namely temperature compensation model of vegetation surface source, is established. (We call it temperature compensation model in the following text.)

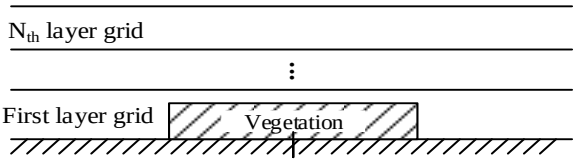



**Figure 2: Height difference between grid and vegetation in the meso-scale**

The speed calculation of vegetation area is shown as following [13]:

$$\Delta B = \frac{1}{\kappa}\ln(1 + C_s K_s^+) \qquad (2)$$

Where up is the velocity of the centre point of the first layer grid, m/s; u* is the friction velocity of the wall function, m/s; τw is the frictional stress of the wall surface, kg/(m•s2). κ is Karman constant, κ = 0.4187; E is the empirical constant, E = 9.793; yp is the distance from the centre point of the first layer grid to the wall surface, m; ΔB is a constant related to surface roughness. The formula for calculating ΔB in the turbulent sufficient development zone is (Kakon et al., 2009):

Where $C_s$ is the rough constant; $K_s^+$ is dimensionless rough height; where $K_s^+ = \frac{\rho k_s u^*}{\mu}$ $k_s$ is the rough height, m

The method used to calculate temperature is to add the energy absorbed in the vegetation canopy to the soil layer on the surface. The source term of the soil layer is calculated from the following

$$S_{Tg} = \frac{1}{\Delta x}[2h(T_f - T_a) - 2\frac{\rho c_p}{\gamma}\cdot\frac{\Delta P}{r_a + r_s}] \qquad (3)$$

Where $S_{Tg}$ is the source of soil layer, W/m$^3$; $\Delta x$ is the thickness of soil layer, m.

When the energy source term of the vegetation layer is transferred to the surface, there are some errors in the surface temperature (Fig. 3).

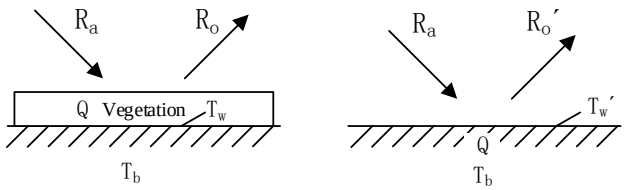



**Figure 3: Relationship of ground energy conservation**

The energy conservation equation of the surface covered with vegetation is shown in the following:

$$R_a - R_o - Q = \frac{\lambda}{\Delta x}(T_w - T_b) \qquad (4)$$

Where $R_o$ is the energy leaving vegetation and surface, W/m$^2$; $Q$ is the energy absorbed by vegetation, W/m$^2$; $\lambda$ is the thermal conductivity of the surface, W·m$^{-1}$·K$^{-1}$; $\Delta x$ is the distance between the surface and the constant temperature layer, m; $T_w$ is the surface temperature, K; $T_b$ is the temperature of the soil constant temperature layer, K.

The energy conservation equation of the surface without vegetation cover is given in the following:

$$R_a - R_o^{'} = \frac{\lambda}{\Delta x}(T_w^{'} - T_b) + Q \qquad (5)$$

Where $R_o'$ is the energy leaving vegetation and surface, W/m$^2$; $T_w'$ is the surface temperature, K. Subtracting the two equations, Eq. 6 can be obtained:

$$T_w^{'} - T_w = \frac{\Delta x}{\lambda}(R_o - R_o^{'}) \qquad (6)$$

When the energy source term is added to the surface, the ground temperature will produce an error which will affect the air temperature near the wall, so the temperature needs to be compensated. It can be known from Eq. (6) that if $Tw = T_w'$, the temperature of the constant temperature layer can be compensated, the value of temperature compensation is is $\Delta T = Tw - T_w'$. And the calculation formula of of $R_o$, $R_o'$ can be calculated according to Eq. (7) and Eq. (8).

$$R_o = \rho_f(1-\sigma_f)R_a + \sigma_f\rho_g R_a + (1-\sigma_f)\left[\varepsilon_g\sigma T_w^4 + \rho_g S_a\right] + \sigma_f\left[\varepsilon_f\sigma T_f^4 + \rho_f S_a\right] \qquad (7)$$

$$R_o^{'} = \rho_f R_a + \varepsilon_g\sigma T_w^{'4} + \rho_g S_a \qquad (8)$$

Eq. (3) − Eq. (8) composes the temperature compensation model of vegetation surface source.

**Modeling of Shaoshan City**

The topographic data of Shaoshan City is downloaded from the Geospatial Data Cloud Platform of the Chinese Academy of Sciences Computer Network Information Center. After the data is downloaded, the elevation information of the study area is exported by the map processing software. The geometric model building and meshing of Shaoshan City will be completed by ICEM. The calculation domain size is about 22km (x) × 19km (y) × 1km (z). Due to the complex terrain of Shaoshan City, the unstructured grid is adopted. The total number of grids is 22,739,353.

**Boundary condition settings**

According to the contour of different underlying surfaces, the surface of Shaoshan City is divided into four types, which are building area, tree area, shrub area, and grass area (Fig. 4). Three cases of different vegetation coverage rate are simulated. Case 1 is shown in Fig. 4, and the percentage of each area is shown in Table 1. In case 2, the tree area, shrub area, and grass area in Fig. 4 are replaced by soil. It is the case of reducing vegetation coverage rate. In case 3, shrub area and grass area in Fig. 4 are replaced by a tree. It can be regarded as the case of increasing vegetation coverage rate.

The south side is set as the speed entrance, and the boundary wind speed is specified according to the logarithmic law. The north side is set as free jet. The east and west surfaces are set as smooth surface. The ground is set as rough surface. The equivalent roughness of the building and the tree is set to 10, the equivalent roughness of the shrub is set to 1.5, and the equivalent roughness of the grass is set to 0.5. The temperature of 0.4m below the ground in the tree area, shrub area, grass area, and soil area is set to 19.2 ℃. The temperature of 0.4m below the ground in the building area is set to 24℃ (Hedquist & Brazel, 2014). Temperature compensation model is used. It is fast in calculation and accurate in calculating the surface temperature. A source term of 120 W/m2 is set in the soil area (Toparlar et al., 2015). The boundary conditions are based on the

monitoring data and from the existing literature

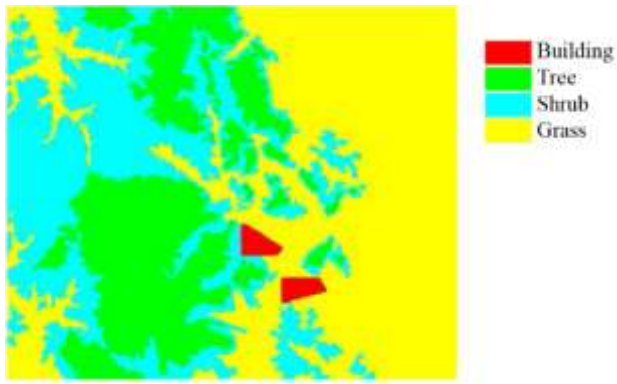



**Figure 4: The surface of Shaoshan City**

**Table 1. Coverage of each area in Case 1(%)**

| | building area | grass area | shrub area | tree area |
|---|---|---|---|---|
| **Coverage** | 1.04 | 47.30 | 28.68 | 22.98 |

**Results and discussions**

Three representative sections of the calculation domain are made to analyze the thermal environment of Shaoshan City (Fig. 5). The first section x=6560m passes ShaoFeng. The second section x=8890m passes the scenic spot with a large number of people. The third section x=131210m is mainly through residential areas.

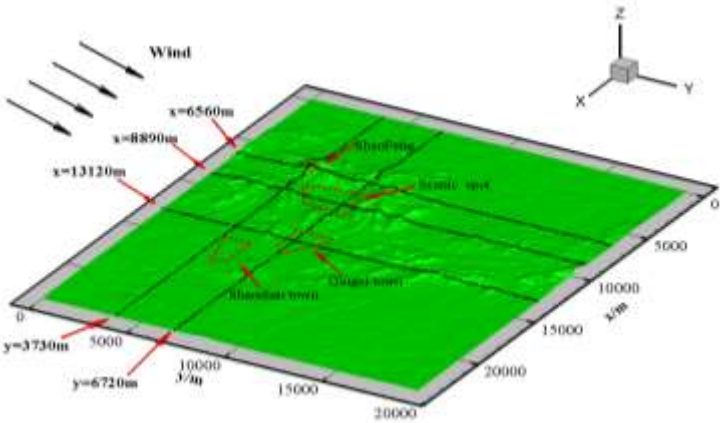



**Figure 5: Schematic diagram of section distribution**

**Analysis of wind field**

On the x = 6 560 m section, the wind speed of ShaoFeng is the highest in three cases. In the area between y= 4,000m and y= 4,400m, there is a low wind speed region with the velocity of 0.5 m/s in case 1 and case 3,

while the minimum wind speed in case 2 is about 3m/s. After the air flows through ShaoFeng, it passed a cluster of hills. The average wind speed in the valley of case 1 and case 3 is about 1m/s, and that in case 2 is about 3m/s. On x = 8, 890 m section, the velocity of the peak at y=4100m in case 1 and case 3 is about 4.34m/s, but the wind speed at case2 can reach 6.5m/s., y=4100m, y=8600m, y=9600m, the heights of the three peaks are basically the same, but the maximum wind speed is at y=8600m, instead of the first peak in the direction of airflow. This is because there are two lower peaks in the upper reaches of the mountain of y=4100. Between y = 4100m and y = 8600m, the terrain is flat, which makes the flow field develop stably and sufficiently. The mountain of y = 9600m is affected by the front peak; the velocity is low, but the air velocity is still higher than that of y = 4100m. The wind speed in the scenic area is relatively uniform. The wind speed in three cases is within a comfortable range of human body (less than 5 m/s). On the x=13 120m section, the terrain is relatively flat. Wind speed on the peak of the mountain in front of building area in three cases is about 5.5m/s. The wind speed behind the mountain changes little.

Urban terrain has a great influence on the distribution of the wind field. The existence of the upper high mountain will reduce the wind velocity at the top of the rear mountainL . The influence of vegetation coverage rate on wind environment distribution is much less than that of terrain. It does not change the basic distribution rule of wind field, but it will affect the local wind speed and gradient change, and will destroy the original relatively stable stratification of the wind field. With the increase of vegetation coverage rate, the degree of wind speed reduction will also increase.

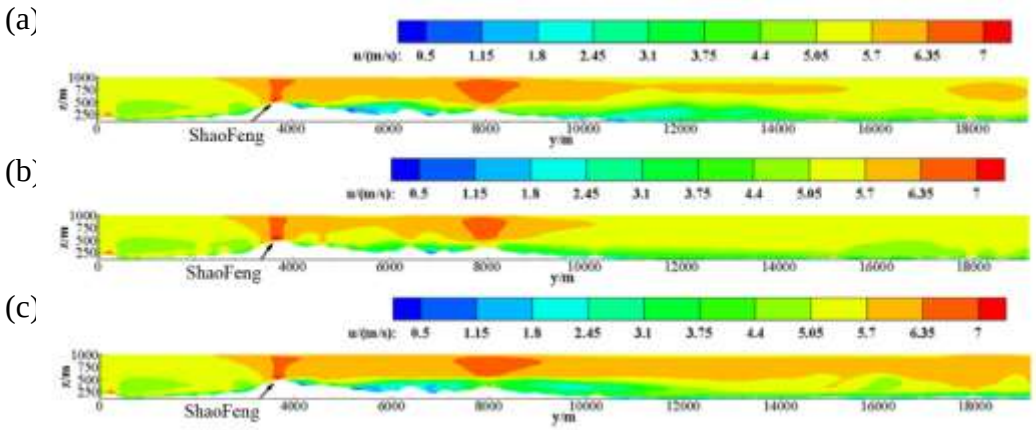



**Figure 6: Inflow velocity of x=6 560m section in three cases**
(a) case 1 (b) case 2 (c) case 3

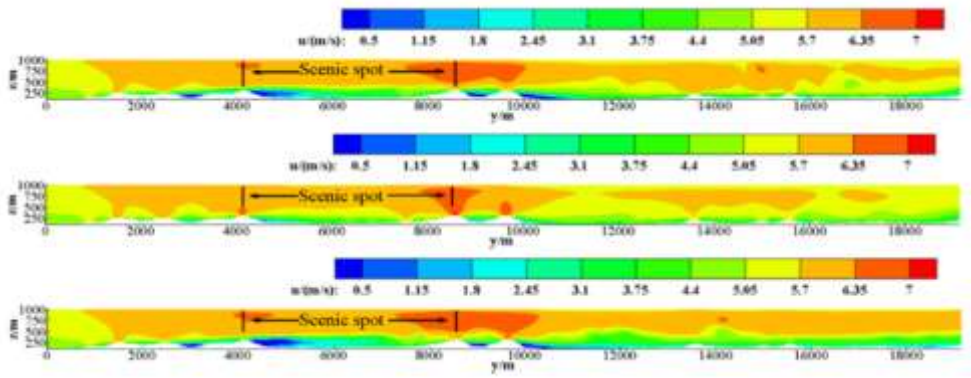
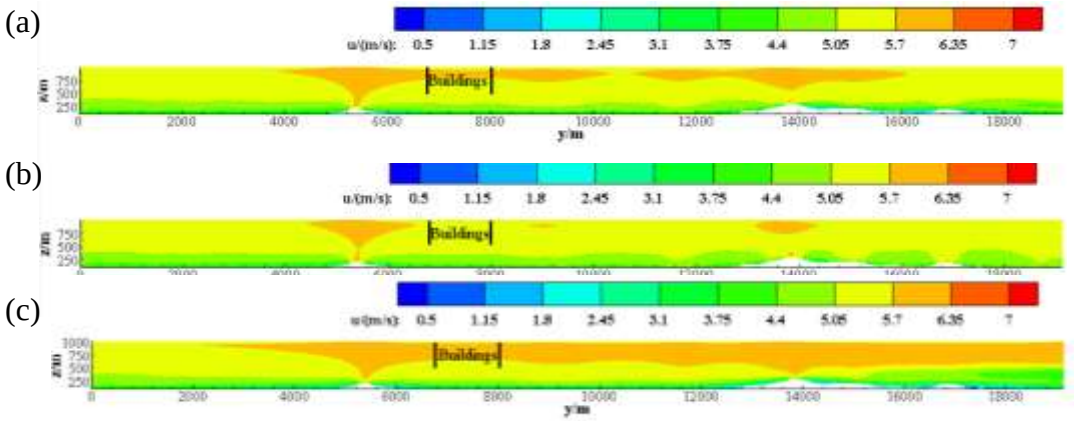



**Figure 7: Inflow velocity of x=8 890m section in three cases**
(a) case 1 (b) case 2 (c) case 3




**Analysis of temperature field**

As shown in Fig. 9, in the area of mountains covered with vegetation, the average air temperature is about 37.5℃ in case 1 and case 3, and the lowest temperature was about 36℃ in the valley. In case 2, there is no cooling phenomenon when air passes through mountains because of no vegetation covering. As shown in Fig. 10, the temperature in the valley area in front and back of scenic spot is relatively low in case 1 and case 3. The temperature of the scenic spot is about 37.5 ℃, which is lower than the inflow temperature. However, as there is no vegetation cover in case 2, air temperature gradually increases in the flow direction, and temperature boundary becomes thicker. Fig. 11 shows that the air temperature of building area and the air temperature near the ground in front and back of building area are higher than inflow temperature in cases 1 and 2. The building materials absorb solar radiation and transfer heat to the air, so the air temperature of building area is also increasing. The distribution of trees at the back of buildings is small, so temperature drop is not obvious. It only dropped by about 0.3 ℃ in the valley. In case 3, the cooling phenomenon is obvious and temperature in building area rises. It can be found that soil has little ability to regulate air temperature and emit heat to the air. With the increase of vegetation coverage rate, the regulation of air temperature is gradually enhanced.

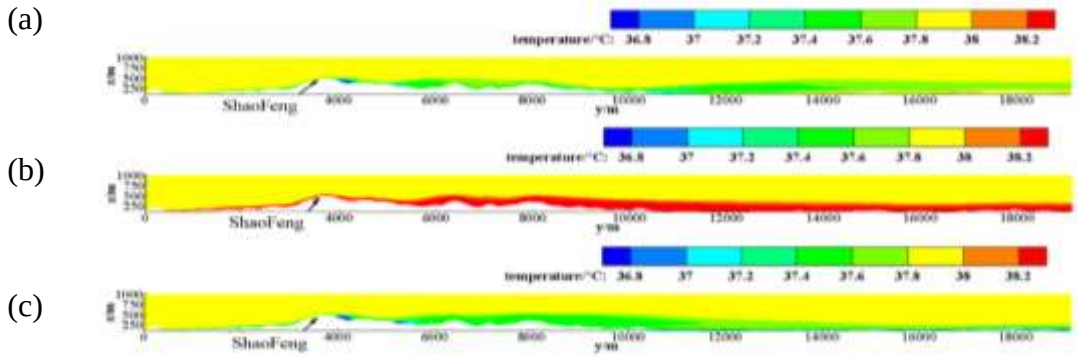



**Figure 8: Temperature of x=6560m section in three cases**

(a) case 1 (b) case 2 (c) case 3

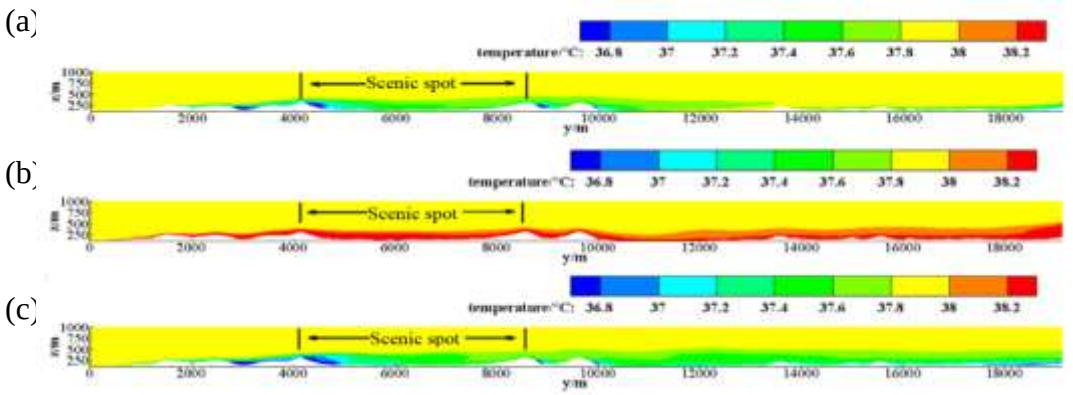



**Figure 9: Temperature of x=8890m section in three cases**

(a) case 1 (b) case 2 (c) case 3

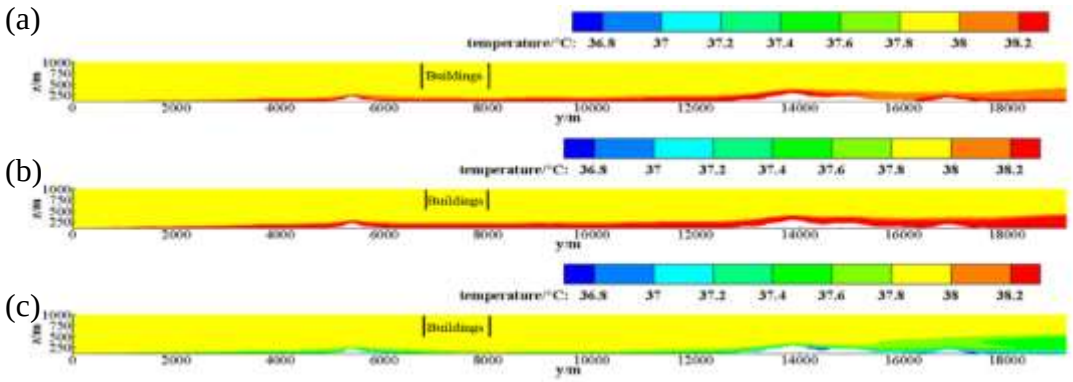



**Figure 10: Temperature of x=13120m section in three cases**

(a) case 1 (b) case 2 (c) case 3

Fig. 11 shows the relationship between vegetation coverage rate and average surface temperature. With the increase of vegetation cover rate, the average surface temperature decreases, but the degree of reduction gradually reduces. Surface temperature will

tend to balance value with the increase of vegetation. When the vegetation coverage rate changes from 0% to 99%, the average surface temperature decreases by 1.74℃ for every 10% increase in vegetation coverage rate

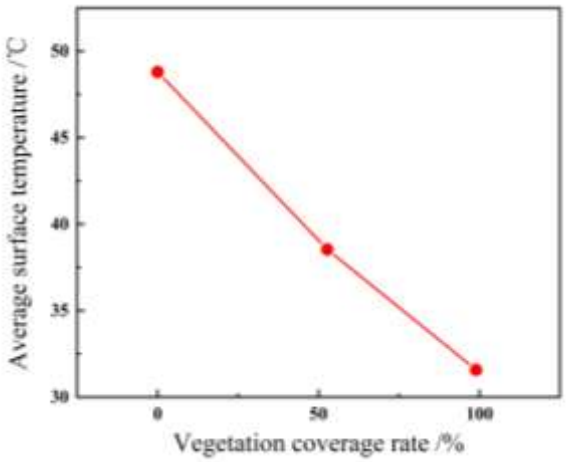



**Figure 11: Relationship of vegetation coverage rate and average surface temperature**

**Conclusions**

This paper has proposed the new simplified method of calculation based on the vegetation simplified model and studies the relationship between vegetation coverage rate and thermal environment of Shaoshan City. The main conclusions are presented as follows:

(1) The simplified vegetation model, namely temperature compensation model of vegetation surface source, proposed in the paper can simplify the calculation to simulate a wider range of urban thermal environments. It can be applied to urban numerical simulations in the meso-scale.

(2) Urban terrain has a great influence on the distribution of the wind field. Vegetation coverage rate does not change the basic distribution rule of wind field, but it will affect the local wind speed and gradient change. The increase of vegetation coverage rate will reduce the wind speed near the ground. When the vegetation coverage rate changes from 0% to 99%, the average surface temperature decreases by 1.74℃ for every 10% increase in vegetation coverage rate.

(3) The findings in this paper have a guiding role for the planning and construction of Shaoshan City. The method proposed in the paper is significant for the numerical simulation of urban thermal environment in the meso-scale. It can be applied to the numerical simulation of thermal environment in other towns and provide some guidance for the planning and construction of vegetation in the town.

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# PHOTOVOLTAIC AVAILABILITY EVALUATION OF SHAOSHAN CITY BASED ON THE DISTRIBUTED PV-ASHP SYSTEM

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**Abstract:** This paper proposes an urban PV availability evaluation method based on a distributed PV-ASHP system. The available PV installed capacity is calculated by the max PV conversion efficiency. The required PV installed capacity is decided by the building cooling load. Then, the PV availability evaluation coefficient is obtained to evaluate urban PV availability based on the distributed PV-ASHP system. A complete PV capacity design method of the distributed PV-ASHP system of a single building and an urban region is formed. The PV installed capacity is decided by the PV availability evaluation coefficient. The single building with the larger PV availability evaluation coefficient value is more suitable to develop the distributed PV-ASHP systems. Meanwhile, results show that the total amount of PV installed capacity can be designed to 13.75% of the building cooling load in the main urban region of Shaoshan city. The PV availability evaluation coefficient proposed in this paper provides a reference for the PV capacity design of the distributed PV-ASHP system and the comprehensive evaluation of green buildings.

**Keywords:** distributed photovoltaic, air source heat pump, photovoltaic capacity, photovoltaic availability evaluation coefficient

## Introduction

The building sector is responsible for an important proportion of global energy use and greenhouse gas emissions. Among these, the energy consumption of building appliances such as air conditioning, kitchenware, sanitation, and hot water account for more than 75% of the buildings (Le & Pitts, 2019; Liu et al., 2019; Yang et al., 2016). Renewable energy (including solar energy, geothermal energy, and wind energy) is widely used in buildings to achieve energy-saving and reduce air pollution (Bellos & Tzivanidis, 2019; Gioutsos et al., 2018; Inayat & Raza, 2019; Werner, 2017). Solar energy is the most abundant, safe, and clean of all the renewable energy resources. Photovoltaic (PV) system is an effective way to utilize solar energy, which is easy to be installed in buildings and has huge market potential (Freitas et al., 2015; Lee et al., 2016).

Researchers have rapidly developed a range of building integrated photovoltaic (BIPV) technologies to efficiently utilize solar energy, such as integrated PV–radiative cooling (PV-RC) systems (Eicker & Dalibard, 2011; Zhao et al., 2017; Zhao et al., 2019), integrated PV-heat pumps (PV-HP) systems (Aguilar et al., 2016; Roselli et al., 2019; Romero Rodríguez et al., 2018), and PV-Thermal (PV-T) systems (Fuentes et al., 2018; Zhang et al., 2012). To sum up, these BIPV technologies can improve the

utilization efficiency of solar energy to some extent. However, these studies were mainly focused on the technology level to improve the performance of PV systems.

From the existing literature, researchers mostly estimated the available rooftop surface area to assess the PV potential in an urban region. The total amount of installed PV capacity or the total system output power can be calculated according to the available rooftop area. Then, the calculated PV capacity is used as the evaluation index of potential PV capacity in the region. However, it is not appropriate to use only the available PV capacity to evaluate the PV availability of a region. Due to the different building cooling load indicators of different buildings, the required PV capacity for different regions is also not the same.

This paper proposes a PV availability evaluation coefficient based on the distributed PV-ASHP system to evaluate the PV availability of an urban region. Firstly, the building information of the target region is gathered by field survey. Then, the available PV installed capacity in an urban region is calculated by the max PV conversion efficiency, and the required PV installed capacity of the region is decided by the building cooling load. Finally, the PV availability evaluation coefficient of the region is obtained to evaluate urban PV availability based on the distributed PV-ASHP system. The proposed PV availability evaluation coefficient fills the blank of the PV capacity design method and can provide guiding significance for the design of urban distributed energy systems in the future.

## 2. Survey on the building distributions of Shaoshan city

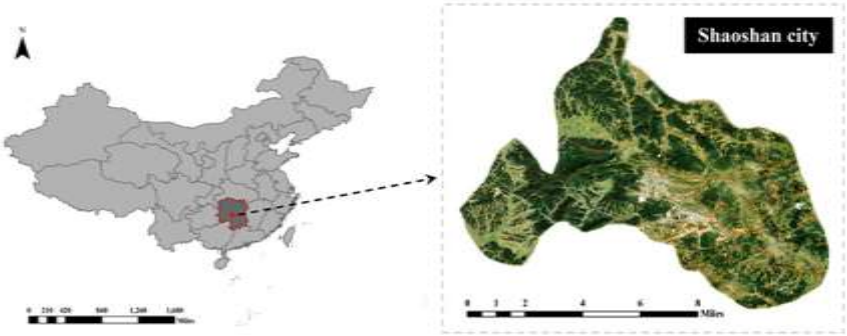


**Figure 1: The location and view of Shaoshan city.**

Shaoshan city is situated in the central-south region of China (Location: 27.326 North, 112.010 East). The four seasons of Shaoshan city are distinct, belonging to the hot summer and cold winter climate zone, with average annual sunshine hours of 1717 hours and an average annual sunshine percentage of 39%, which is suitable to develop solar PV system. Therefore, Shaoshan city is used to verify the applicability of the proposed PV availability evaluation method. The location and view of Shaoshan city is shown in Fig. 1. The building types in the survey region mainly include government public buildings, commercial buildings, residential buildings, and cultural and sports buildings, which can well represent the whole building types of Shaoshan city.

**Methodology**

PV availability is an important factor to evaluate the energy saving of PV buildings. To comprehensively evaluate the PV availability of urban buildings, this paper proposed a PV availability evaluation coefficient based on the dimensionless correlation of the max PV conversion efficiency and the optimal thermodynamic PV capacity design method. In this paper, PV availability evaluation coefficient is defined as the ratio between the available PV installed capacity and the required PV installed capacity. The PV availability evaluation coefficient of a single building can be calculated by Eq. (1):

$$\vartheta=\frac{P_{PV\text{-}ava}}{P_{PV\text{-}need}} \quad (1)$$

Where $P_{PV\text{-}ava}$ means the available PV installed capacity of a single building, $P_{PV\text{-}need}$ means the required PV installed capacity of a single building.

According to our previous work (Wang et al., 2015), the required PV installed capacity of the region under the optimal thermodynamic performance is decided by the building cooling load. Then, the available PV installed capacity and the required PV installed capacity can be respectively calculated by the following equations:

$$P_{PV\text{-}ava}=\beta\cdot\eta_{max}\cdot S\cdot A_{ava}\cdot M \quad (2)$$

$$P_{PV\text{-}need}=\frac{Q_{build\text{-}cold}\cdot A_{build}\cdot N_{floor}\cdot M}{EER} \quad (3)$$

Where $A_{ava}$ means the rooftop area that can be used to install PV panels, $A_{build}$ means the standard floor area of a building. β means the effective area coefficient of PV panels, which is related to the installation angle of the PV panel. In this paper, β is $\sqrt{3}/4$ at the installation angle of 30 degrees. $\eta_{max}$ means the max PV conversion efficiency. $S$ means the light intensity. $Q_{build\text{-}cold}$ means the indicator of building cooling load. $N_{floor}$ means the number of floors. $M$ means the number of buildings. $EER$ means the energy efficiency ratio of the heat pump system. Therefore, the PV availability evaluation coefficient is derived as:

$$\vartheta=\frac{P_{PV\text{-}ava}}{P_{PV\text{-}need}}=\frac{\beta\cdot\eta_{max}\cdot S\cdot A_{ava}\cdot M}{\frac{Q_{build\text{-}cold}\cdot A_{build}\cdot N_{floor}\cdot M}{EER}}=\frac{\beta\cdot\eta_{max}\cdot S\cdot A_{ava}\cdot EER}{Q_{build\text{-}cold}\cdot A_{build}\ N_{floor}} \quad (4)$$

In this paper, it is assumed that $A_{ava}$ is approximately equal to $A_{build}$ for the same building. The PV availability evaluation coefficient can be furtherly simplified as:

$$A_{ava}=A_{build} \quad (5)$$

$$\vartheta=\frac{\beta\cdot\eta_{max}\cdot S\cdot EER}{Q_{build\text{-}cold}\cdot N_{floor}} \quad (6)$$

Based on the PV availability evaluation method of a single building, the overall PV availability evaluation method of urban region was formed. The overall PV availability evaluation coefficient of an urban region can be expressed as:

$$A_{ava}=A_{build} \quad (5)$$

$$\vartheta=\frac{\beta\cdot\eta_{max}\cdot S\cdot EER}{Q_{build\text{-}cold}\cdot N_{floor}} \quad (6)$$

Based on the PV availability evaluation method of a single building, the overall PV availability evaluation method of urban region was formed. The overall PV availability evaluation coefficient of an urban region can be expressed as:

$$\vartheta_{total}=\frac{P_{PV\text{-}ava,total}}{P_{PV\text{-}need,total}} \quad (7)$$

$$P_{PV\text{-}ava,total}=\sum P_{PV\text{-}ava,j},\ j=1,2,3 \quad (8)$$

$$P_{PV\text{-}need,total}=\sum P_{PV\text{-}need,j},\ j=1,2,3 \quad (9)$$

Where $P_{PV\text{-}ava,\ total}$ means the total amount of available PV installed capacity of an urban region, $P_{PV\text{-}need,\ total}$ means the total amount of required PV installed capacity of an urban region under the optimal thermodynamic performance. $P_{PV\text{-}ava,j}$ means the available PV installed capacity for different buildings, $P_{PV\text{-}need,j}$ means the required PV installed capacity of different

buildings under the optimal thermodynamic performance, and *j* means different buildings. The larger this coefficient $\vartheta_{total}$ is, the greater the available PV capacity is, and the energy-saving efficacy will be more significant for the region.

**Results and Discussion**

The temperature data in the main urban region of Shaoshan city were obtained from the observation data provided by the Shaoshan weather bureau. Light intensity in the main urban region of Shaoshan city was measured by field survey. According to the statistical data and field survey data, the average daytime temperature of the survey period was 30.7℃, and the highest light intensity of the period was 933W/m2.

In this study, it was assumed that all the survey buildings adopted the air source heat pump system with the energy efficiency coefficient of 3.0. Then, the PV availability evaluation coefficient of the single building can be calculated by Eq. (6) according to the data collected in the survey region of Shaoshan city. The statistical distributions of PV availability evaluation coefficient for different building types in the survey region are obtained, as shown in Fig. 2. The building type with the biggest average value of PV availability evaluation coefficient in the survey region is government public buildings, followed by commercial buildings and residential buildings. The average values of government public buildings, commercial buildings, and residential buildings are 0.2105, 0.1911, and 0.1442, respectively. The PV availability evaluation coefficient of government public buildings is 1.10 times that of commercial buildings and 1.46 times that of residential buildings.

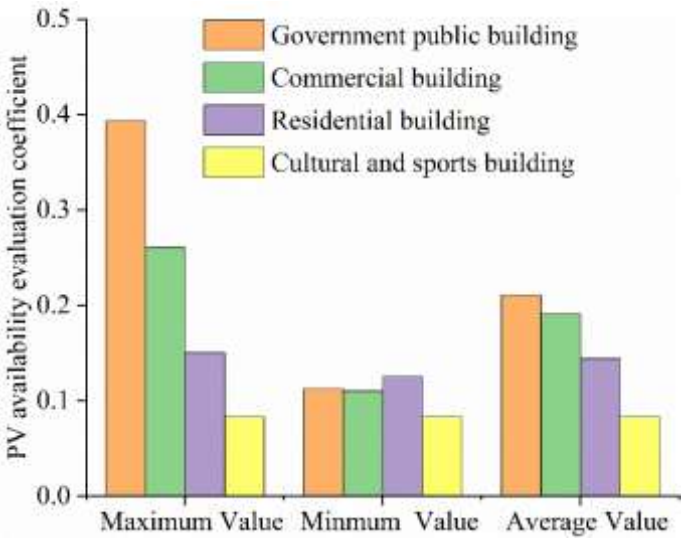


**Figure 2: Statistical Distributions of PV Availability Evaluation Coefficient for Different Building Types in The Survey Region.**

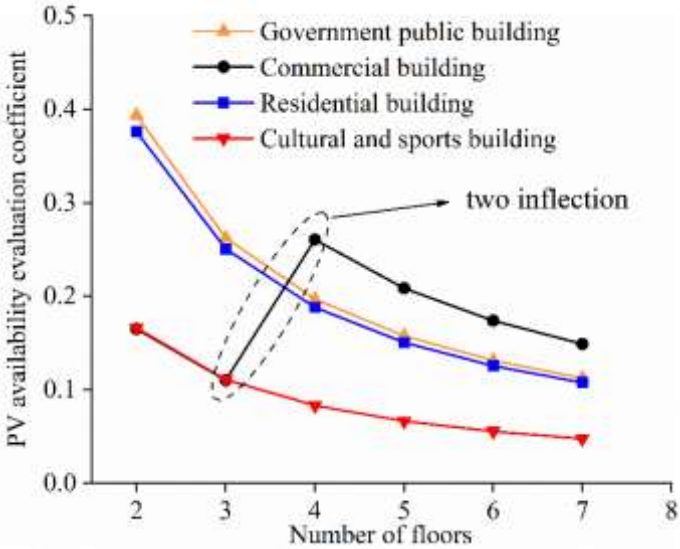


**Figure 3: PV Availability Evaluation Coefficient For Different Floors of Building in Shaoshan City**

At the same time, the PV availability evaluation coefficient is also related to the number of floors. PV availability evaluation coefficient of floors two to seven of different building types in the survey region is shown in Fig 3. It can be seen that the PV availability evaluation coefficient of different building types decreases as the number of floors increases, except for commercial buildings. There are two inflexion points in the PV availability evaluation coefficient of commercial buildings. This is mainly because the commercial buildings with three floors and below are generally restaurants and shops, while those with four floors and above are hotels.

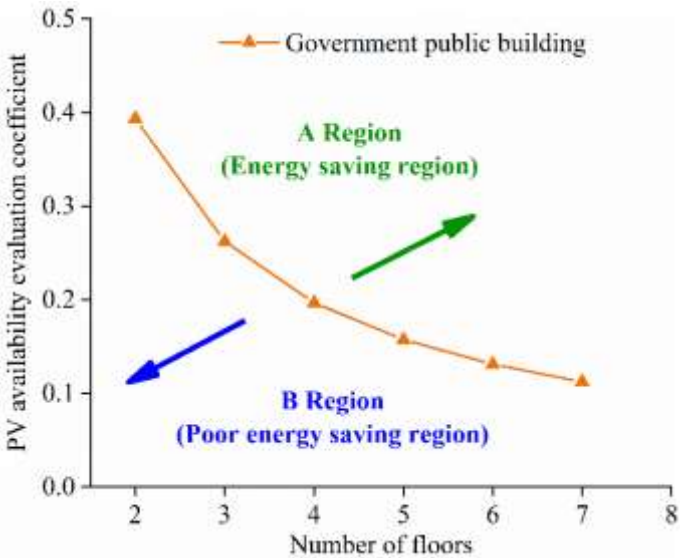


**Figure 4: PV availability evaluation figure of government public buildings**

Therefore, the commercial buildings should be analyzed and compared interruptedly for different floors. Also, this figure can be used for energy-saving evaluation or green building evaluation for buildings with the distributed PV-ASHP system.

According to the curve of PV availability evaluation coefficient shown in Fig 4, the A region above the critical line indicates significant energy saving, while the B region below the critical line indicates poor energy saving for the integrated PV-ASHP systems used in the government public buildings. For example, the recommended PV availability evaluation coefficient of the distributed PV-ASHP systems is 0.1967 in four-story government public buildings. In other words, it can meet the energy-saving standard or the green building standard when the actual PV availability evaluation coefficient of the buildings is 0.1967 or above.

**Table 1 Calculated results of PV availability in the survey region and the main urban region of Shaoshan city**

| Region | $P_{PV\text{-}ava,total}$ (MW) | $P_{PV\text{-}need,\ total}$ (MW) | $\vartheta_{total}$ |
|---|---|---|---|
| Survey region | 0.74 | 5.38 | 0.1375 |
| Main urban region | 3.94 | 28.69 | |

The total amount of available PV installed capacity of the survey region $P_{PV\text{-}ava,\ total}$ and the total amount of required PV installed capacity of the region $P_{PV\text{-}need,\ total}$ can be respectively calculated by Eq. (8) and (9). Calculated results of PV availability in the survey region and the main urban region of Shaoshan city are shown in Table 1. The total amount of available PV installed capacity in the main urban region of Shaoshan city is 3.94 MW, which is equivalent to reducing by a 4 MW level power station. Also, the PV availability evaluation coefficient is 0.1375 in the main urban region of Shaoshan city, which can be used as a reference for design capacity of PV power generation in this region. In other words, it will reach the optimal state of thermodynamics when the available PV power generation accounts for about 13.75% of power required by the building cooling load in the main urban region of Shaoshan city.

## Conclusions

This paper proposed a PV availability evaluation coefficient based on the distributed PV-ASHP system to evaluate urban PV availability. The available PV installed capacity in an urban region is calculated and the required PV installed capacity of the region under the optimal thermodynamic performance is decided by the building cooling load. Then, the PV availability evaluation coefficient is obtained to evaluate urban PV availability based on the distributed PV-ASHP system. Main conclusions are given as follows:

(1) The PV design capacity of a single building should be based on the PV availability evaluation coefficient. The single building with a larger coefficient value is

more suitable to develop the distributed PV-ASHP systems, and the energy-saving efficacy will be more significant.

(2) A complete PV capacity design method of the PV-ASHP system of an urban region is formed. The overall PV availability evaluation coefficient is calculated to be 0.1375 in the main urban region of Shaoshan city.

(3) The PV availability evaluation coefficient proposed in this paper provides a reference for the urban PV capacity design and the comprehensive evaluation of green buildings.

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# ASSESSMENT OF GREEN SPACE DEVELOPMENT IN IBADAN METROPOLIS, NIGERIA

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**ABSTRACT:** Green spaces in cities of developing countries are faced with severe pressure from human activities, particularly uncontrolled pace of urbanization and residential developments, thereby leading to loss of the benefits they render. However, there is a dearth of empirical studies on its assessment particularly in some cities; hence, this study assesses the green space development about the urban population of Ibadan metropolis, Nigeria. Green space area of Ibadan metropolis in $m^2$ was computed from satellite imageries obtained from United States Geological Survey for the years 2000, 2005, 2010, and 2015. The population of the metropolis was also obtained from the National Population Commission (1991 and 2006), with projections made for the corresponding years. The green space per capita was estimated and compared with international minimum standards. Pearson Product Moment Correlation was used to test the relationship between green space per capita and time while charts were used to present the results. Findings revealed that the green space per capita of $0.73m^2$ for Ibadan was below both the United Nations ($30m^2$) and World Health Organization ($9m^2$) minimum standards. The relationship between green space per capita and time also showed a negative correlation with r = - 0.493. The projected green space availability shows that, by the year 2045, given the ongoing processes, there will be zero green space per capita. The study, therefore, recommends the use of master plan, building plan approval, and development control mechanisms among others to ensure compliance with green space coverage in new developments within the metropolis.

**Key words:** Greenspace, Metropolitan, per capita, Satellite Imagery, Sustainability

## Introduction

Urban centres have been projected to play host to more than half of the world population (UN Habitat, 2013). In Nigeria, the situation presents a similar pattern, with about 45% of the population living in urban settlements (Babanyara et al., 2010). Gbadegesin and Aluko (2010) projected that, by 2020, the urban population in Nigeria will increase to about 68%. The threats from this increase are widespread and alarming, including environmental degradation, infrastructural decadence, encroachment and pressure on green space infrastructure, and Urban Heat Island (UHI).

Specifically, urbanization has been found to exert undue pressure on green space development in Africa, leading to the loss of

several benefits associated with them (Mensah, 2014b). This development, as opined by Raheem (2015), mostly results from space constraint as an offshoot of competition from other land uses. Urban planning is not restricted only to the built environment such as housing and transportation network; rather, it includes the integration of green spaces into the physical urban landscape (Baycan-Levent, 2009). The urban green spaces literally encompass all public and private open spaces in urban areas mostly covered by vegetation, which are directly or indirectly available for use (URGE, 2004). These include parks, gardens, allotments, wetlands, and urban trees, among others.

Greening the urban environment has been variously recognized to offer benefits of a different kind to the urban milieu and the people (Crompton, 2001; Isenberg and Quisenberry, 2002; Aldous, 2005; Jim and Chen, 2006; Nowak et al., 2006; Cohen et al, 2008; Fam et al., 2008; Baycan- Levent and Nijkamp, 2009). This explains why planning concepts such as garden city, green belt, green fingers, and greenways highlight the need to preserve the natural environment of urban areas by incorporating many green spaces into the design of cities (Mensah, 2014a).

According to Chiesura (2004), urban green areas are strategic to the quality of life in cities. He argued that the empirical evidence of the benefits and importance of these areas is increasing, especially for environmental, ecological, and visual benefits associated with them. These include air and water purification, wind filtration, noise pollution mitigation, and microclimate regulation, besides the social services such as socialization, recreation, and crime prevention.

However, most cities of the world, especially in the developing countries, have suffered from acute depletion of green spaces principally due to rapid urbanisation, low resource base of institutions on green spaces, lack of priority to green spaces, corruption, political instability, and uncooperative attitudes of the local people (Mckinney, 2002; Mensah, 2014b). For instance, 41% of lands reserved for green spaces in Europe have been lost to different land uses (European Environment Agency, 2002).

In Africa, the case is not different. Several studies revealed a more intense pressure on green spaces, especially in urban areas, and attributed the causes to competing land uses and the attitude of people towards green spaces (Kestermont et al., 2011; Cilliers, 2014b). This rapid depletion of green spaces has resulted in green space in urban centres occupying very small percent of the total land space (Mensah, 2014b). Furthermore, several towns in the Republic of South Africa have less than 10% of their total lands occupied by green spaces (MaConnachie et al., 2008).

In West Africa, the scenario is the same, as urbanization has led to many cities such as Lagos, Kano, Kaduna, Sokoto (Nigeria), Dakar (Senegal), Freetown (Sierra Leone), Abidjan (Cote D'lvoire), Accra, Kumasi, and Tema (Ghana) to lose a substantial amount of urban green spaces to urban sprawl and infrastructural developments (Fuwape et al., 2011). It has been found, for example, that Kumasi in Ghana, a city once tagged as Garden city of West Africa, now has several of its green spaces depleted, remaining only a small fraction which, combined with other open spaces, constitutes about only 10.7% of the total land area (Amoako and Korboe, 2011).

The situation in Lagos metropolitan city (Nigeria) is more frightening. Green spaces now occupy less than 3% of the city's landmass (Oduwaye, 2013). This perhaps informs the recent vigorous beautification project embarked upon by the present administration in the state. Even Abuja, the Federal Capital Territory believed to be a recent city with all apparatus of government, is not exempted (Jibril, 2010). A study on urban sprawl and its effect on the natural vegetation cover of Abuja, Nigeria revealed a considerable loss of the natural vegetation to the expansion of settlements (Fanan et al., 2011).

The consequences of outright absence and/or insufficiency of green spaces in urban area are enormous and challenging on the environment and the people. Environmentally, it has been established that a lack of vegetative cover in urban areas makes many African cities "ecologically unfriendly" with configurations that compromise their resilience to climate change (FAO, 2012). The report further stated that lack of vegetation and the use of heat-retaining building materials raise city temperatures, which leads to shrinking water tables. Flooding is a threat to many large cities; Ibadan particularly has suffered several occurrences of flooding at large scale, resulting in loss of lives and properties. The depletion of green space which could serve as protection for topsoil has, in most cases, aided the flooding.

This study is, therefore, an attempt to assess the urban green space development in Ibadan metropolis, Nigeria, to find some principles and appropriate comprehensive planning issues to guide future urban green space planning and management to enhance sustainability.

**Study Area**

Ibadan was the administrative capital of the old western region and the present capital of Oyo State. It is located approximately at a distance of some 145 kilometres North East of Lagos and North of Abeokuta (Ayeni, 1994). It is located near the forest grassland boundary of South-Western Nigeria (Ifesanya, 2003). Ibadan region consists of five urban LGAs (see Figure 1) and six rural (less city) LGAs, totalling eleven LGAs. The population of the city was put at above three million (NPC, 2006), with the largest metropolitan geographical extent covering a total land area of 3,080-kilometre square. It is predominantly occupied by Yoruba-speaking people, with major economic activities such as farming, trading, and artisanship.

Generally, Ibadan lies within the low lying coastal plain where the average elevation is between 200-400m above sea level. The city has a tropical rain climate and comes under two different prevailing winds: the dry, but cold North-easterlies, which usher in the dry season from November to March, and the moist laden South-westerlies, which last from April to October. Thus, two different seasons (dry and wet) which coincide with prevailing winds are experienced. In the dry season, the average monthly rainfall is less than 30mm, while the monthly precipitation varies from 70 to 170mm during the rainy season, when rainfall is heavy and often accompanied by a thunderstorm.

Rainfall in the area is controlled by the movement of Inter-Tropical Discontinuity (ITD). This is the atmospheric zone between the maritime southwest monsoon and the dry northeast trade wind known as harmattan in Nigeria (Adejuwon, 1979). The movement of the ITD North-south is gradual but consistent.

It is responsible for the regular pattern of rainfall and also has a direct and indirect influence on other climatic elements.

Temperatures remain high throughout the year, with little variations and annual range of between 2oC to 5oC. The hottest months are February, March, and April, when the average daily maximum temperature is 34°C. In the coldest months of December and January, the average daily minimum temperature is 21°C at noon. Sunshine duration ranges from about 2.1 hours to 5.4 hours. The lowest duration is in the cloudy and rainy months of July to September, while November to February have the highest duration. This is the dry season when the sky is mostly devoid of clouds. The average sunshine length for the whole year is 4.3 hours (Akintola, 1994).

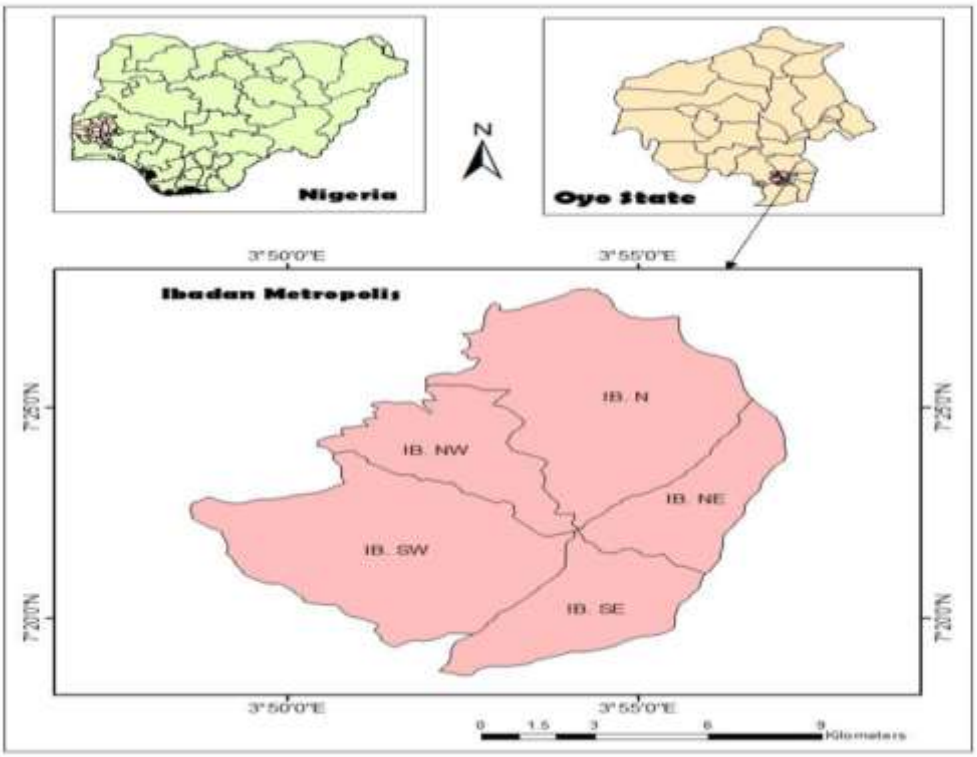


**Figure 1: Physical Setting of Ibadan and Oyo State in Nigeria**
Source: Simon (2015)

**Methods and Data**

Basically, secondary data was used in this study; this included the green space and built-up coverage in square metre. The satellite imageries of Ibadan for the years 2000, 2005, 2010, and 2015 were acquired from the United State Geological Survey. The images were taken by the TM sensor and were obtained from the United States Geological Survey (Earth Explorer) website, where they were already radiometrically and geometrically corrected through the Level 1 T Product Generation System (LPGS). The Landsat images were used because of the advantage of coverage of data for the purpose of temporal studies (Coulter et al., 2016). This

is in addition to the benefit of 30m resolution of images, which also allows for good quality studies. The classification of the images was conducted on the GIS IDRISI Selva through the use of the supervised method. The images were classified under supervision. Minor manual corrections were made on erroneously classified areas that were identified on the images on the post-classification analysis. The post-classification was validated through the use of overall accuracy and through the use of the Kappa Index which can provide the level of agreement between the classified image and the references used to perform the classification. Other secondary data used included maps depicting the study area, obtained from the Department of Urban and Regional Planning GIS Unit, University of Ilorin. Also, population figure was obtained from the 1991 and 2006 census reports of National Population Commission, with projections made for the corresponding years. For the estimation of green space per capita, the total green space in (m2) was divided by the total population of each year and compared with international minimum standards. In achieving the population projection, the population of Ibadan for the selected years was used and derived by using the 1991 census results as the base year for years preceding 2006, while the year 2006 census result was used to project population figure for the years above 2006. Also, while the growth rate of 2.8% was used to project the years 2000 and 2005, 3.2% was used for that of the years 2010 and 2015 (NBS, 2011). Pearson Product Moment Correlation was used to test the relationship between green space per capita and time. Charts and line graph were used to present the results.

## Results and Discussion

### Green space coverage of Ibadan

The availability of green space, as captured by the Landsat satellite imageries (Figures 4.1 to 4.4) shows that Ibadan had 1,791,300m2 of green space in the year 2000, while for the years 2005, 2010, and 2015, there was corresponding coverage of 767,700m2, 1,151,550m2 and 1,023,600m2. During the period, the built-up area of Ibadan metropolis was captured to be 117,842,000m2 at the beginning of the millennium (2000) and rose to 118,993,550m2, 120,784,850m2, and 123,215,900m2 in the years 2005, 2010, and 2015 respectively.

As shown in Table 1, the study revealed that the green space in Ibadan metropolis reduced in coverage from the year 2000 throughout the study, except in the year 2010, when there was an increase over that of the preceding epoch (year 2005). While there was a sharp reduction in the green space coverage from 1,791,300m2 in the year 2000 to 767,700m2 in 2005 (57% reduction in just five [5] year interval), there was, however, an increase five years after to 1,151,550m2 over the 2005 trend, though it kept decreasing in extent till the year 2015 when it had 1,023,600m2.

The result shows that the built-up as against the green space in Ibadan metropolis kept increasing from year 2000 through 2015. The reduction in the urban green space in the metropolis might not be unconnected to increase in built-up resulting from the various massive developments being carried out in the city. This is largely by individual developers while the intermittent increase in green space particularly in 2010 over the previous epoch could also be as a result of a greening programmes embarked on in the metropolis by the state government under

Akala-led administration between 2007 and 2011.

Also, reduction in green space could be as a result of waste dump on green space. This result, therefore, is a confirmation of earlier studies in different urban centres both within and outside the African continent, where urbanization had been identified as a major factor in the loss of green space (McDonald et al., 2010; Olayiwola and Igbavboa, 2014; Mensah, 2014b; Odjugo, Enarubve and Isibor, 2015; Ndubisi and Chukwunoyelim, 2017).

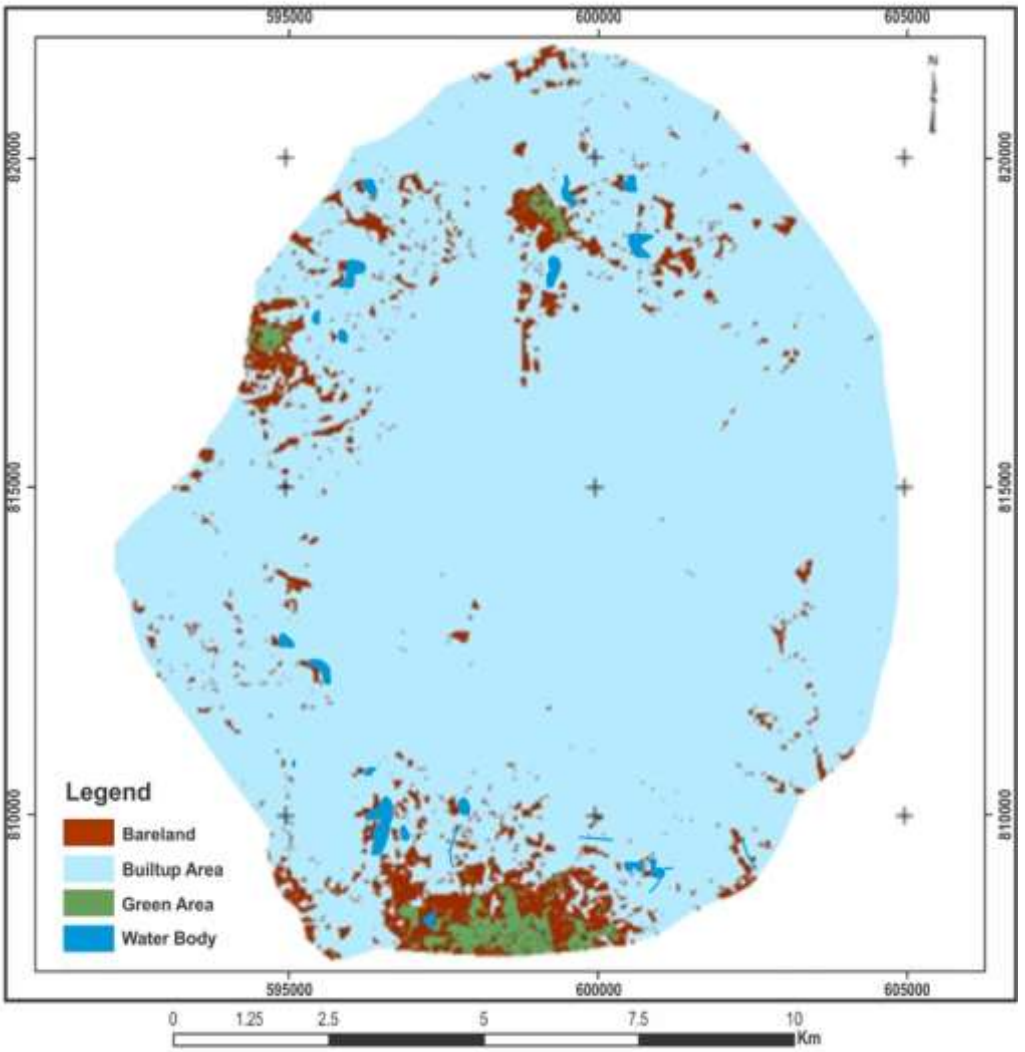


**Figure 2: Land Use/ Land Cover of Ibadan, 2000**
Source: Authors' Fieldwork, 2016

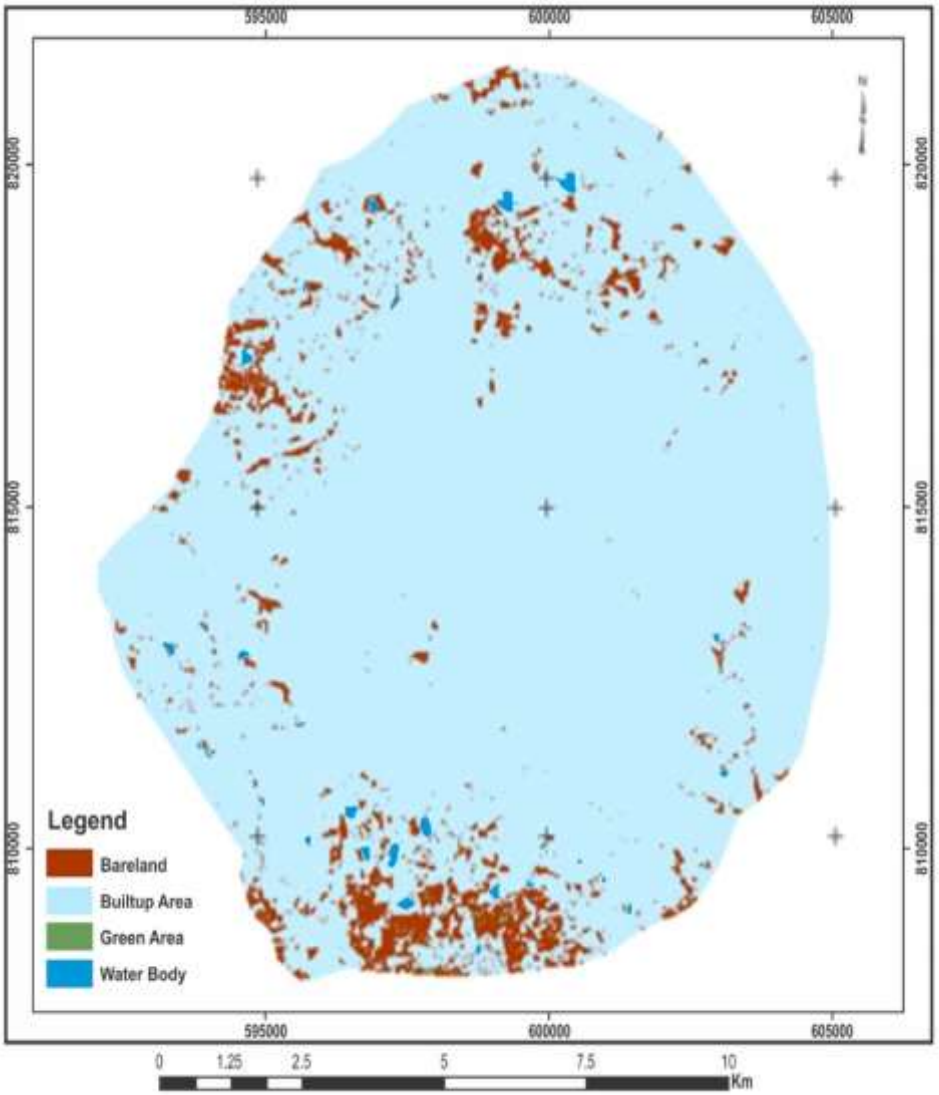


**Figure 3: Land Use/ Land Cover of Ibadan, 2005**
Source: Authors' Fieldwork, 2016

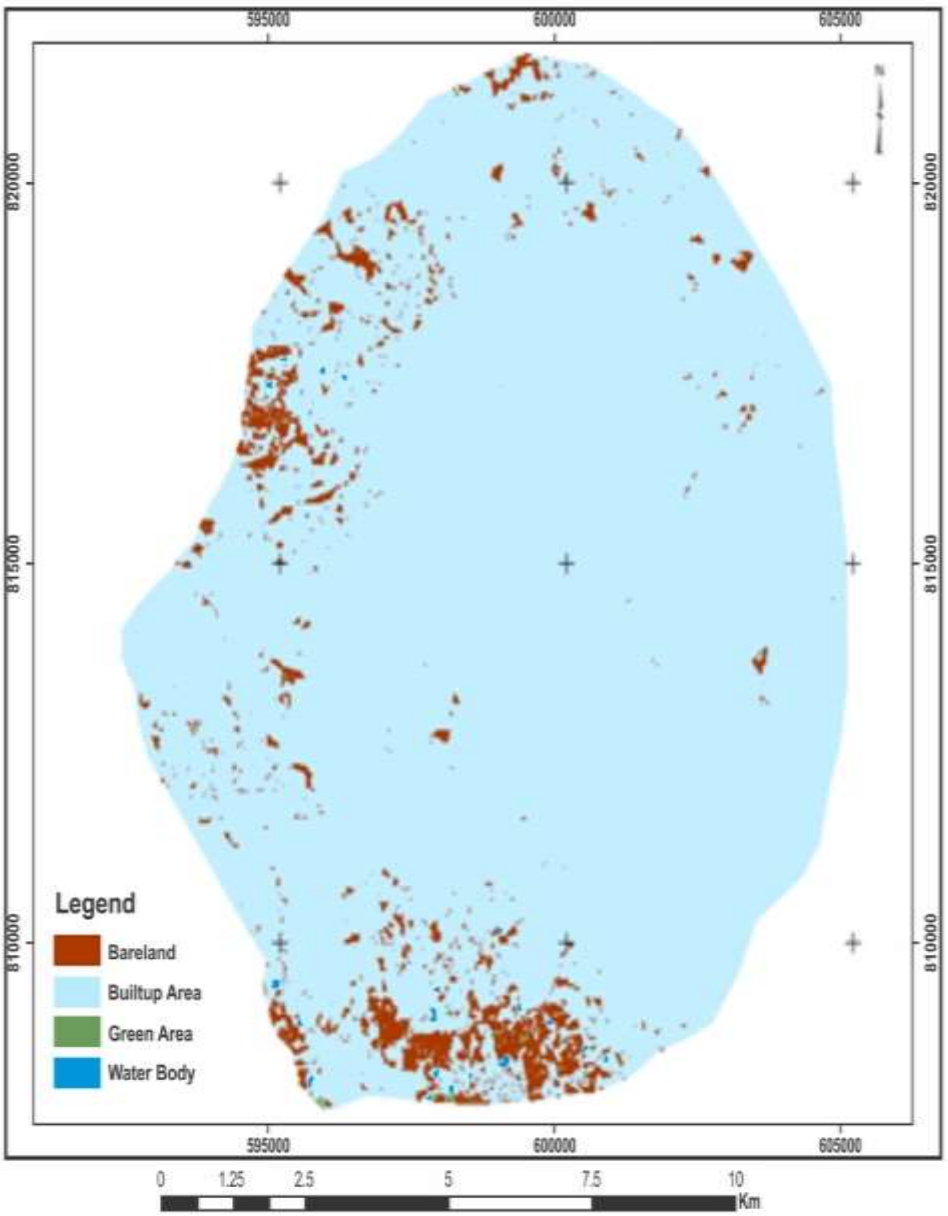


**Figure 4: Land Use/ Land Cover of Ibadan, 2010**
Source: Authors' Fieldwork, 2016

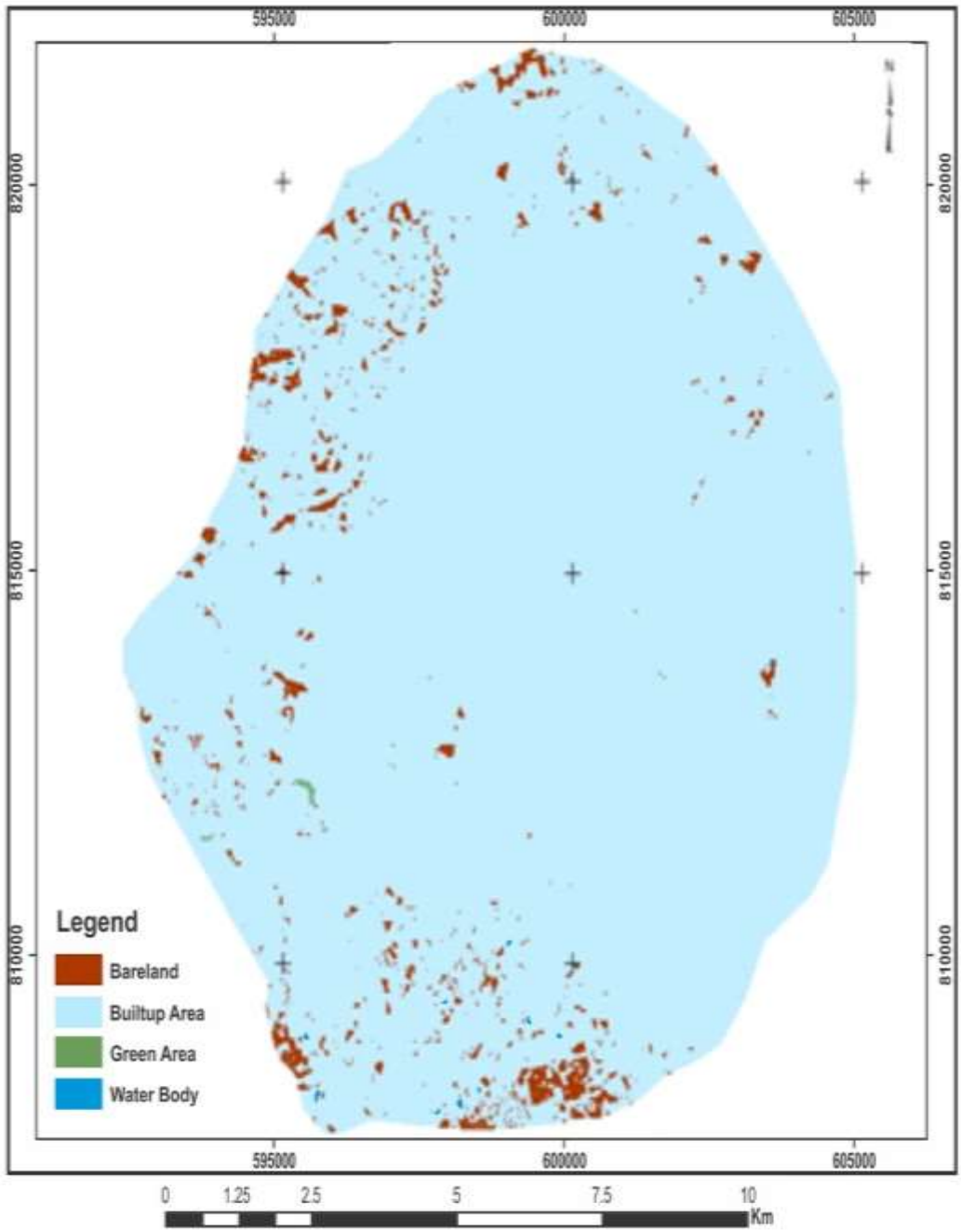


**Figure 5: Land Use/ Land Cover of Ibadan, 2015**
Source: Authors' Fieldwork, 2016

**Table 1: Extent of Urban Green Space in Ibadan 2000-2015**

| CLASS | Areas in Square Metres | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | | 2005 | | 2010 | | 2015 | |
| | Area ($m^2$) | Coverage (%) | Area ($m^2$) | Coverage (%) | Area ($m^2$) | Coverage (%) | Area ($m^2$) | Coverage (%) |
| Bare land/Road | 8,300,116 | 6.1 | 8,174,596 | 6.39 | 6,002,235 | 4.6 | 3,701,520 | 2.83 |
| Built-up Area | 117,842,000 | 92 | 118,993,550 | 93 | 120,784,850 | 94.4 | 123,215,900 | 96.3 |
| Green Area | 1,791,300 | 1.4 | 767,700 | 0.6 | 1,151,550 | 0.9 | 1,023,600 | 0.8 |
| Water body | 16,634 | 0.2 | 14,204 | 0.01 | 11,415 | 0.08 | 9,030 | 0.07 |
| Total | 127,950,050 | 100 | 127,950,050 | 100 | 127,950,050 | 100 | 127,950,050 | 100 |

As illustrated in Table 2, the Pearson Product Moment Correlation indicated that, with r = -0.493, there is a negative relationship between urban green space per capita year. This implies that as years passed by, there was further reduction in the coverage of urban green space per capita in Ibadan during the period of study. It also implies that, with an increase in population and the tendency for more infrastructural development in terms of housing, roads, and other infrastructural services, more years imply less urban green space. With the p-value of 0.431, it was observed that there is no significant relationship between green space and time at $p<0.05$ significance level.

Figures 2-5 show the graphical trends of built-up and green space areas as captured from the study area. Specifically, as shown in Figure 6, the year 2000 to 2005, Ibadan green space reduced from 1.4% coverage to 0.6%. It, however, increased to 0.9% in the year 2010 and again reduced to 0.8% in 2015. On the other hand, the percentage coverage of built-up area for the same city increased from 92%, 93%, 94.4% to 96.3% in the years 2000, 2005, 2010 to 2015 respectively.

**Table 2: Results of Correlation Analysis between Urban Green Space per capita and Time in Ibadan**

| | | Time | Green space per capita |
|---|---|---|---|
| Time | Pearson Correlation | 1 | -.493 |
| | Sig. (2-tailed) | | .431 |
| | N | 4 | 4 |
| Green space per capita | Pearson Correlation | -.493 | 1 |
| | Sig. (2-tailed) | .431 | |
| | N | 4 | 4 |

* Correlation is not significant at the 0.05 level (2-tailed).
Source: Author's Fieldwork, 2016

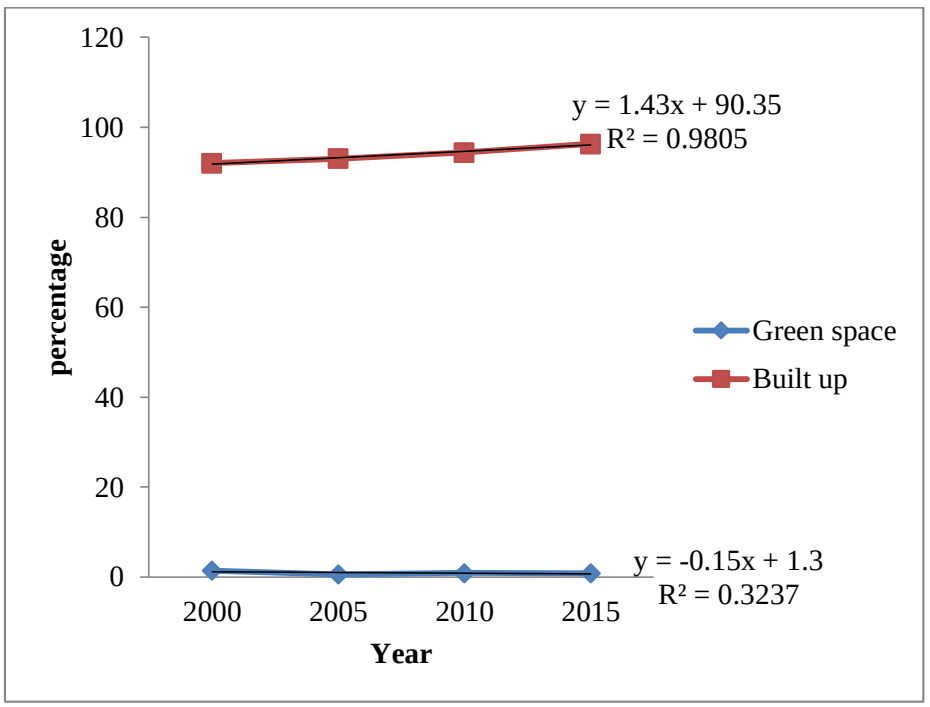


**Figure 6: Trend of percentage change of Green Space and Built-up Area in Ibadan**
Source: Author's Fieldwork, 2016

Furthermore, the trend of percentage increase of built-up of Ibadan with correlation coefficient r = 0.990 reveals a strong positive correlation over time, while that of green space with r = - 0.568 indicated a negative correlation trend over time. It is obvious from the result that, apart from the increase in percentage coverage of green space from the year 2005 to 2010, green space assumed a decreasing trend over the year, while that of built-up was increasing tremendously with years. This result is similar to several other studies of this nature that were earlier carried out in different cities in Nigeria such as Abuja (Fanan et al., 2011) and Suleja (Ejaro and Abdullahi, 2013).

**Estimation of green space per capita**

The study, as shown in Table 3, revealed that the green spaces per capita for Ibadan in the years 2000, 2005, 2010, and 2015 were estimated at 1.14m2, 0.4m2, 0.8m2 and 0.6m2 respectively. It can be observed that none of the year's green space per capita could match the minimum recommended standards of both the World Health Organization 9m2 (Fuady & Darjosanjoto 2012) and the United Nations (UN) 30m2 (Laghaei et al., 2012). In other words, the green space per capita of Ibadan metropolis during the period of the study fell short of the world's recognized minimum standards.

**Table 3: Green Space per capita of Ibadan metropolis**

| Years | Green space of Ibadan in ($m^2$) | Population | Green Space Per Capita ($m^2$) |
|---|---|---|---|
| 2000 | 1,791,300 | 1,574,866 | 1.14 |
| 2005 | 767,700 | 1,808,574 | 0.4 |
| 2010 | 1,151,550 | 1,518,409 | 0.8 |
| 2015 | 1,023,600 | 1,777,408 | 0.6 |

Source: Author's Fieldwork, 2016

By implication, it is perhaps difficult or practically impossible for such an environment and the people therein to enjoy some of the benefits of green space in full capacity. From the findings, it can be inferred that, if no serious measure is adopted in the provision and management of urban green space in the study area, the future appears bleak, as the city is likely to experience some of the climatic negativities such as increase flooding, loss of biodiversity, and excessive heat resulting from urban heat islands, among others.

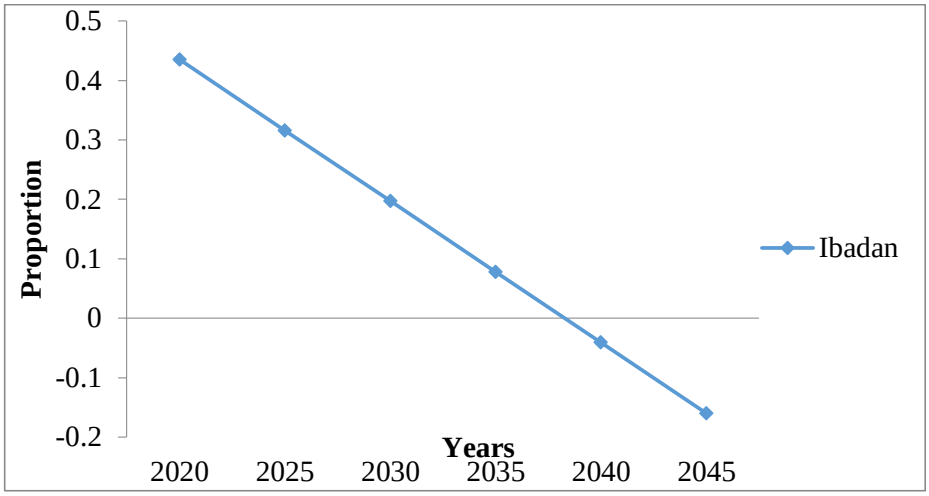


**Figure 7: Linear projection of Green Space per capita of Ibadan metropolis**
Source: Author's Design, 2016

The dwindling state of green space per capita in the city with years deserves to be monitored, at least for policy and planning. The study, therefore, examined the period when the green space per capita would be zero and exhausted. Consequently, a linear projection was specified on the raw data to arrive at future green space per capita. As shown in Figure 7, the study found that the green space per capita of the area under review kept on decreasing such that by the year 2040, Ibadan would be negative.

**Table 4: Linear Projection of Green Space per capita of Ibadan**

| Years | Green Space Per Capita ($m^2$) |
|---|---|
| | Ibadan |
| 2020 | 0.435 |
| 2025 | 0.316 |
| 2030 | 0.197 |
| 2035 | 0.078 |
| 2040 | -0.041 |
| 2045 | -0.16 |

Source: Author's Computation, 2016

As can be seen in Table 4, the study found that there were changes in the green space per resident per period in Ibadan. For instance, the 1.14m2 per resident for Ibadan in the year 2000 drastically reduced by 64.6% within five years interval, an indication of a decrease in urban green space with increased population. The situation, however, changed for better in the year 2010, as the green space per resident doubled from 0.4m2 per resident to 0.8m2, an increase of 100%. This situation is at variance with other periods and so deserves an attention. It was, however, discovered that, while urban green space for

the year 2010 recorded an increase over the preceding year, the population size reduced. The increased size of green space might be hinged on the fact that the two epochs fell in different political administrations. Specifically, 2010 was situated in the Akala-led administration in Oyo state and there was a substantial greening of Ibadan metropolis in terms of greening (see plate 1). Also, the administration, in conjunction with the six municipal local government administrations in Ibadan metropolis at the time, embarked on a better template of municipal waste disposal and management. By this, it means waste were not indiscriminately disposed, such that green space would be affected both in size and quality. Hence, the increase in the green space per capita for the epoch might not be totally dissociated from these areas of administrative change. The scenario in the year 2015 changed, as the green space per capita reduced by 25% from that of the year 2010, from 0.8m2 to 0.6m2 in year 2015.

**Plate 1: Agodi Park Gate, Ibadan**
Source: Authors' Fieldwork, 2016

**Table 5: Percentage change in Green Space per capita of the City**

| Year | Green space per capita ($m^2$) | |
|---|---|---|
| | Ibadan | % Change |
| 2000 | 1.14 | - |
| 2005 | 0.4 | -64.6 |
| 2010 | 0.8 | +100 |
| 2015 | 0.6 | -25 |

Note: (-) denotes decrease while (+) is increase in %
Source: Author's Computation, 2016

It can thus be deduced from the findings that, generally, aside from the situation where green space per capita rose from 0.4m2 per resident to 0.8m2 between year 2005 and 2010, the green space per capita of the study area kept reducing from the year 2000 to 2015 throughout the period. There has been a reduction in the green space per person. Major factors that could be held responsible for this development include the population increase in the city and reduction of green space available, the cause of which might not be too far from the various depletion of green space (e.g competing land uses and takeover of areas). hitherto earmarked and developed as green spaces (see plate 2)

**Plate 2: Road Green Space in Stiff Competition with Refuse at Sango, Ibadan**
Source: Raheem, 2015

This could lead to flooding, incessant heat emanating from resultant Urban Heat Islands (UHI) in the cities among other things. By extension, a heated environment could result in miscellaneous heat-related diseases, as findings have shown that high temperature may favour the occurrence of such ailments as meningococcal and

meningitis diseases (Moore, 1992; Abdullai, 2006).

**Comparison of Green Space per capita with Standards**

Various green space standards exist across cities and countries of the world. For the purpose of this study, the green space per capita estimates of Ibadan were done in relation to several other countries of the world and, by extension, the UN and WHO minimum standards.

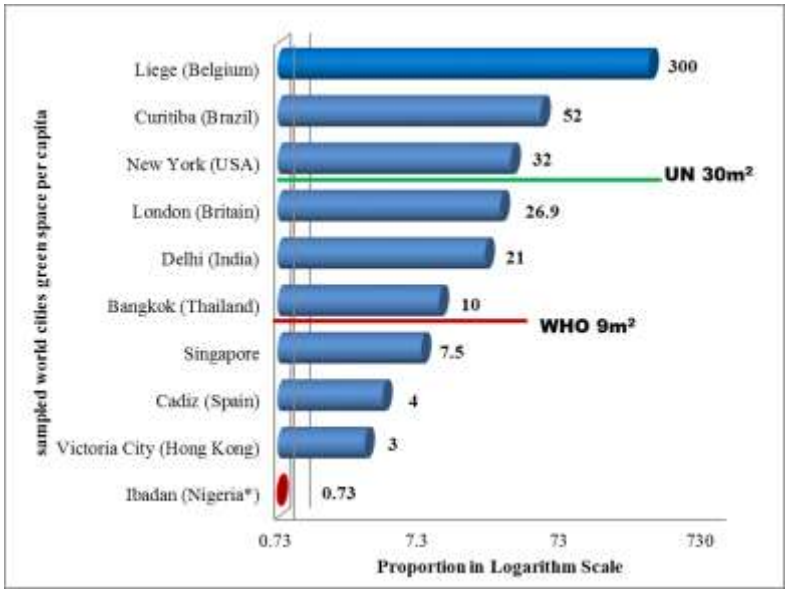


**Figure 8: The Study Area in the context of World Cities Green Space per capita**
Source: Author's Fieldwork 2016, Fuller & Gaston, 2009; Vazques, 2011

It can be observed from Figure 8 that Ibadan metropolis on the average recorded a paltry total of 0.73m2 green space per capita. It did not only record a shortfall, compared to other selected cities, but was also far behind the global minimum standards set by the United Nations and World Health Organisation. It means that for the city of Ibadan to meet up with the minimum standard or 9m2 by WHO, there must be green space provision of 8.1m2 green space per capita amounting to 91.8%.

By implication, it, therefore, means that there is the need for reinforcement to avert further depletion. This is important so, as the rate of reduction as reported earlier in this study was high and consequently. It can be conveniently concluded that incessant flooding in Ibadan city might not be too far from the shortage of green space in the metropolis.

This was confirmed by Akintola (1994) and Ajayi et al. (2012) in separate studies of Ibadan flood where deforestation among other factors was identified to be responsible for flooding in the city. It was further stressed that some forests such as Agala forests that were purposely retained by the colonial administration to serve as water catchment areas were destroyed with impunity. Several other estimates of green space recommendation also exist in some African cities and the study compared some

of the selected countries' green space per capita with estimates of the study area.

As shown in Figure 8, the study, while placing the green space per capita of the study area side by side the selected African cities,' found that, in Ibadan, the green space per capita was abysmally low. As discovered by the study, an average of 0.73m2 placed the city far below what was obtainable in other African cities, except Alexandria (Egypt), which only exceeded it by 0.27m2. Comparing the per capita of Ibadan with the minimum set standards of the international organisations employed as benchmarks in this study too, it can be observed that Ibadan fell far beyond meeting up with them, thereby placing it in the same category with cities like Nairobi (Kenya) with 2.8m2, Alexandria (Egypt) 1m2 , and Kumasi (Ghana) 4.7m2.

By implication, therefore, it can be concluded that, apart from the fact that Ibadan was far from meeting the global standards, it could also not measure up to any of the selected African cities in terms of green space index and if the various sustainable development issues about the environment have to be successfully implemented, there is the need to brace up in the area of green space of the city.

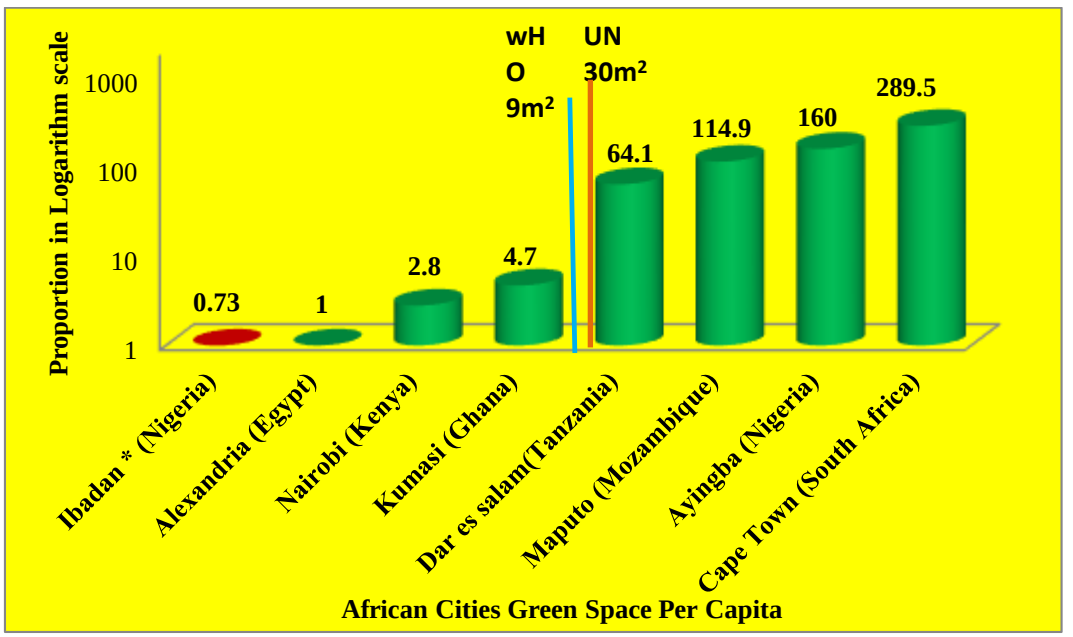


**Figure 8: The Study Area in the context of African Cities Green Space per capita**
Source: Author's Fieldwork 2016, Makworo & Mireri, 2011, Mensah, 2015, Ifatimehin et al., 2015

**Establishment of Green Space Deficit and Surplus**

The study has pointed out that Ibadan generally showed shortfalls within the period under consideration, compared to other cities in Africa. But the question to be answered remains by how much do the green spaces in Ibadan fall short of the global minimum recommended standards employed in this study?

In the quest for a better understanding of the numerical strength of green space in Ibadan, Nigeria in relation to the globally set minimum standards, this

study shows the shortfall. As shown in Table 6, considering the World Health Organization's 9m2 per capita minimum green space standard for healthy living, the study found that Ibadan recorded a deficit in its green space, going by the 9m2 benchmark. Shortfalls of approximately 12,382,494m2, 15,509,466m2, 12,514,131m2 and 14,973,072m2 were recorded in the years 2000, 2005, 2010 and 2015 respectively.

Furthermore, using the UN minimum standard of United Nations of 30m2 per person, Ibadan had a shortfall of 45,454,680m2 in the year 2000, 54,257,220m2 in 2005, and 44,400,720m2 and 52,298,640m2 in the years 2010 and 2015 respectively. It can thus be concluded that, in all the minimum benchmark standards of green space per capita employed by this study, Ibadan has been identified to fall short, an indication that the city is likely to perform credibly low in terms of urban sustainable development.

**Table 6: Green Space in Ibadan with available Standards and Shortfalls**

| Green Space in Ibadan with available Standards and ShortfallsCities | Year | Green space ($m^2$) | Population | Required space based on WHO $9m^2$ | Surplus and Shortfall | Required space based on UN 30m2 | Surplus and Shortfall |
|---|---|---|---|---|---|---|---|
| Ibadan | 2000 | 1,791,300 | 1,574,866 | 14,173,794 | -12,382,494 | 47,245,980 | -45,454,680 |
| | 2005 | 767,700 | 1,808,574 | 16,277,166 | -15,509,466 | 54,257,220 | -53,489,520 |
| | 2010 | 1,151,550 | 1,518,409 | 13,665,681 | -12,514,131 | 45,552,270 | -44,400,720 |
| | 2015 | 1,023,600 | 1,777,408 | 15,996,672 | -14,973,072 | 53,322,240 | -52,298,640 |

WHO- World Health Organization
UN- United Nations
Source: Author's Fieldwork, 2016; Fuady & Darjosanjoto 2012

**Recommendations**

Arising from the findings of this study, it is pertinent to offer suggestions that will not only serve to address the immediate issues identified but also serve as a holistic template of action for policymakers in addressing sustainably, the urban green space development, and its management in Ibadan in particular and the country at large. Specifically, Ibadan did not meet up with any of the minimum standards used as benchmarks, an issue that requires sustained attention. The following comprehensive recommendations are, thus, offered for sustainable policy guidelines.

**Development of master plan**

Lack of master plan for the city has not only affected the development of green space but all land uses (residential, commercial, circulation, and recreational land uses among others). A sustainable development and management of green space in any city should emanate from a comprehensive land-use plan which will continue to guide and control development. By so doing, urban green spaces in cities will

be accorded their rightful place in the scheme of development.

**The use of building plan approval tool**

Development of other land uses outstrips green space development due to urbanization and increasing need for housing, and commercial buildings among others. Arising from this, the use of building plan approval can be utilized to ensure strict compliance with the development ratio of green space. Building plans that do not comply with the reservation of 10% green space of total plot coverage for development should not be countenanced.

**Effective development control authority**

Approval of a plan is one thing and development to comply is another. In ensuring that what is finally developed completely complies with the approved plan, the development control units need to be highly effective in carrying out their monitoring activities. Any development short of the one approved should have its developer sanctioned appropriately. With this, the green space requirement of urban dwellers will be met and its services accessed accordingly.

**Sensitization campaign and awareness on green space protection**

To preserve the existing green space and prevent depletion, there should be sensitization campaigns on the significance of maintaining green space around human habitats and people should be encouraged not to only develop greenings but also maintain and protect them jealously.

**Development of comprehensive tree planting scheme in cities**

There is a need to improve on green space coverage. It has been established by this study that Ibadan alone needs an average of approximately 1,238 hectares of urban green space to meet up with the World Health Organization minimum green space per capita. Road shoulders, road medians, and residential buildings as well as market places should, therefore, be targeted for this tree planting exercise. Apart from reducing urban heat islands, an abundance of vegetative cover in cities will reduce the use of generators and air-conditioners, thereby lessening energy consumption. This can go a long way in achieving the UN SDGs goal 7 (Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all). Also, if this is achieved, there is bound to be less motorization, more walking, and bicycling at city centres.

**Conclusion**

This study of urban green space development of Ibadan metropolis, Nigeria has evaluated the green space development and found that there is a decrease in green space available as well as green space per capita of the study area. The green space per capita was low, compared to other cities around the world and the minimum recommended by the WHO and the UN. Also, the green space per capita and time was found to have a negative correlation, implying a reduction in the size of green space with passage of the year. The projection of the green space per capita was discovered to be at the minimal level in future and even capable of reaching zero if nothing meaningful is done to address the issue.

Given the suggested recommendations, therefore, it is believed

that green space in Ibadan can be adequately improved and sustainably managed

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# EXTRACTION, CHARACTERIZATION, AND APPLICATION OF CASHEW NUT SHELL LIQUID FROM CASHEW NUT SHELLS

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**Abstract:** Cashew nut shell, an agro waste, has now become a major source of petrochemical phenolic compounds and a raw material for bio-based products. In this study, cashew nut shell liquid was extracted from cashew nut shells using an accelerated solvent extraction technique. The extract, cashew nut shell liquid, was a dark brown viscous liquid with an average yield of 30.61 ± 0.200%. Results of the physical analysis showed a moisture content of 4.45 ± 0.020% and a density of 0.95 ± 0.300 gmL-1. The percentage brix and refractive index were 76.20 ± 0.001 and 1.47 ± 0.010 respectively. Chemical characterization showed a pH of 5.65 ± 0.003; acid value of 8.25 ± 0.200 mg KOH/g; ash content of 1.80 ± 0.6%; free fatty acid of 4.12 ± 0.400 mg KOH/g; ester value of 247.01 ± 0.100 mg KOH/g, and a saponification value of 255.26 ± 0.800 mg KOH/g. The FTIR spectra revealed that cashew nut shell liquid is polymeric and possesses carboxylic and hydroxyl groups substituted on the phenolic constructions. The cashew nut shell liquid was employed as a precursor in the synthesis of resin, thus, confirming the reality that higher phenolic compounds that can be used as precursors in industrial applications could be obtained from agro wastes.

**Key words:** Waste valorization; cashew nut; phenolic compounds; characterization; sustainable development

## Introduction

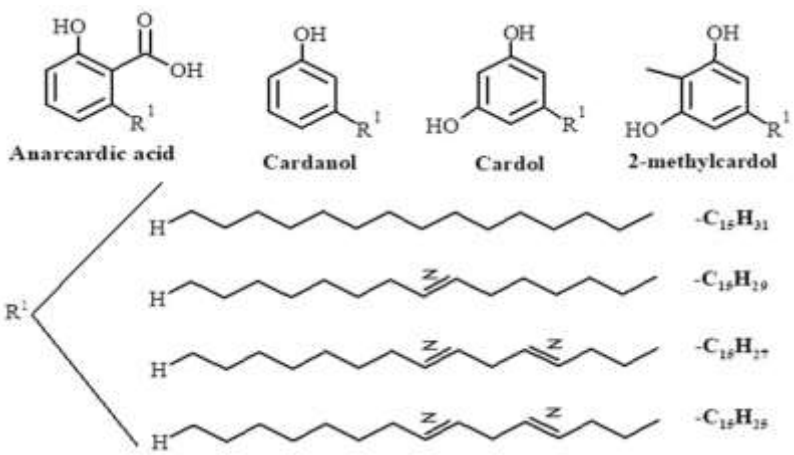
Nature is endowed with many resources which can be exploited for diverse gains – some of which are water, wind, solar energy, plants, and animals. However, unplanned urbanization, rapid population growth, and mismanagement have led to the rapid depletion of some of these resources, hence our quest for proper management and sustainable use of natural resources (Mohanty et al., 2010). The exploitation and application of plant and food resources result in the generation of waste materials which must be effectively managed via recycling, reuse, and/or improved design to enable us to achieve the targets of the United Nation's Sustainable Development Goals 11 and 12 (United Nations, 2016). Of late, scientists have been exploring the use of agro-wastes as a source of raw materials (precursors) in synthesizing several benign functional products, value-added chemicals, and in sustainable energy research areas (Agwu & Akpabio, 2018). The cashew nut shell, an

agro-waste, has now become a raw material for polymer synthesis (Balgude & Sabnis, 2014), a source of petrochemical phenolic compounds (Andrews et al., 2017; Jaillet et al., 2014), among others. The cashew nut shell liquid, an alkyl phenolic oil, is a reddish-brown viscous liquid obtained from the cashew nut shell as a by-product from the cashew nut industry (Mothé et al., 2013).

The cashew nut shell liquid (CNSL) has the following components based on the method of extraction: anacardic acid (71.7%), cardonol (4.7%), cardol (18.7%), methylcardol (2.7%), and unnamed polymeric materials (2.2%), as shown in Scheme 1 (Taiwo, 2015). Cardanol (52-60%) is a major component of a heat-extracted cashew nut shell liquid with cardol (10%) and polymeric materials (30%). Technical grade cashew nut shell liquid (without polymeric material) has about 78% cardanol, 8% cardol, and 0-2% polymeric material (Abbina & Anilkumar, 2017).

The chemistry of cashew nut shell liquid is dependent on the presence of its reactive operational aromaticity, phenolic hydroxyl, and unsaturated alkyl phenol (R side chain), making it suitable for polymerization into resins.

Consequently, modified cashew nut shell liquid has diverse industrial applications (Quirino et al., 2014), some of which are plasticizers (Lochab et al., 2014), adhesives (Balgude & Sabnis, 2014), fuel additives (Vedharaj et al., 2016), surfactants (Telascrêa et al., 2014), resin additives (Balgude & Sabnis, 2014; Ikwuagwu, 2008; Lochab et al., 2014; Mahanwar & Kale, 1996), friction materials, as well as flame retardants (Andrews et al., 2017), and also as intermediates or precursors for other chemical syntheses (Balgude & Sabnis, 2014).




**Scheme 1. Components in cashew nut shell liquid**

Generally, extraction of the liquid from the cashew nut shell could be done by techniques such as hot oil process (Edoga et al., 2006), solvent extraction (Taiwo, 2015), mechanical processes (Lochab et al., 2014), vacuum distillation (Taiwo, 2015; Telascrêa et al., 2014), and/or supercritical fluids (Balgude & Sabnis, 2014). Usually, the extracts are separated by concentration, using a vacuum rotary evaporator or any other appropriate means.

The current scientific research is directed towards concerted efforts to employ economic, time-saving, and efficient methods that would accomplish desired results. The literature on the application of methods that overcome extraction challenges like expensive costs of reagents and solvents, low yield, contamination of the final product, and cost-effectiveness of energy employed is scanty. Therefore, this study aims to extract cashew nut shell liquid from cashew nut shell, an agro-waste, using the ASE technique, which is not only energy-saving but also requires less volumes of solvent to give a higher yield. The cashew nut shell liquid extract was characterized and employed as a precursor in the synthesis of resin, which is a novel approach of adding value to agro-waste in the context of sustainable development.

## Materials And Methods

### Chemicals, reagents, and equipment

The acetone, diatomaceous earth, buffer tablets, ethyl alcohol, phenolphthalein indicator solution, potassium hydroxide solution (KOH), alcoholic potassium hydroxide, hydrochloric acid, formaldehyde, and sodium hydroxide pellets (NaOH) were obtained from Loba Chemie (Mumbai, India). All chemicals were of analytical grade and were used as received.

Extraction was done using the accelerated solvent extractor (Dionex ASE 350, Waltham, USA) and the extract was concentrated using a vacuum rotary evaporator (Cole-Parmer, Vernon Hills, USA). The moisture content of the extract was determined using a moisture analyzer (Sartorius MA 35 Hamburg, Germany) while its density was measured with the aid of a density meter (A. KRÜSS Optronic GmBH – DS7800, Hamburg USA). The refractive index of the extract was carried out in a refractometer (A. KRÜSS Optronic GmBH – DR6300-TF, Hamburg USA). The pH of the sample was measured using a pH meter (Eutech PC700 Navi Mumbai, India). Sample incineration was done in a muffle furnace (Thermo Scientific Thermolyne FB1310M-33 Mumbai, India). Infra-red spectrum of the extract was taken in Fourier transform infrared spectrophotometer (Bruker Alpha Platinum, ATR, Billerica, USA). A magnetic stirrer (SB 162-3, Clare, Ireland) with heating facility was used in periodic heating and stirring.

### Cashew nut collection and pretreatment

Large quantities of cashew nuts were obtained from Kintampo (GPS 8°02’60.00N - 1°42’59.99”W) market in the Bono East Region of Ghana. The nuts were sorted, washed thoroughly with distilled water, and dried in the sun for 24 hours. With the aid of a knife, the cashew nuts were removed from the apple and the shells were dried in the sun for another 24 hours. The dried shells were crushed using mortar and pestle, with the remaining moisture removed by drying in an oven at a temperature of 60 °C for 96 hours (Edoga et al., 2006).

### Extraction of cashew nut shell liquid

The extraction was performed using an accelerated solvent extractor (Thermo Scientific Dionex ASE 350 Waltham, USA). The dried and crushed shell (180 g) was mixed with diatomaceous earth (1:2) drying agent. Aliquots (20 g) of each were transferred into 9 sample cells and the end caps (each containing a frit), and tightened into the cells. The filled sample cells and collection vessels were loaded onto the cell and collection trays respectively. The samples were extracted with acetone using these accelerated solvent extraction conditions:

1000 psi, 80 ºC, 5-minute heat up, three 5-minute static cycles, 100% rinse, 60-second purge, and nine 20 mL cell containing nine cellulose filter.

The concentration of the cashew nut shell liquid was done under vacuum at 50 ºC in a rotary evaporator (Cole - Parmer). The concentrate in a beaker was wrapped in aluminium foil and stored at room temperature.

**Oil yield determination**

The percentage yield of the cashew nut shell liquid was determined at the end of the extraction. It was computed by simple determination of the mass extracted, expressed as a percentage of the mass of cashew nut shell sample (Offurum et al., 2017). Mathematically, the % yield was calculated using Equation 1 below:

% yield= (mass of extracted oil/liquid)/(mass of cashew nut shell (solid)) ×100 (1)

**Characterization Of Cashew Nut Shell Liquid**

**Physical analysis**

The moisture content was determined using a moisture analyzer (Sartorius MA 35 Hamburg, Germany). The analyzer was calibrated using the operator's manual. After calibration, a filter pad was put in the moisture pan and tarred. A syringe was used to fetch 1 mL of the sample into the pan and the door was closed. The start button was pressed for the reading to begin. A beep indicated the end of the task with a display of the percentage moisture content on the screen. Two other replicate determinations were made.

Density was measured with the aid of a density meter (A. KRÜSS Optronic GmBH – DS7800, Hamburg USA). The analyzer was first calibrated using the operator's manual. Afterwards, an aliquot of 0.9 mL CNSL was taken using a syringe into the density meter. Viewing from the window, the filling was done carefully to ensure there were no air bubbles in the sample. The density of the sample was determined in triplicates.

The refractive index of the cashew nut shell liquid was determined in a refractometer (A. KRÜSS Optronic GmBH – DR6300-TF, Hamburg USA). The analyzer was first calibrated and a syringe was used to sample 0.9 mL of CNSL into the port. Afterwards, the system was started, with the result noted. The percentage brix was taken simultaneously on the same analyzer. In both cases, replicate measurements were determined.

**Chemical analysis**

Standard methods as described by the Association of Official Analytical Chemists (AOAC) was followed in all determinations. Chemical parameters determined are pH, acid value, free fatty acid, saponification value, ester value, percentage glycerin, and ash content.

**Potential hydrogen (pH) determination**

The pH of the sample was measured using a pH meter (Eutech PC700 Navi Mumbai, India). The pH meter was calibrated with buffer solutions of pH 4.0, 7.0 and 9.0 prepared from tablets of BDH buffer. About 2 mL of the sample was put in a container and the electrode was inserted into it. The start button of the pH meter was pressed, and the pH was read and recorded.

**Acid value and free fatty acid determination**

The acid value was measured using the standard method described by AOAC

International (2005) with slight modification. Exactly 0.25 g of the sample was weighed in a 250 mL Erlenmeyer flask and 75 mL of freshly neutralized hot ethyl alcohol was added. Afterwards, 1 mL of phenolphthalein indicator solution was added to the mixture. The mixture was then boiled for about 5 minutes. The hot mixture was titrated against 1 M KOH solution with vigorous shaking until a pink colour appeared. Titration was done in triplicate and the titre and/or average titre value was recorded. The acid value (AV) and free fatty acid (%FFA) were calculated using Equations 2 and 3 respectively.

AV = (mL of KOH ×N ×56)/(mass of sample) =mg of KOH (2)

N =Normality of KOH

% Free fatty acid (FFA) =AV ×0.53 (3)

**Determination of Saponification value**

This was determined according to the method described by AOAC International (2005). The sample was filtered to get rid of all impurities and 2 g was weighed into a 250 mL Erlenmeyer flask. Then 25 mL of 0.5 N alcoholic potassium hydroxide solution was pipetted into the flask. A reflux condenser was attached and the contents were heated on a boiling water bath for 1 hour, after which saponification was completed. This was confirmed by the clarity of the solution. After 10 minutes of cooling, 3 drops of phenolphthalein indicator was added and the excess potassium hydroxide was titrated with 0.5 N hydrochloric acid. The volume of acid used was recorded as mL of HCl required by sample. A blank determination was conducted by repeating the procedure but without the sample. The volume of acid used was recorded as mL of HCl required by blank. The saponification value (SV) was calculated using Equation 4.

SV= (56.1 (B-S)×N of HCl)/(gram of sample) (4)

where

SV = saponification value

B = volume of HCl required by blank

S = volume of HCl required by sample

N = normality of standard HCl

2.5.2.4 Determination of Ester value

This was calculated from the saponification and acid values using Equation 5.

Ester value (EV)= Saponification value (SV)-Acid value (AV) (5)

2.5.2.5 Ash content determination

A porcelain crucible was heated, cooled, and weighed. Exactly 1.5 g of the sample was weighed and placed in the crucible. The crucible containing the sample was placed in a muffle furnace (Thermo Scientific Thermolyne FB1310M-33 Mumbai, India) and incinerated at a temperature of 600 °C for 2 hours. Afterwards, the crucible with the content was removed, cooled in a desiccator, and weighed. The percentage of ash content (%Ash) was calculated using Equation 6.

% Ash = (weight of crucible +ash -weight of empty crucible)/(weight of sample ) ×100% (6)

**Fourier Transform Infrared Spectroscopy (FTIR)**

The cashew nut shell liquid was subjected to Fourier transform infrared spectroscopic (FTIR) analysis to ascertain the various functional groups, using a Bruker Alpha Platinum ATR in the wavelength range of 500 – 4000 cm-1. The diamond was cleaned with isopropanol, and a background scan was taken. The sample was then placed directly on the crystal, and the pressure gauge was applied to ensure maximum contact. The

sample was then scanned and the spectrum was generated.

**Conversion Of Cashew Nut Shell Liquid Into Cardanol**

The cashew nut shell liquid extract was kept on the shelf for 2 to 3 days for decarboxylation process to occur after heating, thus facilitating decarboxylation of anacardic acid. The resultant mixture was labelled as cardanol (Lochab et al., 2014).

**Synthesis of cashew nut shell liquid resin**

The resin was synthesized using a modified protocol developed by Keetasombat and Soykeabkaew (2014). The following reagents were mixed in a beaker, using a magnetic stirrer: 10 mL of cashew nut shell liquid (cardanol), 15 mL of formaldehyde, and 5 mL of 1M NaOH. The contents were heated at a temperature range of 75 – 85 °C and stirred simultaneously for one hour. The temperature and curing times were varied until a high viscous good surface finish product was obtained. The formation of the resin was evidenced by the appearance of a brownish colour. This is an alkali catalyzed reaction. Physical properties of the resin were determined in duplicate and recorded.

**Results And Discussions**

**Physicochemical properties of cashew nut shell liquid**

A summary of the physical and chemical characteristics of the cashew nut shell liquid is presented in Table 1. Extraction of cashew nut shell liquid from the shell material with less volume of acetone gave a dark brown coloured liquid with a high yield of 30.61%. The yield obtained in this work is higher than the yields obtained in similar works by Gandhi et al. (2012) and Gandhi et al. (2013), which may be attributable to the accelerated solvent extraction technique and the ketonic solvent used in the extraction. In their work, Lochab et al. (2014) reported that higher yields of cashew nut shell liquids are accomplished by employing polar organic solvents at high temperature and pressure.

The low moisture content (4.45%) recorded is comparable to literature and is an indication that the liquid has a longer shelf life since the rate of microbial growth has a positive correlation with water content. A density (specific gravity) of 0.95 gmL-1 at 30 °C agrees with literature (Lubi & Thachil, 2000) and indicates that the liquid is less dense than water. The % brix, which is the percentage of soluble solids content of the cashew nut shell liquid, is 76.2. Thus, the value shows the sum/percentage of total solids such as carbohydrates, protein, etc. that are dissolved in the liquid. Moreover, the refractive index, which is the level of optical clarity of the cashew nut shell liquid relative to water, is 1.47. This intimates that the liquid is denser than water and other oils with lower refractive indices. The optimal refractive index also confirms the presence of unsaturation and side chains of fatty acid in the liquid (AOAC International, 2005). The value of this property is comparable to what exists in literature (Edoga et al., 2006; Idah et al., 2014).

**Table 1. Physicochemical Properties of Cashew Nut Shell Liquid**
n.a.: not applicable

| Property | Result | Literature Value | Reference |
|---|---|---|---|
| Yield (%) | 30.61 ± 0.2 | 15 – 30 | (Lochab et al., 2014) |
| Colour | Dark brown | Dark brown | (Lochab et al., 2014) |
| Moisture content (%) | 4.45 ± 0.02 | 3.9 – 6.0 | (Balgude & Sabnis, 2014) |
| Density ($gmL^{-1}$) | 0.95 ± 0.3 | 0.93 | (Taiwo, 2015) |
| Percentage Brix (%) | 76.20 ± 0.001 | n.a. | n.a. |
| Refractive index | 1.47 ± 0.01 | 1.48 | (Gandhi et al., 2013) |
| pH | 5.65 ± 0.003 | 5.7 | (Sengar et al., 2012) |
| Acid value (mg KOH/g) | 8.25 ± 0.2 | 12.10 – 15.40 | (Balgude & Sabnis, 2014) |
| Ash content (%) | 1.80 ± 0.6 | 1.22 | (Balgude & Sabnis, 2014) |
| Free fatty acid (mg KOH/g) | 4.12 ± 0.4 | 6.10 – 7.80 | (Balgude & Sabnis, 2014) |
| Ester value (mg KOH/g) | 247.01 ± 0.1 | n.a. | n.a. |
| Saponification value (mg KOH/g) | 255.26 ± 0.8 | 47 – 58 | (Achi & Myina, 2011) |

The pH value of 5.65 indicates the cashew nut shell liquid is acidic. The acidity could be attributed to the presence of anacardic acid in technical grade cashew nut shell liquid (Quirino et al., 2014). The acid value of cashew nut shell liquid is 8.25 mg KOH/g, which is below the range 12.10 – 15.40, reported by Balgude and Sabnis (2014). Although the acid value is below the standard limit, it is an indication that the liquid has not been degraded or oxidized and would be a good precursor for the synthesis of resins for anticorrosion coatings (Sharma & Jain, 2015).

The ash content, which is 1.8%, was considerably higher than 1.2% and 1.53% reported by Balgude and Sabnis (2014) and Taiwo (2015) respectively. This indicates a high slagging and inorganic matter tendency of the cashew nut shell liquid. Moreover, it gives credence to the moisture content of 4.45% since a higher ash content means a higher concentration of minerals/inorganics and a lower moisture content.

The free fatty acid of the liquid is 4.12 mg KOH/g and is lower than the previously reported range of 6.10 – 7.80 mg KOH/g by Balgude and Sabnis (2014).

The free fatty acid content of an oil is an index of its quality and hence the cashew nut shell liquid is of a good quality with a

lower level of enzymatic hydrolysis or degeneration (Japir et al., 2017). The ester value of the cashew nut shell, which is the difference between the saponification and acid values, is 247.01. This high ester value is due to the low free fatty acid of 4.12 mg KOH/g. A high ester value is an indication of the presence of high ester and a corresponding low molecular weight fatty acid content and vice versa (Belsare & Badne, 2017).

The saponification value of the oil is 255.26 mg KOH/g. This is higher than the range of 47-58 mg KOH/g reported by Balgude and Sabnis (2014) and 53 mg KOH/g in an earlier study (Achi & Myina, 2011). This means that the cashew nut shell liquid can be used as a starting material for the synthesis of soap, candles, and other lubricants (Japir et al., 2017) due to the lower molecular weight of fatty acids.

**FT-IR spectrum of cashew nut shell liquid**

The FTIR spectra of cashew nut shell liquid is presented in Fig 1. The broad peak at 3407 cm-1 is characteristic of normal "polymeric" –OH stretch while the absorption band at 3078 cm-1 corresponds to aromatic C–H stretch. Other notable peaks at 3008, 2924, and 2853 cm-1 can be attributed to unsaturated hydrocarbon moiety, C–H asymmetric, and symmetric stretching vibrations of the alkyl side chains. There are also C=C aromatic stretching bands at 1604 and 1450 cm-1. The sharp C–H vibration peaks at 993 and 911 cm-1 are ascribed to conjugated cis-trans double bond and terminal vinyl group in polycardanol respectively. The absorption peak at 644 cm-1 was revealed also in other studies as for the vinyl peak (Lochab et al., 2014). The spectra indicates that cashew nut shell liquid is polymeric and possesses carboxylic and hydroxy groups substituted on the phenolic constructions, as confirmed in the literature (Achi & Myina, 2011; Balgude & Sabnis, 2014; Srivastava & Srivastava, 2015).

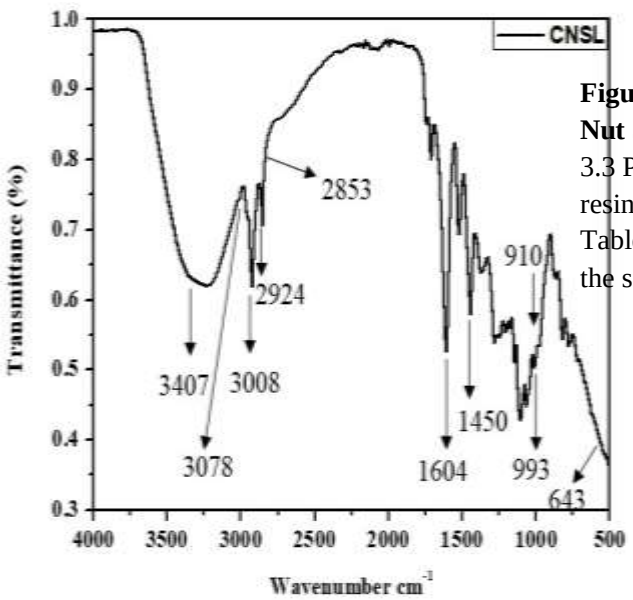



**Figure. 1: FTIR Spectrum of Cashew Nut Shell Liquid**

3.3 Physical properties of cashew nut shell resin

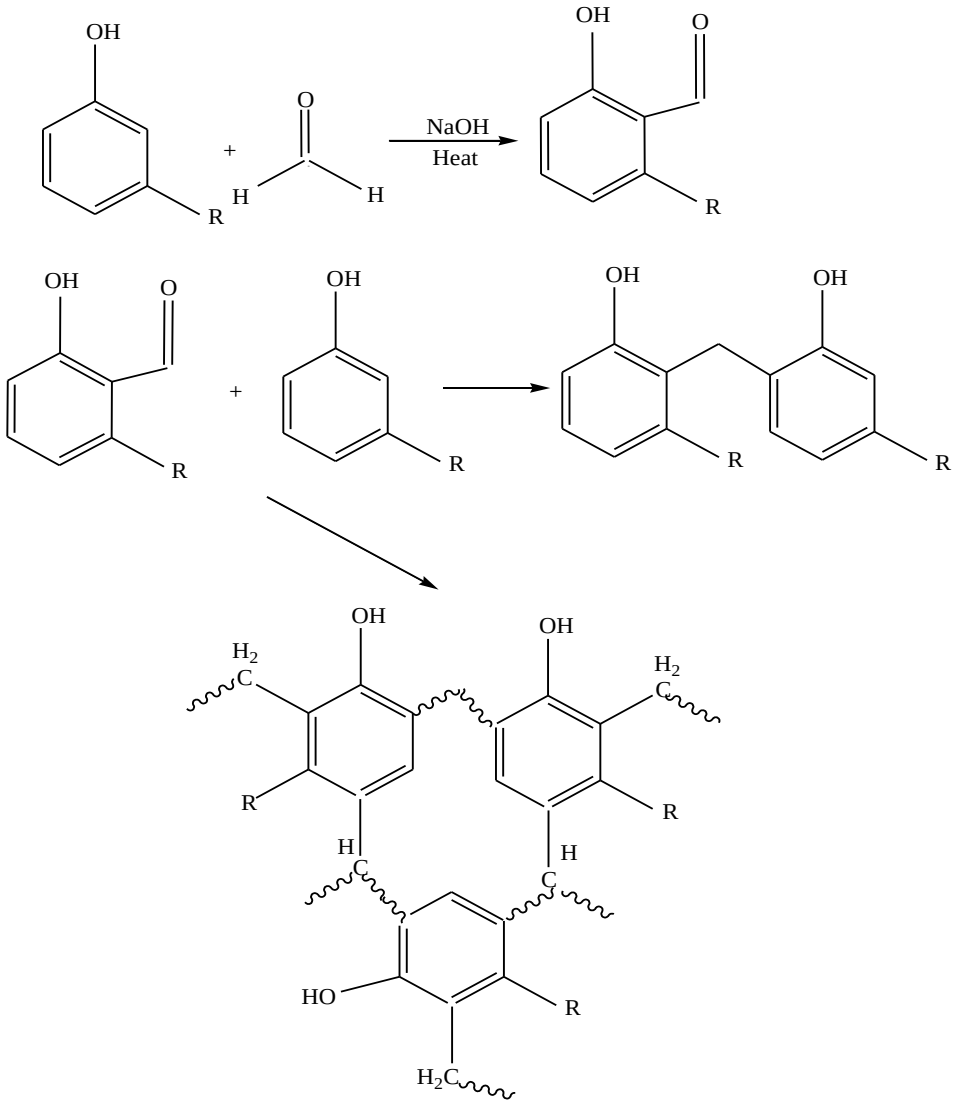
Table 2 displays the physical properties of the synthesized cashew nut shell resin.

**Table 2: The Physical Properties of The Cashew Nut Shell Liquid Resin**

| Properties | First run | Second run |
|---|---|---|
| Composition | CNSL, Formaldehyde, NaOH | CNSL, Formaldehyde, NaOH |
| Colour | Dark brown | Dark brown |
| Surface finishing | Good | Moderate |
| Temperature (°C) | 75 | 85 |
| Curing time (min) | 60 | 60 |
| Observation | Highly viscous, flexible | Tough, semi rigid |

The alkali catalyzed resin was synthesized with a good surface finish at an optimal heating temperature of 75 °C, the point at which the separation between the CNSL-resin and water has occurred. At this temperature, the resin was having a low viscosity and the curing time informed the differences in viscosity (Krishnan, 2015). We can, therefore, confirm that the conditions in the first run could be used to synthesize CNSL-resins for industrial applications.

The co-polymerization of cashew nut shell liquid (cardanol) with formaldehyde in the presence of alkali yields condensation polymers formed via electrophilic substitution reaction. The reaction then continues yielding a relatively high molecular mass structure of crosslinked CNSL-formaldehyde resin (Keetasombat & Soykeabkaew, 2014), as shown in Scheme 2. The CNSL-resin can be employed as a precursor for the synthesis of coatings, friction materials, surfactants, and as intermediates for the synthesis of other resins.




Scheme 2. **Crosslinked structure of CNSL-formaldehyde resin**

**Conclusions**

Extraction of cashew nut shell liquid from cashew nuts shells gave a higher yield with the use of less volume of acetone as the extracting solvent via accelerated solvent extraction technique. Physicochemical parameters mostly were consistent with literature values and FTIR characterization of the extract has confirmed that the liquid is polymeric and possesses carboxylic and hydroxyl groups substituted on the phenolic constructions. The optimum heating temperature for the synthesis of CNSL-resin is 75 °C at a curing period of 60 minutes. A comprehensive study of the chemistry of the CNSL-resin would require further physicochemical and thermal characterization.

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# ENGAGING URBAN GREENING FOR PEACE AND SUSTAINABLE DEVELOPMENT IN AFRICA: A DIALOGUE ON GHANA

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**Abstract**: This paper examines linkages between peace and ecological security and how they are mutually reinforcing for developing resilient city governance and policy implementation in the face of rapid rural-urban migration.It makes the case that resilient cities should be constructed with capacity to withstand challenges imposed by ecological imbalance, skyrocketing population throughheffective waste management and environmental peace as principal coordinates for peace and ecological security. It claims that, environmental development is often associated with irresponsible destructionof man's natural ecological spaces. This narrative has dire generational consequences on water bodies and natural environment as it compromises the philosophical underpinning of sustainable development. As evidenced in Africa today, impact of climate change, global warming, depletion of natural resources, desertification and their associated nuances call for radical shift in today's development trends. How do we effectively address the vicious cycle of the "greed and grievance conundrum?" How enforceable and resilient are current policy interventions in the face of the aggressive search for mineral wealth at the expense of social and environmental justice?How should contemporary development models be crafted to ensure that future resources are not sacrificed for today's needs? From multidisciplinary perspectives, anchored on foundational theories and application of sustainable developmentinterventions, this paper critically interrogates these phenomena in a 21st century Africa where the search for mineral wealth compromises our very existence even before the future generation becomes a reality? Using "GALAMSEY" as a reference point, the paper proffers alternatives for ensuring a regime of peace and ecological justice.

**Key Words**: peace, ecology, security, environment, justice

## Introduction

By 2012, effervescence of the much-hailed Millennium Development Goals (MDGs) begun to thaw. There was an obvious imperative for identifying alternative ways of managing its unfinished businesses. Thus, Sustainable Development Goals (SDGs) came in vogue as a patent replacement. It was in this context that Gro Harlem Brutland's report on Sustainable Development, code-named Our Common Future (1987) came into global prominence with popular appeal as a post-2015 development agenda. At the heart of this report lie the ideals of sustainable development conceived in the idea that the needs of future generations are not

compromised by the needs of today. It is currently the most broadly upheld definition of sustainable development: development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Without prejudice to the brilliant intents of the SDGs, the thrust of this dialogue is to provoke the contemplation that, should Africa continue disrespecting and dishonouring its environment, including through the mineral resource extractive industry, the SDGs and ideals of Our Common Future would become locally-irrelevant and would fail to deliver the continent from its colossal development challenges, come 2030. This would further compromise peace. The paper examines challenges of "galamsey" from Ghana's hinterland to the cities' utter disregard for ecological serenity in contrast to China's emerging eco & sponge city civilizations revolving around green development and urban greening.


**Figure 1 Political Map of Ghana after the 2019 Referendum**

Source: https://www.ghanaembassy.dk/content/ghana%E2%80%99s-new-regions-and-their-capitals

**Brief Country Context**

Ghana, originally named Gold Coast, and internationally acclaimed for its high gold and other natural mineral resource deposits, is an impoverished sovereign multinational state situated on the west coast of Africa, along the Gulf of Guinea, a few degrees north of the equator. Ghana is enclosed within latitudes 5.50N and 7.46N, and longitudes 0.15 and 2.25. The country covers a landmass of about 239,000 square kilometres, a size comparable to that of the United Kingdom. Its administrative regions increased from 10 to 16, following a referendum in 2019. The country shares about 2,093 kilometres of international land borders with three

Francophone countries (Burkina Faso to the north, Cote d'Ivoire to the west, and Togo to the east), with its entire 550 kilometre southern coastline swashed by the Atlantic Ocean. At a current population of nearly 30.5 million, it has witnessed steady growth since independence, and this is indicative that development initiatives need to take into account the impact of population increase, if they are to be effective and sustainable.

Gold extraction in Ghana has often been characterized by stark challenge of the small-scale mining sector where "galamsey" thrives: "Galamsey" simply means "gather them and sell." Unfortunately, this harmless name has engineered one of the most adversarial practices confronting modern ecological civilization and biodiversity today (the illegal and unregulated extraction of minerals, especially gold), and is responsible for massive multiple degradation, deforestation, and water pollution which are deeply injurious to ecological peace. In the name of "galamsey" reckless, violent inconsiderate large-scale tree logging, which hurts our environment by upsetting the balance of nature, is set in motion. In the end, effects of sheet erosion, which destabilizes soil capacity to sustain plant life, compels people to migrate, thus intensifying competition for little available food, vegetation, and water sources, sometimes leading to violent conflicts that destabilize peace. The overall impact of harming the environment is partially responsible for today's drought crisis, flooding, and attendant climate change derivatives. This degenerates, among others, into cattle being migrated beyond their traditional jurisdictions, and this effectively triggers variants of conflicts. In the late 1980s, for instance, harvest failure due to drought in Ethiopia threatened over 4 million people and brought to the fore, once again, the threat to peace and the stark appalling prospects of mass starvation (Morse & Stocking, 1995:70).

Recently, however, "galamsey" has seen massive rejection and criminalization for its ecological and environmental damage to peaceful coexistence. Academia, Civil Society Organizations, Non-governmental Organizations, traditional authorities, media, and the current presidency under Nana Akufo-Addo have unreservedly condemned the practice. In January 2017, the president placed a ban on small scale mining and extended the ban several times. On 31st July, 2017, he commissioned and deployed a special Military Police Joint Taskforce "Operation Vanguard" to combat "galamsey" in three of Ghana's most ravaged regions. Though some tangible results have been achieved, the battle is not yet over.

One worrying twist to the phenomenon, however, is the blame fingers directed at our Asian friends, the Chinese, for their obstinate involvement in "galamsey," notably the case of En Huang (described as Chinese illegal mining "queen"), who was arrested and deported with four of her Chinese mining associates in December 2018. Interestingly, while the Chinese Ambassador places this at the doorsteps of Ghanaian authorities and Ghanaians, H. E. Kofi Annan, former UN Secretary-General might appear to have envisioned similar sentiments earlier:

***Chinese Ambassador to Ghanaians…***

> "*We don't know where your gold is, we don't issue visas too for the Chinese people coming to Ghana. Ghanaians issue the visas. Ghanaians aid the Chinese to where they can find your gold. Why are Chinese not doing illegal mining in South Africa, where there is also a*

*lot of Gold ... because they cannot do that there and the locals don't support such illegalities" ....*

***Kofi Annan…***

"*For too many countries in Africa, natural resources have not been a boon but a curse. We must see much greater transparency in the revenue which Governments receive from the extraction of natural resources and how the money is spent.* ***African leaders must also work harder to ensure the continent's natural wealth is not simply siphoned off by other countries****"*

**Sustainable Development as a Critical Nexus between Peace and Ecological Development**

The congruence between peace and environmental development is so well-articulated in Goal 7 of the MDGs that this nexus becomes too important to be neglected. The UN Commission on Environment and Development popularized the idea of sustainable development in 1987 through the Brundtland Report. Since 1992 when the concept was formalized at the UN Conference on Environment and Development (Rio'92), it has assumed a prominent position in global development dynamics. Yet, like many other novel ideas, the concept of sustainable development has been vilified and rejected in some circles as utopian, unrealistic or, at best, a concept whose *"very appeal lies in its vagueness"* (Redclift, 1992: 25). They include some politicians, business leaders, and mainstream economists who consider sustainable development as demagoguery while others brand it as inherently limited in its applicability to some cases of extreme poverty. Trying to understand why the idea of sustainable development should be subjected to vilification by business-minded leaders and some politicians may not be far-fetched: The realization of this idea hits hard on the very lifestyles of some society's privileged group in whose interest some businesses and political ideologies survive.

Munda (2001) suggests, for instance, that it is difficult for privileged groups of Western-styled economic consumption, in mostly relatively developed countries, to reach their goals without compromising the very ideas inherent in sustainable development, and the mineral extractive industry is a common example. Beneficiaries of such natural resources can hardly attain their goals without resorting to massive environmental depletion and pollution which leads to inequitable distribution of the earth's resources. Such inequitable distribution involves, more importantly, the imbalanced distribution of attendant burdens including toxic waste, polluted air and water bodies (Munda, 2001:18). For such minded people, one cannot make omelettes without breaking eggs. Another plausible reason why some people vilify the concept of sustainable development is that the idea has been misappropriated and misused in some cases to the extent that its antagonists might mistrust and consider that the implications of sustainable development would impose the introduction of authoritative restrictions that would negatively impact on their economic gains (Redclift, 1992:25).

But the very concept and its debate bring on board a basic fact that inherent issues surrounding sustainable development should provide excellent opportunities for evolving novel results-oriented interventions that are supportive of immediate and remote

environmental safety. As Brzezenski (1993) notes, "Unless (our) lifestyle is subjected to considerable re-evaluation, including the adoption of far-reaching self-control regarding the satisfaction, not of real wants but self-gratifying desires, the emphasis on ecology could become yet another intensifier of conflict between the rich and the poor" (Brzezenski, 1993:186). The current extent of climate change damage expressed, including, in Greenhouse effects, global warming and carbon emissions, makes it too important to be ignored in any contemporary development discourse. There is already substantial evidence that various climate factors are being altered in pursuit of today's development at the peril of tomorrow. As Africa explores its most appropriate development options, the spirit of SDGs and ecological security must be allowed to thrive.

In part, Kenya's *Wangari Maathai*, a renowned environmentalist, political activist, and first female African Nobel Peace Prize laureate, spoke to and acted directly on the critical need for greening through her Green Belt Movement (GBM). It is the persuasion of this *dialogue* that unless African leaders prioritize respect for ecological rejuvenation, which is one of the best indigenous autonomous African development interventions, the continent could be losing an essential edifice on which sustainable development could be built.

**Learning from Wangari Muta Maathai, 2004 Nobel Peace Laureate**

> ... Many wars are fought over resources which are becoming increasingly scarce across the earth. If we did a better job of managing our resources sustainably, conflicts over them would be reduced. So protecting the global environment is directly related to securing peace (Beller and Chase, 2008:168).

Wangari's quote above reflects significant underpinnings that our earth is the motherhood of procreation. Besides literarily planting seeds for present and future, Wangari's concerns for the environment are directly linked to Africa's discourse on peace and sustainable development. Having identified a lack of employment as one of the major problems of her villagers, she launched a tree and indigenous fruits planting exercise, and led her GBM to plant over thirty million trees. Beller and Chase (2008) indicate that her original idea was to plant as many as fifteen million trees to represent Kenya's then population and to translate their motto of "one person, one tree" to a reality (Beller and Chase, 2008:166).

This initiative impacted positively on Kenya, drastically reducing malnutrition, soil erosion, providing shade and windbreak, facilitating soil conservation, and creating a flourishing biodiversity and wildlife habitat. Her project transcended other parts of the world, including over thirty African countries, Haiti, and the US, where the Movement also employed over eighty thousand people. This gallant ecological rejuvenating enterprise was to earn her the 2004 edition of the prestigious Nobel Peace Prize for her "**Contribution to sustainable development, democracy, and peace.**" It is, therefore, uplifting that Ole Donbolt, Chair of the Norwegian Nobel Committee, in awarding the prize remarked, "The Norwegian committee has for a long time maintained that there are many different paths to peace ... Environmental protection has become yet another path to peace." For this *dialogue*, the search for peace should, at all times, envisage sustainable development through components of peace ecology if that peace must be durable. It amplifies the

centrality of environmental justice in the peace and sustainable development narrative. The Nobel Committee's acknowledgement that there are many different paths to peace also gives noble credence to the view that "...peace can, and must include not only the absence of war but also the establishment of positive, life-affirming, life-enhancing values and social structures" (Barash and Webel, 2002: 3).

Wangari's GBM provides a concrete example of such positive life-affirming and life-enhancing values through greening and rejuvenation. Perhaps, the simple but profound nineteenth-century proverb, "Only when the last tree has died and the last river has been poisoned and the last fish has been caught would we realize that we cannot eat money" couldn't have been more relevant than in any other context. As Dobkowski and Wallimann (2002) note, for man's over 3.5 million years of inhabiting the earth, our principal economic and social institutions have been built on hunting and gathering, thereby living directly on the flows of nature. We shall, therefore, only be protecting our own peace and environment when we ensure the sanctity of ecological justice. Wangari, in her Nobel Peace Prize speech, thoughtfully stated:

> I believe the Nobel committee was sending a message that protecting and restoring the environment contributes to peace; . . . . I always felt that our work was not simply about planting trees. It was about inspiring people to take charge of their environment, the system that governed them, their lives, and their future.

**Urban Greening to the Rescue: Learning from the Chinese**

Irrespective of one's position regarding China's involvement in "galamsey," this *dialogue* contends that China, one of the world's oldest and unique civilizations, the second largest economic entity since 2010, has some great lessons from which Ghana could learn, especially the Green Development Concept. What is most important is what Africa decides to learn from China. Two of them are (a) China's eco-city system and (b) China's sponge city ideology. Given the high population of China, it is only prudent that they invest in skyscrapers to economize land, which also implies less environmental destruction, and, therefore, an indirect investment in ecological friendliness that comes with additional strengths and smart merits of modern civilization.

**(a) Eco-cities**

**Figure 2: Nanhui is only one of China's numerous serene eco-cities**

China is demonstrating results-oriented uniqueness and environmental preservation through its eco-cities, conceived in a positive vision of a sustainable future, and practically-visible resilience to climate change challenges. The eco-city system is a self-contained, holistically-designed new urban development approach which aspires to be less environmentally offensive than the traditional city circumstances of general pollution. Such eco-cities aspire to bridge the human-nature divide, ensure less pollution, use less resources, emit lower amounts of carbon, utilize renewable energy, recycle more, and have a higher percentage of energy-efficient buildings, set up for lower-carbon means of transport and are projected as models for the way humanity will live.

On the whole, the deliberate switch to "forest cities" would ensure that the countless trees and plants will absorb their toxic smoke. At the same time, its countless species of plant life are expected to absorb tens of thousands of carbon dioxide and tons of associated pollutants yearly, while at the same time producing substantial tons of life-giving oxygen to maintain nature's ecological equilibrium. Interestingly, the system ensures that vertical high-rise architecture does not leave the greed development behind, but grows up with it through vertical forests where greens accompany high rise constructions to their limits. Additionally, roof-mounted solar panels would generate renewable energy to power the buildings.

Indeed, in a 21st Century Africa, which has become a converging point for used and over-aged vehicles with high atmospheric pollution emission levels, together with the ravages of poor mining attitude of its natural resources and dire sanitation deficits, China's eco-city phenomenon stands to contribute significantly to neutralizing a high percentage of Africa's ever-rising environmental hazards. Overpopulated settlements including Chorkor, Odawna, and the Korle lagoon environments in Accra could greatly benefit from the Chinese eco-city renaissance, with multiple benefits.

**(b) Sponge cities**

China's sponge city concept simply thrives on ensuring a more natural environmental system in urban settlements, including by replacing concrete and other non-natural pavements with wetlands as a way of combating flooding, in that, stormwater is naturally absorbed back into the land, thereby making such water work positively for, rather than against, the land and its people. In places like the Lingang (Nanhui) district of China, trees, gardens, green plant beds, and other green infrastructure are deliberately incorporated into pavement structures. This comes as an ecologically-friendly alternative to traditional flood defence initiatives. In a nutshell, the sponge city concept advocates green and pervious infrastructure such as rooftop plants, rain gardens, and wetlands as opposed to hard impervious structures, so that most water precipitation can easily and naturally percolate into the natural ecological system. If Ghana could conceptualize how places like Korle lagoon and the famous or infamous Odaw River could be transformed into world-class resorts like China's Nanhui eco-city project, we would have been making a great orientation from a self-imposed harmful city practice towards modern Chinese orientation worth all the efforts for highly improved, healthy, and durable environment where all the benefits of biodiversity could join hands in ensuring ecological regeneration as championed by Gomes (2018) within the framework of the Dialogue, Empathic Engagement, and Peacebuilding (DEEP) Network.

**Conclusion**

This *dialogue* establishes an undeniable link between peace and (ecological) development, both of which deserve sustained protection and promotion. Environmental injustice inflicted and facilitated by Africans has for too long endangered peace and natural interdependence. The incessant conflicts over land and other natural resources bear eloquent testimony to this. The Chinese green development engagements could provide natural healing for peaceful co-existence and ecological civilization. These eco and sponge city initiatives are capable of mitigating the impacts of climate change and improve environmental justice. Rather than replacing trees and greens on household compounds with cement pavements, architectural designs should accommodate the green revolution expressed in the eco and sponge city systems. Responsible urban planning and construction management should be encouraged. Destruction of the hinterlands including through logging, deforestation, and water pollution in the name of mining must stop! Africans are best positioned to stop this.

Ecological civilization must be incorporated into our industrial civilization. While the government has an onerous responsibility to make this an urgent national agenda, Africans have a responsibility to contribute their quota towards making this happen. To be successful, this *dialogue* calls for the implementation of a strict and unrelenting people-oriented environmental protection policy regime which envisages government-public dialogue, facilitated by decentralized government agencies, supported by deterrent punitive sanctions. As President Akufo-Addo states, “It is our duty to protect the environment.”

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# EXPLORING CHINA'S EMERGING GLOBAL MEDIA VISIBILITY IN GHANA: THE LIMITS OF EFFECTIVE PUBLIC DIPLOMACY

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**Abstract**: This paper provides a descriptive and explanatory analysis of the dominant global news actors in the Ghanaian press. It addresses two specific issues: the amount of foreign news in the Ghanaian press sourced to Chinese global news organisations and its implications, and how the Ghanaian journalists and editors constructed their use of Xinhua news articles for the coverage of foreign news. Relying on ethnographic content analysis, ethnographic interviews, and a survey, the analysis showed a sterling performance by Xinhua as the third most used international source of foreign news in Ghana. However, this does not represent the influence of the Chinese public media because of its poor performance in a perception survey among journalists of the same newspapers that cited it. I argue that Xinhua's visibility is driven largely by public diplomacy, which does not guarantee effective soft power potentialities. The Ghanaian journalists constructed their reliance on Xinhua as South-South cooperation, the resistance of Western domination, and the effects of a severe lack of resources to cover foreign news.

**Key Words:** media, China, soft power, news, journalist

## Introduction

Over the past three decades, international media and scholars have written about China's domestic media with analysis that concentrated on the sharp contrast between the country's economic success and the regime's repressive press control. The Chinese concept of pragmatic approach to press freedom, which opposes a free press that produces lies and rumours, is highly confusing to Western media and scholars (Chang & Tai, 2003). Hachten and Scotton (2016) recounted that this confusion is even manifested when Western global news organisations write about China's media. They showed this confusion by referring to some reports in the Western media enumerating wide positive changes across the Chinese media industry involving an investigation of corruption but around the same time, the Economist Magazine painted a gloomy backward picture of the Chinese press. Thussu, Burgh, and Shi (2018), with their comprehensive exploration of the Chinese media, in general, cited an estimated $7billion set aside to be injected into external communication and expansion of Chinese broadcasting networks around the world. These aggressive investments are geared towards "promoting China's views and vision to the wider world and countering negative portrayals of the country in the US-dominated international media" (Thussu et al., 2018, p. 2).

The massive commercialisation and injection of private capital into the Chinese

media, coupled with an ambitious quest to compete globally, have escaped analysts until recently. The collected articles edited by Thussu, Burgh, and Shi (2018) sum up China's emerging visibility and influence. The Chinese government has successfully "transformed the nation's subsidised public media from being a financial drain into the profit-making global industry" (Hachten & Scotton, 2016, p. 114). The financialisation of the Chinese Internet economy has been comprehensively outlined by Xia and Fuchs (2017), who argued that the emerging trend could result in an Internet bubble that victimises young workers. Xin (2017) has argued that Xinhua's financialisation via Xinhuanet is a state-administrated initiative that supported Xinhua's business ambitions. Although successful in raising very large private capital, state players (such as Xinhuanet's financialisation) do not alter the control of the state on Chinese news media.

The changes occurring in the local Chinese media landscape are equally intended to travel abroad. Yang (2018) examined the strategic context of China 'Media Go Global' policy and argued that the initiative is meant to promote China's influence as an alternative power in the world. The overarching ambition of competing with BBC or CNN on the global media landscape has recorded mixed results. Notwithstanding, "some degree of success in projecting the image of China as a rising power, mainly among developing countries," has been achieved (Yang, 2018, p. 79). China's economic ties with Africa has grown from $10 billion in the year 2000 to $280 billion in 2015, making China the largest donor from the developing world (Thussu et al., 2018).

The activities lined up by China to penetrate and influence the African media landscape can be noticeably seen through the several state-owned Chinese media houses that have established offices on the continent, especially in Kenya and South Africa, and signed scores of agreement with national news agencies on the continent (Serwornoo, 2017; Wasserman, 2016). Wasserman enumerated Xinhua, the newspaper *China Daily*, China Central Television, and China Radio International as the ones whose activities are currently visible, but stressed that, in South Africa, the private media capital has equally witnessed flows and contraflows in investments between China and South Africa that have yielded good results so far. Wu (2016) confirmed that China's attempt to promote bilateral diplomatic and economic relations have resulted in the provision of their content and points of view since 2009. Analysing the case of South Africa, Wu's evaluation of the limits and potential of China's engagement in public diplomacy found the entire agenda as too monolithic and simplistic.

*Soft power* initiatives could potentially be amplified by journalists if they were to "use Chinese media as their source because this would allow local stories to be framed by Chinese perspectives" (Wasserman, 2016, p. 18). The conclusion of Wasserman (2016) that the Chinese media initiatives as an instrument of '*soft power'* penetration in South Africa face imminent challenges instigates a healthy inquiry into individual country description of how *China's media go global* mission is evolving geographically especially on the African continent, where it is increasingly getting noticed. Previous studies that investigated foreign news selection in Nigeria and Ghana (Obijiofor & Hanusch, 2003; Pate, 1992; Sobowale, 1987) neither recorded Chinese news agency news articles nor discussed any

Chinese influences in the foreign news selection just over a decade ago.

This paper offers a descriptive and explanatory critical analysis of the dominant foreign news actors in Ghana. It addresses two main questions:

1. What is the amount of foreign news in the selected Ghanaian newspapers sourced to Chinese news agencies and its implications?
2. How did the Ghanaian journalists construct their use of Xinhua news agency material for the coverage of foreign news?

**Benefiting from the literature**

China's triumphant entry on the African market is a clear search for the influence which is not entirely different from what Western multinational companies have done over the years. Actually, Alden and Davies (2006) have predicted that the Chinese multinationals and their African counterparts might well reach maturity by adopting best practices established by Western multinationals. This notion is not far from the thinking of some figures in China. The CEO of the Chinese National Offshore Oil Corporation is cited to have said that "China's goal is not to overturn the world order but instead to participate in this order and to reinforce it and even to profit from it" (Oil Daily, as cited in Alden & Davies, 2006). China is seeking real access to resources, trade, and any other thing there is to benefit from.

The effort by China to participate in the global economy has received many interpretations that often can get quite confusing. For Yang (2018), China's soft power deficit is associated with lack of effective public diplomacy that matches the aspiration of several Western actors: public, intellectual circles, NGOs, cultural industries, and the media. The fundamental issue stems from the fact that the concepts of soft power, public diplomacy, and external publicity are highly confused and considered the same among Chinese policymakers and media (Yan, 2018). Nye (2005) argued that soft power relates to the capacity to influence the behaviour of foreign publics through attraction that wins hearts and minds to achieve the desired outcome. However, for Chinese officials, Yang (2018) argued that "soft power is not so much the capacity of a society to attract people from other societies as the state's ability to project or persuade" (p. 95). Yang reasoned accordingly that, although external publicity and public diplomacy are used in driving a nation's *soft power*, the Chinese media has not figured out yet what sort of *soft power* they require or whether soft power can be projected using state-orchestrated initiatives.

Nye (2004) has already hinted that soft power is also about the *power over opinion* especially in the current information era and public diplomacy, as an element of soft power, relies on media communication to inform and influence the global publics (Golan & Himelboim, 2016; Guo & Vargo, 2017). Ting (2010) has demonstrated that foreign news reporting has been influenced by a global consciousness, *foreign news going global* or *going transnational*, which re-established the genre's contemporary appeal. Wasserman (2016) argued that Nye's (2005) notion of "soft power" has been applied so often when theorising China's media outreach to the extent that informal and everyday interactions between South Africans and Chinese migrants have been ignored. He, however, opined that these informal aspects might well be more influential than formal policy in shaping public views of China's involvement in the

continent. Kurlantzick (2008) had earlier pointed out that the strategic process by China to revamp its media platforms to aim at global audiences when explained using "soft power" alone fails to adequately capture China's media activities. Some scholars have raised questions about the basic issue of efficacy of China's media strategies in Africa. Shi (2013) described China's activities on the world stage as a 'charm defensive' because they fail to represent an active strategy that can augment the power of the nation-state rather than fighting existing stereotypes brewed by the Western media.

Wu (2016), while analysing the case of China's media strategy in South Africa, evaluated the limits and potential of Chinese engagement in public diplomacy. "Although China's public diplomacy seeks to achieve a wider enabling environment rather than specific objectives, its singular approach to the dynamic and changing continent of Africa is overly simple" (Wu, 2016, p.81). According to Wasserman, China's initiative to spread soft power through its media in South Africa is highly constrained from the perspective of the journalists for several reasons. He contended that:

> Soft power initiatives could potentially be amplified by journalists if they were to use Chinese media as their sources because this would allow local stories to be framed by Chinese perspectives. However, this would not happen if journalists did not consume Chinese media or if the Chinese perspective on news events were rejected (Wasserman, 2016, p.18).

The argument put forward by both Wasserman (2016) and Wu (2016) is anchored on the assumption that the consumption of Chinese media by South Africa journalists would amount to soft power success for China. Wasserman pointed out that that this situation has not yet materialised because most South African journalists do not cite Chinese news agencies beyond news about China itself or news about China-South Africa relations. It is established already that the Chinese media visibility currently being experienced does not necessarily mean influence (Nye, 2005b; Wasserman, 2016). Nye (2005b) believes that public diplomacy alone is not enough. He argued that "even the best advertising cannot sell a bad product. A country's attractiveness or soft power stems partly from its resources-culture and values, but also it grows out of a country's policies when they are seen as legitimate, consultative, and inclusive of the interests of others. In this paper, I offer empirical evidence that contributes to the debate about China's soft-power visibility and influence in Ghana as an addition to these findings emerging from South Africa and other places.

**Background and Methodology**

This paper is part of a bigger study seeking to understand the role and influences of global media organisations on the coverage of Africa in the Ghanaian press. Based on a corpus of 12,388 foreign news articles published across top four Ghanaian newspapers (2011- 2012), Xinhua News Agency was the third single most used foreign news source in Ghana. To get a deeper understanding of this finding, an ethnographic interview was developed, which included prolonged newsroom observations and different genres of interviews. To synergise the views of the 10 journalists and editors involved in the ethnographic interview, a 3page questionnaire was

designed to provide organisation-wide illuminations in a perception survey. About 100 journalists working in editorial roles for the top four newspapers in Ghana filled out the survey. A response rate of about 61% was achieved, meaning 61 questionnaires were retrieved for analysis. The intention was not to arrive at a generalizable conclusion but to rather put the previous content analysis and ethnographic interview findings into perspective. The design of the survey instrument was largely based on the findings of the earlier methods and they were tested on four journalists with the *Mirror* and *Spectator* newspapers, which were not part of the main study.

I relied on the findings from the ethnographic interview conducted at the top four daily newspapers in Ghana: *Daily Graphic*, *Ghanaian Times*, *Daily Guide*, and the *Ghanaian Chronicle*. The ethnographic interview consisted of two weeks of non-participant observation combined with different genres of interview. For the first two days, there was a total lack of structure and control. A total of eight hours of observation per day was made. The ethnographic encounter eventually evolved to include informal interviews with no conscious structure, beginning from the fourth day. At this stage, I reduced the observation to four hours each day to allow me an hour-long conversation at the close of the working day. The interviews and field notes were thoroughly perused overnight before the next working day. This continued with sit-down semi-structured interviews and later structured interviews in the second week. The focus of both the interview and observation gained shape and structure, as I moved through the interview genres from "lack of structure" (Day 1) to "structure" by the end of the fieldwork.

The process was repeated among the four selected newspapers. To synthesise the various experiences expressed by the journalists in the individual interviews and observations, I administered a structured survey for the editorial staff of the four newspapers. I developed the field notes into thick descriptions and transcribed interviews. After a close reading of the interview transcripts, I developed a list of concepts that were revealed by the data in addition to initial codes. I read the transcripts for the second time and noted possible modifications to initial concept ideas. Using key-words-in-context and constant comparison strategies of analysis separately, I coded the entire data, making the necessary comments and memos for the reasoning behind each code. After the initial coding process, I printed out the code systems from the MAXDQA software for manual consistency check with a colleague in the office. Based on the code system, memos, and comments, I began the second level coding with the purpose of seeking patterns and connecting codes into a conceptual hierarchy.

**Findings**

The findings presented here were derived from the entire study, looking at the coverage of foreign news in the Ghanaian press. They were specifically based on ethnographic content analysis, ethnographic interviews, and a perception survey.

**Amount of foreign news, in the selected Ghanaian newspapers, that is sourced to Chinese agency and its implications**

Out of a total of 12,388 foreign news articles counted during a 24-month period, 717 of them, representing 5.42%, were sourced to Xinhua news agency. This placed the Chinese news agency in fourth place on

the list of dominant foreign news sources in Ghana. The BBC World Service occupied the first position, with 58.36%. This was followed by the "*Other*" category which represented a vast number of international news organisations that were not sourced consistently across the four selected newspapers to warrant a place on the code sheet. However, there were prominent international news organisations in this category, such as Al-Jazeera, Nigerian newspapers, Yahoo News, and Mirror, Telegraph from the UK. The fifth to ninth positions were occupied by Reuters, Unsourced news items, CNN, AFP, and Own reporters, respectively. Because the "*Other*" category included several news agencies, it is fair to say that Xinhua was the single third dominant international news organisation relied on, in Ghana, for the coverage of foreign news.

To seek further illumination on the performance from Xinhua News Agency, the journalists were confronted with these preliminary results during the ethnographic interview. It became clear that Xinhua signed an agreement with the two public newspapers, allowing them free access to the agency's news articles. For *Daily Graphic* and *Ghanaian Times* (public newspapers), the use of Xinhua news article largely emanated from this agreement while the two other private newspapers in this study rather expressed their surprise at Xinhua's performance.

All editorial staff of the selected newspapers stood the chance of working for the foreign news desk either as replacements staff or changes in the editorial role. In a survey aimed at an organisation-wide understanding of these preferences, editorial staff were asked to rank nine dominant international news organisations they would turn to for foreign news. Xinhua news agency ranked almost last, showing generally the unfavourable perception Ghanaian journalists have of the Chinese agency. The gap between the actual performance of Xinhua news agency in the Ghanaian press as a rising source of foreign news and the organisation-wide perception of journalists is occupied by the public diplomacy agreement. Across the interviews, the journalists justified their selection based on the agreement they have signed with Xinhua.

Wasserman (2016) reasoned that re-use of Xinhua News Agency material by South African journalists beyond South Africa-China relations would amount to a soft-power success of the Chinese international media. Although this analogy seemed constrained in the case of South Africa, it is a reality in Ghana that Xinhua News Agency has become one of the dominant foreign news actors. However, soft-power visibility and influence are little beyond public diplomacy, which is a state-orchestrated initiative. The Chinese strategy to concentrate on only monolithic public diplomacy has been questioned (Yang, 2018). Yes, it has produced a good result in the Ghanaian case and seems to be the only feasible possibility available now, but it is crucial to add that public diplomacy successes are largely different from soft-power because the success has not won hearts and minds of the Ghanaian journalists as per the perception survey rankings. That is to say that the sustainability of such successes is largely transient.

**Ghanaian journalists' construction of their use of Chinese new agency material as a source of their foreign news coverage**

From the ethnographic interview data, three different rationalisations were

offered by the journalists for the use of news articles from Xinhua News Agency: South-South cooperation, the resistance of Western domination, and economic conditions.

*South-South Cooperation*: When the journalists were confronted with the result of the Xinhua's sterling performance as the single third international news organisation they relied on for foreign news, they resorted first to the argument of South-South cooperation, which is defined by the agreement they signed to allow them access to Xinhua news database. Interestingly, two of the chief editors of these newspapers portrayed a very concrete understanding of this cooperation agreement than their page editors who rather worked on the pages. They felt more comfortable working with the Chinese because of the argument that both parties were fighting a similar battle of redeeming their negative Western image. They also stressed the striking differences in the Xinhua news articles and those coming from the Western countries. Although New World Information Communication Order (NWICO) suggested more of such collaborations as a way of reducing the concentration of global news in few Western countries, two fundamental reasonings were revealed in the construction of the editors. One, they seemed to understand and appreciate the agreement with Xinhua differently from the page editors who worked on the foreign pages daily. The page editors argued that Xinhua news articles require more editing and attention than others. They added further that the agreement has not been recognised in any editorial in-house style document and remains completely a suggestion by the editorial management of the newspaper. Second, the editors and page editors agreed that the agreement in its true essence was meant to be an exchange of news between two Southern hemisphere countries: Ghana and China. However, their Chinese counterparts are yet to request them to file a story for Xinhua. These show the weak power dynamics involved in the entire engagement.

*Resistance*: The idea of Western news agencies dictating the coverage of foreign news was depicted as a condition that required resistance. They related their soft acceptance of Xinhua as a way to demonstrate this resistance. But the very magnitude of their reliance on the BBC, AP, Reuters, AFP, and CNN could not corroborate this claim. Apart from that, the perception survey involving all editorial staff showed equally the contrary. Most of the journalists ranked Xinhua as the last international news agency they would turn to for news. Again, the concept of resistance seems to be a unique *editorial management* explication for the re-use of Xinhua news articles. The two private newspapers, with no agreements with Xinhua, have rather justified the re-use of the Chinese news agency's articles, by their competitors, as indicative of the growing influence of China in the world, although they were highly surprised at the magnitude of Xinhua's performance without their participation. The resistance concept remains, based on the analysis, an elite opinion that is not very well appreciated by all the four selected newspapers in a similar manner. Even within the two public newspapers, where Xinhua got wildly sourced, the overall editors (Editor-in-Chief) were the only people with fond appreciation of what this resistance meant. Until now, it is neither documented nor enforced with any consistency.

*Economic conditions*: According to the interviewees, the economic conditions under which newspapers operate in Ghana are quite severe for survival. Rising production cost, coupled with dwindling circulation

income, spell a real doom for the press. One editor drummed home this point right from the start when he was responding to the issue of reliance:

> The biggest challenge is funding because we need a certain amount of money to have correspondents all over the world. We need to even have that collaboration among ourselves but rather we are having to even collaborate with Xinhua, a Chinese news agency. They have approached us for collaboration so that they would be sending us their items and we also send them items (jim-edt).

This indicates the role economic incapacity plays in creating this reliance. But the editors agreed that the only time this reliance did not exist was when Ghana had a national news agency plus the effective days of the pan-African news agency, PANA Press:

> Because of the economic reasons we cannot have a presence everywhere. The Pan-African news agency that was supposed to fill that gap has not been well successful and therefore we are challenged (Rans-edt).

The interviewees established that their challenge with reliance is in part inherited from other failing national institutions that played such roles excellently in the past:

> It used to be that Ghana News Agency was our sure hope but again almost all institutions are facing challenges. GNA as an institution themselves also have challenges, as a result, it creates that general challenge for us. So we try going around it and we can't do without the foreign media. It only requires that we will be more diligence in looking at their contents to make it relevant to our situation (Rans-edt)

These examples are not very peculiar to China but they provide us with the general economic framework within which the newspapers are working. One of the editors, when confronted with the sterling performance of Xinhua, reiterated resources as a major reason why they have to rely on Xinhua for entire Asia and some neighbouring countries:

> We have some kind of collaboration with Xinhua, that is a Chinese news agency except that it not very regular but it can be better. That's the only way forward, as I said, we don't have the resources to go to Asia. Even some neighbouring countries are difficult, lest to talk about far away in Asia. So the only way is to have some collaborations and I'm sure in the spirit of South-South cooperation it will be useful to do that with Xinhua as we have done (Ran-edt).

These assertions are quite telling because of the way they fit the current conditions in place. While newspapers in Ghana complain of lack of resources and severe economic conditions threatening their domestic newsgathering abilities, China's global media organisations are attracting very promising capital injections even from the private sector.

**Implications and Conclusion**

The spread of China's global media strategies across the African continent accounts for the sterling visibility of Xinhua News Agency as a source of foreign news in Ghana. However, this does not necessarily translate into influence or winning the heart and minds of the Ghanaian journalists. The position of Yan (2018) that China's soft-power dissemination agenda is completely

merged with public diplomacy and external publicity is rightly upheld in Xinhua's activities in Ghana. As a public diplomacy success, the performance of the Xinhua news agency cannot be considered as a soft power success because the agency does not wield much influence on most Ghanaian journalists. Even though highly sourced as an emerging global media organisation, Xinhua was poorly ranked in the perception survey. These insights suggest to us, once more, that China's global media visibility ought to be analysed beyond its manifest attributes because they do not represent a sustainable agenda. Like Shi (2018) reasoned, Xinhua's sterling media visibility in Ghana is only a *damage repair* agenda carried on the wings of public diplomacy. No matter how effective public diplomacy has been in producing the results we are witnessing now, it is incapable of winning the hearts, minds, and appreciation of local journalists. That is to say that this success is fleeting and its soft-power potentiality is equally minimal. Nye (2005) cautioned that a country's soft-power or attractiveness of a nation goes far beyond public diplomacy to the appreciation of its values and culture by receiving nations.

Moreover, the construction Ghanaian journalists offered for their reliance on China's Xinhua revealed a rather soft acceptance to fill in the gap in their estimation. It misses the very essence of South-South cooperation which is an exchange and not dependence. In resisting Western reliance, one would expect the journalists and their editors to question running power relations. The structural weakness and dependency so far experienced in the Chinese deal do not differ significantly from how Western global media dominations started. They will rather get worse in the coming years because China's global media agenda is nowhere close to recognising that South-South cooperation operated on a state-orchestrated initiative, which pays little attention to the basic problem of power imbalance, will eventually look like the very Western domination they sought to resist now.

I argue that public diplomacy, as an element of China's soft power, largely accounted for Xinhua News Agency's significant journalistic co-orientation and visibility in the Ghanaian press. The success of Xinhua's visibility in Ghana has little merit on its own. Nonetheless, it has recorded an impressive success derived from public diplomacy. The efficacy of the strategies of Chinese global media organisation is highly enhanced by the severe economic conditions that have prevented Ghanaian press from reporting foreign news from their own perspective (own reporters). The claims of South-South cooperation and resistance raised by the Ghanaian journalists rather represent a rationalisation of their economic incapacity.

This study provides us with the opportunity to update the literature on the potential potency of public diplomacy in nation branding within the modern global communication space, a site of immense power dynamics. However, it also firmly establishes, with empirical evidence, the distinction between soft power and public diplomacy. Future research could analyse to what extent such public diplomacy successes can be translated into soft-power.

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# URBAN RESILIENCE AND CLIMATE CHANGE ADAPTATION STRATEGIES

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**Abstract:** Urbanization is a global multidimensional process connected with an increasing uncertainty due to climate change, migration of people, and changes in the capacity to sustain ecosystem services. Sequel to this inescapable challenge being imposed by the global environmental changes in building urban resilience and economy, this prevalent occurrence has become very imperative in the face of global environmental challenges via climate change, flood, depletion of natural resources, and overpopulation due to rural-urban drift etc. This research tends to study urban resilience, a remedy about abnormal variations to the climate and new paradigm to building. Consequently, it will enable cities to navigate change, build capacity to withstand shocks, and use experimentation and innovation in the face of uncertainty. A mixed-methods approach is taken to investigate various issues related to the development and implementation of integrated resilience assessment tools. This includes an extensive review of a vast body of literature published on urban resilience, interviews, and a workshop. Today, more than half of humanity lives in cities and that number is rising every day across the globe. Urban areas are growing by 1.4 million people each week. Much of this growth is happening in the developing world. Responding cities are keys to alleviating poverty, degenerating wealth, and filling global prosperity but with more and more people becoming concentrated in urban areas, and when cities are struggling to keep up these growth rates, they are bound to face a growing risk from hurricane, floods, and collapses and densities. Conventionally, a single natural disaster can be so devastating if allowed to happen and as the climate changes, those disasters will become more common and more destructive. Climate change may cause the world hundreds of billions of dollars every year and push 77 million urban dwellers into poverty, but what happens next is dependents upon our ability to manage the effect of such phenomime now.

**Keynotes:** Urban Resilience, Safety climate change and Adaptation strategies.

## Introduction

Today, cities face a growing range of adversities and challenges in the due to the effects of climate change, growing migrant populations, inadequate infrastructure, pandemics, and cyber-attacks. Resilience is what helps cities to adapt and transform in the face of these challenges, helping them to prepare for both the expected and the unexpected circumstances.

100RC defines urban resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience." Again, "urban resilience is the capacity of urban systems,

communities, individuals, organizations and businesses to recover to maintain their function and thrive in the aftermath of a shock or a stress, regardless its impact, frequency or magnitude" (Frantzeskaki, 2016).

The urban sector is the key driver of economic growth in our region, and banks recognize that updated revenue policies are very important to assisting our countries in enhancing that sector and achieving sustainable development goal of making our cities safer, more resilience, and more inclusive.

A resilient city is the one that approaches urban development in a holistic manner, a city that is resilient to climate change, a city where citizens' security has been addressed and citizens feel safe to move around and to live and to enjoy themselves without the fear of being a victim of crime. It is the one that can withstand the future and present shock, be it economic, environmental, social, or institutional.

In a revealing context of poverty economy, a resilience city must work to create wealth with just job-seeking quality, create jobs, and, at the same time, secure the environment within a context such that we can all enjoy it. More so, it is a city that can absorb, accommodate, and recover from the impact of a disaster on time before any significant disruption to the economic activities. It might interest us to know that over sixty per cent of those places that will be urban by 2050 haven't been built yet. We have the chance to help the urban poor, by unmaking the economic potentials to protect the stride we make in development across the globe. Now, the question is: what will it take? we need global commitment to invest in urban resilience. We need at least 500 billion dollars every year from the government and private sector to make city infrastructure safer and stronger in the face of disasters, and that is why over the last five years the World Bank Group has invested over 90 billion dollars to help cities in the 49 countries to become stronger and sustainable. The world bank has also worked in partnership with some agencies like the Global Facilities for Disaster Reduction and Recovery to achieve these goals. The World Bank is giving cities the knowledge and technical assistance they need to become resilient, with its powerful financial product and innovative services. The World Bank is helping cities resist the disaster, recover, and adapt for the future. This is because we need cities that can meet the need of today and face the challenges of tomorrow. And to keep people safe, we need to invest more in urban resilience; to build a better world, we need you.

**Methodology**

A mixed-methods approach is taken to investigate various issues related to the development and implementation of integrated resilience assessment tools. This includes an extensive review of a vast body of literature published on urban resilience, interviews, and a workshop. Since resilience is a normative concept, any research related to it involves participatory methods to obtain knowledge from a diverse array of stakeholders. In the present study, we were able to access only a few stakeholders, which is a limitation of the study.

Resilience is a contested concept and various definitions can be found for it in the literature (Sharifi, 2016). The definition provided by the National Academies and many others was adopted for this research project. It defines resilience as "the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events" (TNA, 2012).

As one of the main objectives of this study was to identify a comprehensive list of


Figure 2 in Sharifi and Yamagata (2016a). Different factors related to the assessment of urban energy resilience. Items of the pink band should be considered during planning, absorption, adaptation, and recovery phases in order to ensure availability, accessibility, acceptability, and affordability of urban energy

criteria that can be used for assessing urban resilience, an extensive literature review was conducted. A broad review protocol was developed to include criteria related to various aspects of urban resilience. As a result, research from various fields, including, but not limited to, urban planning, disaster management, sociology, economy, environment, infrastructure, governance, water, and energy was included in the study. Further details about the review protocol can be found in Sharifi and Yamagata (2016a) and Sharifi (2016).

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**Results and Discussions**

Review of the extensive resilience literature also revealed that there are various qualities (principles) that should be met in order to appropriately achieve urban resilience. These qualities include robustness, stability, flexibility, resourcefulness, coordination capacity, redundancy, diversity, foresight capacity, independence, interdependence, collaboration, agility, adaptability, self-organization, creativity, efficiency, and equity (Sharifi & Yamagata, 2016; Tyler & Moench, 2012). At the International Workshop on Disaster Resilient Infrastructure (RWDIR) held on 19-20 March, 2019 at New Delhi, the Principal Secretary to the Prime Minister, Dr. P. K. Mishra, proposed three mantras for achieving sustainability in DRI - the need to focus on the poor and the vulnerable; to follow an inclusive approach of collaboration with multiple stakeholders, and ensure proactive connectedness with other global processes in Disaster Risk Reductions (DRR).

**Building a resilient city**

First and foremost, when building resilience city, we need to consider the position of the vulnerable and the disadvantaged group. These include women that had household, people with abilities, employed and unemployed youth, children, and indigenous persons and immigrants. These groups are excluded from the central decision-making processes and have limited resources to access.

Natural resources conservation is also a very important part of the resilience of cities. Chief among the necessities of urban areas is water. Urban areas make high demands on water and this only increases the frequency of drought and long periods of water scarcity in urban cities.

Recognizing the need for a coordinated approach to developing all urban spaces, take, for instance, Caribbean Development Bank (CDB) is creating the urban sector strategy policy and operation guideline to safeguard all of its future

investment within the urban sector. What the policy seeks to do is to respond to Sustainable Development Goal 11 (SDG11), which articulates the need to make cities inclusive safe resilient and sustainable. Therefore, within all our urban policies, what we shall be seeking to do is to ensure that urban space in our continent and the investment we make in this space guide the urban sector development to achieving these within the designed period in 21 Century.

Any new infrastructural development which will take place or any new replacement of existing infrastructure will have to consider the question of resiliency because as it is the repel hub of prevalence, it is very important that after a disaster in a city, cities should be able to absorb, accommodate, and recover from invasion in a timely manner and be able to ensure that economic activities continue. CDB's urban sector policy strategy and operation guideline emphasizes that it will be utilizing some drastic challenges. Its policy objectives will include good governance, enhanced urban infrastructure, and mobility enhanced urban development. It also look at security, welfare, and social inclusion. Additionally, it looks at climate change and the environment, and also the urban economy.

Very important to mention also is the institutions of urban resilience. In building a climate-resilient city, the state must make building resilience an essential urban policy and a smart investment for cities. And to achieve that, proactive leadership is paramount (Prasad et al., 2009, p. 9-11). It is important to anticipate shocks and understand the long-standing vulnerabilities experienced due to urban stresses. In this front, political leadership and other governmental agencies may face resistance to new measures and institutional arrangements, since long experienced stresses may not be perceived as 'urgent matters' to take into consideration for investing public resources and may also be understood as manifestations of systemic conditions rather than as 'resolvable issues. For political action to be backed up, proposed actions require a multi-actor partnership from public, private, and civil actors too.

Institutional arrangements for supporting urban resilience need a promoted and enabled interconnectedness, redundancy, sensibility, and flexibility. A way to achieve this is by forging partnerships between different social actors: public, private, and civil society actors. As Flint (2013, p. 208) addresses, "collaborative partnerships are a powerful way to improve communities. That is, to improve a community, we must all work together to solve problems. Even neighbourhood-level change requires some level of relationships and partnerships with entities beyond the neighbourhood to optimize funding and access needed expertise and skills." This goes beyond social synergies. Enabling collaboration between these different actors creates the conditions for resource and governance synergies (Frantzeskaki et al., 2014) that further ensure the resourcefulness of social institutions. For the substantial investments in infrastructures required by more resilient cities, partnerships between different public, private, and civic actors are of paramount importance (Newman et al., 2009).

Another important dimension is also to look at partnerships to revitalize urban economies. In his work on local economies, Shuman (2015, p. 158) addresses that "partnerships also provide another way to think about economies of scale. (…) Partnerships offer local businesses the possibility to achieve almost any economy of scale, not through

endless growth, but carefully constructed collaborations."

Considering the extreme weather, calls for corporate climate action have been growing in volume and intensity from regulators, governments, investors, and youth. Among companies, the board of directors as the most prominent corporate fiduciaries and ultimately accountable to shareholders are responsible for overseeing effective management of climate-related impacts. They need to ensure climate risks and opportunities are centrally embedded in company strategy. In order to achieve this effectively, however, directors need the right tools to make the best possible decisions to ensure the long-term resilience of their organizations.

Many, if not most, boardrooms are still grappling with how exactly to frame the risks and opportunities, and embed a viable transition strategy into their business models and strategies. In response to growing requests from corporations and investors, the World Economic Forum, in collaboration with PricewaterhouseCoopers, to develop a set of climatic governance principles, these principles are set in January 2019 to achieve the following objectives:

i. Raise awareness and promote board ownership of this topic.
ii. Enhance the climate competence of executive and non-executive directors to enable informed investment decision-making, effective oversight of enterprise and systemic risk, as well as long-term strategic planning consistent with a zero-carbon economic system.
iii. Increase board-level understanding of current mandatory and voluntary requirements related to managing, mitigating, and reporting on climate risks and opportunities worldwide.

The principles are built on the recommendations of the Task Force on Climate-related Finance Disclosures (TCFD). They are intended to help boards and senior management to consider the quality of climate governance at the organizations they oversee and identify aspects in need of development or enhancement. And they should, within a given period, ultimately, help companies improve both their climate governance practices as well as their TCFD disclosure guidelines publicly supported by more than 50% of investors worldwide, who together hold almost $100 trillion of assets under management.

Another very important example of robustness in urban planning is the explicit use of downscaled climate change information like the Prairie Climate Atlas for infrastructure design. In Iowa, the Department of Transportation (DOT), Iowa State University, and the University of Iowa Flood Center used historical rainfall data to forecast peak discharge flows from two local basins that had recently experienced severe flooding events affecting primary and interstate highways. Using climate forecasting and stream flow modelling, researchers were thus able to estimate future flooding, using projected climate data for the region. These revised forecasts were then compared to the DOT asset inventory, allowing analysis of all transportation infrastructure. This enabled the DOT to identify at-risk roads, bridges, and other infrastructure, and include design elements to reduce their vulnerability to future flooding. Applying the projected climate data provided engineers with a higher level of confidence that their infrastructure designs

were indeed robust enough to meet future climate impacts.

The Pecan Street Project (PSP) is a public-private partnership with the "very modest goals of reinventing the energy system of the United States." The PSP is a non-profit organization that tests leading-edge smart grid technologies with the long-term goal of scaling up those that work best.

PSP's work in Texas is another very promising example of resilience building. In Austin, PSP has tested a smart grid of 1,000 networked residences and 75 businesses using smart metering for both energy and water systems. A 2015 Duke University review confirmed that the Austin smart grid was resulting in significant energy and water savings, as well as helping the overall grid become more autonomous. Even better, PSP's success has the potential to attract high-tech partnerships and reinforce Austin's reputation as an innovation hotspot and desirable investment location.

In addition to robustness, another quality of a climate-resilient city is redundancy: that is, fail-safe networks and spare capacity built into a city's system to account for disruptions and surges in demand. For the energy sector, this means having grids that can still generate, distribute, and, in the future, store energy if other parts of the grid are disrupted. Smart grids are a proven way to boost an energy system's resilience, with major potential benefits for homeowners, including quicker recovery time after power outages as well as lower bills.

Netherlands is highly vulnerable to flooding, with nearly 30% of the country lying below sea level and a further 30% vulnerable to flooding along its rivers including the Rhine, the Meuse, and the Scheldt. In cases like this, building a city may require a more broadly coordinated approach.

Recognizing that climate change will exacerbate existing flood risks, Netherlands has shifted from a reactive to a proactive approach to dealing with flooding, adopting a national strategy called the Delta Program, in which cities are important actors. To tackle river floods, one of this program's initiatives called Room for the River includes efforts in 30 locations. The program restored landscapes along the country's rivers to create more room for floodwaters by removing silt, creating diversions to redirect excess river water, and restoring marshy riverine landscapes.

This type of transformational adaptation that resulted in more resilient cities shows what can be achieved when there is political will from multiple levels of government working toward a common goal like flood prevention.

Urban ecosystems and green infrastructure are important assets that provide solutions at a lower cost than traditional infrastructure approaches, as the city of St Paul found when they replaced a crumbling mall with an urban wetland, Phalen Wetland Park. With the assistance of the city of St. Paul, residents of the Phalen neighbourhood explored a range of design alternatives for what would replace a local shopping centre that had gone bankrupt. The residents embraced a plan to restore the original wetlands. The shopping centre was demolished and the restored wetlands have become an effective part of the area's stormwater retention system, serving as natural holding tanks for rainwater and prevent sewer overflow. Also, they create an attractive natural landscape, have increased local biodiversity, and become a popular part of the cultural life of the community.

This is another area of high interest. Plastics are ubiquitous in any modern economy. This

is because of their positive and negative impacts on the world economy. And it could be a vital means to help us to achieve several Sustainable Development Goals the United Nations guideposts designed to help put the world on a more sustainable footing by 2030. Positively, in building the infrastructure required to supply clean energy, for example, plastic is required for related electronics, while plastic packaging helps preserve and protect food necessary to feed an expanding global population. Sterile, lightweight plastics are also very essential for medical devices like catheters, syringes, and IV bags. Notwithstanding, the extensive and expanding use of single-use plastics is causing severe environmental damage. The priority of any "circular economy" (as opposed to the traditional, "take, make and dispose" model) approach to the issue should be to reduce the overall use of plastics and not necessary to ban the use of it. Just reducing annual growth in plastics demand from the current 4% to 2% would result in a 60% reduction in carbon emissions generated by the plastics sector by 2050. Total global plastic production rose to 348 million tonnes by 2017, compared with 335 million tonnes in the prior year, according to the pan-European plastics manufacturers association, PlasticsEurope.

Bans or taxes on items such as plastic bags or straws in several countries have already resulted in substantial reductions in use. In the United Kingdom, single-use plastic bag use has declined by 86% since the introduction of a 5p tax per bag in 2014. 70 countries have now introduced bans on single-use plastic bags, and many countries are moving towards full bans on all single-use plastic products including straws, cups, bottles, and utensils. However, there are potential unintended consequences of a move away from plastic. These include a possible, related increase in demand for aluminium, paper, or wood—the use of which may deliver a heavy environmental impact. A UK government study found that a single cotton tote bag must be reused more than 130 times to have lower global warming impact than a conventional, single-use polyethene plastic bag. The issue of less-than-helpful alternatives is particularly relevant in countries such as India, which has instituted a ban on single-use plastics but already has relatively low per-capita use of plastics (11 kilograms annually per capita, compared to 96 in the US), coupled with high economic growth expectations.

**Safety climatic change**

Conventionally, climatic change is the abnormal variations to the climate over a significant period, and the effects of these variations on other parts of the Earth. Carbon dioxide is the climate's worst enemy we have today. It's released when oil, coal, and other fossil fuels are burned for energy—the energy we use to power our homes, cars, our home electronics etc. By using less of it, we can curb our contribution to climate change while also saving money. The physical signs and socio-economic impacts of climate change are accelerating as record greenhouse gas concentrations drive global temperatures towards increasingly dangerous levels, according to a new report from the World Meteorological Organization (WMO).

The WMO statement on the state of the global climate in 2018, its 25th-anniversary edition, highlights record sea-level rise, as well as exceptionally high land and ocean temperatures over the past four years. This warming trend has lasted since the start of this century and is expected to continue.

"Since the statement was first published, climate science has achieved an unprecedented degree of robustness, providing authoritative evidence of global temperature increase and associated features such as accelerating sea-level rise, shrinking sea ice, glacier retreat, and extreme events such as heatwaves," said WMO Secretary-General Petteri Taalas. "More related impacts include estimated 821 people undernourished due to drought" (FAO), "over 35 million people affected by floods" (CRED), "ocean acidification and decrease in ocean oxygen is ongoing seriously" (UNESCO-IOC), "over 2 million people displaced by weather and climate-linked disasters" (IOM), "out of 883,000 international displacements, 32% are linked to flood and 29% to droughts" (UNHR), "over 1,600 deaths are associated with heatwaves and wildfires" (WHO).

**Tackling climatic change**

We need to invest in energy innovations. We can now build on the progress we've made so far in deploying current technology like renewables, which will help accelerate the transition from fossil fuels to a future of reliable and affordable carbon-free electricity. Although it sounds incredible to achieve, it is the most important step we can take to prevent the worst impacts of global warming.

The reason is because electricity generation is the single biggest contributor to climate change. It is responsible for 25% of all greenhouse gas emissions in the world today and growing every day, so solving that alone has provided a bigger part of the solution. And when we have clean electricity, we can go ahead to improve on which will not only light our homes but to power our grid as well. We will unlock a source of carbon-free energy to help power the sectors of the economy that produce the other 75% of greenhouse gas emission, as pointed out by Bill Gate in 17th October, 2018, which include transportation, buildings, and manufacturing. Think electric cars and buses; emission-free heating and cooling systems in our homes and businesses; and energy-intensive factories using more clean power to make products.

We can then decarbonize many other sectors of the economy such as most of the manufacturing, residential heating, and road transport, following the report of "mission possible." The report Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors by mid-century outlines the possible routes to fully decarbonize cement, steel, plastics, trucking, shipping and aviation – which together represent 30% of energy emissions today and could increase to 60% by mid-century as other sectors lower their emissions.

The "Mission Possible" report was developed with contributions from over 200 industry experts over a 6-month consultation process. Its findings show that full decarbonization is technically feasible with technologies that already exist, although several still need further investment to reach commercial readiness. The total cost to the global economy could be made possible to less than 0.5% of GDP by mid-century and could be reduced even further by improving energy efficiency, by making better use of carbon-intensive materials (through greater materials efficiency and recycling), and by limiting demand growth for carbon-intensive transport (through greater logistics efficiency and modal shift). The report shows that this would have only a minor impact on the cost of end-consumer products.

However, the "Mission Possible" report concludes that the most challenging

sectors to decarbonize are plastics, due to end-of-life emissions; cement, due to process emissions; and shipping because of the high cost of decarbonization and the fragmented structure of the industry.

The Energy Transitions Commission supports the objective of limiting global warming ideally to 1.5°C and, at the very least, to well below 2°C. In the wake of the IPCC's urgent call for action, the "Mission Possible" report sends a clear signal to policymakers, investors, and businesses: Full decarbonization is possible, making ambitious climate objectives achievable.

Changes in agricultural, forestry, and other land-use practices is another way to tackle climatic change and create more room for safety environment. Changes in land use also have the potential to be an important factor in reducing carbon emissions. For example, from 2000 to 2005, the burning of tropical forests accounted for 7% to 14% of all anthropogenic CO1182 emissions. Because forests act as sinks that remove carbon from the atmosphere and place it in the ground, the destruction of those forests accelerates the pace of climate change drastically. Biochar charcoal added to soil to enhance crop yields and nutrition is one potential means of reducing GHG emissions while simultaneously improving soil health. Rather than burning agricultural and forestry waste, a source of enormous GHG emissions, waste biomass could be converted to biochar, which stores carbon in the soil for thousands of years and many more to come. Other changes in agricultural practices aim to reduce methane emissions as well from livestock, which account for 14.5% of global CO2eq emissions. One possible solution is the use of feed additives, which could reduce these emissions by 25% to 30%. The U.N. Food and Agriculture Organization estimates that changes in practices within existing [livestock agriculture] production systems could cut agricultural emission by about 30%.

Geoengineering is the deliberate large-scale intervention in the Earth's natural systems to counteract climate change. There is a wide range of proposed geoengineering techniques to solving issues of changes in climate and possible solutions to it. According to some scientists, geoengineering, or intentionally interfering in the world's climate systems, is a possible solution to mitigating climate change. They suggest exploring possibilities like injecting sulfates into the atmosphere, where their high reflectivity would stop up to 1% of the sun's radiation from reaching the Earth's surface. One plan in the U.K. involves pumping "water nearly a kilometre up into the atmosphere, by way of a suspended hose" attached to a "stadium-size hydrogen balloon" in the stratosphere, 20 km above the Earth. The plan, called Stratospheric Particle Injection for Climate Change (SPICE), is meant to test the feasibility of one-day spraying sulfate particles in place of water. SPICE and other geoengineering ideas were inspired by studying the atmosphere-cooling effects of volcanic eruptions, such as the Mount Pinatubo, Philippines eruption of 1991, which spewed 20 million tons of sulfate particles into the atmosphere, cooling Earth by 0.5 degree Celsius for 18 months."129,130 preliminary estimates suggest that geoengineering could be relatively cheap, although it would have to be maintained continuously to control the Earth's temperature. However, this suggestion is hugely controversial. There are concerns that we have very little understanding of what the widespread distribution of sulfates might do and fear that they will damage the ozone layer, lead to drought, and possibly "disrupt

the Asian and African summer monsoons, reducing precipitation to the food supply to billions.

**Adaptation Strategies**

**Proper education for all**

Lack of awareness among the common people is also one of the major aspects of the misuse of resources, which ultimately leads to pollution. And ignorance is the highest form of disease to a society. The government of every country should take up the responsibility of educating its citizens. People should be educated by the aid of documentaries, short films, advertisements, and campaigns.

**Use of public transport**

Using public transport not only provides an easy solution to cope up with the pollution issues, but it also allows us to make friends and meet new people in our journey to the office. It also aids in reducing the traffic congestion on the streets, thus, allowing one to reach his or her destination faster. Recently, the government of Luxembourg has waived all the fares of public transport to make their country less polluted and traffic-free. This small step by the Luxembourg government can save gallons of fossil fuels and, hence, aid in slowing down the process of climate change and reduce more emission to the air.

**Forego fossil fuels**

Fossil fuels sidetracked the renewable source of energy in the mid-twentieth century owing to their abundance and ease of utilization. But few people knew that these abundant resources will soon run out of stock due to their careless use. In the current scenario, it has become essential to focus on renewable sources like wind turbines, hydroelectric power, and solar energy. To make this planet sustainable for future generations, we have to learn to do away with fossil fuels.

**Stop deforestation**

Deforestation is one of the major enemies of safety environment and reasons why the quality of air has degraded to an all-time low. The loss of trees and other vegetation has tremendously cause climate change, desertification, soil erosion, fewer crops, flooding, increased greenhouse gases in the atmosphere, and a host of problems for indigenous people. Due to the decline in the number of trees, the environment of the Earth has been adversely affected. Many flora and fauna are on the verge of extinction due to the loss of their natural habitat without afforestation.

**Switch to electric vehicles**

The electric vehicle market is booming, and although electric vehicles are quite expensive for the time being, these will soon provide an effective alternative for petrol and diesel operated vehicles. The use of the EVs would not only lessen the pollution on the Earth, but it will also decrease the traffic due to their tiny size. Ensuring good health of our planet is for our good. We've been exploiting the natural resources since long ago, but it is high time we realized the damage we have done to ourselves and also done to the planet, and take necessary steps to protect our only shelter before it is too late.

**Suppressing overpopulation**

Overpopulation has overburdened our planet, not only in terms of space but also for food and water. It will soon emerge as the largest single threat to the ecology and biodiversity

of the planet in the decades to come if kept unchecked.

**Conclusion**

A resilient city is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures to still be able to maintain essentially the same functions, structures, systems, and identity."

To increase their capacities for resilience, we believe that cities will need to adopt urban planning and building design strategies that allow them to increase their abilities to better respond and adapt to the economic, social, and physical stresses they will face as they confront the challenges of increasing energy scarcity, climate change, and population change.

Developing the capacity for greater resilience will involve cities in a complex web of economic, planning, design, and development decisions that, in combination, must be designed to transform our current highly energy-intensive urban economic systems into much less energy-intensive and much less carbon-intensive ones. Our planning and design professions will be hugely challenged to find new paradigms, new technologies, new public services, new economic models – and more – to plan for and then implement the strategies that will in combination adequately increase the resilience capacities of our cities.

**Recommendations**

**Finance:** mobilizing public and private sources of finance to drive decarbonization of all priority sectors and advance resilience;

**Energy Transition:** accelerating the shift away from fossil fuels and towards renewable energy, as well as making significant gains in energy efficiency; thereby transforming industries such as Oil and Gas, Steel, Cement, Chemicals and Information Technology;

**Nature-Based Solutions:** Reducing emissions, increasing sink capacity and enhancing resilience within and across forestry, agriculture, oceans and food systems, through biodiversity conservation, leveraging supply chains and technology;

**Cities and Local Action:** Advancing mitigation and resilience at urban and local levels, with a focus on new commitments on low-emission buildings, mass transport and urban infrastructure; and resilience for the urban poor;

**Resilience and Adaptation:** Advancing global efforts to address and manage the impacts and risks of climate change, particularly in those communities and nations most vulnerable. This could be achieved via youth Engagement, Sensitization, and Public Mobilization: To mobilize people worldwide to take action on climate change and ensure that young people are integrated.

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# OWNERSHIP OF CARS, ABILITY TO DRIVE AND THE USE OF PUBLIC TRANSPORT IN CAPE COAST METROPOLIS, GHANA.

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**Abstract:** This paper analyzes the influence of personal/family car ownership and ability to drive on the use the public transport services in the Cape Coast Metropolis with a view to helping in planning all efficient and effective transport system to boost the local economy. It deployed a cross-sectional descriptive design to develop a nuanced understanding of the complexities involved in the relationship between car ownership and ability to drive on the one hand, and the use public transport on the other hand. A survey was carried out on users of public transport users (bus (transports (n = 309) using a mobile phone application "Kobocollect" to gather the data. The findings revealed that the majority of the respondents used taxis and used it twice daily, own a personal/family car and can't drive, walked to the terminal, spent 5-10 minutes in-vehicle waiting time and 10-15 travel time. The study further showed that there was a statistically significant association between ownership of personal/family car and the frequency of public transport use. Also, there is a statistical association with the ability to drive and the use of public transport.

**Key words:** Public Transport; car ownership; ability to drive; Commuters

## Introduction

Low vehicular ownership in low and medium-income countries (LMICs) makes urban commuters captive users of public transport services (PTSs) (mainly buses and taxis) (Poku-Boansi 2003; Amoh-Gyimah, & Aidoo, 2013). Demand, supply, and quality of service provide a barometer to measure the quality of the urban living environment, household, community and social networks (Amoh-Gyimah & Aidoo, 2013). Several studies have revealed how factors such as vehicle kilometres operated, income of passengers, trip duration, transport fares, access to transport services, total population and employment status affect the demand for PTSs (Poku-Boansi & Adarkwa 2013; Sam et al., 2014). Different vehicle types are used for PTSs to meet increasing demand, especially in areas of the city with low vehicle population and ownership (Poku-Boansi & Adarkwa 2013). For instance, with increasing demand for PTSs, motorcycle taxis have been adopted to fill the supply gap in many urban areas in LMICs, such as Ghana, that have previously relied on buses and taxis.

Ownership of cars (be it private or family-owned) and ability to drive have been topical among all factors influencing the use

of PTSs such as frequency of use, the type of PT use, the means of access to the terminal, in-vehicle waiting time and travel time (Beirao & Cabral, 2007; Garling & Schuitema, 2007).

Studies on PTSs in Ghana have been conducted in Accra, Kumasi, Tamale and Sekondi-Takoradi metropolises with Cape Coast metropolis receiving little research attention despite its position as the former national capital, the educational and tourist hub of Ghana (Abane, 2011; Poku-Boansi & Adarkwa 2011; Poku-Boansi &Adarkwa, (2013). For instance, Abane (2011) assessed the travel behaviour of urban commuters in four metropolises-Accra, Kumasi, Tamale, and Sekondi-Takoradi with Poku-Boansi and Adarkwa (2011) and Poku-Boansi-Adarkwa (2013) focusing on the determinants of demand and supply of public transport services in Kumasi. Whereas Amoh-Gyimah and Aidoo (2013) determined the mode of transport by government workers in Kumasi Metropolis. More recently, Sam, Hamidu and Daniels (2017) analyzed the quality of public transport services in Kumasi Metropolis.

Although these studies provide adequate information on the use of PTSs, they failed to specifically look at how the ability to drive and ownership of private/family cars influence the use of PT in Cape Coast Metropolis. The findings of this study will shed more lights on the use of PT in Cape Coast Metropolis which will help in planning for all efficient and effective transport system to boost the local economy. The study will further provide information on how the ability to drive and ownership of private/family vehicles influence the use of PTS in the metropolis.

## Material and Methods

### Study area

Cape Coast Metropolis is the administrative and economic capital of Cape Coast Metropolitan Assembly sharing boundaries with Twifo-Hemang Lower Denkyira to the north, Abura-Asebu-Kwanmankese to the East, Komenda-Edina-Eguafo to the West and Gulf of Guinea to the south (Fig 1).

### Research design

The study is a cross-sectional-descriptive research.

### Target population

The 2010 population reveals that there were 250,000 people in the metropolis with an annual growth rate of 2.5% (287,489 in 2017). As noted in Nutsogbodo et al. (2018), almost 90% of Ghanaian urban dwellers are PT users. Therefore, 258,737 urban dwellers were the target population in Cape Coast Metropolis.

### Sample size

PTS studies have attracted varying sample sizes (0.1%-0.5%) depending on the target population ((Abane, 2011; Agyemang, 2018; Ojo, 2018). The sample size for the study was 0.15% of the target population (388 respondents) with 79.6% response rate.

### Method of data collection

A mobile phone application "Kobocollect" was used to gather the data. The survey comprised section A containing the socio-demographic characteristics (such as gender, age, and ownership of private vehicles) and section B comprising the use of public transport such as frequency of use, type of public transport used, mode of access to the terminal, travel time and in-vehicle waiting time.

**Data analysis**

The quantitative data was coded in SPSS V 22 with the results presented using frequencies, percentages, and tables. Pearson Chi-Square Independence was carried out to the relationship between independent and dependent variables.

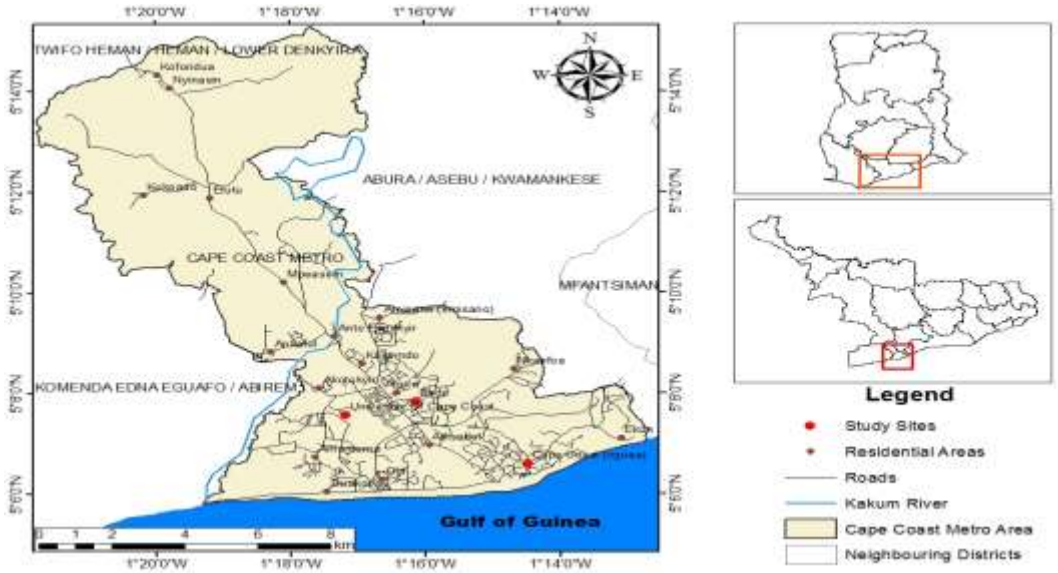


**Figure 1:** Map of Cape Coast Metropolis

Source: GIS unit of the Department of Geography and Regional Planning, UCC.

**Results**

**Socio-demographic characteristics of respondents**

Table 1 shows that 61.8%, 68.0% and 51.1% of the respondents were male, having tertiary education and students respectively. The majority of the respondents earned Ghc 300-600 monthly (US$ 60-120) with more than half (55.0%; 52.8 %) owning a personal/family vehicle and cannot drive respectively. Most of the passengers (51.5%) used PT twice daily and the taxi was the

**Table 1: Socio-demographic characteristics of respondents**

| Socio-demographic characteristics | | Frequency | Percentage |
|---|---|---|---|
| Gender | Female | 118 | 38.2 |
| | Male | 191 | 61.8 |
| | No Education | 9 | 2.9 |
| Educational level | Primary education | 21 | 6.8 |
| | Secondary education | 69 | 22.3 |
| | Tertiary education | 210 | 68.0 |
| | Self-employed | 59 | 19.1 |
| | Government | | |
| Occupation | employees | 55 | 17.8 |
| | Private employees | 37 | 12.0 |
| | Students | 158 | 51.1 |

| | | | |
|---|---|---|---|
| | < Ghc300 | 106 | 34.3 |
| | Gh300 – 600 | 107 | 34.6 |
| Monthly income | Ghc601 – 900 | 38 | 12.3 |
| | Ghc901 – 1200 | 32 | 10.4 |
| | >Ghc 1200 | 25 | 8.1 |
| | Irregularly | 136 | 44.0 |
| The frequency of public transport use | Once a day | 14 | 4.5 |
| | Twice daily | 159 | 51.5 |
| Ownership of a personal/family vehicle | No | 139 | 45.0 |
| | Yes | 170 | 55.0 |
| Ability to drive | No | 163 | 52.8 |
| | Yes | 146 | 47.2 |
| Frequently used public transport | Taxis | 286 | 92.6 |
| | Trotro(mini-bus) | 23 | 7.4 |

Source: Field survey, 2018.

dominant modal choice (92.6%).

**Personal/ family ownership of cars and the use of public transport**

Taxi is the dominant modal choice for both owners (98.2%) and not-owners (85.6%) (Table 2) with the majority (85.6%) of non-owners using it twice daily. Non-owners of (14.4%) used "trotro" the more and travelled by walking shorter distance to the terminal. Owners used PT mainly to school (50.6%) as against the use of PT to work (37.4%) by non-owners. Respondents having personal/family cars mostly spend <Ghc 5 (US$ 1) daily on PT with non-owners spending Ghc 5-10 (US$ 1-2) daily (Table 2). Both owners (61.8%; 54.7%) and non-owners (59.7%;42.4%) largely spend 5-10 minutes in-vehicle waiting time and 10-20 minutes travel time respectively.

**Table 2: Ownership of cars, ability to drive and PT use.**

| PT use | | Yes (F/%) | No(F/%) |
|---|---|---|---|
| | Ownership of cars | | |
| The frequency of using PT | Irregularly | 83(48.8) | 53(38.1) |
| | Once a day | 5(2.9) | 9(6.4) |
| | Twice daily | 82(48.3) | 77(55.4) |
| Frequently used PT | Taxi | 167(98.2) | 119(85.6) |
| | Trotro | 3(1.8) | 20(14.4) |
| The distance of terminal to the residence | <5km | 128(75.3) | 82(59.0) |
| | 5-10km | 37(21.8) | 45(32.3) |
| | 10-20km | 5(2.9) | 6(4.3) |
| | >20km | 0 | 6(4.3) |
| Means of accessing the terminal | Dropped by a family/friend | 16(9.4) | 13(9.4) |
| | Motorcycle | 1(0.5) | 1(0.7) |

| | | | |
|---|---|---|---|
| | Taxis | 5(2.9) | 6(4.3) |
| | Personal vehicle | 16(9.4) | 1(0.7) |
| | Walking | 132(77.6) | 119(87.5) |
| | School | 86(50.6) | 43(30.9) |
| Purpose of using PT | Work | 45(26.5) | 52(37.4) |
| | Home | 12(7.1) | 13(9.4) |
| | Markets/shopping | 9(5.3) | 21(15.1) |
| | Place of worship | 10(5.9) | 8(5.8) |
| | Recreational/leisure | 8 (4.7) | 2(1.4) |
| Daily expenditure on PT | <Ghc 5 | 87(51.2) | 51(36.7) |
| | Ghc 5-10 | 71(41.6) | 75(55.1) |
| | Ghc 11-20 | 11(6.5) | 10(7.1) |
| | >Ghc 20 | 1(0.5) | 3(2.2) |
| In-vehicle waiting time | <5minutes | 50(29.4) | 34(24.5) |
| | 5-10minutes | 105(61.8) | 83(59.7) |
| | 11-20 minutes | 12(7.1) | 17(12.2) |
| | >20 minutes | 3(1.8) | 5(3.6) |
| Travel time | <10minutes | 88(51.8) | 38(27.4) |
| | 10-15minutes | 93(54.7) | 59(42.4) |
| | 15-20 minutes | 15(8.8) | 20(14.4) |
| | >20 minutes | 4(2.4) | 12(8.6) |
| | Ability to drive | | |
| The frequency of using PT | Irregularly | 69(47.6) | 67(40.8) |
| | Once a day | 8(5.5) | 6(3.7) |
| | Twice daily | 68(46.9) | 91(55.4) |
| Frequently used PT | Taxi | 136(93.2) | 150(92.1) |
| | Trotro | 10(6.8) | 13(7.9) |
| The distance of terminal to the residence | <5km | 101(69.6) | 109(66.5) |
| | 5-10km | 38(26.2) | 44(26.8) |
| | 10-20km | 6(4.1) | 5(3.0) |
| | >20km | 0 | 6(3.7) |
| Means of accessing the terminal | Dropped by a family/friend | 16(11.0) | 13(7.9) |
| | Motorcycle | 0 | 2(1.2) |
| | Taxis | 4(2.8) | 7(4.2) |
| | Personal vehicle | 14(9.7) | 2(1.2) |
| | Walking | 111(76.6) | 140(85.4) |
| Purpose of using PT | School | 55(37.9) | 74(45.1) |
| | Work | 51(35.2) | 46(28.0) |
| | Home | 6(4.1) | 8(4.9) |
| | Markets/shopping | 10(6.9) | 20(12.1) |
| | Place of worship | 7(4.8) | 11(6.7) |
| | Recreational/leisure | 7(4.8) | 3(1.8) |

| | | | |
|---|---|---|---|
| Daily expenditure on PT | <Ghc 5 | 63(43.4) | 73(44.5) |
| | Ghc 5-10 | 69(47.6) | 77(47.0) |
| | Ghc 11-20 | 12(8.3) | 9(5.5) |
| | >Ghc 20 | 0 | 4(2.4) |
| In-vehicle waiting time | <5minutes | 42(29.0) | 42(25.5) |
| | 5-10minutes | 91(62.8) | 97(59.1) |
| | 11-20 minutes | 9(6.2) | 20(12.2) |
| | >20 minutes | 3(2.1) | 5(3.0) |
| Travel time | <10minutes | 49(33.8) | 43(26.2) |
| | 10-15minutes | 70(48.3) | 82(50.0) |
| | 15-20 minutes | 18(12.4) | 27(16.4) |
| | >20 minutes | 7(4.8) | 9(5.4) |

Ability to drive and the use of PT

The majority of those "who can drive" used PT irregularly (47.6%) and twice daily (55.4%) with taxi as the dominant modal choice for both (93.1%;92.1%) respectively (Table 2). Respondents mostly travelled <5km irrespective of the ability to drive (69.6%, 66.5%) respectively with walking is the dominant means of accessing the terminal on their way going to school. Both mostly spent Ghc 5-10 (US$1-2) daily with 5-10minutes in-vehicle waiting time and with travel time.

**The relationship between ownership of personal/family ownership of cars, ability to drive and the use of PT**

Chi-Square test results indicate a statistically significant association between ownership of personal/family vehicle and the frequency of PT ($\chi$^2 (2)=7.23,p=0.03). An association between car ownership and frequently used PT was also observed,〖 χ〗 ^2 (1)=17.86,p=0.00.

**Discussion**

The study sought to determine the relationship between the ability to drive, ownership of personal/family cars and the use of PT in Cape Coast Metropolis, Ghana. It emerged that the majority of respondents used mostly taxis twice daily, own a personal/family car and can't drive, walked to the terminal, spent 5-10 minutes in-vehicle waiting time and 10-15 travel time, travelled <5km, walked to the terminals, spent Ghc 5-10 (US$ 1-2) daily, spent 5-10 in-vehicle-waiting time and 10-15minute travel time.

In the current study, taxis are the popular means of PT in Cape Coast Metropolis, similar to findings in Sekondi-Takoradi and Tamale (Abane, 2011; Sam et al., 2017). Cape Coast metropolis is not as big as Accra and Kumasi where commuters have to travel a long distance to work, school etc. The use of "trotro" in the Cape Coast metropolis is dominantly to and from neighbouring villages and towns.

Availability, accessibility and affordability play a significant role in the use of PT in Ghana. For instance, trotros tend to be readily accessible and relatively affordable in Accra and Kumasi compared to taxis. In Cape Coast Metropolis like Sekondi-Takoradi and Tamale metropolises, taxis are more available and accessible. Hence, a comparative analysis of affordability between taxis and trotros may be difficult to assess. Respondents spent Ghc <5 daily on taxis compared to how much spent in other cities in

Ghana such as Kumasi and Accra where trotro is the main means of PT (Abane, 2011; Poku Boansi & Adarkwa, 2013).

The dominant mode of accessing terminals is walking in the current study. These terminals are located at Central Business Districts (CBDs) such as Kotokuraba, Kingsway and Abura with two popular terminals on University of Cape Coast campus (i.e. Old site and new site). The streets or roads linking neighbourhoods in the metropolis to the terminals lack pedestrian walkway and the available ones have been taken over by traders in displaying their wares. This phenomenon inadvertently reduces the size of the road for two way traffic in addition to pedestrian trying to use this space. Both motorists and pedestrians are forced to share this road creating confusion which can lead to road traffic crashes (Ojo, 2018).

The low level of private/family vehicles makes PT users in LMICs (such as Ghana, Nigeria, Brazil) captive users (Abane 2011). The use of PT is often perceived not to be the best alternative to car use inducing the quest of commuters to own one (Linda, 2003). The findings of this paper on ownership of cars is contrary to the generally low ownership of private cars in LMICs. These commuters can decide to use their private/family vehicles (Garling & Schuitema, 2007).

As evident in the study, less than half of the respondents could drive showing that some of them had access to private /family cars but could not drive. Psychographic variables such as accessibility, daily expenditure on PTS, length of in-waiting time and travel time influence the use of PTS especially when the user has access to personal/family vehicles (Nutsogbodo et al., 2018). As evident in the study users who could drive and own a personal car used PTS irregularly unlike their cohorts. Despite taxi being the dominant modal choice a significant percentage of those who could not drive and did not have access to a personal/family vehicle used “trotro” in the current study.

In-vehicle waiting time and travel time have been receiving great attention as it influences the choice of mobility ( Carteni & Henke, 2017). These two variables highly affect the quality of public transport especially for users having access to personal/family cars and that can drive. The use of personal/family vehicles attracts less travel time as drivers of public transport stop every now and then to attend to passengers who may be alighting or boarding the vehicle on its route (Sam 2015; Ojo, 2018). The recommended in-vehicle waiting time is 5-10minutes for PTS and is inconsonant with the current study irrespective of car ownership and the ability to drive status. Longer in-vehicle and travel time negative affects travel experience (Carteni & Henke, 2017).

**Conclusion**

In this study, the relationship between the use of PT and ownership of personal/family car as well as the ability to drive has been determined in the Cape Coast Metropolis of Ghana. Taxis were the most used public transport mode compared to minibuses (trotros). Owners of personal/family cars mostly used it to access schools whereas non-owners used it to work. Most respondents walked for <5km) to access PT, spent 5-10 minutes in-vehicle waiting time and travel time respectively. There is a statistically significant association between ownership of personal/family cars and the frequency of public transport use. Also, there is a statistically significant association between

ownership of personal/family cars and frequently used PT.

**Policy implication**

The Government of Ghana through the CCMA should promote efficient and effective PT operations. Good and effective PT makes ownership of personal/family cars less attractive, where PT is affordable to all people, comfortable, safe and easily accessed. Again the availability of walk-ways facilities in residential areas further decreases the value of owning a car for private use. Public transport terminals/stations must be close to the neighbourhood such that people do not have to walk for more than 2km. For quality of service, in-vehicle waiting time 5-10minutes must be enforced by CCMA on the PT operators.

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# INVESTIGATING HETEROGENEITY IN TRIP MAKERS' PERCEPTIONS OF INTERCITY BUS TRANSPORT SERVICES ON THE ACCRA-TAKORADI ROUTE, GHANA

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**Abstract:** Intercity bus transport service is the most preferred means of public transport in Low and Medium Income Countries (LMICs) for intercity trip makers. These trip makers have certain socio-demographic characteristics (such as gender, age, educational level, and income) that influence the "perceived quality" of intercity bus transport service. This paper adopted a mixed-method approach involving a modified SERVQUAL model questionnaire and an in-depth interview guide. Multistage sampling techniques comprising purposive, quota, accidental and systematic sampling techniques were employed for the questionnaire administration and purposive sampling technique used for the in-depth interviews. The results indicate that the majority of the trip makers were males, aged <40 years, educated and students. The heterogeneity of perceived quality was good across all categories except <15 years old, self-employed and pensioners' trip makers. There were significant differences in perceived functional quality across age, educational level and occupational status. There is a need for market segmentation to keep and attract trip makers to reduce the use of personal vehicles, which will influence traffic congestion, road traffic crashes, air and noise pollution and energy demand.

**Key words:** Socio-demographic characteristics; Perceived functional quality; SERVQUAL.

## Introduction

Intercity bus as a form of public transport is the preferred mode of intercity transportation in Low and Medium Income Countries (LMICs) such as Ghana, Malaysia and South Africa (Aidoo et al., 2013; Govender & Pan, 2011; Roza et al., 2013). Its use holds many advantages over the use of private cars either for the individual, community and the cities because of energy conservation, environmental impact, social equity and economy. Besides, fare and travel time attributes make the intercity bus the most popular transport mode from the passengers' perspective. These attributes have been seldom exploited to their fullest extent because an efficient and cost-effective intercity bus transport system essentially connects people to daily life over short, medium, and long-distance.

A number of studies (with the majority being modified SERVQUAL scale) in Ghana have assessed the quality of public transport service ((Parasuraman et al., 1988; Aidoo et al., 2013; Kwabena et al., 2013; Nutsugbodo, 2013; Sam et al., 2014). Although these studies provide ample information on the perceived quality of public, transport in general but failed to analyze the heterogeneity of "perceived

quality" of intercity bus service. This heterogeneity comprises how certain socio-demographic characteristics influence the "perceived quality" (Govender, 2014). Based on this, the intercity bus transport operators may not be able to satisfy the higher level of expectations, desire, tastes and preferences of all these heterogeneous groups.

Therefore, the paper seeks to reveal the dominant socio-demographic characteristics of intercity bus trip makers in relation to their "perceived quality". This will help transport operators in market-segmentation as a marketing strategy. The paper will also add to the literature on the heterogeneity of the perceived quality of intercity bus service obtained from a LMIC.

The paper is structured as follows: Section 2 contains the literature review with Section 3 introducing the study area and the methodology. Section 4 reports the results with section 5 focusing on the discussion. Section 6 reveals the conclusions, policy implications.

**Literature Review**

Socio-demographic characteristics (such as gender, age, educational level, occupational status and monthly income) define intercity trip makers (Bin Maskeen et al., 2013). Women generally make more intra-city or short distance trips (Rojo, et al., 2011) because of the demand to manage or stay closer home. In contrast, Govender and Pan (2011) assert that males generally travel more than females irrespective of distance by public transport. Income has a positive impact on the amount of travel and that there is evidence that trip lengths are increasing with income (Paulley, et al., 2006). In pursuit of that, Kumar and Lim (2008) and Govender (2014) used these socio-demographic characteristics to ascertain its effects on trip makers' "perceived quality". The use of SERVQUAL pervades the literature in order to measure perceived quality.

The SERVQUAL scale is in the form of a questionnaire that uses a Likert scale on seven levels of agreement/disagreement (from "1= strongly disagree" to "7 = strongly agree"). Four or five numbered dimensions on the SERVQUAL scale comprising twenty-six attributes are measured in two ways (Parasuraman et al., 1988; Ladhari, 2008):

1. The expectations of passengers concerning a service; and
2. The perceived levels of service rendered.
3. "Expectations" are based on what a passenger feels a transport operator should offer (Botsch, 2009). Whereas, perception is the subjective assessments of actual service experienced (Zeithaml& Bitner, 2000). Perceived quality is the outcome of an evaluation process where passengers compare their expectations with the perception of service received. The assumption is that when the "Expected Service" (ES) is greater than the "Perceived Service" (PS), quality will be perceived to be poor or negative. However, when ES=PS then quality is good, when ES<PS, quality is more than good as the difference between PS and ES grows wider.

There are three ways by which one can arrive at the "perceived quality" (Buttle, 1996),: Perception (P) – Expectation (E) divided by one; perception ((P1+P2+P3+P4) – expectation (E1+E2+E3+E4)/4), where P1 to P4 and E1 to E4 represent the four perception and expectation statements relating to a single dimension and 26 attributes ((P1+P2+P3+P4+…+P26) -

(E1+E2+E3+E4+…. +E26))/26, or 5 dimensions which are the SERVQUAL gap. The greater the "gap score" (calculated as G = P - E) the higher the perceived quality. The current study adopts the dimensional and gap score approach (the latter two) of assessing "perceived quality".

## Study Area and Methodology

### Study area

The study area covered trip makers on the Accra-Takoradi route (228km) with travel time of 3-4hours (Figure 1). Accra is the administrative and political capital of the Republic of Ghana and Takoradi (one of the twin city Sekondi-Takoradi) is a city with vibrant port activities.

### Target population

The target population was 1,655,657 being the estimated number of trip makers in 2013 as provided by these seven intercity transport operators on the route.

### Sampling size

The sample size was 497 as in Abane (2011) representing 0.03 % of the estimated target population of more than a million in travel behaviour studies.


**Figure 1: Map of Southern Ghana showing the study route**

Source: GIS Unit, Geography and Regional Planning Department, University of Cape Coast 2014.

### Sampling techniques

Multi-stage sampling technique was employed in this paper with quota and accidental sampling techniques used to identify the contribution of each of the transport operators to the target population

and the buses in which the passengers were surveyed respectively (Table 2). Systematic sampling technique was used to survey every third and fifth passenger small buses (<15 passengers) and midi and large buses (>15-60 passenger-seat) respectively. Meanwhile, 6 respondents were purposively chosen from each of the transport operators for the in-depth interviews.

**Research instruments**

Two forms of data collection instruments (in-depth interviews and self-completed questionnaires) were used. The questionnaire was divided into two sections: socio-demographic characteristics of trip makers. and the modified SERVQUAL model with 5 dimensions and 26 attributes (Table 1) measured on five Likert scales. The IDIs sought to elicit information on the experiences of trip makers onboard the intercity bus.

**Data collection procedures**

540 Copies of the questionnaires were served on board the buses and the respondents were asked to submit all filled questionnaires to the drivers when alighting with a response rate of 92.03%. The in-depth interviews (IDIs) were held on-board, as respondents were more relaxed than when waiting for a bus.

**Reliability and validity of the study**

Two research assistants trained in a classroom environment collected the data. The Cronbach's alfa coefficient (0.84) ensured the reliability of the paper. The respondents were assured of confidentiality and could opt out if deemed necessary. The consent of the guardians of respondents aged < 15 years for the in-depth interview was sought. This is because there is a growing concern for the views of children users of transport services. The in-depth interviews were also subjected to content checking.

**Data analysis**

The qualitative data was thematically analyzed. Both descriptive (such as frequency, percentages and means) and inferential statistics (ANOVA and P-value<0.05) were used to analyze the differences in means scores of the quantitative data.

**Results**

**Socio-demographic characteristics of trip makers**

The majority of the respondents were males (80%), aged <40 years old (86.2%), students (27.4%) and had at least tertiary education (56.5%), (Table 1).

**Socio-demographic characteristics and perceived functional quality**

Females revealed a better "perceived quality" (Table 1). On the other hand, only the <15 –years-old respondent revealed poor "perceived quality" (-0.01). The 15-year old respondent remarked:

> *I don't like boarding small buses because they don't show movies. Without the movies, I am forced to sleep. Besides, I enjoy the air condition in big buses. Sitting on my mum's lap in small buses is very painful but I do feel better in big buses such as this one.*

Ages of respondents have accompanied challenges as noted by a retiree:

*I have a problem with public transport in Ghana because they don't offer the best of services to the passengers. If not for the fact*

*that my son alighted me very close to this station, I would not have boarded this bus. Otherwise, I would have climbed the overhead bridge to VVIP station. Because of old age and medical reasons I could not go there. The seats in this bus are not spacious and the bus is stuffy. Although looking at the economic side of it, a pensioner like me can afford it.*

Respondents with no formal education had the best "perceived quality" (0.46) and self-employed and pensioner respondents revealed poor "perceived quality".

**Differences in perceived quality across the socio-demographic characteristics of trip makers.**

There was a statistically significant difference $p < 0.05$ significance level in "perceived quality" across the nine age groups, five educational groups and eight occupational groups (Table 1)

**Table 2: Socio-demographic Characteristics and Perceived Quality**

| Socio-demographics | | | Perceived quality | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % | Reliability P-E | Assurance P-E | Tangibility P-E | Empathy P-E | Responsiveness P-E | SERVQUAL P-E | P-Value |
| Gender | Male | 56.7 | 0.22 | 0.10 | 0.17 | 0.29 | 0.21 | 0.19 | 0.698 |
| | Female | 43.3 | 0.26 | 0.14 | 0.19 | 0.45 | 0.11 | 0.21 | |
| Age | <15 | 4.0 | -0.06 | 0.46 | -0.54 | 0.02 | 0.33 | -0.01 | |
| | 15-19 | 18.7 | 0.30 | 0.40 | 0.13 | 0.50 | 0.20 | 0.27 | . |
| | 20-24 | 31.4 | 0.38 | 0.11 | 0.22 | 0.45 | 0.16 | 0.26 | |
| | 25-29 | 18.7 | 0.13 | -0.04 | 0.08 | 0.03 | 0.07 | 0.06 | 0.024 |
| | 30-34 | 6.4 | 0.29 | 0.09 | 0.18 | 0.49 | 0.27 | 0.25 | . |
| | 35-39 | 7.0 | 0.48 | 0 | 0.29 | 0.48 | 0.18 | 0.28 | |
| | 40-44 | 5.6 | 0.04 | -0.18 | 0.22 | 0.30 | 0.21 | 0.12 | |
| | 45-49 | 2.4 | 0.14 | 0.06 | 0.01 | -.59 | -0.06 | 0.06 | |
| | 50> | 5.6 | 0.19 | -0.11 | 0.35 | 0.40 | 0.03 | 0.18 | |
| Education | No school | 2.4 | 0.38 | -0.23 | 0.70 | 0.79 | 0.68 | 0.46 | |
| | Basic | 5.6 | 0.17 | 0 | 0.04 | 0.40 | 0.03 | 0.11 | 0.026 |
| | Sec | 21.5 | 0.33 | 0.08 | 0.25 | 0.54 | 0.28 | 0.29 | . |
| | Tertiary | 56.5 | -0.31 | 0.18 | 0.14 | 0.32 | 0.15 | 0.21 | |
| | Post | 13.9 | -0.19 | -0.09 | 0.09 | 0.16 | 0.04 | 0.02 | |
| Occupation | Unemployed | 12.7 | 0.37 | -0.08 | 0.31 | 0.47 | 0.09 | 0.21 | |
| | Self | 23.7 | 0.31 | -0.02 | 0.15 | 0.29 | 0.10 | -0.16 | |
| | Student | 18.9 | 0.20 | 0.39 | 0.11 | 0.44 | 0.15 | 0.25 | 0.018 |
| | Civil | 8.2 | 0.13 | 0.07 | 0.04 | 0.18 | 0.27 | 0.14 | |
| | Teacher | 6.8 | -0.11 | -0.23 | 0.28 | 0.27 | 0.11 | 0.07 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Private | 27.4 | 0.24 | 0.62 | 0.77 | 1.39 | 0.47 | 0.79 | |
| | Business | 1.8 | 0.26 | 0.10 | 0.27 | 0.32 | 0.24 | 0.24 | |
| | Pension | 0.4 | 0.10 | -0.60 | 0 | 0 | 0 | -0.04 | |
| Income | <100 | 4.8 | 0.27 | 0.36 | -0.01 | 0.06 | 0.16 | 0.16 | 0.400 |
| | 101-300 | 23.9 | 0.25 | 0.18 | 0.21 | 0.23 | 0.18 | 0.20 | |
| | 301-500 | 21.9 | 0.40 | -0.14 | 0.22 | 0.47 | 0.26 | 0.25 | |
| | 501-700 | 13.2 | 0.36 | 0.14 | 0.20 | 0.42 | 0.38 | 0.26 | |
| | 701-900 | 5.9 | 0 | 0.14 | 0.01 | 0.10 | 0.33 | 0.11 | |
| | >900 | 30. | -0.01 | 0.10 | 0.16 | 0.25 | 0.13 | 0.11 | |

Source: Fieldwork, 2014. *US$1=Gh¢3.8

**Discussion**

Socio-demographic characteristics of trip makers offer heterogeneous perspective to assessing perceived quality of intercity bus service (Aidoo et al., 2013). Males generally travel more than females irrespective of distance in both LMICs and HICs as evident in the paper (Nutsogbodo, 2013; Javid et al., 2013). Generally, males are always on the road trying to make a living with the women always staying closer home performing household chores. Intercity trip makers in Ghana, Japan and Nigeria are generally aged <40 years, educated and students as evident in the current paper (Ibrahim- Adedeji, 2011; Aidoo et al., 2013; Javid et al., 2013). These trip makers are active and mobile.

The effects of gender on perceived quality of public transport services present somewhat conflicting results with females having better-perceived quality ((Ganesan-Lim et al. 2008; Juwaheer (2011). But the current paper reveals otherwise and supported by Govender's (2014) study in South Africa.

Trip makers of different age groups (<15, 25-29, 40-44,50>), educational levels (no formal and postgraduate) and occupational status (unemployed, self-employed and teachers) revealed poor "perceived quality" on assurance, empathy, reliability and responsiveness dimensions. These trip makers were not satisfied with the service rendered. Both theoretical and empirical types of research link trip makers' satisfaction to a company's market shares, performance or organizational profitability and trip makers' retention (Ooi et al., 2011).

The poor "perceived quality" exhibited may cause these trip makers to resort to private cars use with its attendant environmental concerns-traffic congestion, air and noise pollution and road traffic crashes. In addition, there will be an increase in the demand for fuel consumption due to increase in the use of personal cars for intercity trips which will be a big challenge in Ghana as most of the fuel used is imported.

The poor "perceived quality" exhibited by respondents aged <15 years is as a result of the experience of the only 9 years respondent. The mother was holding the girl instead of being seated. Besides the presence of television sets, air conditioning system and ample space in large buses might have influenced the "perceived quality".

**Conclusion and Policy Implications**

The study has concluded that the majority of the intercity trip makers were males, aged<40 years old, educated and students. Female trip makers showed a better

"perceived quality" with <15 years old trip maker having poor "perceived quality". Trip makers with no formal education had the best "perceived quality". The poor "perceived quality" on assurance, empathy, reliability and responsiveness dimensions were exhibited by <15 years old, self-employed and pensioners trip makers.

Intercity bus transport operators should pay attention to the dominant socio-demographic characteristics to make their service attractive to these heterogeneous users with an emphasis on reliability, assurance, empathy, and responsiveness dimensions. Notwithstanding, maintaining the level of service delivered based on tangibility dimensions.

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