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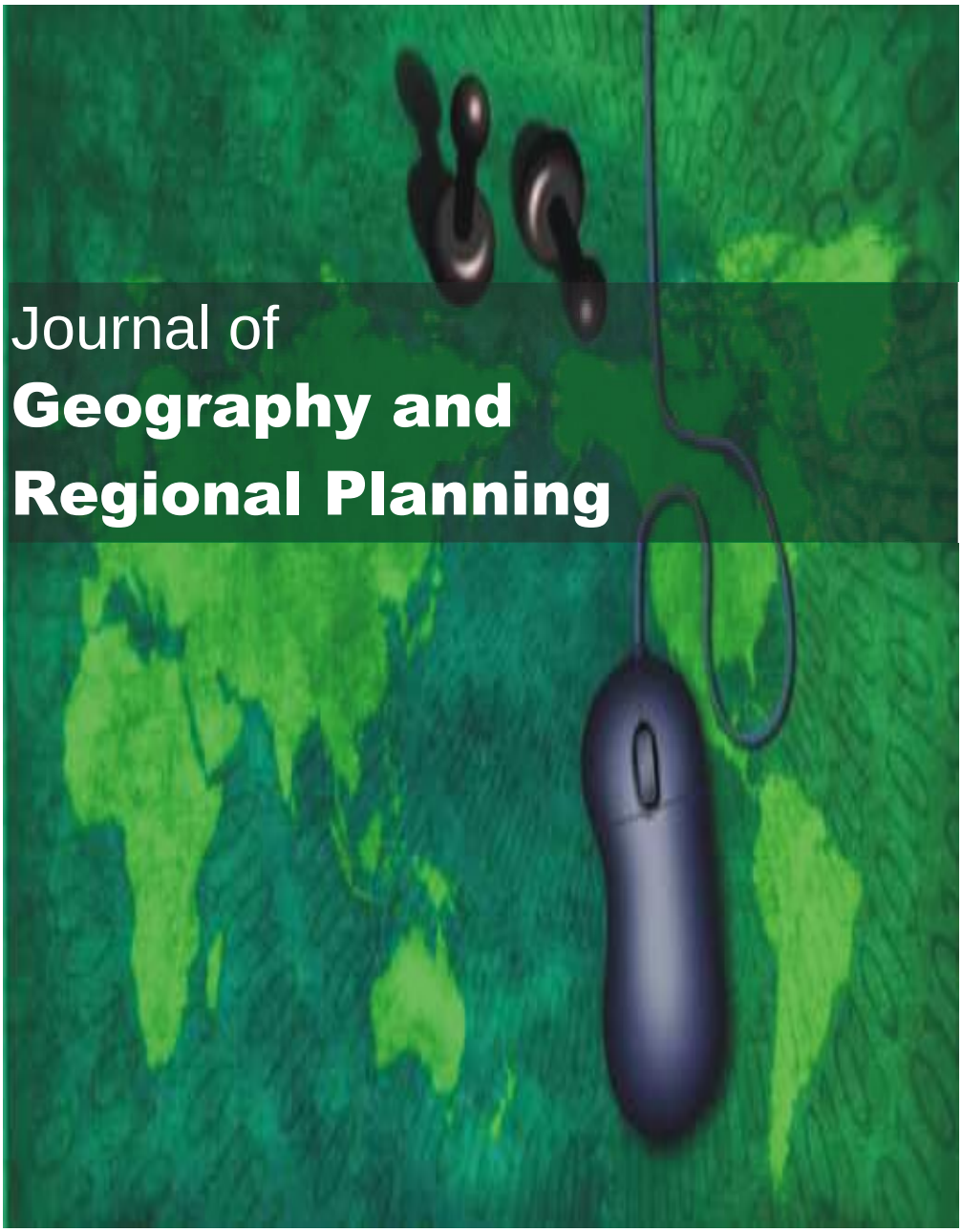

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Table of Content

Rural-urban migration and household livelihood in the Agona West Municipality, Ghana 1
Tanle A., Ogunleye-Adetona C. I. and Arthor G.

Climate change and smart city development: The challenge of non- implementation of Abuja-Nigeria light rail project
Jaiye Dukiya 19

Public-Private Partnership (PPP) in residential solid waste management in Ibadan: Challenges and opportunities 30
Moruf Adekunle Alabi, Oluwasinaayomi Faith Kasim and Mubarak Olatunji Lasisi

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Rural-urban migration and household livelihood in the Agona West Municipality, Ghana

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Rural-urban migration, a multidimensional phenomenon, is becoming part of the daily reality in Ghana and many other developing countries. For instance, the impact of migration on households whose member(s) migrated is relatively not very clear. A study was therefore undertaken to examine and explain the impact of rural-urban migration on rural migrant's households' livelihood in three communities in Agona West Municipality, Ghana. Snowballing technique was used to select and interviewed 121 respondents to obtain information on the motives of migration and the impact of remittances on household livelihoods. Eight male and female heads of households were purposively selected from each village for the focus group discussion. Frequencies, percentages, diagrams and tables were used to explain the data obtained. The study identified two types of households; the migrant and non-migrant households. Also it was observed that males, were often forced to migrate because of their poor living conditions and low educational attainment, the better-off migrant households characterized with higher educational attainment on the other hand, often migrate in order to accumulate more wealth. The better-off migrant households are therefore positively impacted; better access to health-care, more education opportunities, and agriculture than the poor migrant households. The study therefore recommended that government policy on poverty and employment especially for rural areas need to be revisited for better employment opportunities in the rural areas for the young adults and thereby curb the drift to urban areas.

Key words: Migrant households, non-migrant households, poor households, better-off households, remittances, socio-economic status, household livelihoods.

INTRODUCTION

Migration (internal and international) occurred both in developed and developing countries. Internal migration appears as a massive phenomenon, exceeding international migration as there are around the world 740 million internal migrants compared to 214 million international migrants (UNDP, 2011). Many internal migrants originate from rural areas, and many of them are youth, given their higher propensity to migrate than older individuals (World Bank, 2011). Initially, migration patterns in sub-Saharan Africa were mostly male-dominated however it is progressively becoming feminized, in other words there is an increasing number

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of female migrants in cities working in informal sector jobs (Oberhauser, 2016). And that female migrants oftensend more remittances to the rural part of their family regularly (Tacoliand Mabala, 2010).

Migration is neither a new phenomenon, nor a failure of development, nor replacement for development. Rather it has been seen as a response of individuals to better economic and non-economic opportunities and an expectation of increased economic welfare in urban areas (Tanle, 2003). The patterns of migration especially in the sub-Saharan Africa are multifaceted. For instance an individual may be tempted or forced to migrate as a result of cultural, demographic, socio-economic, ethnic conflicts, environmental, natural disasters, or political (large scale infrastructure projects and resettlement) (Zoomer and Otsuki, 2016). The decision to eventually migrate is influenced by a mixture of several of these aforementioned factors.

Current trends in migration in Africa also seem to have significant socio-cultural effects on households and communities, because migration is now becoming an important livelihood strategy worldwide (Reda et al., 2012;Ghana-United Nattions, 2017; UNDP, 2011). It is believed to be one of the most important elements that trigger rural-urban migration especially; in developing countries. It is seen as one of the main strategies to diversify, secure and improve livelihood, often in combination with other strategies (McDowell and De Haan, 1997). A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Oberhauser, 2016). Livelihood assets enable households and individuals to produce, participate in labour markets and to collect sufficient household income (Ellis, 2000). Livelihood assets are the stocks of capital that can be used by households to create the means of living or to improve their welfare level. The notion of livelihood is associated with social institutions like family, village and other social networks facilitating and sustaining diversified livelihoods (Jiao et al., 2017; Nyberg-Sorensen et al., 2002).

Livelihood strategies of people changes in response to the constraints and opportunities they are exposed to, and likewise the decision to migrate or not. There are many factors that shape these decisions which correspond to the contextual, socio-economic and policy considerations. A policy like the resettlement program in Ethiopia affects not only people's livelihood strategies, but their access to assets and every other aspect of their livelihoods (Tacoli, 2010). Adopting migration as a livelihood strategy, may not necessarily lead to improved livelihoods. In other words, migration may lead to either improvement or deterioration in livelihood status of people.

Rural-urban migration in this case can be considered as a household strategy in which economic and social links between the migrant and his or her rural household are maintained because the migration process is a conscious strategy of the whole migrant household inorder to diversify the household income sources and to become less vulnerable to shocks, risks or local constraints in their livelihood (Ellis, 2000). The decision of the household is based on the consideration of the profits of migration (like remittance flows, higher local incomes or the spreading of risks) and the costs of migration (like travelling costs or the lack of labour forces) (Lindley, 2008).

The contribution of remittances in migration processes and the whole migrant household act tactically as one decision-making unit (Braw et al., 2014). Migration can then be conceptualized as a type of livelihood diversification by households, an answer to household's income risks and in this way remittances can form a kind of income insurance of the sending households (Okhankhuele and Opafunso, 2013)

Migrants remit or transfer money to relatives in rural areas. Remittances improve chances of access to land and other resources, while the need to access land can be a key motivating factor for migration. Remittances are invested in land and other resources, used to pay for education, health, housing and direct food purchases. Remittances maintain multi/spatial households that combine farm and non-farm activities and rural and urban residence (Tacoli and Mabala, 2010).

The impact of rural-urban migration however, is not a linear process rather it is more complex with a lot of variables coming to play-type and extent of migration, size of remittances and local context. These variables are interrelated with each other and can have influence like the loss of human resources in rural areas and the impact of remittances and earnings for rural households. The major impact of migration and remittances on the livelihoods of rural households therefore depends on the expenditure, investments and labour allocation of the sending households.

Migration in Ghana is not only on the forefront of the demographic and development transitions in Africa, but also at the front of the urbanization trend. In recent years, the migration routes have tended to be more of rural-to-urban migration to cities in Ghana, like Accra and Kumasi attracting traders, young adults seeking employment and educational opportunities (Adepoju, 2003; Appiahnig, 2013).

Ghana's rapid population growth and urbanization also have important linkages to migration. For instance, the 2010 national census in Ghana recorded a population of 22.7 million (2006), 24.66 million (2010) to 29.09 million people (2017) (United Nation Estimate, 2017; Ghana Statistical Service, 2017). At the national level, about 53.4% of Ghana's population is urban, an increase from the 1984 level of 32% (Ghana Statistical Service, 2017).

Ghana, like most parts of Africa, is still predominantly

rural, but it is urbanizing steadily due partly to rural urban migration. More than 80% of Ghanaian migrate with about 70% going to the urban areas (Ballard, 1983;Ghana Statistical Service, 2000, 2010). The greater Accra and Ashanti regions attract more than half of all internal migrants and migrants make up a substantial share of the population in these regions (Tutu, 1995; Tanle, 2003; Ghana Statistical Service, 2010). The southern regions of Ghana; Western, Central, Eastern, greater Accra, Volta, and Ashanti are the destinations for 88% of all internal migrants, while the Northern and the two Upper regions together account for only 5% of the total.

On the other hand, the "pull" hypothesis emphasizes the attractiveness of the urban life and the rural-urban wage gap. In particular, in Todaro (1969) and Harris and Todaro (1970) probabilistic models, migrants are attracted to cities with the expectation of a higher wage than they receive in agriculture. In view of this, migrants are willing to accept the probability of urban unemployment, or lower wages and "underemployment" in the urban informal sector. According to Todaro, a migrant is willing to accept urban employment or lower wages in the urban informal sector as long as he expects to "graduate" to the urban modern sector in the future.

Problem statement

Studies of migration in Ghana exploring its patterns, determinants, and impacts on welfare and poverty date back to the 1960s. Early contributions by Caldwell (1969) used census and survey data and found a negative effect on migrants place of origin/locality's (rural) in terms of income, but a positive effect of a household's own income on the probability to migrate. Other important determinants of the likelihood to migrate as noted by Caldwell (1969) include presence of friends or relatives in the destination (migration networks). Tutu (1995) also observed that males are more likely to migrate than females and that younger persons are more likely to migrate than the aged. In the Agona West Municipal, migration of the youth from rural areas to urban areas has been a matter of great concerns (Appiahnig, 2013). This is because those who migrate especially the young adults, return with improved livelihoods or remit their families which in turn improve their family's socio-economic status in the community. This situation according to relative deprivation theory of migration may encourage other youth in the community to also migrate to urban areas. These developments have much implication on the rural communities.

In addition, much of the influence depends mostly on household size, the larger the households the greater the number of migrants. It is therefore not clear whether the increasing migration of members of households in the Agona West Municipality suggest a simple response to the persistent relationship of the poor economic conditions in rural areas. Moreover whether the poor and uneducated from the Agona West Municipality like their counterparts from other regions engage in migration to the towns in other to improve their household livelihoods as the findings regarding the relationship between education and the probability to migrate have been conflicting, with estimating a negative relationship and Caldwell (1969) reporting a positive asso, ciation. Castaldo et al. (2012) also highlighted the importance of remittances sent by migrants in urban areas to rural origin communities in raising the welfare of households and narrowing the welfare gap between rural and urban communities. It is also not clear whether those who migrate to the towns remit their household members in the rural areas to increase their income and consumption or even the family's social status as observe by Tutu (1995).

More recently, efforts at establishing a relationship between migration and household welfare generally found that migration tends to increase the welfare of sending households. Using data from the 1991/1992 and 1998/1999 rounds of the Ghana Living Standards Survey (GLSS), Sam et al. (2013) found that migrants have a higher standard of living than non-migrants. But one question that still remains is that, is this phenomenon visible in the Agona West Municipality among the rural folks who send their members to the towns?

The uncertainty and connection between rural-urban migration and livelihood and the effect of rural-urban migration on households livelihoods need to be unravelled in order to enhance our understanding of the socio-economic context in which rural households in the Agona West Municipality live, and make suggestions that may help curb or regulate rural migration. It is therefore important to study and comprehend the motives behind migration in the Agona West Municipality.

Objectives of the study

The main objective of the study was to assess the effects of rural-urban migration on household livelihoods in the Agona West Municipality.

Specifically, the study sought to: outline the main motives for migration; investigate the use of remittances by households; and examine the effects of remittances on household livelihoods.

Research questions

The study therefore sought to answer the following questions: What are the main motives for migration in the Agona West Municipality? What are the uses of remittances by migrants' households? What are the effectsof rural-urban migration on household livelihoods?

Rationale of the study

It is hoped that this thesis will add to the existing knowledge on the perspective of the migrant-sending households and the effects on the households.

Facilitate an understanding of the development potential of out-migration for the migrant-sending households, a force that may increase or diminish inequalities in the sending area particularly in Ghana.

The study may also inspire other researchers to conduct further research on the issue on rural-urban migration and the impact on household livelihood especially in Ghana by focusing on the areas of origin.

This will in turn then provide information for planners, policy makers and local agencies like the Ghana National Population Policy, the Growth and Poverty Reduction Strategy in their overall effort to formulate and implement population redistribution or migration policy and related programmes.

LITERATURE REVIEW AND THEORIES OF MIGRATION

The scale and patterns of migration have been of interest to social scientists since the laws of migration were first formulated by Ravenstein (1885) explaining migration-distance hypothesis, states that migration is inversely related to distance and that most migrations occur over short distances. Adepoju (2003) in reviewing Ravenstein's migration-differential hypothesis added that economic motives were the most dominant causes of migration and that development in transport and communication would invariably increase the tempo of migration. The impact of migration on the rural household was not captured by the theory.

Many of the subsequent migration theories in contemporary studies are more or less variations of his arguments. For instance, Lee (1966)explains the factors affecting migration could be positive and negative characteristics of both the origin and destination. And added that a framework for analysing the volume of migration; the characteristics of migration and the decision-making process. The framework classified the pull-factors as the attractions and socio-economic opportunities available in other localities and the push-factors to include the deteriorating socio-economic conditions in the areas of origin (Lee, 1966).

According to Lee (1966), if the negative features of the origin were more powerful, then migrants were pushed out, while at the destination, if the positive features were more powerful, then migrants were pulled in. Since the 1950s in developing countries Ghana inclusive, rural poverty has pushed migrants out, while higher incomes and cultural amenities associated with the large cities have lured migrants. Lee's theory is more applicable to the changing socio-economic context of contemporary society tried to explain migration as transition from a stagnant rural agricultural sector to a growing modern industrial urban sector due to the labour surplus in rural areas will supplement the labour shortage in urban areas, which serves as the drive for rural-urban migration. This model, assumed that rural economies initially present a specific context in which there is surplus labour in the agricultural sector. Hence, the agricultural sector is able to supply labour force to the modern industrial sector which can grow by accumulating capital and obtaining labour from the agricultural sector (Dugbazah, 2012).

Unfortunately, this model's assumption of zero marginal productivity and remuneration in the agricultural part is highly arguable. Also, it does not adequately describe the rural-urban migration process of many developing countries in contemporary time. This is because even if agriculture productivity and wages may be low, they are not completely non-existent as rural people are able to make a living at the subsistence level. This model might have been applicable in the late 1960s when urban areas experienced high levels of unemployment (Dugbazah, 2012). Ravestein (1885) and Lee (1966) were able to establish the relationship between migration and socio-economic development, emphasizing that people will always move when confronted by better opportunities.

The neoclassical economic theories were developed on principles of individual optimizing behaviour treat migration as an economic phenomenon in which the migrant weighs the costs and migration (Free, 2010). Todaro (1969) one of the fore runners of the neoclassical economists in terms of classic rural-urban migration theory postulated that migrants respond mainly to economic incentives, earnings differentials, and the probability of getting a job at the destination is the major influence in the migration decision. In other words, the decision to migrate is a function of the wage differentials that exist between urban and rural areas and the probability of finding a job in the city. This model thus highlights the importance of the probability of finding a job in cities along with the popularity of higher wages there, which motivates a potential migrant to finally migrate. This theory assumes that rural-urban migration will take place whenever the urban expected wage exceeds the rural wage (Todaro, 1969: 73). Also, the Neo-classical economic explanations, assume a homogenous individual who is undifferentiated by gender, class or other factors, to be making rational decisions to maximize economic interests and ignores other factors, like marriage, dependency relations (social factors), floods, river erosion, drought, etc. Despite its limitations, the model/theory identifies a very vital link between perceived employment opportunities and migration. A lot of studies support the argument that the basic motive behind the decision to migrate from rural to urban areas is guided by a search for employment opportunities in urban settings (Tacoli and Satterthwaite, 2003). This is evidenced by

the fact that after migrating, most of the people usually enjoy higher income relative to agricultural income (Adepoju, 2003).

Current models of internal migration, like the household theorists by Clarke and Drinkwater (2001) explained that people act jointly not only to maximize expected income, but also to minimize risks for the members of the kinship unit (Farkhanda et al., 2014). The main focus of this approach is that migration decisions especially in developing countries are not made by isolated individuals, but by families or households (Krantz, 2001; Farkhanda et al., 2014; Tacoli, 2002). Network theoryby Bakshi (2008) another relevant theory to this study (migration and livelihood), attributes migration to personal, cultural, and other social ties. And argues that in migrant-sending communities, information about jobs and living standards are efficiently transmitted through an arrangement struck between personal networks such as friends who emigrated (Agesa and Kim, 2001). This is because, the family eventually benefits from the migrant through remittances which enable them to cope with adverse economic shocks.

Evidently, traditional migration theories have not addressed the household aspects of migration. For instance, in the neoclassical economic models and the push-pull demographic models, migration was seen as the outcome of individual decisions (Krantz, 2001). The new economic concepts and theories emphasized the importance of the family or the household as the primary site of decision-making however could not explain the fact that household decisions and actions do not necessarily represent unified and equally beneficial outcomes for all members (Tacoli, 2002; Potts 2009).

Livelihood approaches

The concept of livelihood is associated with social institutions, as family, village and other social networks facilitating and sustaining diversified livelihoods (Carney and Clark, 2008). Therefore, the livelihood approach became popular. The livelihoods of people are ways and means through which they make their living with resources available to them (Ellis, 2000). Chambers (2008), however stressed that livelihood is sustainable when it is able to cope with, and recover from stresses and shocks, able to keep its assets and capabilities both now and in the future, while not depleting the natural resource stock. The fundamentals of the livelihood concept are livelihood resources, livelihood strategies, livelihood outcomes and vulnerability context (Chambers, 2008).

Livelihood approach is used to identify the main constraints and opportunities faced by poor people, as articulated by them. It builds on these definitions and then supports poor people as they address the constraints, or take advantage of opportunities. The framework is neither a model nor a universal solution but rather a means of stimulating thought and analysis, and it needs to be adapted and elaborated depending on the situation. Chambers (2008) argue that the ability of households to have access to sustainable livelihood strongly depends on whether or not they have access to five forms of capital assets: natural, physical, human, social, and financial assets. The idea of a livelihood framework as a tool for analysis is simply to capture the main elements, which comprise the complex livelihoods of people at a given point in time, as well as the course and dynamics of change in livelihoods (Carney and Clark, 2008). The natural capital water, land and natural resources in the environment of people are used to create means of survival. The profits of these sources can be direct or indirect and they are related with user regimes and property. Human capital: labour, health, education, skills and everything that is required for able-bodied and talented labour forces. Furthermore, physical capital: machines, transportation vehicles, buildings, roads, electricity, communications, etc.; all assets that are produced by industrial production processes. Financial capital: all the financial resources in the form of accessible stocks and regular inflows of money that people use to attain their livelihood outcomes, like savings, loans and credits. Finally, social capital, the social resources through which people are able to achieve their livelihood objectives (Ellis, 2000).

The livelihood framework offers no explanation for the role of power relations and politics. However, these power issues like institutions, laws or policies affect the choices that people make with their livelihood assets. Not enough emphasis is given to the informal structures and processes that affect access within the community. Krantz (2001: 25) noted that though the frameworks taking note of gender considerations attempts to increase the voice of women which is difficult to achieve successfully in practice. It is therefore important to include political capital in livelihood research. And a modification of this framework to suit the study being undertaken became necessary.

CONCEPTUAL FRAMEWORK

The concept of a livelihood strategy has become central to development practices in recent years. However, the uncountable possible proportional mixes of activities undertaken by a households, is not always clear regarding the constituents of a distinct livelihood rather than just a slightly different mix of activities within the same general livelihood (McDowell and Hess, 2012). A precise operational definition of *livelihood* remains vague, as does an associated method for identifying livelihoods in quantitative data (Francis, 1999). This probably helps explain why the more quantitative development scholars

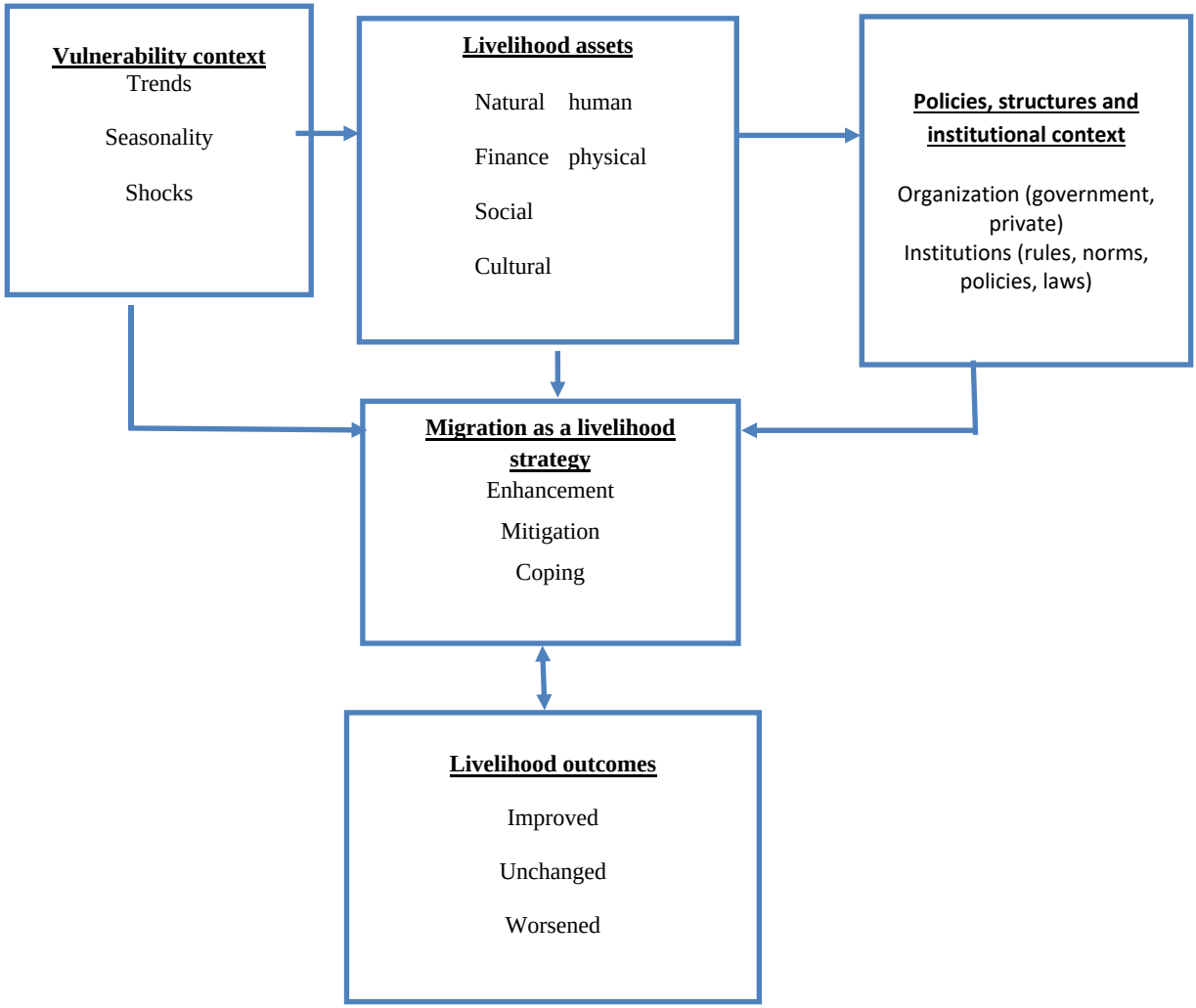

Figure 1. Migration as a livelihood strategy.
Source: Adapted from Theime(2005).

(e.g. economists) have been slower to adopt the concept as compared to the most qualitative ones (e.g. anthropologists and sociologists).

The ability to operationalised the concept of a livelihood strategy becomes especially important when examining the 'improvement' of livelihood to paraphrase much current development discussion (Scoones, 2009). Thus it is quite important in choosing distinct livelihood strategies that earn high returns for households, especially in rural agricultural areas.

As explained earlier on, thisstudy adopted the"migration as a livelihoods strategy" as its conceptual framework which was originally adapted by Thiemes (2005) from the Sustainable Livelihood Framework. This framework is seen to be the appropriate framework for this study because it clearly shows the relationships between migration and livelihood outcomes taking into consideration how vulnerable households are to external effects (Figure 1).

The basic elements of most livelihood frameworks are: livelihood resources: what people have, variously referred to as stocks and stores, assets and capital (both tangible and intangible); livelihood strategies: what people do (e.g. agriculture, wage labour, migration); livelihood outcomes: what goals they are pursuing, and the living that results from their activities.

As a component of the framework (Figure 2), livelihood strategies differ with regard to whether people have to deal with gradual changes or crises Carney (1998). These are agricultural intensification, livelihood diversification and migration (Carney and Clark, 2008). Agriculture is notably the most important economic activity of rural households in most developing countries (Tsegai, 2005). In the past, it has often been assumed

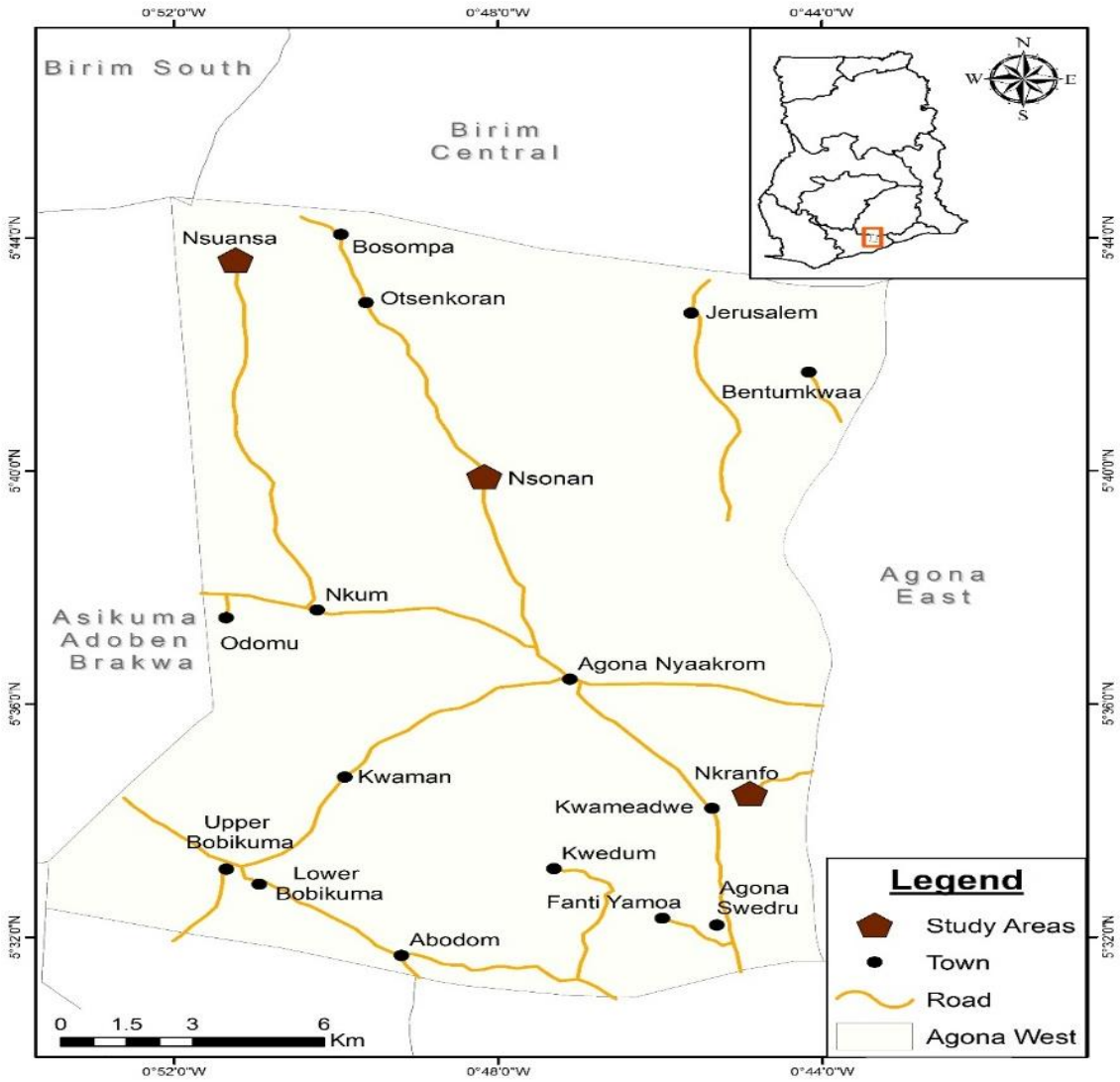

Figure 2. Map of Agona West Municipality showing the study areas.
Source: GIS, Remote Sensing and Cartography Unit, Department of Geography and Regional Planning, UCC.

that increasedin farm productivity would create more non-farm income earning opportunities in the rural economy via linkage effects.

However, this assumption is no longer tenable for many poor rural families as it is obvious that farming on its own is unable to provide a sufficient means of survival (Potts, 2009).

As a result of inadequate income from agriculture, most households are compelled to embark on livelihood diversification strategies such as migration, in order to vary the sources of household income (Afshar, 2003). In sub-Saharan Africa, most household level diversifications are not just non-farm, but also non-rural in character, such as rural-urban migration. It is widely agreed that the capability to diversify livelihood is more beneficial for poor rural households (Toulmin et al., 2000; Mack et al., (2005) however argues that having alternatives source of income generation can make the difference between sustainable livelihood and destitution. Diversification does not necessarily have an equalising effect on overall, rural incomes as families, that are relatively better-off are typically more able to diversify their livelihoods than poorer rural families (Ellis, 2000).

For this study, the theory of sustainable livelihood, migration as a livelihood theory are adopted even though it may raise some debate in terms of rural livelihoods sustainability, because the concept lay emphasis on the fact that people's livelihood may depend on migration. Migration is said to reduce poverty in the migrant's home of origin. Zoomer and Otsuki (2016) however argues that it is the migrants themselves who's level of poverty reduces as they find themselves with good jobs and therefore contribute more to the area of the destination than the origin.

According to Knowles and Anker (1981), there are uncertainties surrounding income of families, savings and investments are reduced by migration. For instance, remittances from migrants have for a long time provided generations with an inseparable source of income among the Bihari migrants in Calcutta (McDowell and De Haan, 1997). It has also been found in Kenya that income from migrants plays crucial role in the lives of the less endowed as compared to the wealthy ones since the less endowed have little livelihood opportunities. Most of the remittances from migrants are geared towards payment of households' debts (Francis and Hoddinott, 1993).

Even though migration is often linked to insecurity in the literature because of break of family ties, labour repatriation and retrenchment due to economic failures and political reasons, reduces risks, seasonality and shocks (Francis, 1999). For instance, migration of young ones from a household reduces the household's tendency to face food insecurity in times of hardships. And young women who migrate tend to save and invest their earnings in preparation to their marriages and in so doing may not contribute physically to the household but they also do not rely on their households (Krantz, 2001). These contribute vitally to the reduction of insecurity, shocks and seasonalities. Migration also reduces tensions that exist within households and keep families longer in the long run.

Furthermore, migration as a means of diversifying livelihood will also favour households, due to their higher level of education relative to that of poor households, which subsequently translates into their higher propensity to obtain employment (Toulmin et al., 2000). The evidence is mixed regarding the gains and losses of household diversification strategies to agriculture (Toulmin et al., 2000). Negative effects are associated with the withdrawal of critical labour from farming activities, while positive effects include the alleviation of credit constraints and a reduction risk to income (Ellis, 2000; Banerjee and Duflo, 2007).

Efforts made to make the standard of living better for the migrants than before are known as enhancement strategies (Thieme et al, 2005). It is hoped that these efforts will make households better in comparison to their situation before leaving as it is believed to make them wealthy.

The outcome as theutmost of the components in Figure 2 could either be improved, worsened or unchanged. Because the framework is human centred, it identifies opportunities and how people use them but also how externalities influence their usage. The outcomes in most cases are in the form of income, well-being, vulnerability, and food security which could either be improved, worsened or unchanged due to migration. Taylor (1999), states that although individuals migrate, they do not sever ties with their source households because at times source households may pay migration costs and support migrants until they become established at their destinations. Family members who remain behind may reorganize both their consumption and production activities in response to the migrant's departure and migrants (often children) share part of their earnings with their household of origin through remittances.Continuing interactions between migrants and rural households suggest that a household model would be more appropriate than an individual level model of migration decisions. Consequently, migrants become involved in the economic development of their places of origin and therefore are considered as agents of development. They can contribute to development not only through remittances, investment and entrepreneurial activities but also through the transfer of newly developed skills and knowledge, or through fostering democratisation and the protection of human rights in their countries of origin (Taylor, 1999). The current study adopted a modified version of the sustainable livelihood framework considering migration as the only livelihood strategy. Migration as a Livelihood Framework is shown diagrammatically in Figure 2.

A keen study of the statistical report of the Agona West Municipality indicates that, economically, the resource base of the municipality is determined by the natural resources of the area (Agona West Municipal Aurthority Profile, 2010). The implication is that, the municipality is predominantly agricultural. Whether the factors influencing migration are 'push' or 'pull', migration is not a one-off phenomenon that occurs in a specific place at a fixed time. Studies on internal migration clearly demonstrated that greater job opportunities in the cities and metropolitan areas 'pulled' migrants from rural areas (Afsar, 20003). Normally, rural dwellers have little incentive to remain in agriculture. Instead, they chose to migrate to nearby towns or district towns or cities in search of more remunerative non-agricultural jobs. So, considering the fact that agriculture is the main occupies of most of the land use of the Agona West Municipality. It may therefore be expected the active work force move from their rural dwellings to the urban areas in search of industrial or factory employment. The need to find out explain whether they get more remunerative jobs after migration or end up swelling the ranks of unemployed in the urban labour market as predicted by Todaro (1969) is necessary. Given the fact that poor migrants can hardly afford to remain unemployed, one must go far beyond unemployment data to examine the impacts of migration on poverty. However, for those who live on the edge of extreme poverty in rural areas, migration to nearby towns may give them temporary relief from unemployment.

Study area

The Agona West Municipality is situated in the eastern corner of the Central Region and is made up of six sub-districts or Town/Area Councils. The area falls within the

Table 1. Population size, number of households and sample size of the study area.

Village	Total population	Total number of households	Households with migrants	Number of respondents
Nkranfo	485	78	56	39
Nsuansa	506	111	72	50
Nsonan	467	68	47	32
Total	1458	257	175	121

Source: Agona Municipal Population and Housing Estimate Survey and Reconnaissance Survey (2016).

moist tropical and semi-deciduous forest with a lot ofvaluable timber trees like mahogany, sapele, silk cotton, wawa and odum (AWMA Profile, 2010). Forest food crops like plantain, banana, cassava, cocoyam and maize are also cultivated. The major soil type found in the municipality is classified as forest ochrosols. These soils are alkaline and richly supplied with nutrients which make them suitable for cultivating varied agricultural produce like cocoa, citrus and coconut. Vegetable and sugar cane cultivation are widespread (AWMA Profile, 2010). The majority of the people in the municipality are into the production of cocoa and cassava. Agriculture is the major economic activity engaging more than 64% of the municipal population (AWMA Profile, 2010). Being a nodal town, the municipal capital, Swedru, is a nodal town and the availability of markets in most of the major towns in the municipality, trade and commercial activities are promoted.

The municipality has a total population of 115,358, out of which females constitute about 61,199 (53.1%) and males are 54,159 (46.9%)(Ghana Statistical Service, 2010). Sex structure of the municipality shows that the population is predominantly female 53.1%. According to the Ghana Statistical Services (2017), youths in Agona West Municipality are well known for out-migration; this might have been made easy because of the location being a nodal with a trunk A and other roads.

MATERIALS AND METHODS

Research philosophy

Based on the positivist and the interpretivist research paradigms, the mixed method approach (quantitative and qualitative) was used. The data collected from both the quantitative and qualitative will add more credence from the result that will be obtained from the field.

Data, sources and target population

Data for this study were collected from primary sources from the respondents on the field. The secondary sources include information from GSS, literatures and other relevant records.

The target population for the study consisted of households' heads from the three selected study communities: Nkranfo, Nsuansa, and Nsonan in Agona West Munipality. The selection of these communities was based on the fact that the rate of youth out-migration in these communities is more frequent and higher (Arthur, 2009; Agona West Municipal Authority, 2014).

Sampling technique and procedure

The sample size for the study was 169 made up of 121 household heads who had some household members as out-migrants and 48 key informants from the study communities to partake in the focus group discussion. About 171 household were identified in the three communities during a reconnaissance survey but only 169 respondents accepted to participate in the actual survey.

Purposive sampling technique was used to select the three communities for the study. Purposive because it was observed that the rate of youth out-migration in these communities are more frequent and higher, as such the likelihood of obtaining the needed information for the study could be easy (Arthur, 2009; Agona West Municipal Authority, 2014). Snowballing technique was then used to randomly identify and select 175 migrant households. Quota allocation based on number of migrants' was used to select Nkranfo (39), Nsuansa (50), and Nsonan (32) in the study areas. Snowballing technique was then used to identify households that have family members that have migrated through the help of the community leaders who identified some migrant households who in turn identified other migrant households until the required sample size was obtained for each community (Table 1)

Research instruments and data processing and analysis

Interview schedule, questionnaire and focus group discussions (FDG) were used to obtain the necessary information for the study. The responses from the interview schedule was then numbered serially, edited, coded and summarised in tables, charts and graphs, frequencies and percentages. The FGD's were cleaned and manually transcribed verbatim to supplement the quantitative result.

RESULTS AND DISCUSSION

Socio-demographic characteristics of respondents

Table 2 shows that majority (42.1%) of the respondents were in the young adults aged between 30 and 39 19.9%, below the age bracket of 20 to 29 years (19.8%). The demographic implication is that a large number of the respondents (62.0%) were in the economically active age group of 20 to 39 years. With respect to sex, the analysis revealed that 57.0% (69) of the household heads were females; these results is consistent with Brydon (1987)

Table 2. Some socio-demographic characteristics of respondents.

Variable	Frequency (Absolute number)	Percentage
Age		
20-29	24	19.9
30-39	51	42.1
40-49	29	24.0
50 & above	17	14.0
Marital status		
Single	28	23.1
Married	47	38.8
Separated	27	22.3
Divorced	11	9.1
Widowed	8	6.6
Educational status of respondents		
None	6	5.0
Primary	12	9.9
Middle School/JSS	47	38.8
Secondary/Technical/Vocational	33	27.3
Tertiary	23	19.0
Household size		
1-3	7	5.7
4-6	22	18.2
7-9	48	39.6
10 & above	44	36.5
Total for each sub-title	121	100

Source: Field Survey (2016)

findings in the same study area that the gender composition of household heads has been altered due toearly migration patterns that made more women to become heads of households. This conclusion is also inagreement with Lee's theory of migration that postulated that more males migrate than females. The males in these localities travelled to the cocoa growing areas in search of new employment opportunities.

Moreover, about 38.8% of the household heads were married followed by respondents who were never married (23.1%). This finding is in line with Amanor's (2001) conclusion that more people in rural areas are likely to be married compared to the urban area population perhaps due to their farming activities. With regards to household size, the study showed that the largest household size in the study areas was between 6 and 7 members (39.6%) and closely followed by households who had 10 and above (36.5%).

Socio-demographic characteristics of migrants

One of the main objectives of this study was to find out the underlying causes of frequent out-migration of youth in the Agona West Municipality of the Central Region of Ghana. Hence, heads of migrants' households were used as a proxy to obtain the needed information migration in the study areas. This was necessary because the literature on internal migration indicate that the migration decisions of individuals have the propensity to influence their migration outcomes, in particular, issues relating to resource accumulation (Anarfi et al., 2003; King, 1998).

Results in Table 3 showed that more than half (54.8%) of household migrants in the study area were predominantly males which go to validate what has been observed earlier in Table 2 where the majority of those left behind were females and became the household heads. This finding is in agreement with what Clarke and Drinkwater (2001) observed, that culturally, men everywhere in the world Ghana inclusive, are expected to fend for their households and therefore migrate and remit to their households was an alternative source of income. Also, according to Dugbazah (2012) in rural traditional society, women are often expected to stay at home caring for children and cultivating the household farm, while the men migrate.

Table 3. Socio-demographic characteristics of migrants.

Item	Variable	Frequency	Percentage
Sex	Male	216	54.8
	Female	178	45.2
Age	14-19	4	3.3
	20-30	53	43.8
	31-40	37	30.6
	41-50	17	14.0
	51-60	10	8.30
Occupation	Professionals	8	6.6
	Clerical support workers	22	18.2
	Service and sales	35	28.9
	Agriculture forestry and fishery worker	34	28.1
	Elementary works	10	8.3
Total	-	121	100

Source: Field Survey (2015).

The results from Table 3 showed that most of those who migrated in the study areas were within the age cohort of not only are the majority of those who migrate from the study area males, but are also in the economically active age group (74.4%). This finding supports the literature on internal migration dynamics in Ghana which suggest that most rural out-migrants are mainly males (GLSS, 2005; GSS, 2012). It was also discovered that about 28.9% of migrants who migrate out of study area secure jobs in the service and sales sectors followed by 28.1% who are involved in agricultural related occupations. This later conclusion also gives credence to Brydon's (1987) findings that the males migrated to cocoa producing areas in Ghana to look for employments by engaging in agricultural activities

Motivations for migration in Agona West Municipality

The study revealed that the main reasons for youth out-migration in Agona West Municipality were economic (40%) followed by the desire to pursue further education (31.2%) and escape from conflict was the least reason why people migrated (5.0%). This finding confirms the fact that the most important determinants of migration from the study area are the search for better economic opportunities. This conclusion agrees with Todaro's (1969) andLipton (1997) argument that areas that cannot absorb their own employable labour tend to become sending areas as its people seek better livelihood options. In the FGD session, the discussants agreed that due to the vulnerability in farming activities resulting from rainfall failure in the Agona West Municipality, most 20 to 30 (43.8%) and that was followed by the age cohort of 31 to 40 (30.6%). This result implies that young people involved in agricultural production consider migration as a risk-averse livelihood strategy (Table 4). This was further confirmed by a female discussant in the FGD:

"Rainfall has not been consistent here, whereas it fails in a current year, there will be excess the following year and hence farmlands are flooded. To prevent the yearly agricultural problems, some members should try other sources of livelihood. This, in the long run, will work to perfection because we believe that when the farming fails, the non-farm migrants will bring something home"

A 60-year-old male FGD participant added:

"The decision to migrate is seen as an economic investment and that household members raise funds for transportation cost and use networks to help their household members settle in the city. You see in the city they are able to work and help the family in so many ways".

The aforementioned evidence lends credence to what Harris and Todaro(1970) observed that the main reasons for migration among many people is to secure urban industrial jobs and the perceived existence of higher wages and differences in expected earnings. It can, therefore, be said that perceived income differentials between rural and urban areas contribute significantly to internal out-migration of youth in Agona West Municipality.

Table 4. Motivations for out-migration in Agona West Municipality.

Motive	Frequency	Percentage
Economic	48	40.0
Education	38	31.2
Marriage	22	18.2
Escape from conflict	6	5.0
Adventure	7	5.6
Total	121	100.0

Source: Field Survey (2015).

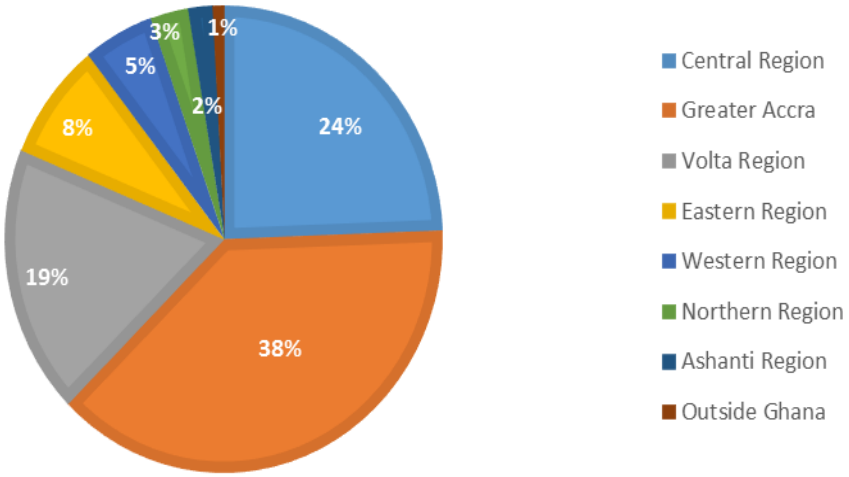

Figure 3. Migration destinations of migrants.
Source: Field Survey (2015).

Migration destinations of migrants

As observed in the literature, the destination choice ofmigrants depends on their motives for migration (Agesa and Kim, 2001). The results in Figure 3 showed that the Greater Accra region (38%) was the preferred destination of most youth from the study areas followed by the Central Region (24%). The respondents' preference for Greater Accra as their main destination could be attributed to the fact that most opportunities for employment and facilities for modern living are concentrated in the Greater Accra region, which functions as the national capital as well as the headquarters of most multi-national companies and government institutions (Ghana Statistical Service, 2017). It is thus not surprising that most migrants (38%) from the Agona West Municipality migrate to the Greater Accra region to take advantage of the aforementioned opportunities. This to an extent confirms the fact that about 40.0% of the migrants from the study area migrated to the cities for economic reasons (Table 4).

In a FGD held with household heads in the study areas, it was revealed that employment in farm and non-farm sectors in the rural areas of Agona West District was by far less attractive in terms of income than employment in Accra and elsewhere.

On this same issue this was what a 45 year old female household head said about the precarious nature of working at home (Agona West Municipality):

"Even if migrants find jobs in the municipality, the relatively low wages would make it not possible for them to meet their financial responsibilities such as the payment of school fees, buying uniforms for their children and meeting emergency health expenses" [A female household head aged 45].

Another female indicated that:

"The migrants who go to Accra are often better off than the others, so we even advise them to go to Accra. Moreover, in Accra, there are much more opportunities than anywhere in Ghana" [A 35-year old female participant].

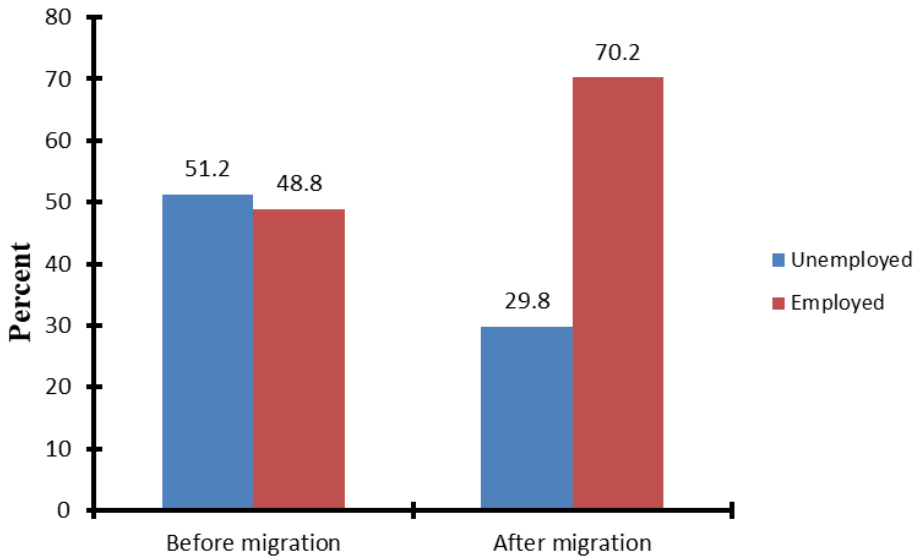

Figure 4. Migrants' employment status before and after migration.
Source: Field Survey (2015).

With respect to Central region as the second leading destination for most migrants (Figure 3) from the study area, it could be due to the role Central region (Cape Coast) played and continues to play as the major hub of most educational institutions nationwide. In relation to the Central Region, a male discussant stressed:

"*Why on earth will I send my child to school in any part of Ghana when Central Region boast of the best secondary schools in Ghana coupled with tertiary institutions, I cannot even bear the extra cost of sending him/her afar when we have the best here*" [A 49-year old male FGD participant].

Employment status of migrants before and after migrating

The literature on migration suggests that migration of people in search of greener pastures in urban settings is largely influenced by the employment status of the people involved in the migration process (Thieme and Wyss, 2005; Conway, 1992). In this regard, the present study assessed the employment status of migrants in the Agona West Municipality before migration and after their migration to their current destinations. Results in Figure 4 shows that before migration, 51.2% of the migrants in the study area were unemployed but after migration the percentage of migrants employed at their respective destinations increased to 70.2% and the number of migrants that were not unemployed after migration at the their destination place being as low as 29.8%.

These revelations suggest an apparent existence ofmore job opportunities at the destination than at their places of origin and this is in tandem with findings by Oberhauser (2016) who opined that migrants tend to have access to employment opportunities at their destinations than their hometowns or places of origin. In addition, urban areas offer many economic opportunities to rural people for changing jobs and becoming upwardly mobile even with a low asset base and few skills (Okhankhuele and Opafunso, 2013; GSS, 2010). Even if urban wages are not higher, work seems to be available more regularly than in subsistence agriculture. Hence, although rural-urban migration requires more capital and contacts, a general advantage is that work can be found all year round independent of the season.

Remittance behaviour of households' migrants

Remittances can be a valuable source of income for a household livelihood and can also serve as a means of risk diversification as it compensate for a loss of labour (Tsegai, 2005). These remittances can significantly assist the purchase of consumer goods, and in some cases, raise household savings and may, in turn, change the local household income distribution in a positive direction (de Haas, 2007; Dugbazah, 2012). To unravel some of these nuances, this study analysed the uses of remittances by households in the study areas.

To begin with, the respondents were asked to indicate whether they have ever received any form of remittances from migrants. The result showed that majority (85.1%) of households indicated that they receive remittances from migrants with only a few (14.9%) respondents saying otherwise. This result is supported by the findings that majority (80%) of migrants remit (either in cash or

Table 5. Frequency of migrants' remittances.

Period	Frequency	Percentage
Monthly	74	60.3
Quarterly	21	17.4
Yearly	9	7.4
Once a while	17	14.9
Total	121	100.00

Source: Field Survey (2015).

goods) their households back home after migrating. And this remittance help in compensating for the labour lost due to migration (Africa Development Bank, 2008; Castaldo et al., 2012; Tacoli C, Mabala, 2010). This finding however, contrasts Adams (2007) and Anarfiet al. (2003) findings in Ghana that about 49 to 24% of internal migrants remit to their households. This could probably be due to the fact that the studies were undertaken in different study periods and areas though in Ghana.

The frequency of remittances was also measured in order to understand the remittance pattern of household migrants in the study areas since the frequency of remittances from migrants has implications on the livelihood status of migrants' households. Table 5 shows that out of a total of 121 household heads surveyed, 60.3% confirmed that they received remittances from migrants every month while 7.4% said they received remittances on an annual basis. It was also found that nearly 14.9% (17) of household heads said they received remittances once a while from migrants. This implies that most migrants from Agona West Municipality remit to their household members on monthly basis perhaps due to the kind of occupations the migrants are engaged in.

This was summarized in the FGD where participants explained that:

"*This is our government work where we also receive our monthly salary (remittances), by receiving it on a monthly basis you feel like you are a monthly salary worker. It is because of this remittance that I have understood how joyous it is to be receiving a monthly salary as a government worker* [A 35-year old female FGD participant].

A male household head also added that:

"*I only feel pressured when the remittance does not arrive on time (monthly) as has been agreed because the household depends on it and plan on it every month. Besides that I think the monthly basis is really helpful to us in the village* [A 44-year old participant].

Types of remittances received and amount

The literature on remittances revealed that migrants often remitted to their household with cash than any other material items (Afsar, 2003). This study sought to explore the various forms of remittances migrants send home. About 95.0% received cash as the main form of remittances sent by most migrants. These findings support Afsar's (2003) observation that most migrants' households receive cash as remittances compared to other forms of remittances. The findings also parallel that of Sam et al. (2013) that majority of the remittance receivers prefer cash remittances rather than goods or combination of both.

In a focus group discussion, a male household head discussant affirmed the significance of cash among migrants' remittances in the Agona West Municipality:

"Here if you travel and want to send anything back home it must be in the form of cash because we value cash than goods. How can you be in the city working and sending only material things home when you know we pay school fees?" [A 51-year-old male household head].

"Even if you send so many goods home without money we will sell the goods for money because it is money we use to do everything, ahh! … Why do you send me goods when you know I have to provide housekeeping money in the house?" [A male FGD participant aged 44].

With respect to the amount of remittances sent, it was discovered that about a third (31.4%) of the respondents said the most frequent amount received as remittance was between 201 and 300 Ghana cedis followed by 23.1% who indicated that they frequently receive between 101 and 200 Ghana cedis (Table 6). Only 6.6% households got remitted with 500 Ghana cedis and above. Though not much is known from literature on the average amount remitted to a household from internal migrants, Sam et al. (2013) found that 44.5% of households receive between GH¢4000 and GH¢7000 annually with others (22.8%) receiving GH¢7000 and above as remittances from international migrants. Adams (2007) added that the mean per capita total remittances received from internal migrant is only about 30% compared to the amount received from international migrant.

During the FGD session, a 44-year-old male participant who often receives cash from his daughter had this to say:

Table 6. Average monthly amount of money migrants remit.

Amount (GH¢)	Frequency	Percentage
100 and below	15	12.4
101 - 200	28	23.1
201 - 300	38	31.4
301 - 400	21	17.4
401 - 500	11	9.1
501 and above	8	6.6
Total	121	100.0

Source: Field Survey (2015).

Table 7. Recipients of migrants' remittances.

Item	Frequency	Percentage
Household head	54	44.6
Spouse	25	20.6
Other Relatives	21	17.4
Mother	18	14.9
Others	3	2.5
Total	121	100.0

Source: Field Survey (2015).

"*The money is not enough to take care of the household and it does not come as often as we expect so we do a lot to support ourselves back here"* [A 44-year-old male household head].

However, some household heads said they do not receive many remittances from migrants as was explained by a 59-year-old female participant during an FGD session:

"Some migrants believe that their left behind households are not used to seeing a sufficient and regular amount of money. Others also believe that when large sums of money are sent home their households might think they are into illegal works (such as robbery) or they would be witch-hunted by their households because they are making progress in life" [A 59-year-old female household head].

In a further discussion regarding the amount of remittances received, some participants indicated that migrants were not mandated to remit to their households and that husbands were more likely to remit to their households compared to other category of migrants. This was what a 45-year-old female participant said to support their claim:

"*My husband sends money very often even though it is not as big as expected and he alerts me anytime he cannot remit on time but my younger sister in the city hardly remits to our mother"* [A 45-year-old female household head].

Recipients of migrants' remittances

Table 7 presents the recipients of migrants' remittances in the study communities. This is important because a study by Morales et al. (2002) showed that though the flow of remittances through migration has the ability to improve people's access to other capabilities but this however largely depends on the receiver of migrants' remittances. From the analysis, the main recipients of remittances were household heads (44.6%) followed by migrants' spouses (20.6%). The present evidence was expected in view of the fact that household heads are regarded as bread winners in most Ghanaian cultural systems and are therefore expected to receive any form of remittances that flow into the household.

However, this finding contrasts that of Adams (2007) that though 53% of all migrants in Ghana remit, 99% of them rather remit to relatives and friends for accountability and possible legal actions.

Concerning the recipients of migrants' remittances in the study area, this was what a 45-year-old female discussant had to say during a FGD:

"My husband used to send the remittance through hiselder brother but I was not getting the full amount of what was meant to be mine. This continued for about five

Table 8. Uses of remittances by households.

Item	Frequency	Percentage
Food items	33	27.3
Education	29	23.9
Health	14	11.6
Agriculture	30	24.8
Investment in non-farm activities	15	12.4
Total	121	100.0

Source: Field Survey (2015).

months so my husband became annoyed and stopped remitting to us through him" [A 45-year-old participant].

Uses of remittances by households

This part of the study assessed the uses of migrants' remittances from the perspective of household heads. Many households use the money to provide for their basic needs such as food, shelter and clothing. According to IFAD (2008),households can choose to spend remittances on basic needs like increased consumption and investments in housing, health and education or on agricultural production or for investments in commercial activities, like small enterprises or business. As such the study sought to find from respondents the main uses of remittances from migrants.

Table 8 shows that 27.3% of the remittances received were used to purchase food items for households' consumption; this was followed be agriculture (24.8%) which is the primary economic activity of the villages. Meanwhile, remittance was least (11.6%) spent on health. It is, therefore, clear from the findings that remittance was spent largely on households' up keep. This agrees with the observations of de Haas (2007) and Reda et al. (2012) that remittances are mainly spent on households' daily consumption rather than investments in agriculture and entrepreneurial activities. But it can be inferred from Table 8 that remittances were largely spent on basic needs as 62.8% (27.3 + 23.9 + 11.6) except housing and investment. The result also supports the claim that remittances led to increase in food consumption and food security, better access to health and increase in educational opportunities (Dugbazah, 2012).

Literature further added that the uses of remittance are subject to the consumption pattern of the households; this is because some households will invest, others will spend on food items or invest in agriculture, health or education of household members (de Haas, 2007; Dugbazah, 2012).

In the FDG, a female household head said:

"*Prior to migration, there was no help from anybody and hence at times we were devoid of three square meals per day, on the contrary, due to the remittances, the household can boast of three square meals. At times when the household is yet to remit, we borrow from friends just to ensure we meet our normal daily consumption pattern as has been since the remittances started flowing*" [A 37-year-old participant].

Effect of remittances on household living conditions

Moreover, a male household head indicated that the household is now enjoying things they could not enjoy prior to the migration of a member:

"We now have television and refrigerator in this house which we could not previously acquire, had it not been this money life would have been same, indeed it is good to travel elsewhere to make a living. My happiest moment with the remittances is that the rest of the children are no longer facing school fees challenges as he (the migrant) did, anytime he remits to the house there would be a special allocation for school fees" [A 45-year-old FDG male participant].

Even though the current findings are similar to an earlier study by Caldwell (1969), the main use of migrants' remittances was to meet household basic needs such as food requirements for migrants' households. This according to the respondents improved their food security and nutritional status. It was observed that in the case of Agona, the investment in productive sectors was limited, but consumption on basic needs was greater. This situation, however, is not necessarily negative, as improvement in livelihood is broadly defined to include access to basic needs, which in turn have positive effects on the well-being of household members(Schiff, 1999; Ballard, 1983). Findings from this research suggest that remittances make a strong contribution to the provision of households' basic needs in the Agona West Municipality.

About 80.2% of the respondents admitted that the social status of their households have improved only about 14% of the respondents said that there had not been any change in their social status even though they have some of their family members migrated. This was,

however, expected because the type of jobs the migrants are engaged in at the destinations and other factors could play a critical role in the ability of migrants to cause a change in the status of their families. The fact that most of the respondents said their social status has improved could be what de Haas (2007) had observed that only when economic status (poverty level has reduced) of households improves that societal status is seen to also improve.

In the FGDs, it was found that there was some prestige associated with being a member of a migrant household and that the prestige increased with the quantum of remittances.

This was the response a male discussant gave during a FGD session:

"When your household migrant remits to your household enough and as frequent as possible, your status in the society is gone up, people tend to associate with you the more and you become highly respected and honoured" [A 50-year old male household head].

Conclusion

A large proportion of rural out-migrants from Agona West Municipality are mostly young adult males within the age category of 20 to 30 years.

Generally, the migrants have various motives for migrating, but most people move from the study areas because of economic reasons such as employment. This is because their level of employment increased after migration since unemployment among the migrants was higher after migration as compared to before migration.

Remittances were frequently sent by most migrants to their households members on monthly bases and mainly in the form of money. The highest amount of money remitted among most migrants to their household members is between 201 to 300 Ghana cedis per month.

A large proportion of remittances received by migrants' households are largely used for household consumption such as food and this lead to improvement in the livelihood status of the migrant's households in the study areas, the Agona West Municipality.

Recommendations

The following policy recommendations are made based on the findings from the field work, Agona West Municipality Authority should encourage the young people in the study area to take advantage of the numerous social interventions programmes established by government. The National Youth Empowerment Programme aimed at providing jobs for young peopleeither living in the rural or urban areas in the country. The Ministry of Agriculture and Agona West Municipality should ensure effective and efficient support for rural farmers to make farming attractive to the young people.Future research should be carried out to compare the differences between the livelihood status of migrants' and non-migrants households in other municipalities study areas.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Climate change and smart city development: The challenge of non- implementation of Abuja-Nigeria light rail project

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In the present century, there has been increasing global pressure on governments to implement policies to incentivize reductions in CO_2 emissions based on the devastating effects of global climate change. Researchers generally have established the fact that the automobile sector generates more than 50% of the atmospheric carbon concentration. It has also become obvious that FCC-Abuja Nigeria is merely a replica of Lagos transport-wise in all ramifications. The Abuja master plan as of 1979 specifically recommended the development of mass transport by light-rail when the city's inhabitants are about 1.6 and 3.1 million for airport. The non-implementation of the light rail in the city has aggravated the flood of vehicular traffic that generates a lot of Green House Gas that in turn swells up the city's ambient temperature. This research therefore used the handheld outdoor thermometer to measure the traffic corridors in Abuja in relation to the WHO and FEPA tolerance threshold standard. This is compared with the modern electric rail that is environmentally friendly, and the result reveals that the present transport system in the city negates the global crusade for Green Mobility. It is therefore recommended that the Federal Government of Nigeria should as a matter of urgency cease from her lip-service to the global SDGs and fully implements the overdue Abuja light rail that will positively woo the other cities of the federation.

Key words: Atmospheric temperature, climate change, mass-transit, light-rail, transportation.

INTRODUCTION

Globally, there has been a growing scientific consensus on the need for governments to implement policies that incentivize reductions in CO_2 emissions. Evidence from both instrumental temperature measurements, increased melting of glaciers and loss of polar-ice cover supported the fact that global temperatures are increasing, and this observation can be used to estimate the rate of temperature increase since the late 19thcentury. According to IPCC (2007), a 10% decrease in snow cover since the 1970s, a 15-20% reduction in Arctic sea ice, and a shortened period of lake and river ice cover have been observed. It has also been observed that ocean heat content has significantly increased over the past several decades with an abnormal rise in sea level

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accompanying a hurricane or other intense storm, above the level of the normal or astronomic tide.

A small proportion of the atmosphere has long been composed of GHGs (water vapour, carbon dioxide, ozone, and methane). These gases actively hinder part of the heat emitted by the earth's surface from otherwise escaping to the outer space, and apart from the natural greenhouse effect explained above; a change is anticipated in the greenhouse radiation balance. Some GHGs are flourishing in the atmosphere because of the anthropogenic activities that are increasingly trapping more heat (Morris et al., 2001; Robert et al., 2010). Direct atmospheric measurements made over the past 50 years have shown abundant steady increase in the atmospheric carbon dioxide (CO_2). If projected climate changes thrust environmental variables beyond the range for which a country's system is designed and the scientific evidence surges, then there will be environmental catastrophes that must be managed and adapted.

LITERATURE REVIEW

The question that readily comes to mind is 'what warms and cools the earth'? The sun is the main energy source of man on earth, and although its output is relatively constant, a small change during an extended period of time can lead to climate changes. Greenhouse gases such as: Water vapour (H_2O), Carbon dioxide (CO_2), Methane (CH_4), Ozone (O_3), Nitrous oxide (N_2O), and Halocarbons have continued to be used as substitutes for chlorofluorocarbons (CFCs) in refrigerant fluids, and CFCs from pre-Montreal Protocol usage as refrigerants and as aerosol-package propellants remain in the atmosphere (Forster et al., 2007).

The anthropogenic and natural activities' impacts of these changes have now been fully established (IPCC, 2007). A series of researches have examined the nexuses between climate change and the transportation sector. Studies have also been conducted principally from the perspective of transportation's contribution to global warming through the automobile's partial burning of fossil fuels, which releases carbon dioxide (CO_2) and other greenhouse gases (GHGs) into the atmosphere. CO_2 from combustion of fossil fuels is the largest source of GHG emissions. Although the susceptibility of the transportation sector to these impacts has not been fully investigated, nor has it been widely considered by transportation planners and decision makers, designing, constructing, retrofitting, and operating the transportation infrastructure has since been operational.

The challenging question to which the answer is not far-fetched is why transportation professionals should be distressed with climate change? First, it is not just a problem for the future but the present challenges, such as global warming and resulting sea level rises, have revealed the effects of GHG emissions that were released into the atmosphere over the past centuries. What appears shocking is the greater certainty that human activity warms the climate and that the rate of change is likely to be greater than at any time in modern history (IPCC 2007, 2013).

Secondly, climate change may not occur gradually but higher temperatures will be amplified by normal variability in climate, leading to new extremes far outside current experience such as the heat wave in Europe in 2003 (Stott et al., 2016) and the near record heat of 2006 in the United States.

Thirdly, the transportation profession is futuristic in nature, typically planning for between 20 to 30 years into the future, many present curent decisions, particularly about the location of infrastructure; helps in shaping development patterns that endure far beyond these planning horizons. In the same vein, decisions about land use regulation, zoning activities, and development controls often create demand for long-term transportation infrastructure investments. Therefore, it is important for transportation decision makers to put into consideration the potential impacts of climate change now in making these investment choices as it will affect how well those infrastructures can be adapted to climate change.

Fourthly, other professionals in the built environment especially those in finance and building (where protecting against flooding, earthquakes, wildfires, or cyclone is a concern), and water resources (in the design of dams and canals), are continually making decisions in the face of global warming uncertainties about disaster risks. In addressing climate change, more quantitative impact assessments and contingency planning at the level of geographic and modal specificity are needed by transportation planners and engineers (Ali and Elsan, 2017; Gonzalez et al., 2005).

Finally, transportation professionals have already cooperated weather and climate-related factors in designing and operating the transportation infrastructure. For instance, many transportation networks and facilities are designed with adequate drainage and pumping capacity to handle a 100-year storm. Also materials and maintenance models are built with assumptions about temperature and precipitation levels. Thus, economic activity is projected to produce greenhouse gas emissions across this century, while exponential increase in human activities now exerts pressure on land use/ water resources, fossil fuels utilization and natural resources (Van Asselen and Verburg, 2013; Avis et al., 2011). These emissions of greenhouse gases are making the Earth to warm, and, in aggregate, the global warming effects are expected to be deleterious and thereby endangering the global welfare systems (Comrier 2000).

Generally, road pavement infrastructures cover about 40% of urban surfaces, as estimated by Akbari et al. (2009) and asphalt concrete which is the most used road pavement material; and dark pavement materials together with automobiles traffic flow significantly contribute to

UHI, as confirmed by Mohajerani et al. (2017). Black surfaces which usually absorb incoming solar radiant energy have low albedo and the different thermal characteristics of these materials are recognized by Doulos et al. (2004) as a strategic challenge in cooling urban spaces. Thermal infra-red images confirmed that the albedo significantly contributes to the urban microclimate (Baldinelli and Bonafoni, 2015). Comparison of air temperature above reflective concrete, porous asphalt, porous concrete and conventional asphalt pavements (Coseo and Larsen, 2015) shows the difference between these materials in terms of heating an urban landscape.

The agglomerations of cars in the urban centres have been adjudged to significantly contribute to urban temperature. Thus, mass transport by hybrid rail is already attractive for its carbon efficiency, for example direct CO_2 emissions per passenger km from London Underground (LU) are around one third of what is typical for a single occupant car (DEFRA, 2013). Global sales of plug-ins are up by 63%, topping two million units. Forecasts predict vehicles with at least some type of plug-in capability will account for nearly half of global auto sales by 2040 (Tom, 2019). In California and San Diego, it has been established that even though they are in love with their cars and driving to work is a precious right as far as most of them are concerned, if given a pleasant alternative, a large number of them will take advantage of it to get to work.

According to NRC (1982, 2008), North America Committee on Light Rail Transit defined this mode of urban transportation based on thoroughly proven electric railway technology as:

"Light rail transit is a mode of urban transportation that uses predominantly reserved, but not necessarily grade-separated, rights-of-way. Electrically propelled vehicles operate singly or in trains. Light rail transit provides a wide range of passenger capacities and performance characteristics at moderate costs".

This definition clearly reveals the overriding benefits of light rail above other urban means of mobility and justifies the centrality of national investment on it.

The concept of smart city in urban mobility

In the recent decade, carbon-free energy such as wind and solar costs have decreased dramatically, yet there are still substantial challenges in completely decarbonising our electricity system, and even more challenges in completely decarbonising the transportation and industrial sectors (Davis et al., 2018).

A smart city therefore can be defined as an urban system driven by Information and Communication Technology (ICT) and Internet of Things (IoT) that provide useful information to effectively manage resources and assets. This involves data emanating from citizens and mechanical devices, which are processed and analysed to monitor and manage traffic and transportation systems, power plants, water distribution networks, waste disposal, etc. It is aimed at improving the quality of urban services and reducing its costs. It generally stands out for its specificities: smart management, lifestyle, mobility, housing, as well as a smart economy. It is also to harmonize technological innovation with the economic, social and ecological challenges of the city of tomorrow. Their leitmotiv is the quality of life: how to live better together while respecting our environment.

CO_2 footprint reduction is the main driven force behind the development of smart and sustainable cities. Improving energy efficiency and storage, waste management, and traffic conditions are among the greatest advantages. Smart grids and smart water management are recurring themes of smart cities. In the hope of optimizing mobility, many cities are turning to smart technologies to ease traffic congestion and provide users with real-time updates for clean and efficient transportation of goods, services and people as emphasized in the works of Laura and Giuseppe, (2018), and Fensterer et al (2014).

The concept of green mobility and light-rail

Light rail or light rail transit (LRT) is a form of urban public transportation system that generally has a lower capacity and lower speed than heavy rail and metro systems, but with higher capacity and speed than traditional street-running tram systems. The system typically operates with rapid transit-style features that usually use electric rail cars mostly in private rights-of-way separated from other traffic but sometimes, if necessary, mixed with other traffic in city streets as displayed in Figure 1. The key attributes of LRT service include: use of exclusive lanes usually in the medians of roadways, exclusive rights-of-way, and stations that are spaced further apart than with bus services, typically every half kilometre (although stations are often spaced more closely within the Central Business District (CBD).

Aim and objectives of study

The aim of this study is to assess the environmental implication of the non-implementation of Abuja light-rail as proposed by the first master plan in relation to the green mobility crusade and global Climate Change. This is to be achieved through the following objectives:

(i) Examine the concept of Climate Change and green mobility in the light of fossil fuel dependent vehicles.
(ii) Examine the importance of light-rail as urban mass transit and sustainable development strategy,

Figure 1. Typical electric powered Light rail in Africa.
Source: Adapted from Air-Rail Africa 2016

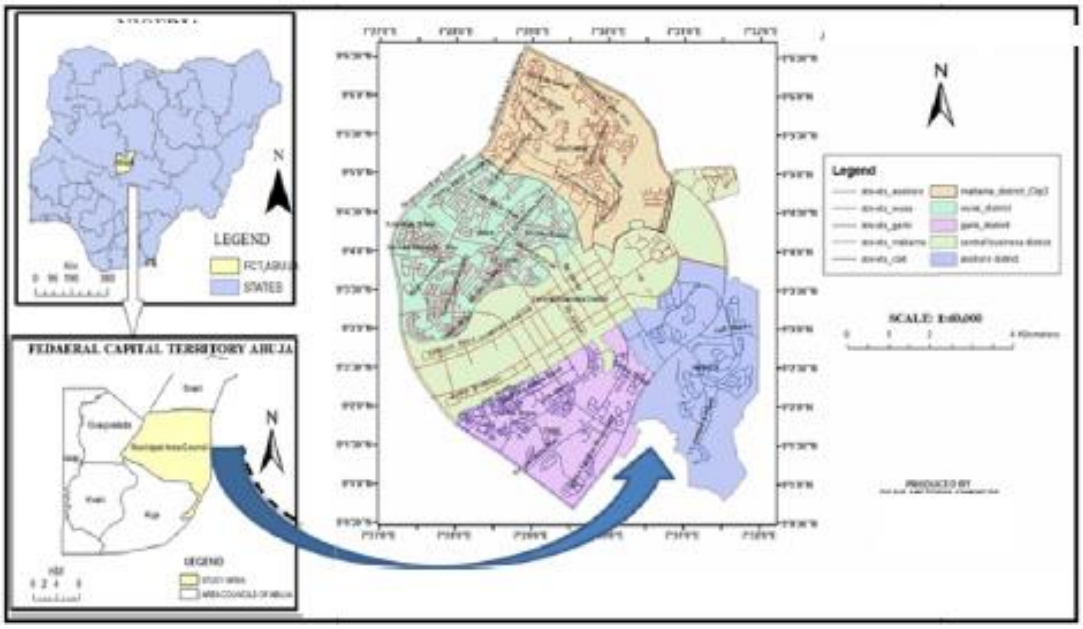


Figure 2. Study location, FCC-Nigeria.
Source: Adapted from Ayo et al. (2014).

(iii) Assess and map the vehicular heat emission level along the major transport corridors in Abuja,
(iv) Assess the environmental implication of the road corridor temperature in relation to ambient air temperature standards, and recommend planning solutions.

METHODOLOGY

Study area

Geographically, the Federal Capital Territory (FCT) lies between latitude 8° 25' and 9° 20; North of the equator and longitude 6° 45; and 7° 39; East of the Greenwich meridian, with a land area of about 7,315 km^2 (Figure 2). The estimated metropolitan population of Abuja is well over 3,000,000, but the population in 2012 was 2,245,000 making it the fourth largest urban area in Nigeria after Lagos, Kano and Ibadan.

Procedure

There are several ways of determining the mean radiant temperature (Tmrt) which is one of the main meteorological parameters governing human energy balance and has therefore a strong influence on thermo-physiological indices like Physiological Equivalent Temperature (PET) and Predicted Mean Vote (PMV) described in the literature. For instance, Thorsson et al. (2006) comparing integral radiation measurements and simple black globe temperature measurements measured. The mean radiant temperature (Tmrt) in two different urban structures, that is, a square and a courtyard in central Göteborg, Sweden. While George et al. (2015) used outdoor Wet-bulb globe temperature (WBGT) to examine the outdoor temperature stress on the FIFA players in Brazil. In carrying out this study, the entire city was divided into

Figure 3. Digital handheld outdoor thermometer and GPS.

quadrants of convenience, and the major roads were selected for survey nodes. On each of the roads, three different locations were identified where an ETL outdoor digital Thermometer was used to take temperature readings along the roads at about two-meters above the ground level. The readings captured the road corridor temperature during the peak periods of 7 to 10 am, 12 to 1 pm and 4 to 7 pm.

A geo-referenced map of Abuja was acquired and a hand-held Garmin 78 model Global Positioning System (GPS) was used to determine the survey nodes coordinates that was used to carry out the mapping in ArcGIS software (Figure 3). The corridor temperature readings were compared with the surrounding environment to determine the differences.

Status of vehicular growth and pollution scenario in Abuja

According to the National Bureau of Statistics (NBS), as at the end of the third quarter of 2017, Nigeria had about 11,547,236 motor vehicles in the country, of which about 4,656,725 of these vehicles are privately owned, while 6,749,461 of those vehicles are registered as commercial vehicles. A total of about 135,216 vehicles are registered as government owned vehicles, while another 5,834 vehicles are registered as diplomats. Vehicle-per-person in Nigeria is therefore about 0.06 as of the third quarter of 2017. This definitely presents huge opportunities for local vehicle production and assembly plants in Nigeria. For instance, the rate of motor vehicle ownership and use is growing faster than population in many places, with the vehicle ownership growth rates rising to 15 to 20% per year (Odeleye et al., 2008).

Vehicular transport emissions and air quality standard

Incomplete combustion of fossil fuels leads to the emissions of various pollutants (Larssen et al., 1993). Vehicles can emanate particles through exhaust emission, abrasion process, brake linings; road surface material and mechanical turbulence help in the re-suspension of the particles (Charron and Harrison, 2005). In the atmosphere, particles can experience further transformative procedures, including nucleation, coagulation, dissipation, build-up, and agglomerations, which change their shape, size, and piece (Lighty et al., 2000). Diesel-fuelled vehicles additionally transmit more nanoparticles, making a bigger contribution to particle number (PN) contrasted with gas-fuelled vehicles (Kittelson et al., 2004). There has been an exploration of the effects of alternative energy fuels. Modern Biofuel series has been found to significantly abate PM and vaporous toxins (counting CO and CO_2). Driving condition can also influence the molecule mass and number of outflow rates. Percentage share of pollutants emissions from different mode of transport is summarized in Figure 4.

Control over ambient atmospheric pollution has now become a big challenge not only due to the rising numbers of traffic volume as a source of non-point source pollutant but also due to the contribution of toxic risk resorted by the growing numbers of diesel cars. Diesel cars emit 7.5 times more toxic PM as compared to gasoline cars (Amrit, 2018). Keeping in mind the emission scenario, it is very much essential to create awareness among people to make their vehicles environmental–friendly in order to reduce emissions. Air quality standards are used to measure the air quality with respect to its effects on health. It identifies the amount of exposure permitted for the populace and ecological system. The permissible air quality standards prescribed by WHO, NAAQS and CPCB are mentioned in Table 1.

Abuja master plan and the light rail development

Population growth of the Federal Capital City (FCC) at the onset only supports initial development of bus transit services on the spine transit ways. In economic terms, operation of light rail does not begin to become attractive until hourly volumes of 6,000 or more passengers are reached according to the master plan. These volumes correspond to 60 or 70% of the population of 1.6 million inhabitants in the capital city. The population of Abuja based on the 2006 population estimate, the projected population of Abuja urban is 2.4million, while the metro estimate is 6 million as of 2011. The city was experiencing an annual growth rate of about 35% as of 2015, thereby still positioning the country as the fastest-growing city in Africa and as one of the fastest-growing cities in the world. As of 2016, the metropolitan area of Abuja is estimated at eight million (8,000,000) persons, placing it behind only Lagos, as the most populous metro area in Nigeria. The transit system of Abuja as evolutionary is long overdue for transition into a carbon-free rail system going by the master plan proposal. Figure 5a and b shows the proposed corridor design.

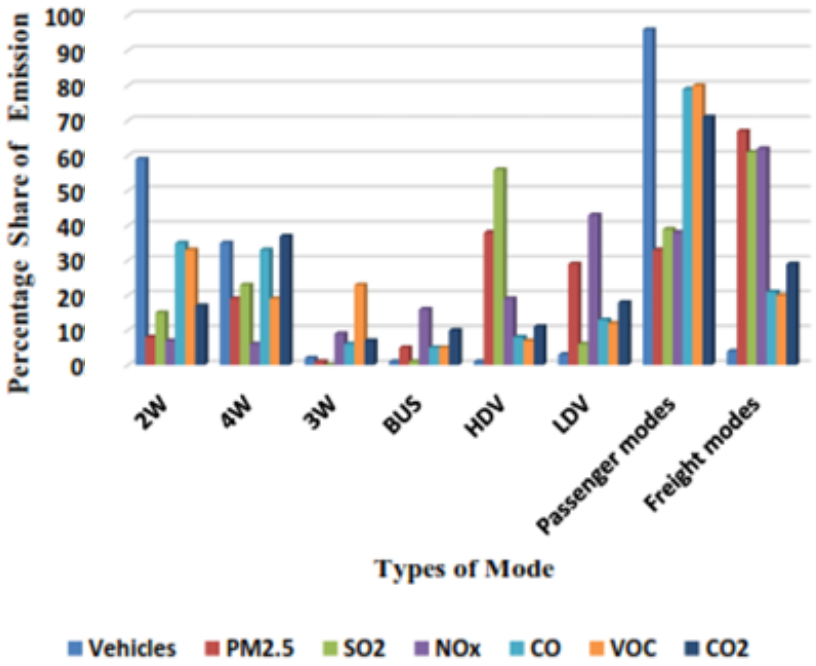


Figure 4. Share of emissions by passenger (2Ws, 3Ws, 4Ws and freight modes .
Source: Goel et al. (2015).

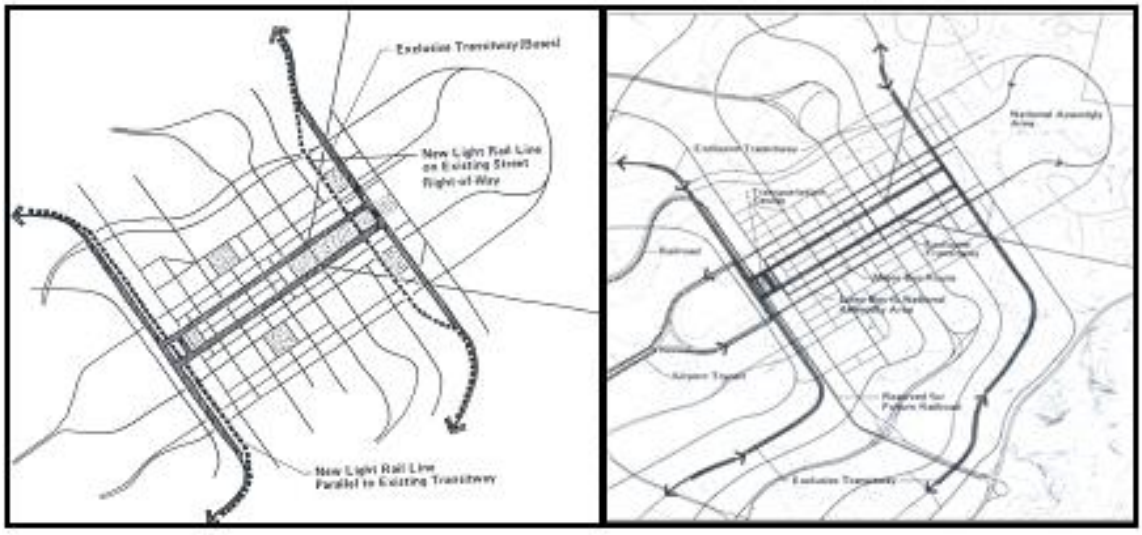
Table 1. WHO ambient air quality standard.

S/N	Pollutants	Time weighted average	Guideline values
1	Particulate Matter (Size less than 10 µm) or PM_{10} µg/m^3	Annual 24 hours	20 50
2	Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$ µg/m^3	Annual 24 hours	10 25
3	Sulphur Dioxide ($SO_{2)}$), µg/m^3	24 hours 10 minute	20 500
4	Nitrogen Dioxide (NO_2) µg/m^3	Annual 1 hour	40 200
5	Carbon Monoxide (CO), µg/m^3	1 hour Annual	30 50

Source: WHO (2013).

Implementation of light rail in Abuja

The initial Abuja Light Rail was first commissioned in 2007 by former President Olusegun Obasanjo as the first light rail network in West Africa. The Light Rail began operation after undergoing 11 years of construction during the time of four presidents gulping a total of $831million. The 45 kilometre rail connects the city to the Nnamdi Azikiwe International Airport and to later links other parts of the city to ease transportation. The China Civil Engineering Construction Corporation (CCECC) handled the project and was to have delivered the first phase of the project last year. The entire system wholly depends on fossil fuel power as against the modern electric system in even Ethiopia and other African countries. What was implemented in standard is far below the 21st century light rail



(A) (B)

Figure 5. (a) Interconnected light rail, (b) Central area public corridor and buses transportation system figure.

Figure 6. Rail transit in Nigeria and other African countries in the 21st century.
Source: Adapted from Air-Rail Africa (2016).

in comparison even to other African countries like that of Ethiopia in terms of the conveyor and the electric power infrastructure as revealed in Figure 6. The Abuja-Kaduna standard gauge rail is not environmentally friendly in terms of power source. Modern rails are expected to operate on electric power, Solar or Hydrogen cell as in Ethiopia.

A Light-Rail system has a lot of advantages above other commuter modes of transport that should move a country like Nigeria to readily adopt and implement without lip service and politicking. When it comes to System cost, Scheduling and reliability, Public comforts and social acceptability, light-rail is rated higher comparatively as revealed in Table 2.

RESULTS AND DISCUSSION

Meteorological aspects of air pollution and human health

In the words of Bob Patricelli, light rail should not be considered a panacea for the growing woes created by our increasing urban congestion. But, in conjunction with other traffic management strategies like park-and-ride, it is the right answer to the needs of a lot of commuters as it can make their lives more pleasant, and make the cities where they live more vital and interesting places which can contribute to the quality of the air they breathe.

Abuja has turned out to be a replica of Lagos in terms of the transport system and its woes. Atmospheric pollution is a widespread problem in Nigerian urban cities and is caused primarily due to fossil fuel combustion at point and non-point sources (Usman, 2014; Jaiyeola, 2017). Due to inadequate mass transit system in the various major cities like Abuja, the use of personal vehicles has continued to be on a steady increase. In addition to 70% two and three wheelers, petrol driven vehicles with four-stroke engines constitute about 14%, and diesel driven vehicles are about 8% of the total vehicles on the road.

Generally, an average normal human body temperature

Table 2. Key characteristics differentiating LRT from other transit modes.

Characteristic	Light rail	Bus	Commuter rail	Automated guide way	Rapid rail*
System costs					
Initial	Moderate	Low/moderate	Low-to-high	High	Very high
Operating and maintenance, per passenger mile(b)	……..	Higher	Higher	Similar	Lower
Attributes					
Schedule reliability	Excellent	Fair	Good	Superior	Excellent
Grade separation	Varies	Loss	More	100%	100%
Automatic operation	No	No	No	Yes	Maybe
Entrained vehicles	Yes	No	Yes	Maybe	Yes
Public perception					
Comfort, ride quality	Good	Fair	Good	Good	Good
Route comprehension	Easy	Hard	Easy	Easy	Easy/Hard
Social acceptability	High	Low	High	High	
Railroad involvement					
Operating labour	No	No	Yes	No	No
Freight coordination	Maybe	No	Maybe	No	No

is 98.6°F (37°C), and this ought to be maintained without the help of warming or cooling devices. The surrounding environment needs to be at about 82°F (28°C) as established in the work of Santamouris (2013). High environmental temperatures can be dangerous to the human body. In the range of 90° and 105°F (32° and 40°C), one can experience heat cramps and exhaustion. Some common symptoms of heat exhaustion already experienced in FCC as in Lagos include:

(i) Sweating heavily
(ii) Exhaustion or fatigue
(iii) Dizziness or light-headedness
(iv) Blacking out or feeling dizzy when standing up
(v) Weak but fast pulse
(vi) Feelings of nausea

Mapping of the Abuja rout corridor temperature

Mapping of Urban Heat Island (UHI) is a modern technique used in addressing urban temperature challenges as carried out by researchers like Heisler et al. (2007). The major streets in Abuja were selected, and temperature readings were taken simultaneously to determine the variation in the ambient temperature from the surrounding areas. Based on the field temperature readings, the streets were grouped into five, and Aminu Kano, Sani Abacha, Kashim Ibrahim, Ademola Adetokunbo, and Herbert Macaulay Way have the highest temperature range of 31.3-34.2°C as displayed in Table 3. The same data were imported into the ArcGIS to produce the map in Figure 7.

Conclusion

By the year 2050, around 66% of the world's population will be living in cities and this is no longer strange. But without commensurate planning in place, growing societal pressures in the built-up areas and the attendant climate change impacts could see the costs of managing an overwhelming city stacking up. For instance, economists from the UK, Mexico and the Netherlands suggested that around a quarter of the 1,692 cities surveyed could become warmer by as much as 8°C (14.4°F) by 2100 (Li et al., 2016; Robert et al., 2010). As a panacea, green mobility in the form of mass transit electric powered light rail is one of the solutions that Nigeria must key-in. Nigerian roads are littered with out-modelled and out-of-use vehicles. The heat island effect is a phenomenon that causes urban areas to become warmer than the surrounding rural regions, as concrete buildings and roads replace open land and vegetation (Al-Obaidi et al, 2014). According to the US Environmental Protection Agency (USEPA), pavement surface temperatures can be as much as 50-90°F (27-50°C) hotter than the surrounding air on a hot summer's day.

Apart from the direct impact on public health, higher-than-average temperatures could also cripple a city economically via civil unrest and reduced productivity due

Table 3. Abuja urban road temperature classified.

S/N	24.2 - 26.0°C	26.1 - 28.4°C	28.5 - 29.9°C	30.0 - 31.2°C	31.3 - 34.2°C
1	Ahmadu Bello Way	Alvan Ikoku Way	Aguiyi Ironsi Street	IBB Way	Aminu Kano Way
2	NnamdiAzikwe	Shehu Shagari Way	Shehu Shagari Way	IBB Way	Sani Abacha Way
3	Ahmadu Bello Way	Independence Avenue	Aguiyi Ironsi Street	Ademola Adetokunbo	Kashim Ibrahim Way By Wuse
4	Ahmadu Bello Way	Ladoke Akintola	Sani Abacha Way		Adetokumbo road
5	Muhammed Buhari Way	Obasanjo Way	Aguiyi Ironsi Street		Herbert Macaulay Way
6	LadokeAkintola way	By Tafawa Balewa Road	IBB Way By Ahmadu Bello		
7	Murtala Mohammed	Mashood Abiola Way	Constitution Avenue		
8	Independence Avenue	Funmilayo Ransome Kuti	Tafawa Balewa Opposite NICON		

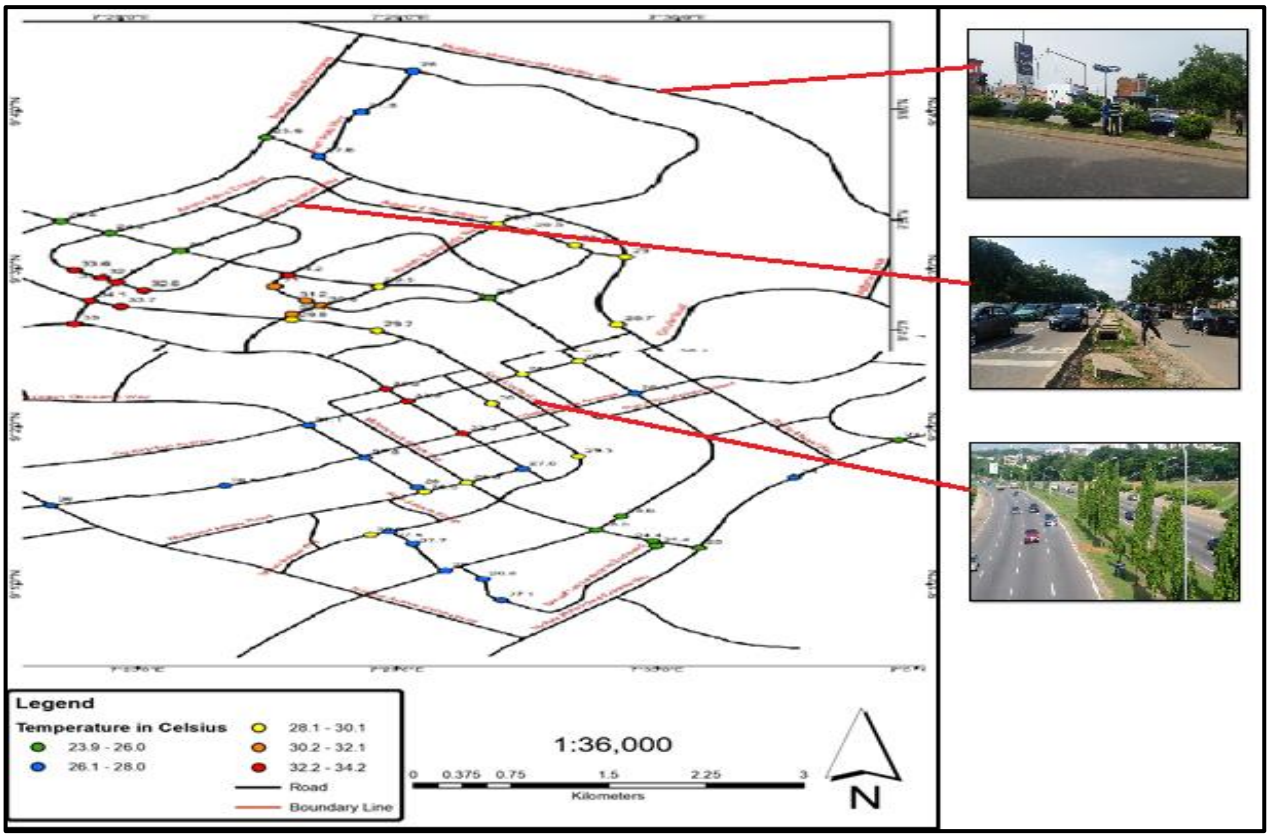


Figure 7. Abuja road corridor temperature distribution survey.

to heat stress and disrupted sleep as observed in the works of George et al (2015). This would also be exacerbated by an increased demand for electricity, which would in turn put more stress on a city's power grid, resulting in more frequent or prolonged outages, or a need for a whole new system entirely. This is not unconnected to the government policy on the evacuation of nation grid supply to Abuja to the detriment of other states of the federation.

Recommendations

Based on the above discussions, the following urgent approaches are recommended:

(i) The Abuja Development Authority in conjunction with Municipal Council should re-visit and renew the Abuja master plan
(ii) The federal government should as a matter of urgency

fully implement the overdue Abuja Light Rail as specified in the existing Abuja master plan, and that will positively woo the other cities of the federation like Lagos is presently doing.
(iii) To reduce the volume of traffic flow in the city, a Pack-and-Ride transport system should accompany the light rail system when implemented.
(iv) There should be a deliberate attempt to have a targeted year of moving the country from fossil fuel dependent automobiles to Eco-friendly ones in consonant with the global crusade on Global Warming and Climate Change Mitigation as in USEPA (2012).

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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Public-Private Partnership (PPP) in residential solid waste management in Ibadan: Challenges and opportunities

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Waste management authorities have adopted different strategies at different times in managing waste in Nigeria. In spite of the various efforts put in place, municipal solid waste remains one of the most conspicuous and repugnant environmental problems that threaten the Nigerian city. This paper examines the challenges and opportunities of Public-Private Partnerships (PPP) in residential solid waste management in Ibadan, Nigeria. Data for the study were obtained from the Oyo State Solid Waste Management Authority (OYOWMA). Findings revealed that the commonly-generated wastes were organic wastes and there existed a mismatch between waste generation and collection. Between 2012 and 2015, city waste managers collected and transported 2,411,145.78 metric tonnes of waste to the four dumpsites in Ibadan. The dumpsites' locations were sub-optimal, surrounded by sprawling neighbourhoods due to inadequacy in urban planning and enforcement of development control. This has adverse effects on the well-being of residents. Municipal solid waste management is capital-intensive and the decline in budgetary allocations to waste management necessitated the PPP user-charges arrangement. This intervention notwithstanding, indiscriminate dumping of wastes continued to be cheap means of disposing of solid wastes, with implications for drainage system and flooding. Waste sorting, recycling and conversion should be given adequate consideration and the informal waste managers should be mainstreamed into the urban waste management architecture.

Key words: Private waste contractors, Oyo State Solid Waste Management Authority, residential solid waste, informal waste collectors, dumpsite, Ibadan.

INTRODUCTION

Individuals, organizations and governments have advanced several definitions to describe the term waste (Cointreau-Levine, 1982; Centre for Africa Settlement Studies and Development (CASSAD), 1998; Harris et al., 2001). Waste is often associated with unused or discarded material (Harris et al., 2001). Kasim and Arobo (2016) conceptualise waste as material thrown away or set aside as worthless. Waste can also be seen as a scrap from the application of any process, or any substance, which requires to be disposed of Igoni et al.

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(2007). Thus, it can be defined as any material discarded as having no consumer value to the person abandoning it (Cointreau-Levine, 1982). However, what an individual calls a waste is subject to the value judgment of such a person. An output of a process may be considered a waste if it has no further use, but it could be a valuable by-product if reused or recycled. Harris et al. (2001) contend that a material is only a 'waste' if it is useless; as soon as it is usable, it becomes a resource.

Waste could be in gaseous, liquid or solid forms. Solid waste is seen as a heterogeneous mass of discarded materials arising from human activities (Wahab and Sridhar, 2014; Kasim and Arobo, 2015). Sources of municipal solid waste can be classified into seven: residential (household or domestic waste), commercial, institutional, street sweeping, construction and demolition, healthcare/sanitation and industrial wastes (Ndum, 2013). Residential solid wastes are generated by everyday activities of a household. These include paper, cans, food waste, yard waste, ashes, glass bottles, aluminium, metal, plastic, and some specific wastes which require special handling, such as household hazardous wastes (electronics, light bulbs, batteries, asbestos) (Ukem, 2008). Residential solid waste has become a major environmental issue in Nigerian cities. With reference to Ibadan, for example, Wahab and Ola (2016) observe that solid waste has become one of the most challenging and enduring urbanization-induced challenges.

Waste generation has been on the increase since 1960 in Ibadan. The rate of waste generation increased from 0.37 kg/capita/day in the late 1960s/early 1970s (PAI Associates, 1982; Egunjobi, 1986, 2008) to 0.55 kg/capita/day between 2012 and 2015 (Odewumi et al., 2016; Wahab and Sridhar 2014; OYOWMA, 2017; World Bank, 2017). In 2012, about 635,000 tons, approximately 0.55 kg/person/day quantity of waste was generated in the city (Odewumi et al., 2016). Oyelaran and Rufai (2015) disaggregate the waste generated in the city of Ibadan into organic waste (accounting for 42% by weight), paper (10%), textile (2%), glass (4%), metal (5%), wood (3%) and plastics (9%). Some of the wastes are hazardous, flammable, or non-biodegradable. Without adequate provision for residential solid waste management, a diverse range of disease vectors will likely breed or feed within and around houses and residential neighbourhoods, reducing quality of life, well-being and hindering sustainable development (Archor, 1998; Asubonteng, 2011; Agbola et al., 2012).

In the past, waste management tends to be the responsibility of the public sector. However, this responsibility cannot be performed exclusively by the public sector because government alone cannot afford the huge financial, technical, administrative and human resources required to carry out the responsibility effectively. It is on this premise that this paper examined the various challenges and opportunities associated with public-private partnerships (PPP) in residential solid waste management in Ibadan, Nigeria.

Conceptual anchor

The concepts of Public-Private Partnership and sustainable waste management provided the conceptual anchor for this study. PPP can be defined as an arrangement between a public body and a private party or parties (including community beneficiaries) for the purpose of designing, financing, building and operating an infrastructural facility that would normally be provided by the public sector (Asubonteng, 2011). Asian Development Bank (ADB) (2012) states that PPP presents a framework that, while engaging the private sector, acknowledges and structures the role for government in ensuring that social obligations are met and successful sector reforms and public investments achieved. It is a contractual agreement between a governmental organization and a private party whereby the latter performs whole or certain parts of the government organization's service delivery, infrastructure provision or administrative function, and assumes the associated risks (Asubonteng, 2011).

Effective PPP structure allocates tasks, obligations, and risks among the public and private partners in an optimal way. The public partners in a PPP are government entities, including ministries, departments, municipalities or state-owned enterprises. The private partners can be local or international entities and may include businesses or investors with technical or financial expertise relevant to the project. The PPP may also include non-governmental organizations (NGOs) and/or community-based organizations (CBOs) that represent stakeholders directly affected by the project.

Effective PPP recognises the fact that the public and the private sectors have certain advantages, relative to the other, in performing specific tasks. The government's contribution to a PPP may take the form of capital for investment (available through tax revenue), transfer of assets, or other commitments or in-kind contributions that support the partnership. The government also provides social responsibility, environmental awareness, local knowledge and ability to mobilise political support. The private sector's role in the partnership is to make use of its expertise in commerce, management, operations and innovation to run the business efficiently (Adegoke, 2011). The private partner may also contribute investment capital, depending on the form of contract. The partnership in residential solid waste management service delivery is expected to reduce the burden of the public sector that is finding it difficult to achieve sustainable waste management.

Afroz et al. (2010) state that sustainable solid waste management involves control of generation, storage, collection, transportation, processing and disposal of

solid wastes in a manner that is in accordance with the best principles of public health, economics, engineering and other environmental concerns. The idea of sustainable waste management, which shows the interdependence of waste management and sustainable development process, was codified at the 1992 UN Rio Conference. At the heart of the Agenda 21 emanating from the 1992 conference is a vision of promoting sustainable waste management. Having examined the opportunities and the challenges of rapid urbanization, most especially in the developing countries, the Habitat Agenda concluded that properly-planned and properly-managed cities hold the promise for human development and the protection of the world's resources by supporting large numbers of people and limiting their impact on the natural environment. A rapidly-growing city with inefficient wastes management systems poses a huge threat to the environment (Babayemi and Dauda, 2009).

One of the most pressing problems facing urban managers in developing countries is how to manage residential solid waste in a sustainable manner. Long-term sustained development cannot occur in situations of deteriorating environmental circumstances and improper management of waste can lead to irreversible destruction of natural resources. Sustainable management of residential waste is imperative if the goals of city managers are to reduce the health-endangering potential of residential solid waste, improve human welfare, and promote sustainable human settlement development.

MATERIALS AND METHODS

Ibadan is located in south-western Nigeria, about 130 km in land northeast of Lagos and 530 km southwest of Abuja, the federal capital. The city is a prominent transit point between the coastal region and the areas in the hinterland of Nigeria. In 2006, the National Population Commission (NpopC) put the population of Ibadan at about 3 million. At present, the national population growth rate is 3.18% and the city's population was estimated to be 3,565,108 in 2018 (World Population Review, 2018). The rate at which the population of Ibadan is growing has significant implications for solid waste generation. As the city is rapidly expanding in area and population, the residential solid waste management issue has become a major urban environmental problem.

The responsibility for solid waste management in the city currently lies with the Oyo State Government, Ministry of Environment and Water Resources, Oyo State Solid Waste Management Authority (OYOWMA) and local governments. Each organ of government has different roles and responsibilities. In terms of waste management, OYOWMA is the statutory body established in 1997 by the state government to undertake waste collection, processing and disposal (Wahab and Ola, 2016). It has the direct and operational responsibility for residential solid waste management in the city. The Ministry of Environment and Water Resources performs a supervisory role over the Oyo State Solid Waste Management Authority. The Oyo State Solid Waste Management Authority is charged with the responsibility of collecting wastes along major roads, markets, inner city areas and other areas not covered by private waste contractors. Prior to Edict No. 8 of 1997 establishing OYOWMA, municipal solid waste collection and disposal were undertaken by the Ibadan Solid Waste Management Authority. The authority was functioning under the Ibadan City Council and later when Ibadan Municipal Government was created, the responsibility was transferred to Ibadan Municipal Council. Later, Ibadan city and its environs were constitutionally divided into eleven local government areas (LGAs) to shoulder the responsibility of collecting, transporting and disposing of municipal solid wastes (Omoleke, 2004; World Bank, 2017). The idea of involving the private sector in residential solid waste management started in 1985. According to Cointreau-Levine (1994), the collection service by licensed private contractors was initiated in 1985 when private franchise of residential waste collection in high-income residential layout areas was implemented.

The data for this research were obtained from secondary sources and they were mainly quantitative. Data were collected from published and unpublished documents of OYOWMA and from the 11 LGAs that constitute the Ibadan region. Information on the number of registered private waste zones and routes covered (Figure 1), mode of operation, frequency of waste collection, time of collection, service charges and quantity of waste collected and transported to dumpsites and maintenance procedure of the dumpsites were obtained from OYOWMA and registered private waste contractors (PWC). A reconnaissance survey was conducted to validate the data obtained from OYOWMA, LGAs and the private waste contractors. Additional data on the PWC were sourced from the records of the Association of Refuse Contractors and the exiting literature. The Master Plan of Ibadan and the Map of Ibadan Region were used to identify the routes, residential neighbourhoods and zones covered by private contractors. Data were analysed using descriptive statistics, with the results presented in map, tables and chart.

RESULTS

Fifty-eight registered private waste contractors (PWCs) were in operation in the 11 LGAs in Ibadan. These registered private contractors collect waste from residential, commercial and industrial zones that are ready to pay for their services (Odewumi et al., 2016; OYOWMA, 2017). Each of the private contractors pays for an operation permit, which often remains valid for a year. The operational permit is granted after the payment of registration and license fees. After meeting statutory requirements, OYOWMA designates areas that each operator is permitted to cover. Currently, 64 routes are covered by the 58 registered private contractors. Table 1 shows residential areas that PWCs cover in Ibadan sub-urban LGAs and Table 2 shows residential areas assigned to private contractors in Ibadan urban area LGAs.

Various routes were covered by the private wastes contractors, the local governments (LGs) and OYOWMA workers. Routes were delineated based on capacity to pay for services rendered. Therefore, all the routes allocated to private waste contractors were within formal and semi-formal residential neighbourhoods, industrial and formal commercial zones. Waste management activities within the informal neighbourhoods, in the city, were managed by either LG or OYOWMA. Private operators and contractors undertook door-to-door collection of wastes mostly from residential buildings

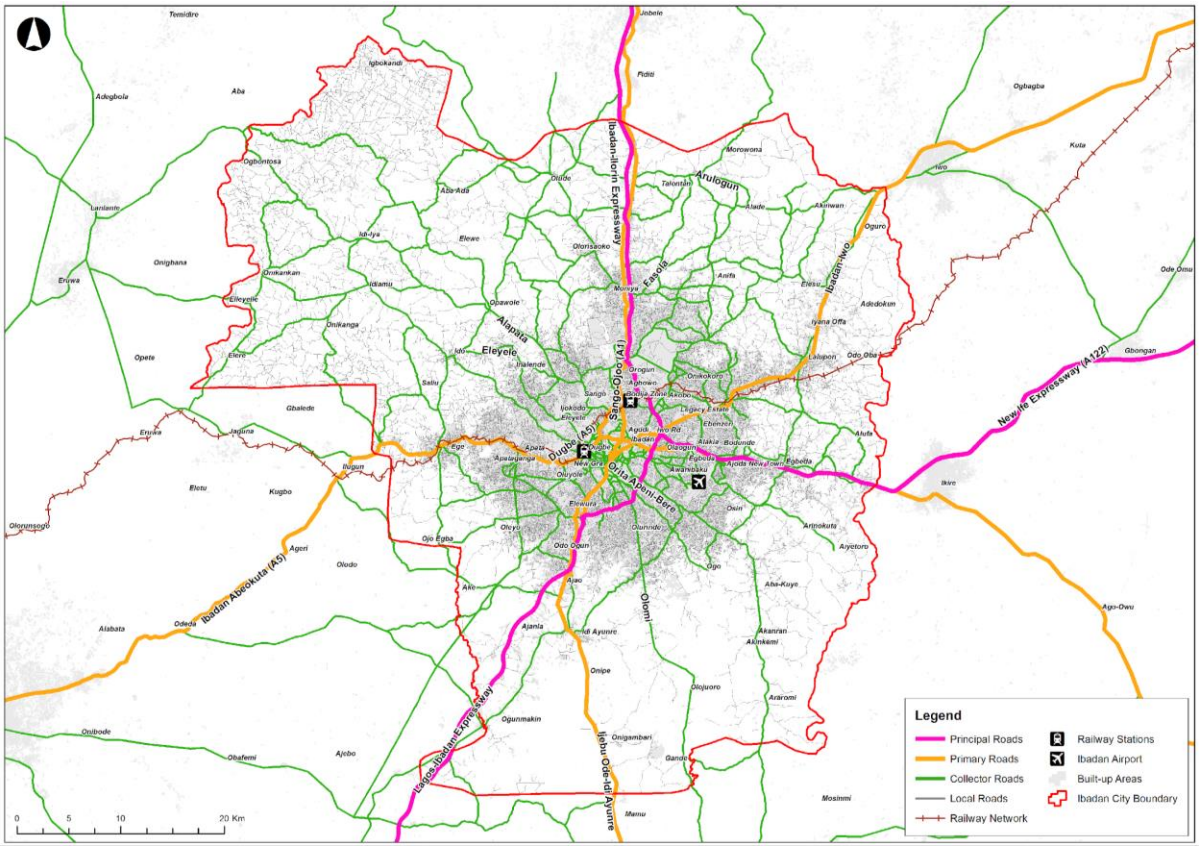

Figure 1. Road networks and routes plied by waste contractors in Ibadan.
Source: Adapted from Ibadan City Master Plan Report (2018).

twice in a month; commercial/institutional buildings three times in a week; and industrial buildings and zones on a daily basis. The mode and time of collection were based on agreed payment structure and service supported by the OYOWMA's laws and regulations. The OYOWMA and some local governments were responsible for general wastes collection, especially along principal and major transport corridors. Part of the function of the agency included collection of wastes dumped along major roads, waste swept by street sweepers, and wastes in public areas and open spaces within Ibadan. Local government wastes managers performed skeletal wastes management activities within the geographical jurisdiction of the LGAs.

Oyo State Solid Waste Management Authority oversees waste collection, street cleaning, and management of landfill sites. The four landfills in the city are easily accessible and located along major routes: Aba-Eku, on Akanran Road; Lapite, on Oyo Road; Awotan, on Akufo Road; and Ajakanga, on Odo-Ona Elewe Road. If the four landfills (covering about 50 hectare of land) are properly managed, they could store up to 3,000,000 tons of wastes (World Bank, 2017). The amount of solid wastes collected and transferred to the landfills by waste management authority was 862,393.70 metric tonnes (MT) in 2012, 2013 (586,436.96 MT), 2014 (503,309.68 MT) and 2015 (459,005.44 MT), as shown in Figure 2.

From 2012 to 2015, OYOWMA, LGs and private waste contractors (PWCs) collected and transported 2,411,145.78 MT to the four dumpsites in Ibadan. Oyo State Solid Waste Management Authority (OYOWMA) transferred and deposited the highest volume of solid wastes (1,477,565.51 metric tonnes). However, there was reduction in the volume of wastes transferred by OYOWMA between 2012 and 2015. In 2012, 658,867.85 metric tonnes were transferred by the Authority but this reduced to 306,941.18 metric tonnes in 2013, 265,176.32 metric tonnes in 2014 and further to 246,580.16 metric tonnes in 2015 (Table 3). This reduction could be attributed to the returning of the wastes collection responsibility to the LGs in 2013. LGs and PWCs were able to transport 327,855.12 and 605,725.15 metric tonnes, respectively within the same period to designated dumpsites in Ibadan.

Previously, OYOWMA collected wastes fees on behalf of PWCs from the households using government revenue contractors. The contractor's evacuated waste generated within the designated routes and zones. Evidence of payment would be presented by the clientele before waste would be evacuated. The OYOWMA, at the

Table 1. Residential neighbourhoods covered by private contractors in Ibadan.

LGA	Route	Residential neighbourhood	Private contractor
Akinyele	1	Ajibode, Shasa, Akingbinle and Moniya	Victom Function
	2	Ojoo, Arulogun, GOFAMINT, Arorokole, Idi-Ose, Shogunro, Abatakan, Shasa and IITA Environs	Addwest Midland
Lagelu	3	General Gas, Akobo Ojurin, Baptist, Basorun Estate and Okebadan Estate	Bukol
	4	Akobo Ojurin, Olorunda Aba, Yawiri, Olewuro, Unity and Wisdom Estates	Dapat
	5	General Gas, Kolapo Ishola and Carlton Gate estates, Iyana Church and Iwo Road	Global Brand
	6	Wofun, Exide Junction, Olodo Bank and Lalupon	Rite Environment
Egbeda	7	Iwo Road, Bishop Philips Academy, Agboola, Adogba, WEMA Area, Gbagi, Raji Alusekere and Shop Mesan	Arkman Associates Nig Ltd
	8	Adeojo Estate, Olaogun (Fash Fash), Gbaremu, Oremeji, Agugu, Onipepeye and Airport Junction	Admack
	9	Iwo Road, Onipepeye, Adegayi, Alakia, Oniyanrin Sarumi, Iyana Agbala, Egbeda, Alakia, Agadebgayi	Everest Dayton
	10	Olubadan Estate, Asaju Area, Adelubi, Agoro, Aroko, Alalubosa, Arolu and Isebo Alakia	Olounnu
	11	Monatan, Iyana Church, Nigeria Brewery Area	Ocean Wave Technical Chemical Product Ltd
	12	Wakajaye, Olodo Garage, Orogbangba, Sakute, Amero, Oki, Kumapayi and Eremu	Gboola-Toyin
	13	Isebo, Papa, Olosan, Akanle, Ogungbade, Ile Tintun, and Aladun and Egbeda	Kumaaz Ventures
	14	Akingbade, Mato, Oluso Aja Meta, Hope, Airport, Gbaremu and Idi Obi Road	Faytem Global
Oluyole	40	New Garage, Podo, Idi Ayunre, Abanla, Arapaja, Aba Ibeji, Kasamu area. Ajide I and II and Agara Environs	Alluvia
	41	Soka, Toll Gate, Atoni Village, Alomaja and Ajanla	Karyz
	42	Ireakari and Abese Estates, Oloruntedo, Irepodun, Elebu Junction, Yidi area, Akure Ajila, Abgeru, Akoto, Ashaupa Owo, Part of Ogunkeye, Araromi, Unity, Idi Aliu and Alaka	T.J Consultancy
	43	Elebu Junction, Akeredolu Street, Part of Eleta, Orita Merin, Olose Community, Aba Paanu, Oke Alaro, the right side of Elebu junction and Jankata	Wallyco
	44	Wallam Hall, D'Rovans Hotel to Mile 110, Gada Area of Odo-Ona, Apata and Oke Ayo	Prime Plus
	45	Muslim Academy and Olomi	Kanfalad
	46	Boluwaji and Sanyo	John
Ido	47	Apete Garage, Lakoto, Arola, Awotan, Orisun, Dump Site and Life Fort	Joy and Goodness
	48	Ologuneru Bridge, Aba-Nla Junction, Lulu Hanah Junction, Adetokun, Ologuneru Entrance, Ajadi and Ologuneru Bus/Stop	BGML
	49	Wema Bank Junction, Apata, Owode Estate and Omi-Adio	Tamfol
	50	Ologuneru Bus/stop to Ekerin Area, Gbopa, Peace Cathedral, Olunde Estate, Idi-Igbaro	Sandel Ventures
	51	Apete Market, Papa, Ori-Oda, Adaba/Akowo Community and Life Fort Environs	Joy and Goodness
	52	Bcj Apata, Adebisi Layout, NNPC, Wire & Cable, Bako and Environs	Five Star
Ona Ara	53	Babanla, Oniyangi and Airport Area	Ona Opemipo
	54	Oju-Odo Olunloyo, Amuloko and Aba Ekun	Ajitop Nigeria Enterprises
	55	Olorunsogo and Muslim	Osundeyi Tijani
	56	Oremeji Agugu, Olorunsogo and Olunloyo	Botreed

Source: Adapted from OYOWMA (2018).

end of every month, paid the private contractors for the services rendered based on agreed sharing formula (OYOWMA, 2016). Most of the private wastes contractors were not satisfied with this arrangement. Currently, the reverse is the case, the private waste contractors collect

Table 2. Residential neighbourhoods covered by private contractors in Ibadan Urban Core LGAs.

LGA	Route	Residential neighbourhood	Private Contractor
Ibadan North West	15	Idi-Ape, Oloronbo Express area and Iwo Road	Shekayate
	16	American Quarters, Yidi Area, Iyana Agbala, I.K Dairo, Holy Trinity, Fagbamila and Iwo Road	X-Clean
	17	Oremeji Agugu, Olorunsogo, Orita Aperin, Adekile, Beere and Iyana Oke-Adu	Richard Akinwale Elect.
	18	Odejayi, Aromolaran, Agugu and Oke-Ibadan	Dumapek
	19	Basorun, Olonrobo, Owo-Ade Adigun Street, Balogun Area and Akobo	Glorious G & C Consult.
	20	Dugbe, Labowo Street, Orita-Merin, Yemetu, New Palace Way, Dandaru, Kube Atenda and Molete Gate	Abbey Nigeria
Ibadan South East	21	Felel Junction, Keshiro, Molete, Scout Camp Area, Felele Express and parts of Boluwaji and Odo-Oba	Prime Reach Limited
	22	Olorunsogo and Academy	Boleso Company Limited
	23	Academy, Odo-Oba, Adeyemo Layout, Back of Ibadan Grammar School, Molete and Beere	Top Legend Citizens Ltd.
	24	J Allen, Iyaganku, Oke-Bola, Oke-Ado, Kobiowu, Joyce B, Oni & Sons, Liberty, Ososami, Cresent, Molefalafia, Ajeigbe, Anfani and Challenge	Babs
	25	Felele Straingt, Felele Express, Soka Bus/Stop, Orita Challenge, Orita Challnge and Yinka Ayefele environs	Adenad
Ibadan North	26	Agodi G.R.A, Ikolaba, Ikolaba Estate, Favours, Aare, Lekan Salami Estate and Oluwo Kekere	Crown FMS Limited.
	27	Bodija Market area, UI, Major Salawu street and Agbowo Junction and Express	H.O.K
	28	Awolowo Junction, Oshuntokun to Preboye Junction, Samonda and Aerodrome Estate	Musan Waste
	29	Awolowo Junction, Redeem Church Side, Adele and Davis,	Admok
	30	Veterinary, Oke Itunu, Sango, Okoro (Baracks Area), After Baracks, Olopo-Meta, Baba Legba and Benjamin	Mowaje
	31	Kongi, Akingboola, Ashi, Winners Way and Oluwo-Nla	Yemron
	32	Orogun and Ojoo	Justo Custodian
	62	Sabo	Garas Global Limited
	63	Onile Gogoro, Adeile Avenue, WEMA Bank Area and Old Tapa Community	Total Care Nigeria Ltd
Ibadan South West	24	J. Allen, Iyaganku, Oke-Bola, Oke-Ado, Kobiowu, Joyce B, Oni & Sons, Liberty, Ososami, Cresent, Molefalafia, Ajeigbe, Anfani and Challenge	Babs
	33	Eleyele, Idi-Ishin, Alafara and Elenu Sonso	Joint Envmtal Cleaning Services
	34	Adeoyo Hospital road, Filade, Mobil, Lister, Federal High Court Area, Mobil, Heritage Estate, Aremolekun and Alebiosu Close.	Alpha-Skin
	35	Mobil, Aare Lanre, Sharp Coner and Ada Ibeji	Metropolitan
	36	Sharp Corner, part of Kuola, Orelope, Aalafin, Oluode and Oke-Alaro	Mega Emolad
	37	Iyana Adeoyo, Bolomole and Eleruwa	Sun Musico
	38	Orita Challenge, Odo-Ona Elewe, Fodasis and Agbaje	Deletech
	39	Aleshinloye, Alalubosa Estate, Odo-Ona, Gbekuba, Akilapa, Ifelodun, Up Jesus and Agbofeti	Poroku
	64	Mile 110, Challenge, Efunsetan, Molete, G Allen and Queen Cinema	Great Good Concept

Source: Adapted from OYOWMA (2018).

wastes and fees directly from households. The amount paid, per building, varies across neighbourhoods and is influenced by frequency of evacuation. To maintain the existing dumpsites, the private waste contractors are made to pay a fixed dumpsite access charges. The amount to be paid depends on the category of wastes conveyed to the dumpsites. The access charges by OYOWMA for industrial waste is ₦5,000 (16.4

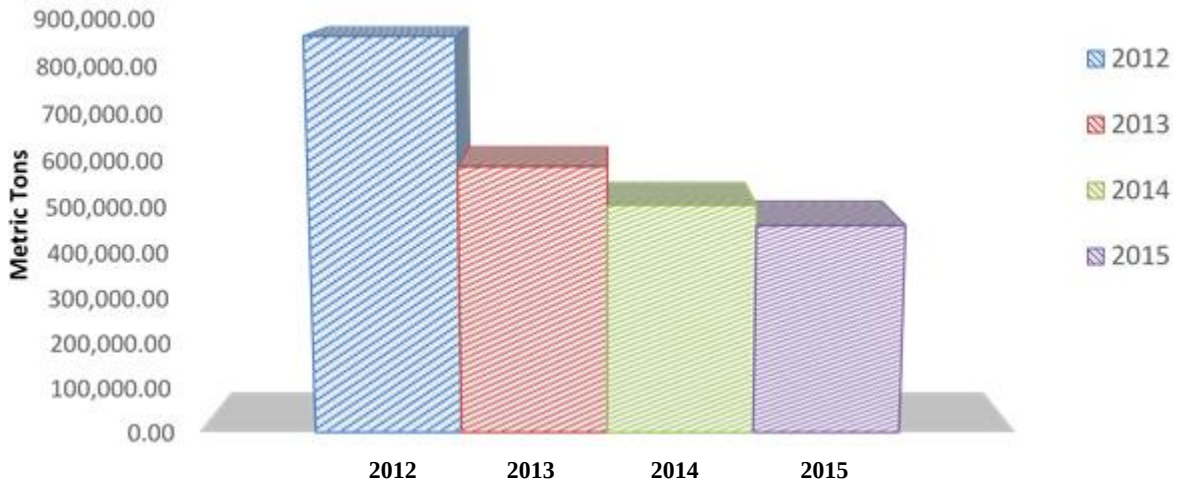

Figure 2. Amount of solid wastes collected and transferred to dumpsites (2012 - 2015).
Source: OYOWMA (2017).

Table 3. Solid wastes transferred by OYOWMA, LGs and PWC (2012 - 2015).

S/N	Year	OYOWMA (MT)	LGs (MT)	PRC (MT)	Total (MT)
1	2012	658,867.85	73,288.20	130,237.65	862,393.70
2	2013	306,941.18	135,460.61	144,035.17	586,436.96
3	2014	265,176.32	90,902.24	147,231.12	503,309.68
4	2015	246,580.16	28,204.07	184,221.21	459,005.44
Total		1,477,565.51	327,855.12	605,725.15	2,411,145.78

Source: OYOWMA (2017).

Table 4. OYOWMA sources of funding for the 2014 budget.

Source	Cost (₦ per year)
State Government	1,248,164,800
Local Governments	198,000,000
Total	1,482,164,800

Source: OYOWMA (2017).

USD); commercial waste is ₦ 3,500 (11.5 USD) and household waste is ₦ 2,500 (USD 8.2) per truck. The major financier of solid waste management services in Ibadan is the Oyo State Government. Table 4 indicates that, in 2014, the LGs contributed only ₦198 million (15.9%) to funding of municipal solid wastes management. The financial contributions of the PWC could not be easily ascertained owing to a number of issues, which include variation in staff wages, poor management structure and equipment holding and inability of most of the PWCs to quantify operation costs in terms of fuelling, mileage covered per operation, and staff and other logistic requirements.

Owing to limited budget and adequate capacity, OYOWMA could not effectively manage the increasing amount of solid waste generated. For example, OYOWMA's total budget for 2014 was ₦11,844,972. The internally generated revenue for the agency in the years under review was as follows: revenue from the registration of PWC (₦1,355,000), revalidation of old permits and change of title (₦889,000), dumpsites usage charges acquired from PWCs (₦8,663, 472), and fines for contravention of environmental laws (₦937, 500). The annual budget for year 2014 was about ₦12 million. However, the operation cost for the same year was about ₦1.5 billion. The break-up of OYOWMA annual revenue

Table 5. The OYOWMA annual revenue for 2014.

Source of financing	Costs (₦)
Registration of private refuse contractors	1,355,000
Revalidation of old permit and change of title	889,000
Refuse dump usage charges acquired from private refuse contractors	8,663,472
Fines for contravention of environmental laws	937,500
Total	11,844,972

Source: OYOWMA (2017)

Table 6. The OYOWMA operation costs in 2014.

Cost lines	Costs (₦)
Staff costs (Salaries)	42,200,000
Equipment costs	669,000,000
Truck fuel and maintenance	174,164,800
Other costs (clean street initiative, etc.)	596,800,000
Total costs	1,482,164,800

Source: OYOWMA (2017).

Table 7. OYOWMA own trucks for solid waste collection.

S/N	Name of truck	Number of Units
1	Mitsubishi Canters (Ro-Ro) - side loading	10
2	Leyland Skip Eater Compactors - rear loading	3
3	Sterling Goliath Compactors - rear loading	9
4	Leyland Ro-Ro	2
5	Toyota Tipper	1
6	Bedford Tipper	1
	Total	26

Source: OYOWMA (2013).

and operation costs in 2014 are contained in Tables 5 and 6. Further analysis of the revenue revealed that staff costs (salaries) alone was more than ₦42 million, equipment costs (₦669, 000,000), truck fuel and maintenance (₦174,164,800) and other costs, such as the street sweeping initiative (₦596,800,000).

There was a major mismatch among internally generated revenue, budgetary allocation and operation cost. The capacity of the state government to fully finance OYOWMA has been continuously challenged by the Nigerian economic outlook. This is further compounded by the unwillingness of individuals and communities to pay for service rendered by waste managers. Waste management service has always been provided by government as social good, which is not sustainable. This has implications for the efficiency of waste management apparatus manifesting in mountains of uncollected waste dotting the nooks and crannies of the city. The challenge is daunting and seemingly unsurmountable. Thus, the authority finds it extremely difficult to perform its statutory functions, thereby turning the city into a public dustbin susceptible to environmental hazard (Omoleke, 2004; World Bank, 2017).

Given the population of the city, the number and state of the available vehicles coupled with the condition of roads in Ibadan, the operation vehicles owned by OYOWMA, shown in Table 7, were not enough for effective waste collection in the city. However, the available operation vehicles were relatively new, standardized and appropriately designed. The PWCs, which are expected to be a viable alternative to government agencies did not perform better. The operation vehicles of the PWCs were old, unstandardized and inappropriately designed. The PWCs did not perform optimally owing to paucity of funds and inadequate equipment to operate as expected. The private contractors

used all kinds of trucks, not specifically designed for waste collection. The capacity of the vehicles in use was about 5 to 10 tons. Most of the PWCs operated on a small scale and supplemented vehicular needs by hiring vehicles for waste management operations.

DISCUSSION

Constitutionally and within the tenets of the local government reform of 1985 waste management is a primary function of the local government in Nigeria. OYOWMA, in 2015 alone, was responsible for more than half of the waste collected in the city with only 26 trucks, as indicated in Table 5. The roles of LGs and the private contractors in solid waste collection and transportation were not significant. In Ibadan, as noted by World Bank (2017), the LGs were responsible for about 6% of the waste collected, while more than 50% of the waste collected was done by OYOWMA. The private contractors were able to cater for about 40% of the total waste collection. The private sector has been involved in solid waste collection in Ibadan for more than three decades. The amount of solid wastes collected and transferred to the existing dumpsites by both the private and public sectors between 2102 and 2015 was 2,411,145.78 metric tonnes. However, the public sector was responsible for the collection and transfer of 1,805,420.63 metric tonnes. The private sector was able to transfer 605,725.15 metric tonnes only within the same period. With the government's drive towards public-private collaboration, there is a lot to be done by PWCs in waste management in the city.

Egunjobi (2008) claims that the greatest challenge to waste management is lack of congruence between the rate of generation and collection of wastes. The rate of urbanization has given rise to the immense and ever-increasing amount of solid wastes generated. The wastes have long outstripped the capacity of nature to assimilate them and of city authorities to collect and dispose of the waste generated safely and efficiently (Agbola, 2001). This necessitated the involvement of private waste contractors to complement the efforts of the public agency. However, the PWCs have been inundated with several challenges. The most significant of these challenges is paucity of funds. It is also noted that the private contractors are not able to access the finance they need to improve the quality and efficiency of their operations (World Bank, 2017). The uncollected waste causes different social economic menaces, like diseases, city eyesore, clogging of drains, pollution, and disruption of infrastructural systems and normal community life (World Bank, 2006).

Ideally, with public-private partnership, the collection of residential solid wastes should be effective, efficient, and predictable. However, this is not the case in Ibadan; waste management in the city is inadequate. What has developed is a combination of private and public initiatives that ultimately culminate in collection of waste from one neighbourhood and depose of it somewhere else within the neighbourhood or at open dumpsites (Wahab and Sridhar, 2014; Odewumi et al., 2016).

Residential solid wastes transportation is capital-intensive, especially in the area of equipment and vehicle procurement and running cost. Normally, one truck can handle waste collection for 7,000 inhabitants under public operation or 10,000 inhabitants under private operation. Therefore, for a city as big as Ibadan, at least 400 - 570 collection trucks would be needed. In 1995 when the exchange rate was fixed at ₦22 to US$1, a skip vehicle, according to Agbola (2001), cost approximately ₦15 million. Today, the official exchange rate is ₦305 to US$1. In Nigeria, city authorities are hard pressed to obtain enough capital to finance a sustainable residential solid waste management system. In 2014, for instance, while the total budget of OYOWMA was N12 million, the operations cost for the same year was N1.5 billion. The private contractors use or hire trucks that are not specifically designed for residential solid waste collection and transportation.

Wastes cannot be managed by merely disposing of them into the environment. About 75% of the solid wastes collected in most Nigerian cities are disposed of in open dumpsites erroneously called sanitation landfills (Agbola, 2009; Kasim and Arobo, 2016). Open dumpsites are rampant, and a misnomer as an alternative to sanitary landfills. Sanitary landfill, as perceived by Heeramun (1995), implies a controlled operation employing an engineering method in which waste is deposited in excavated land or in strip mines, compacted to the smallest practical volume and covered with a layer of soil at the end of each day's operation. Currently, all the landfill sites managed by OYOWMA could best be described as open dumpsites. In addition, the locations of these dumpsites are sub-optimal. The four dumpsites in Ibadan were initially located in the suburb areas of Ibadan. Currently, these dumpsites are surrounded by sprawl neighbourhoods owing to ineffective physical planning structure and poor enforcement of development control. Informal waste scavengers and material recovery at the dumpsites are allowed (Wahab and Ola, 2016).

Solid waste management suffers a setback due to unwholesome waste disposal habits of the citizens as well as inadequate funding and poor enforcement of sanitation laws (Sangodoyin, 1993). Typical negative impacts of poor waste management include blockage of waterways and the drainage system leading to flooding as well as health hazards from human contact with untreated waste (Agbola, 2001; Agbola et al., 2012; OYSG, 2013; Ojolowo and Wahab, 2017).

There are different methods of sustainable residential solid waste disposal methods. The use of organic recycling (the biogas option) should also be considered in Ibadan. Through recycling, foreign exchange is saved,

natural resources are conserved, industrialization is promoted and wasted disposal cost is minimized (Cointreau-Levine, 1994). The current attraction of recycling in waste management operations is necessitated by the high cost of industrial raw materials and high level of poverty and unemployment. Poverty has motivated government refuse collection workers, private workers and scavengers to operate various sorting and recycling systems. With recycling opportunities, scavengers are motivated to search for materials which are reusable, such as plastics, metal scraps, steel rods, bottles, cartons, cardboards, used papers from waste dumps and dustbins in residential areas (Wahab and Ola, 2016). Agbola (2001) observes that waste recycling can no longer be treated lightly in view of its many inherent advantages needed to be tapped. The present harsh economic condition, coupled with the high rate of unemployment in the country, provides justification for mainstreaming informal waste recycling enterprises. Through residential solid waste recycling, foreign exchange will be saved, natural resources will be conserved, industrialization will be promoted and waste, storage, collection, transportation and disposal costs will be is minimized.

The informal sector has been actively involved in recovering recyclable materials from generated residential solid wastes. Items recovered are either reused or used to mend other materials or sold directly to retailers and merchants of relevant industries. Such items include paper, polythene, wood, metal scraps, bottles, saw dust, ashes, rubber, bones and plastics. The so-called "*scavengers*" sort and recover valuable materials from the waste along their way. There are about 200 informal waste pickers (*scavengers*) recognised by OYOWMA across the four dumpsites. The informal actors recover significant amounts of waste and sustain a market in recyclable materials (World Bank, 2017).

The informal sector has not only grown in Nigeria but it has also emerged in new guises and unexpected places, such as residential waste collection and disposal sites. Supporting informal waste enterprises and improving informal jobs in residential solid waste management are now recognized as key pathways to promoting sustainable urban growth and reducing urban poverty. The policy dilemma appears to be how to contain the adverse environmental impacts of many of the activities of the urban informal sector without disrupting livelihoods and causing social distress; how to promote environmental awareness and guarantee the right to the city, while at the same time protecting the vulnerable groups in the informal sector from harm and exploitation (Nwaka, 2005).

Mainstreaming the informal waste sector is not automatic and does not depend solely on the informal waste enterprises themselves. The opportunities for development of this sector and for it to fulfil its roles in the transitional economies and provide employment opportunities for the less educated and formally unemployed must be supported by creating an enabling environment which takes into account their particular characteristics. The contributions of the informal waste sector to human livelihood show that the poverty circle can be escaped from and a faster rate of urban economic growth and development can be achieved. Thus, enhancing the productivity of informal waste businesses/activities and making them competitive is crucial, as they absorb the job-seeking citizens, most specially the youth. Also, community participation in solid waste management is always required because solid waste management is a continuous maintenance system, involving for example storing the garbage in a specific bag or bin, bringing it to an agreed collection point, and separating the contents of the waste (John, 2015). This is an effective way of providing solution to "Not in My Backyard Syndrome". Community participation in solid waste management is perceived by Egunjobi (2008) and Wahab and Ola (2016) as important as any other urban service.

Conclusion

The responsibility for residential solid waste management in Ibadan lies with the public and private sectors, but the public sector still remains the dominant actor. The role of the private sector in residential solid waste management has not been significant. With public-private partnership, the collection, transportation and disposal of residential solid waste should be efficient but this is not the case in Ibadan where refuse collected from one area is deposited somewhere else within the city or at open dumpsites. Despite various efforts aimed at managing wastes in Ibadan, the residential solid waste problem still remains one of the most conspicuous and repugnant aspects of environmental problems in the city. The major challenges facing PPP in residential solid waste are limited budget and equipment; improper locations of solid waste containers; the capital-intensive nature of solid waste transportation; and inadequate capacity to handle the increasing amount of residential solid waste generated. While the locations of the open dumpsites serving the Ibadan metropolis are sub-optimal, informal waste pickers have been recognised by OYOWMA across these dumpsites. High levels of poverty, harsh economic condition and unemployment have motivated waste scavengers to embark on waste sorting and recycling. Informal waste businesses will not only play significant roles in employment creation, but they will also reduce crime and government expenditure on security and legal services.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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