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EFFECTS OF RAPID POPULATION GROWTH ON WASTE DISPOSAL IN THIKA TOWN, KIAMBU COUNTY, KENYA

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ABSTRACT

The purpose of the study was to establish the effects of rapid population growth on waste disposal in Thika town, Kiambu County, Kenya. The study was based on the Driving Force-Pressure-State-Effect-Response (DPSER) model (OECD, 1994), and adopted a survey research design. The target population for the study was town physical planners, local officials of NEMA, members of the public and community groups who engaged in environmental conservation in the municipality. Stratified random sampling was used to select community group members, officials from NEMA, the Physical Planning Department and District Environment Officers. Data for the study was collected by use of questionnaires and interview guides. Quantitative data collected was analyzed using descriptive statistics such as frequency counts and percentages. On the other hand, qualitative data was analyzed thematically in line with the study objectives. The results of the analysis were presented using tables, pie charts and bar graphs. The study established that the rapid population growth in Thika Town has led to environmental problems such as water pollution, air pollution, poor disposal of waste, formation of slums, poor maintenance of water supply, sewerage and sanitation systems and congestion in the transport system. The study recommends that environmental education should be incorporated into the school curriculum at all levels to build a generation of environmentally conscious citizens; the government should provide adequate funding for agencies concerned with environmental management and ensure proper implementation of programs and policies; the government should also install a recycling plant within Thika Town to curb environmental degradation; among other actions.

Keywords; *Rapid Population Growth, Waste Disposal, Environmental Problems*

INTRODUCTION

There is widespread concern about the environmental challenges brought on by population increase. (Barbier, 2019; Lu et al., 2019; United Nations, 2018) Researchers have shown that fast urbanization and population increase may have serious effects for the environment, such as air

pollution, water pollution, and loss of biodiversity. These environmental concerns may have a deleterious effect on human health and well-being, economic growth, and ecological sustainability. Over the last several decades, urban regions all over the globe have seen fast population development, which has resulted in enormous environmental challenges. According to Angel et al. (2011), the issues that are related with fast urbanization include pollution of the air and water, deforestation, the loss of biodiversity, and the depletion of natural resources.

Studies have demonstrated that the fundamental cause of these environmental challenges is the increasing demand for housing, transportation, and services that is connected with population expansion (Anguelovski et al., 2018). According to Hossain et al. (2019), urbanization may also result in shifts in land use and land cover, both of which can contribute to ecological imbalances and environmental deterioration. Rapid urbanization is connected with a large increase in environmental challenges, one of which is pollution of the air. According to Angel et al. (2011), a rise in the number of cars on the roads, building activities, and industrialisation all contribute to air pollution, which in turn leads to an increase in respiratory disorders and other health issues among urban populations. Another serious environmental problem that arises as a direct consequence of high population increase in metropolitan areas is the contamination of water supplies. According to Hossain et al. (2019), the growing demand for water combined with inadequate wastewater treatment and management systems may lead to the contamination of surface water bodies like rivers and lakes as well as sources of groundwater. Rapid urbanization is related with a number of serious environmental challenges, one of which is the destruction of natural ecosystems and a reduction in biodiversity. According to Anguelovski et al. (2018), the fragmentation of natural habitats, the loss of biodiversity, and changes in ecological dynamics are all caused by the clearance of natural habitats for the construction of infrastructure and housing.

This rapid population growth is evident in countries all over the world. In China for example is a city named in Shanghai. The registered population in this city has increased continuously from 5.03 million persons in 1949 to 14.12 million persons in 2010. Cui and Shi (2012) notes that this rapid population growth has resulted to serious environmental problems in Shanghai, including climatic and ecological effects. Environmental pollution has also been seen to be on the rise. The garbage produced in this city has increased from 960 thousand tons in 1950 to 8900 thousand tons in 2010, with an increasing rate of 1443.7 thousand tons per decade in Shanghai during 1950–2010 (Guo and Hu, 2010). The rapid population growth and urbanization in Asia-Pacific city regions has also placed great pressure on their environment. As a result of the urbanization, a range of environmental challenges have resulted. Some of them include: overcrowding, proliferation of slums, increasing vehicular and industrial pollution, overused urban facilities and urban poverty (Dutt *et al*., 2003).

In Africa and Asia, urbanization is still considerably lower (at 40 percent). Both countries are expected to have 54 percent urban population by 2025 (UN, 2002). Although urbanization is the driving force for modernization, economic growth and development, there is increasing concern about the effects of expanding cities, principally on human health, livelihoods and the environment. The implications of rapid urbanization and demographic trends for employment, food security, water supply, shelter and sanitation, especially the disposal of wastes (solid and liquid) that the cities produce are staggering (UNCED, 1992). There however are African countries where urbanization is still considered as being high. In Nigeria for example, there has

been an increasing in the urban population growth rates. The overall effects of this growth have been felt on the living standards, resources use and the environment. These effects are presently felt most especially in; energy consumption, carbon emissions, air pollution and human congestion (Theodore, 2006).

According to Kithiia and Kioko (2021), urbanization in many African nations has led to a rise in the demand for housing, infrastructure, and services, which often comes at the price of the natural environment. Thika Town is one of the rapidly growing metropolitan areas in Kenya that is confronting environmental challenges. According to the published research (Njenga et al., 2020; Kithiia & Kioko 2021) in this field, growing urbanization in Kenya has resulted in a number of environmental challenges, including deforestation, air pollution, and water shortages. According to Njenga et al.'s research from 2020, the pressure that has been put on the world to accommodate a rising population has led to the destruction of natural ecosystems, which has resulted in a loss of biodiversity and an increase in carbon emissions. In addition, the absence of appropriate sanitation systems and methods for waste management has resulted in the pollution of water sources, which has led to a paucity of water and created potential health risks (Kithiia & Kioko, 2021). According to other research (Njenga et al., 2020; Kithiia & Kioko 2021), rapid urbanization has resulted in a rise in the number of private automobiles on the road, which has contributed to an increase in both traffic congestion and air pollution in cities. Furthermore, the literature emphasizes the necessity for sustainable urban planning and development to meet the environmental challenges of fast urbanization (Njenga et al., 2020; Kithiia & Kioko, 2021). This includes the promotion of green areas, public transit, and waste management methods.

Like most developing countries, Kenya's urban population has been growing. Twenty years ago, Kenya's urbanization level was only 18%. Since then, Kenya's urban population has been rising rapidly with an urbanization rate of 4%. Currently, about 30 percent of the population lives in urban areas. The share of the urban population is set to rise to 37 percent by 2020, and by 2033 most of the Kenyan population will be living in urban areas (World Bank, 2014). As is well known, rapid urbanization has various implications on the infrastructure and service needs of cities, since in most cases urban populations are increasing at rates that are outstripping any reasonable expectations in improvements on housing, health care, employment opportunities, and infrastructure required for healthy living environments (Forman, 2008). As shown by Asoka, Thuo and Bunyasi (2013), in Eastleigh, a neighbourhood of Nairobi Town, 90% of the basic infrastructure and sewerage services have been negatively affected by population growth. The major goal of this study was therefore be to establish the environmental problems associated with rapid population growth of Thika Town.

Statement of the Problem

Due to its fast population increase, Thika Town is dealing with a number of environmental difficulties, which puts the sustainability of the town in jeopardy. The rising need for housing, transportation, and other forms of infrastructure has resulted in the destruction of natural ecosystems, as well as the loss of trees, erosion of soil, and degradation of land. In addition, the increase in vehicle traffic has resulted in pollution of the air and noise, as well as an increase in traffic congestion, which has had a substantial negative impact on the environmental quality of the town. In spite of these concerns, there is a dearth of study into the fundamental factors that underlie these issues as well as the feasible long-term remedies that may be available to solve them. As a result, the purpose of this research is to analyze the environmental difficulties that

have arisen as a result of the fast population expansion in Thika Town and to propose solutions that are both practicable and sustainable for achieving a balance between population growth and environmental sustainability.

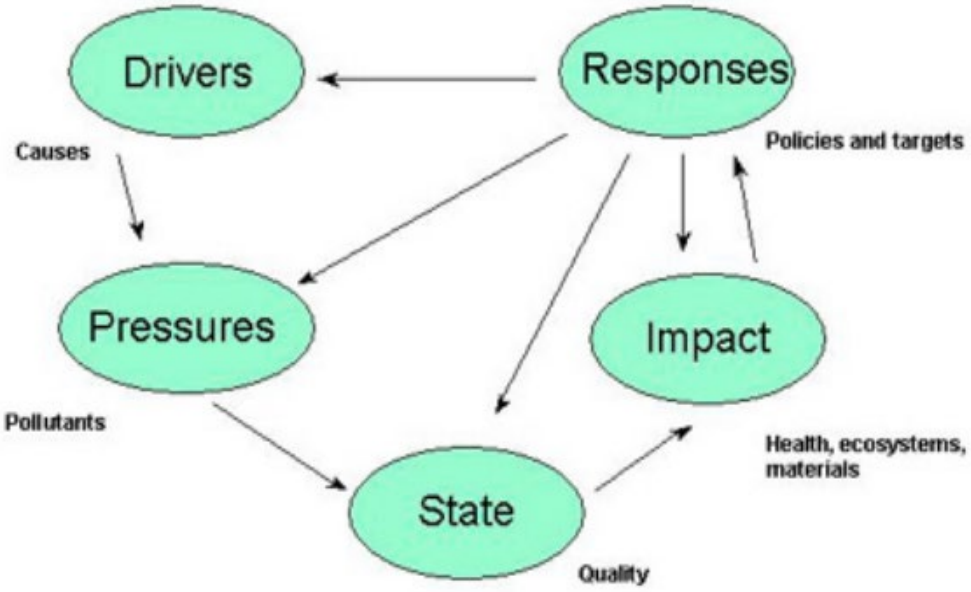
In order to accomplish this goal, the purpose of this study is to seek answers to important questions such as the environmental challenges that are associated with the rapid population growth in Thika Town, the fundamental causes of these challenges, potential solutions to address them in a sustainable manner, and how the findings of this study can contribute to the development of sustainable urban growth policies not only in Thika Town but also in other rapidly growing urban centers in Kenya and beyond. The most intensive interactions between human beings and the environment take place in cities and their peripheries. Rapid growth of cities and Towns causes land use /cover changes, while at the same time it brings about increasing environmental loads due to expanding use of energy and resources and impacts on human health and ecosystems. Thika Town serves as the dormitory Town of Nairobi City. Once considered the industrial Town of Kenya, this Town is witnessing a rapid growth in population. Statistics from the County government of Kiambu (2015) indicate that in 2009, the population in Thika was 136,917, in 2012 it rose to 148,960 and currently in 2015, the population was 162,061. The statistics further reveal that the population is projected to rise to 171, 430 in the next few years. These rising trends in population growth result to pressure on the environment due to an increased use of resources. It is in this regard that the study sought to establish the environmental problems associated with rapid population growth in Thika Town.

Objective

To assess the impact of rapid population growth on waste disposal in Thika Town, Kiambu County, Kenya.

Theoretical Model

The study was based on the Driving Force-Pressure-State-Effect-Response (DPSER) model, which was developed by the OECD (1994) in its work on the State of the Environment Reports and environmental data compendium. This model has been widely used in various international and national studies such as those by the United Nations Committee for Sustainable Development (UNCSD, 1996). The DPSER model (see Figure 1) was used in the study to analyze the urban environmental problems generated in the process of urbanization. The interactions between human activities in cities and the environment are particularly on the flows of energy and resources such as air, water, food, raw materials and land which are needed to support cities. According to the DPSIR framework, there is a chain of causal links starting with '*driving forces*' (economic sectors, human activities) through '*pressures*' (emissions, waste) to '*states*' (physical, chemical and biological) and '*impacts*' on ecosystems, human health and functions, eventually leading to political '*responses*' (prioritization, target setting, indicators). Describing the causal chain from driving forces to impacts and responses is a complex task, and tends to be broken down into sub-tasks, e.g. by considering the pressure-state relationship.



Source: Kristensen, P. (2004).

Figure 1: The DPSIR Model

In the DPSIR framework, a 'driving force' is defined as a need. Examples of primary driving forces for an individual are the need for shelter, food and water, while examples of secondary driving forces are the need for mobility, entertainment and culture. In this study, the driving forces for people to move the cities and Towns are the desires to fulfill their needs e.g. due to poverty in the rural areas, the need to look for greener pastures in terms of jobs employment or the motive to venture in new entrepreneurial opportunities within the Towns. These driving forces as a result lead to movement of people into Towns. Having moved to the Towns, there results to increased human activities such as transportation or food production for meeting the needs. These human activities exert 'pressures' on the environment, as a result of production or consumption processes, which can be divided into three main types: (i) excessive use of environmental resources, (ii) changes in land use, and (iii) emissions (of chemicals, waste, radiation, noise) to air, water and soil.

As a result of pressures, the 'state' of the environment is affected; that is, the quality of the various environmental compartments (air, water, soil, etc.) in relation to the functions that these compartments fulfill. The 'state of the environment' is thus the combination of the physical, chemical and biological conditions. The changes in the physical, chemical or biological state of the environment determine the quality of ecosystems and the welfare of human beings. In other words changes in the state may have environmental or economic 'impacts' on the functioning of ecosystems, their life supporting abilities, and ultimately on human health and on the economic and social performance of society. A 'response' by society or policy makers is the result of an undesired impact and can affect any part of the chain between driving forces and impacts. According to the DPSIR framework, it can be seen that it is the human needs that result to activities which negatively impact on the environment e.g. in terms poor solid waste disposal, effect on the transport system and a strain on the natural resources.

LITERATURE REVIEW

According to Dogan and Acar (2019), improper disposal of garbage may lead to a range of environmental problems, including contamination of the soil, pollution of the air and contamination of the water. Recycling, disposal in landfills, and the burning of garbage are the three methods of waste management that are used most often in urban environments. On the other hand, these methods have been connected to a variety of environmental problems, such as the emission of greenhouse gases, the contamination of water sources, and the contamination of soil (Tchobanoglous et al., 2014).

Research conducted by Lopez-Maldonado et al. (2018) found that efficient waste management systems have the potential to lessen the detrimental impacts that rapid population growth has on the ecology in the surrounding area. According to Tchobanoglous et al. (2014), integrated solid waste management methods such as reducing trash, sorting materials, and recycling may help cut down on the amount of garbage that is transported to landfills and burnt, which in turn leads to a drop in the emissions of greenhouse gases. Other integrated solid waste management strategies include reducing the amount of trash that is sent to landfills via the use of trash compactors. In conclusion, rapid population growth in urban areas has resulted in an increase in the production of garbage as well as poor processes for its disposal. Both of these factors have detrimental effects on the environment. In order to decrease the influence that rapid population growth has on the environment, more sustainable waste management systems are necessary to be implemented. These rules should promote recycling and responsible disposal while also reducing down on the quantity of garbage that is created.

According to Ahmed et al. (2016), urbanization has led to an increase in the consumption of commodities, food, and energy, which in turn has led to an increase in the production of waste as a consequence of the increased consumption. Urbanization and population growth have a significant impact, study that was published in Adebola (2018) found, not only on the amount of garbage that is generated but also on how it is managed. The present infrastructure for waste management is put under pressure by growing populations, which may result in inadequate garbage collection and disposal. This, in turn, might have a detrimental influence on the environment that is in the surrounding area.

The rapid growth in population has resulted in poor garbage disposal techniques, which in turn has led to a significant rise in the level of danger posed to the environment. These unacceptable behaviors include dumping waste in an illegal manner, burning trash in the open, and littering. These activities, as stated by Wang et al. (2016), are a factor in the contamination of the air and water, the creation of greenhouse gases, the contamination of the soil, and the dissemination of diseases. Burning garbage in an unregulated manner releases toxic substances into the atmosphere, which has a detrimental effect on the health of the people who live in the area. When garbage is dumped in an open area, it creates leachate, which is the liquid that is responsible for contaminating the groundwater.

The rapid natural population expansion in Kenya, together with growing levels of living, rural-to-urban migration, and higher standards of life overall, have all contributed to a rise in the accumulation of solid garbage in our cities and towns. For example, in Nairobi, the private sector is only responsible for collecting 20% of the city's garbage while the City Council is only responsible for collecting 40% of it. The remaining forty percent of waste is either not collected at all or is disposed of by burning it openly or dumping it in open spaces and pits (Ikiara, 2006).

This contributes to further environmental deterioration and increases the risk of health problems for those living in urban areas. The management system for municipal solid waste has to be created in order to enforce their management, including conceptual transition, sort collection, integrated disposal, and policy guarantee, in order to limit the health problems and environmental degradation that are caused by trash in cities. This will help to keep waste's impact on these issues to a minimum.

METHODOLOGY

The study employed a descriptive survey research design. The study was carried out in Thika Town in Kiambu County. The target respondents were Town Physical Planners, Local Officials of NEMA, members of the public and community members engaged in environmental conservation in the Town. Stratified random sampling was used to select 384 out of 162,061 community members (Kenya Bureau of Statistics, 2009). The researcher employed the use of questionnaires and interview schedules as the main tools for data collection. The data was coded and keyed into the computer using Statistical Package for Social Sciences (SPSS) Version 17.0. Quantitative data was analyzed using descriptive statistics like frequency counts and percentages. On the other hand, qualitative data was analyzed thematically in line with the study objectives.

FINDINGS AND DISCUSSIONS

The data used in the study was obtained through the use of questionnaires and interview guides. Questionnaires were structured to collect data from 384 community members; interview guides collected data from 5 local officials of NEMA, one Town physical planner and 1 District environmental officer yielding a total of 391 respondents.

Impact of Rapid Popultaion Growth on Waste Disposal and the Associated Environmental Problems

To address this objective, the study first sought to establish from the community members whether rapid population growth had any impact on waste disposal and the associated environmental problems. In response, 371 (96.6%) respondents reported that rapid population growth had an impact on waste disposal while 13 (3.4%) of them felt that it had no impact on waste disposal.

Environmental Problems Associated with Rapid Population Growth

Table 1 illustrates the most common environmental problems associated with rapid population growth in the study area.

Table 1: Environmental problems associated with rapid population growth

Environmental problems	Frequency (n=371)	Percentage
Water pollution	342	92.2
Air pollution	291	78.4
Poor disposal of waste	247	66.5
Creation of slums	234	63.1
Leaking of sewers	107	28.8
Soil pollution	84	22.6
Drainage system blockage	79	21.3
Clearing of natural resources	66	17.8
Natural disasters	57	15.4

As shown in Table 1, 342 (92.2%) respondents were of the view that water pollution was one of the most common environmental problem associated with rapid population growth. Majority of

these respondents stated that as the human population increases in Town, water pollution also increases. This problem occurs as a result of human activities, industrial waste, untreated sewage and urban settlement. Consequently, this leads to polluted water that is unsafe and not healthy for human consumption, animals and the plants. This concurs with what the Word Bank (1990) found out that about 400 million people or about one-third of the population in the developing countries do not have safe drinking water.

Another environmental problem encountered as a result of rapid population growth was air pollution. According to 78.4% of the community members, air pollution mostly occurs in Towns as a result of industrial pollution and also increased traffic between residences and workplaces, schools and shopping places. This as a result leads to a lot of noise in Town from traffic and residents, bad smell from industrial waste, higher production of carbon monoxide through exhaust from motor vehicles and also industrial smoke which eventually causes health problems such as respiratory systems infections, lung problems among others.

Poor disposal of waste in Town was another major challenge cited by 66.5% of the respondents. The findings revealed that although the Town municipal council discouraged waste discharge into land and water from industries and the residents, this problem still existed within Thika Town. This problem could be influenced by factors such as ignorance from some of the residents in Town or lack of awareness among the community members towards the negative impact of poor waste disposal. These results are in line with United Nations Centre for Human Settlements (UNCHS 2001b) which revealed that the volume of solid waste generated in urban areas is increasing with the growing population, higher consumption levels and the use of more packaging in the retail industry. It also stated that the rates of waste generation were outstripping the capacities of local authorities to collect, treat and dispose of the waste and that across Africa; only 31 per cent of solid waste in urban areas was collected.

Formation of slums was another environmental problem which occurred as a result of population growth in Thika Town. A notable number of respondents (63.1%) said that due to inability of the Town government to plan and provide affordable housing for the low income earners of the urban population, majority of these people move to the nearby slums where houses are cheap and hence increasing the proportion of people living in slums. Deforestation was also mentioned by 57.4% of the community members.

High population growth in Town brings with it negative influence on surrounding areas. This is because as the large population uses the available resources around them, they become more dependent on expansion and also human settlement. Other problems mentioned by a small number of community members were natural disasters such as drought (15.4%), clearing of natural resources (17.8%), drainage system blockage (21.3%) and soil pollution (22.6%). From the above findings, it therefore emerged that rapid population growth had negative impacts towards the environment. In line with these results, previous studies showed that rapid urbanization along with its increasing human activities imposes great challenges to urban environmental management. Rees, (1992); Rees and Wackernagel, (1994) emphasized that urbanization leads to the outward expansion of cities and results in changes in land use whereby urban residents buy up prime agricultural land for residential or commercial purposes. The conversion of farm lands and watersheds for residential purposes have negative consequences on food security, water supply as well as the health of the people, both in the cities and in the urban areas.

Health Problems Associated With Waste Disposal

Inappropriate management of waste disposal not only increases the pollution to the environment, but also threatens human health through its collection, transfer and disposal processes. In this view, the study sought to identify the most common health problems associated with waste disposal. Table 2 shows results of this analysis.

Table 2: Most common health problems associated with waste disposal

Problems	Frequency (n=371)	Percentage
Waterborne diseases e.g. Cholera	239	64.4
Skin diseases	176	47.4
Respiratory system infections	149	40.2

As shown in Table 2, 239 (64.4%) community members reported that water borne diseases such as Cholera and Diarrhoea were some of the most common health problems associated with waste disposal, followed by skin diseases (47.4%) and then respiratory system infections (40.2%). Based on these findings, it emerged that water and air pollution are significant factors associated with health problems. This concurs with the result findings by APHRC (2002) which found out that un-attended municipal solid waste poses health risks to the area residents such as water borne diseases that results to high mortality rates among children. The results also agree with the findings by UNEP (1994) which revealed that air and water quality in many cities threatens the health of millions of city residents. The major health problems experienced as a result of water pollution were diarrhoea, cholera, typhoid while those experienced as a result of air pollution were respiratory diseases such as lung problems.

Conclusion

The study concludes that rapid population growth in Thika Town is threatening the environment through uncontrolled growth of urbanization, industrialization, destruction of natural habitats and congestion in transport system. This has therefore become a main concern in Thika Town as it has led to various effects. The study revealed that rapid population growth has led to environmental problems such as water pollution, air pollution, poor disposal of waste, formation of slums, deforestation, poor maintenance of water supply, sewerage and sanitation systems and congestion in the transport system. The deterioration of living conditions in the Town had negative effects towards the environment and the health of people living in these areas. For instance, the study found out that people living in these areas are vulnerable to waterborne diseases, respiratory diseases and also skin diseases.

Recommendations

The study recommendations that; the government should install recycling plant within Thika to curb environmental degradation, set policies and implement proper urban planning focusing on possible population growth, encourage development of less developed areas to reduce population density and establish waste collection point that would control pollution.

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