**Journal of Social, Humanity, and Education (JSHE)**
*ISSN2746-623X, Vol 5, No 2, 2025, 119-130* https://doi.org/10.35912/jshe.v5i2.2365

# Dynamics in the carrying capacity of Ghana's population

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**Article History**
Received on 16 August 2024
1st Revision on 30 August 2024
2nd Revision on 25 October 2024
Accepted on 28 October 2024

**Abstract**
**Purpose:** This study assesses the limitations of Thomas Malthus' population theory and explores how Cornucopian perspectives offer solutions to the sustainability of Ghana's population within the framework of the vicious cycle model.
**Research methodology:** The study used existing literature to analyse historical and contemporary sources on Malthusian and Cornucopian perspectives; and applied it to the analysis of demographic data and socio-economic indicators to assess the applicability of these theories in a modern Ghanaian context.
**Results:** The study finds that Malthus' theory is limited by its failure to anticipate technological advancements and improved agricultural practices, which have mitigated the risks of a Malthusian crisis. Cornucopian theorists provide a more optimistic view, arguing that innovation and socio-economic development can counteract the negative effects of rapid population growth. In Ghana, strategic investments in education, health, and technology have the potential to break the vicious cycle of poverty and population growth, aligning with Cornucopian ideas.
**Limitations:** The study does not account for all local factors influencing population dynamics in Ghana.
**Contribution:** This study contributes to the field of population studies by providing a comparative analysis of Malthusian and Cornucopian theories, with a specific focus on their relevance to contemporary issues in developing countries like Ghana.
**Novelty:** The novelty lies in its application of classical population theories to the modern context of Ghana.
**Keywords:** *population, carrying capacity, sustainable development, vicious cycle model, poverty*
**How to Cite:** Bans-Akutey, A. (2025). Dynamics in the carrying capacity of Ghana's population. *Journal of Social, Humanity, and Education*, 5(2), 119-130.

## 1. Introduction

Developing countries are faced with issues of poverty which is partly a result of the rapid population growth in such countries (Gu, Andreev, & Dupre, 2021). In Ghana, the situation is not any different despite the marginal progress made in poverty reduction (Molini & Paci, 2015). Thomas Malthus' *Essay on the Principle of Population* (1888) has significantly influenced the study of population dynamics, asserting that population growth inevitably outstrips food production, leading to crises such as famine and societal collapse (Malthus, 1888). However, this theory is increasingly criticized by contemporary demographers for its failure to account for modern advancements in technology, agriculture, and socio-economic development (Kelly, 2021; Sharma, 2004; Unat, 2020). These criticisms highlight the need to reassess Malthus' predictions in light of current global and local contexts. In contrast, Cornucopian theorists argue that human innovation and technological progress can mitigate the challenges posed by population growth, presenting a more optimistic outlook (Bohr, Mestieri, & Yavuz, 2021; Jonsson, 2014; Marquette, Koranteng, Overå, & Aryeetey, 2002; Wagner, 2017). This study seeks to critically evaluate the limitations of Malthus' theory, particularly its relevance in the modern era, and to explore the potential of Cornucopian solutions to address these challenges. Additionally, it will assess the

sustainability of Ghana's population within the framework of the vicious cycle model, determining whether strategic investments in education, health, and technology contribute to better navigation of the challenges of rapid population growth.

## 2. Literature Review

### *2.1 The earth's carrying capacity*

The capacity of the Earth to maintain life is likened to a bus with a limited number of seats, where there are more people than there are seats. The bus's systems start to malfunction as more passengers board because of the strain. Similar to this, Earth can only host a limited number of living things before endangering its ecosystems permanently. The concepts of carrying capacity and limiting variables are essential to comprehending this idea. The highest population number of a species that can be maintained throughout time without running out of resources or harming the ecosystem is referred to as the planet's carrying capacity. The resources and environmental elements that establish this maximum population include food, space, and natural resources (Femmer, n.d.). Like the bus, vital systems will begin to fail if Earth's population grows above its carrying capacity. The entire web of life that depends on the resources of the planet will be impacted by this stress. Focusing on Earth's carrying capacity entails prudent resource management, reducing negative human environmental impact, and accepting the limitations of the planet. To guarantee a healthy relationship between humans and the Earth, it is essential to comprehend these concepts in order to make informed judgments concerning environmental legislation, conservation, and sustainability (Del Monte-Luna, Brook, Zetina-Rejón, & Cruz-Escalona, 2004).

Discussions concerning environmental conservation and the sustainability of Earth must take into account both government policies and technical developments (Bans-Akutey, 2023; Bans-Akutey & Ebem, 2022; Bans-Akutey & Tiimub, 2021). The carrying capacity of the planet is directly impacted by the decisions made by society. The carrying capacity of the Earth is a dynamic equilibrium in which natural variables and the availability of resources moderate population expansion (Wang, 2022). A population can expand quickly when it is below this limit. But when it gets closer to the limit, resource competition as well as external factors constrain growth, bringing the birth and death rates into equilibrium. The environment deteriorates, competition becomes intense, and resources become scarce as population growth outweighs carrying capacity. This leads to a precipitous drop in population as a result of higher death rates and reduced birth rates brought on by unhealthy living practices.

The carrying capacity of an ecosystem is determined by a multitude of elements that add up to the greatest number of people that can be supported sustainably over an extended period of time. These variables include the accessibility of resources, the appropriateness of habitats, the capacity to manage waste, the state of the ecosystem, and biological interactions (Cheng, 2024). The existence of basic resources like food, water, and other commodities needed for a population's survival is referred to as resource availability. There may be times when the population experiences hardship and shortage as a result of overpopulation making these resources scarce. A habitat's suitability and quality are major factors in population expansion. When a habitat satisfies a species' basic requirements, like offering enough space, shelter, and other necessities—it promotes healthy population growth. The environment must be able to handle the waste produced as the population grows. Degradation of the environment happens if waste generation outpaces the environment's capacity to handle or recycle it. This could ultimately reduce the amount of people that the environment can sustain. There is a direct correlation between population number and environmental factors like pollution, climate change, and general environmental health. Furthermore, carrying capacity is influenced by interactions within species, such as predation and illness. All of these elements work together to create the dynamic character of carrying capacity, which is necessary to preserve healthy ecosystems and guarantee the long-term survival of the communities that live there (Sayre, 2008).

Limiting factors fall into two categories: density-dependent and density-independent (Lerch & Abbott, 2024). They are restrictions that affect a habitat's carrying capacity. As the population increases, density-dependent effects become more significant, resulting in problems including higher rates of predation, increased competition for resources, and increased disease transmission. Population density

increases these effects, which have a direct impact on the population's capacity to flourish. On the other hand, variables unrelated to density have an impact on populations of any size. These include things like climate change, natural catastrophes, and other catastrophic events that have an impact on everyone, regardless of population size. Both kinds of limiting variables are essential in determining how populations behave and how well ecosystems function as a whole.

It is simplistic to assume that an environment's carrying capacity is exclusively based on the amount of open space that is present. In actuality, a number of intricate aspects, such as the availability of resources, the handling of waste, and diverse environmental conditions, affect an ecosystem's ability to support life. The entire range of factors that affect the number of people that an area can sustain over time is not taken into consideration by open space alone. Stress on Earth's carrying capacity is evident in current environmental challenges such as emissions of greenhouse gases, deforestation, and species extinction. These issues highlight how human activity is straining the planet's resources, particularly in light of the world's population which has exceeded 8 billion (Suhuyini, Akwotajie, & Yahaya, 2024). Stress like this indicates that the planet's capacity to support future generations is being threatened by our existing way of life. This raises important issues for society to consider: Is our planet's carrying capacity getting closer? In what way are we approaching this limit? What effects will this have on other organisms whose habitats are also being impacted? What obligations do we have as the present generation to the environment's preservation and resource management? In order to lessen the impact we have on the environment and guarantee that future generations may live within sustainable bounds, it is imperative that these questions are answered. We can more clearly see the necessity of resource conservation and comprehensive environmental management when we acknowledge the larger variables that affect carrying capacity.

Maintaining healthy ecosystems and populations requires an understanding of Earth's carrying capacity and limiting constraints. These ideas direct environmental preservation, management of resources, and policy-making initiatives to make sure human activity stays within the planet's long-term capacity to support life. The necessity for proactive conservation policies and appropriate resource management is highlighted by the realisation of the wider effects of environmental stress and population increase. This strategy emphasises how crucial ethical issues are to maintaining ecological balance and guaranteeing the well-being of future generations. Precautionary planning and efficient management of natural resources is necessary to protect the health of the planet and the welfare of all creatures that rely on it.

### *2.2 Vicious Cycle Model*

A self-perpetuating pattern of increasing populations and economic hardship is described by the population model known as the Vicious Cycle Model, which is frequently linked to the theories of Reverend Thomas Malthus (Malthus, 1888). According to the concept, population expansion tends to outpace the economy's capacity to meet people's basic requirements, creating a vicious cycle of poverty and hardship. One common way to define the self-reinforcing aspect of the Malthusian viewpoint is as a "vicious cycle". The theory put forth by Thomas Malthus in his 1798 publication "Essay on the Principle of Population" postulated that resource growth is linear but population growth is exponential. This mismatch causes a never-ending battle for resources, which fuels cycles of famine, sickness, and population increase. The self-perpetuating dynamics found in Malthusian Theory are characterised by the Vicious Cycle Model, which is not a distinct theory in and of itself. The link between population increase and resource availability, which results in cycles of poverty and struggle, is at the heart of both conceptions. Though Malthusian theory has some historical influence, arguments on population dynamics nowadays frequently take a wider variety of issues into account, such as government policies, advancements in society and economy, and technological breakthroughs.

### *2.3 Arguments of the proponents of the Vicious Cycle Model of population*

Advocates of the Vicious Cycle Model of growth in population primarily point to population checks, exponential population growth, decreasing agricultural returns, Malthusian crises, and limited advancement in technology. It is stated that populations often double over predetermined spans of time due to exponential growth. The vicious cycle is thought to be mostly driven by this rapid expansion. The burden on vital resources like food, water, and arable land rises as the population grows (Matthew

& Onwuzor, 2023). As a result, more land is used for agriculture. Proponents counter that the increased work and resources used in farming yield declining benefits. Malthusian crises result when the agricultural sector is unable to meet the demands of a fast-expanding population since each extra unit of input reduces overall production. Widespread starvation, illness, and mortality are hallmarks of these crises; these natural controls on population expansion serve to bring it back into balance with available resources. As a result, the cycle contains harsh times that serve as restraints on population growth. Technological innovation and agricultural breakthroughs have limited incentives in a world where resources are perpetually scarce. Because survival is the primary concern, cultures might not invest in creating technologies that could break the cycle by boosting productivity and resource efficiency (Seidl & Tisdell, 1999).

The foundation of the Vicious Cycle Model is the theory that population expansion, left unchecked, can result in an endless cycle of resource depletion, poverty, and recurring crises. While these concepts have had historical sway, it's vital to remember that modern viewpoints on population dynamics take a more comprehensive approach and acknowledge the influence of progress, technology, and government. The sections that follow go into great detail about the proponents.

### *2.3.1 Exponential Population Increase*

One of the main tenets of the Malthusian Vicious Cycle Model is the idea of exponential population growth. The usual line of argument for proponents of exponential population growth is that populations have the capacity to develop at an exponential rate, meaning that over predetermined times, the population size doubles. A situation known as exponential growth occurs when a population grows by a predetermined proportion over a given amount of time. It is typified by a steadily increasing growth rate, which, when plotted, results in an ever-steeper upward trajectory. The theories of Reverend Thomas Malthus, who expressed them in the latter part of the 18th and early 19th centuries, helped to popularise this concept. According to Malthus, populations have a tendency to develop exponentially when unrestrained and to double every few years.

The rapid increase in population, according to advocates of exponential population growth, severely strains vital resources including food, water, and land. Demand for these natural assets rises exponentially with each doubling of the population, possibly beyond the environment's ability to support such development. A key component of the Vicious Cycle Model is the exponential tendency of population expansion. Some argue that the population is growing faster than available resources, creating a vicious cycle of limited supplies, poverty, and catastrophes. It is frequently connected to the average human population's natural rate of reproduction. Proponents contend that unregulated population expansion and population momentum can be caused by the biological potential for reproduction in conjunction with specific cultural and socioeconomic conditions. Population momentum is linked to exponential growth, whereby a population's age distribution allows it to sustain development for a while even in the face of declining birth rates. This phenomenon is thought to be a result of previous exponential expansion and keeps the population growing.

Even though the theory of exponential population growth had significant influence in the past, modern demographers and economists frequently stress the significance of taking into account a variety of factors in order to understand and manage population growth, including family planning, educational attainment, and technological advancements. As civilisations advance, high birth and death rates typically give way to low ones, according to the demographic transition theory, for example. Thus, when studying modern population dynamics, it is crucial to take a wider range of variables and viewpoints into account. The proponent of exponential population increase, in summary, highlights the innate capacity for populations to grow quickly and how this may contribute to the dynamics defined by Malthusian theory in the Vicious Cycle Model.

### *2.3.2 Diminishing Returns in Agriculture*

One of the main ideas of the Malthusian Vicious Cycle Model is the idea of declining returns in agriculture. According to this theory, there comes the point at which every additional unit of input such as labour, fertiliser, or land, contributes a decreasing proportion to overall agricultural output as the

population increases and more resources are allocated to agriculture. A key idea in economics is the principle of diminishing returns, which argues that when one input variable is raised while other inputs remain constant, there will come a point at which the additional output per unit of input will decline. The concept of decreasing returns is applied to agricultural productivity within the framework of Malthusian theory. More area is farmed and resources are dedicated to agriculture as the population rises. Proponents counter that the productivity increases brought about by more inputs have a limit.

At first, yields may rise as additional land is put to use for farming. However, the quality of the land that is accessible is limited, and productivity benefits from cultivating marginal or less productive ground are smaller. Once more, hiring more people to work in agriculture may initially increase output, but eventually this will cause overpopulation, which will lower productivity and efficiency per worker. Lastly, there can be decreasing returns as more resources such as water, fertilisers, and machinery, are used in agriculture since they might not be used as effectively or efficiently over time.

The idea of diminishing returns is commonly represented on a graph by a curve that slopes upward at first, signifying growing returns, but ultimately levels off and may even begin to slope downward, signifying diminishing returns. In the framework of the Vicious Cycle Model, diminishing returns in agriculture are essential. There is more demand to farm more area and intensify agricultural operations as the population expands. But because of the diminishing returns, more work and money may need to be put into agriculture in order to fulfil the rising demands of a population that is expanding quickly.

Though previous debates were influenced by the notion of decreasing returns in agriculture, substantial gains have been made in modern agricultural operations (Baron, 2024). The application of genetically modified organisms, enhanced farming practices, and technological advancements have partially mitigated the impacts of diminishing returns. However these developments vary from place to place and might not completely solve the problems brought on by population expansion and resource shortages.

*2.3.3 Malthusian Crises and Population Checks*

Malthusian theorists contend that natural processes, sometimes known as population checks or Malthusian crises, take over to control the population when unbridled population expansion and finite resources collide. Malthusian crises are characterised as times of great adversity and suffering brought on by an unbalanced population increase and resource availability. Famine, illness, and high death rates are hallmarks of these crises, which serve as organic controls that bring the population down to a level where resources can support it. Population checks are thought to be innate systems that keep populations from continuously growing faster than the environment's ability to support them.

Positive and preventative checks are the two main categories of population checks that Malthus distinguished. Positive checks include natural occurrences like starvation, illness, and conflict that raise death rates. Positive checks are thought to restrain population increase by lowering the total number of people. On the other hand, preventive checks are deliberate steps that societies and individuals take to lower birth rates. Although Malthus conceded that people could control their reproductive conduct, he maintained that positive checks on population increase were a more effective means of limiting population expansion.

Periods of crisis arise as resources become limited and the population expands, bringing the population down to a level that is more sustainable. Nevertheless, the cycle might recur as the population begins to rebound during periods of relative abundance. Malthusian crises were historically documented in a number of countries where phases of population expansion were followed by bouts of sickness, starvation, and other calamities. Malthusian theories were frequently applicable to food shortages in pre-industrial agrarian civilisations because agricultural output was unable to keep up with population growth. Malthusian crises have important ramifications for society and the economy. Famine and disease outbreaks can cause social instability, economic downturns, and heightened competition for resources. After a crisis, population demand on resources may momentarily lessen, allowing for a time of recuperation.

Modern researchers and critics of the Malthusian paradigm frequently point out that improvements in agriculture, technology, and society have lessened the incidence and severity of Malthusian crises in various parts of the world. Still, the idea is still applicable in areas where resource shortages continue.

*2.3.4 Limited Technological Innovation*

One of the main components of the Malthusian Vicious Cycle Model is the idea of limiting innovation in technology. The theory's proponents contend that population expansion and ongoing resource scarcity limit nations' ability and motivation to engage in and implement technical advancements that have the potential to end the cycle of poverty. It is argued that there is little motivation for cultures experiencing chronic resource scarcity to make investments in and adopt new technology, especially when it comes to agriculture. It is more common to prioritise short-term necessities and subsistence over long-term technological advancement. Rapid population growth puts more strain on the resources that are available. According to proponents, in these kinds of circumstances, most resources are devoted to addressing pressing issues like food supply, leaving little time and money for new technology adoption, research, and development resulting in what is referred to as the "Malthusian trap" According to the theory known as the "Malthusian trap," population increase eventually absorbs all technical productivity advances, meaning that living standards barely change. Even if technological advancements are made, supporters contend that the benefits are frequently fleeting because the expanding population soon outpaces the advancements.

Advocates point out that in the agriculture industry, limiting technological innovation is a factor in diminishing returns. New farming methods, equipment, or crop types may at first increase production, but if population growth remains high and puts strain on available resources, the gains might not last. Supporters point out that institutional and cultural variables might also be important in constraining technical advancement. Adopting new technology can bring about changes that societies with deeply ingrained institutions and social norms may find difficult to accept, especially if such changes contradict long-standing customs (Mohammed, Philip & Labaran, 2024).

People and communities may not have the financial means to support education and research in settings with limited resources and low incomes. The struggle for resources and the emphasis on short-term survival might impede the growth of a culture that values creativity and education. Hunger crises and disease outbreaks are examples of Malthusian crises that might discourage innovation. During times of crisis, attention and resources are frequently directed towards short-term relief and recovery efforts rather than longer-term investments in technology developments.

Although the notion of limited technical innovation held sway in the past, modern viewpoints recognise that advancements in technology have been instrumental in disrupting Malthusian cycles in numerous locations. Opponents contend that rather than concentrating just on technological limitations, the emphasis should be on sustainable development, governance, and equal distribution. To interrupt the cycle, policies addressing poverty, population growth, and resource distribution are crucial (Achiro & Mwesigwa, 2023). Encouraging sustainable farming methods, healthcare, and education can foster an atmosphere that is more innovative (Price, 1999).

In conclusion, exponential population expansion, falling agricultural returns, Malthusian crises, population checks, and limited technical innovation are the key points of support associated with the Vicious Cycle Model of population. While these ideas were historically linked to Malthusian thought, it's crucial to remember that modern perspectives on population dynamics take a wider range of issues into account, such as government policies, social and economic progress, and technological advancement. Many contend that advancements in technology and adaptable tactics can end the alleged "vicious cycle" that the Malthusian viewpoint describes.

## 3. Research Methodology

The study first conducted an extensive review of existing literature on Malthusian and Cornucopian perspectives. This review involved examining classical sources, seminal works, and recent studies that

discuss these population theories. The literature review helped outline the key arguments, strengths, and criticisms of each perspective, thus providing a theoretical basis for further analysis. It explored how these perspectives respond to current issues like climate change, technological advances, and changing socio-economic landscapes. The approach helped reveal any shifts in relevance or applicability of the theories in recent context. It then integrated demographic data specific to Ghana to assess population growth trends, birth and death rates, and other key population indicators. After gathering and analysing the data, the study then applied the insights derived from the literature review, demographic data, and socio-economic indicators to the Ghanaian context.

## 4. Results and Discussions

### *4.1 Sustainability of Ghana's population in relation to tenets of the Vicious Cycle*

The key components of the vicious cycle include exponential population expansion, decreasing agricultural returns, Malthusian crises and population checks, and restricted technical progress, as was covered in the preceding section. According to the vicious cycle, population expansion tends to outpace the economy's capacity to meet people's basic needs, creating a vicious cycle of poverty and hardship. Before starting any development goal, countries must assess their population structure in order to build successful policies and strategies that handle population concerns. As to the 1969 National Population Policy of the Republic of Ghana, the human population is deemed a crucial element for social and economic planning and advancement (Benneh, Js, & Gyepi-Garbrah, 1989; Kwankye & Cofie, 2015). Recommendations from the International Conference on Population and Development (ICPC, 1994), proposed the need to take into account demographic features during national development planning (UNFPA, n.d.). Comprehending the historical, contemporary, and prospective demographic patterns of Ghana is crucial for making well-informed judgements.

Ghana's population roughly doubled between 1960 and 1984, according to the Institute of Statistical and Social Research's May 2023 policy brief. The total number of people doubled and grew by 25% between 1984 and 2010, hitting 30.8 million in 2021. If the present annual growth rate is sustained, Ghana's population is expected to double during the subsequent 33 years, hitting 61.6 million by 2051. The research states that in 2021, males accounted for 49.3% of Ghana's population, while females made up 50.7%. The demographic composition of Ghana is changing from a wide pyramid with a large percentage of youth into an aging pyramid with a protruding middle class. Between 2000 and 2021, the percentage of young people aged 0-14 progressively decreased from 41.3% to 35.3%. With a dependency ratio of 66, it means that for every 100 people of working age (15–64 years), there are approximately 66 dependent people (ages 0–14 and 65+). The percentage of young people aged 15 to 35 has increased from 34.6 percent in the year 2000 to 38.2 percent in 2021, in contrast to children. In order to bolster the nation's development strategy and leverage the demographic dividend, it is imperative to invest in improving the skills and capabilities of the younger generation.

According to the research, the Greater Accra Region surpassed the Ashanti Region in numbers (17.7% of the total population) to become the most populated region in Ghana in 2021 (17.6%). By 2040, the population of the Greater Accra Metropolitan Area (GAMA) is projected to be at 10.5 million. The region still faces environmental and socioeconomic concerns despite tremendous advances. Due to a severe housing scarcity, population growth has led to a spike in informal settlements, especially slums. Waste management problems have been made worse by the region's expanding population; only 15% of GAMA is serviced by sewage systems, and 32.3% of garbage and trash is dumped in open spaces or sewers.

Although there have been regional and spatial variations, the nation's fertility rate has declined dramatically in recent decades. The total fertility rate (TFR) is expected to drop to 3.7 in 2021 from 6.4 per woman in 1988. The declining fertility rate affects a nation's development socioeconomically in both positive and bad ways, especially in terms of the size of its workforce. Between 2000 and 2020, the average life expectancy at birth grew from 57 to 64 years (Worldbank, 2022). Generally speaking, women outlive males. In Ghana, chronic non-communicable diseases accounted for the majority of institutional deaths. The Covid-19 epidemic claimed lives as well.

Over time, Ghana has experienced a tremendous increase in urbanisation. 2021 saw a 56.7% increase in the urban population from 23.1% in 1960. Urban primacy, with large populations in towns and cities and relatively unpopulated villages, is a defining feature of Ghana's urbanisation, creating challenges for infrastructure development and spatial planning. Interregional migration is the main factor driving Ghana's urbanisation; resource-rich regions get more migrants than less prosperous ones. Urbanisation and migration are related as the third factor influencing population change. The vast majority of the nation's migration occurred in urban areas between 2000 and 2017. Urban-urban migration has overtaken urban-rural migration in terms of prominence. Large cities and towns draw more migrants as people relocate from smaller to larger urban regions, which raises population densities and concentrations. Due to migrant inflows from smaller urban centres, Ghana's urbanisation is predicted to continue, albeit to differing degrees within the country's regions.

The May 2023 edition of the Institute of Statistical and Social Research's policy brief details the notable changes that Ghana's demographic landscape has experienced. The section that follows examines Ghana's population sustainability in light of the main principles of the Vicious Cycle Model, with a particular emphasis on urbanisation, demographic transitions, and exponential population growth.

*4.1.1 Exponential Population Growth*

The data illustrates a historical trend of exponential population expansion, with Ghana's population increasing by 25% between 1984 and 2010 and nearly tripling between 1960 and 1984. There are questions regarding how long this population boom can be sustained given the prediction that it will double to 61.6 million people by 2051. The Vicious Cycle Model states that high population increase can put a strain on available resources, impede economic growth, and exacerbate poverty. These could have an adverse effect on sustainable development.

The challenges of maintaining such growth are further highlighted by the changing demographic structure, which is moving from a broad pyramid with a large proportion of youth to an ageing pyramid with a protruding middle. Opportunities and challenges arise from the proportion of youngsters (0–14 years old) declining and the proportion of young individuals (15–35 years old) rising. Younger people can increase economic production, but they also put more pressure on healthcare, employment, and education systems. This is due to the fact that there will certainly be more individuals to take care of due to the nation's scarce resources.

Ghana's fertility rate dropped dramatically from 6.4 births per woman in 1988 to 3.7 expected in 2021, according to the report. The country's development is impacted by this drop in both beneficial and detrimental socioeconomic ways, especially in terms of the workforce's size. A decreased reproduction rate raises issues with labour market dynamics and provides for an ageing population, even though it could additionally lead to a prospective demographic dividend. According to the vicious cycle concept, a decline in fertility will have a favourable impact on Ghana's population's sustainability. By ensuring that parents only have as many children as they can care for, a declining birth rate will help to break the cycle of poverty.

Security, work, education, and health are just a few of the areas that are impacted by the pace of population growth. A nation's labour supply is derived from the country's population and rate of growth, which are influenced by migration, birth rate, and death rate. The demand for work is met by the state of the economy. An imbalance in the labour supply and demand leads to underemployment and unemployment. A high dependency load and young age structure feed a vicious cycle that results in low investments and savings per person, limited economic growth, and an inadequate standard of living. Their high reproductive rates add to the cycle's perpetuation by raising the load of dependents. Only two times could such a vicious cycle be broken. First, during the period of high fertility, mainly through the implementation of a successful family planning program; and second, during the period of poor economic growth, through the adoption of measures to quicken economic development.

*4.1.2 Urbanization and Regional Challenges*

The Vicious Cycle Model heavily relies on Ghana's fast urbanisation, which is defined by an increase in the number of urban residents from 23.1% in 1960 to 56.7% in 2021. Due to a lack of housing, the Greater Accra Region has grown to be the most populous, posing problems like garbage management and informal settlements. If urban population density is not controlled properly, it can worsen resource depletion, environmental damage, and social inequity. The Greater Accra Metropolitan Area (GAMA)'s issues that have been reported draw attention to the possible negative effects of increasing urbanisation. The vicious cycle may be sustained by informal settlements and insufficient waste treatment systems, which may result in health problems, environmental damage, and social discontent.

*4.1.3 Demographic Changes and Economic Implications*

A complicated situation is presented by the demographic shifts, which include a declining fertility rate and an increasing life expectancy. The declining fertility rate presents difficulties due to a declining workforce size, even if it may also have favourable socioeconomic implications as an anticipated demographic dividend. The demographic scenario is further complicated by the impact of the COVID-19 pandemic and the incidence of chronic non-communicable diseases.

Ghana's demographic difficulties are made more complex by the stated dependence ratio of 66, which indicates that for every 100 people of working age (15–64 years), there are 66 people who are dependent (aged 0–14 and 65+). A high dependency ratio puts a heavy burden on working-age people to support their dependents, which could impede economic growth and prolong the cycle of resource depletion.

In conclusion, the policy brief's description of Ghana's population dynamics shows that there are a variety of opportunities and difficulties. Effective policies addressing difficulties associated with urbanisation, demographic transitions, and exponential population growth are critical to ensuring the continued existence of Ghana's population. It is imperative to strike a balance between resource management, social development, and economic growth in order to break the possible vicious cycle and give Ghana's people hope for a future that is sustainable. For Ghana to be resilient and affluent, efforts should be concentrated on comprehensive strategies that take into account the interaction of socioeconomic, demographic, and environmental factors.

***4.2 Carrying Capacity of Ghana's Population***

The carrying capacity of Ghana's population is determined in large part by the dynamics of population growth, demographic transitions, urbanisation, and dependence ratios, as noted in the policy brief from the Institute of Statistical and Social Research (Quartey, 2023). The interdependence of these elements and their consequences for Ghana's population carrying capacity and sustainability are examined in this conversation.

Ghana's population has grown significantly: it nearly doubled between 1960 and 1984, doubled again between 1984 and 2010, and is expected to double again, reaching 61.6 million by 2051 if the present growth rate continues. Carrying capacity is the highest population that an ecosystem can support without degrading. Unchecked population expansion can put a strain on Ghana's resources, affecting things like the production of food, water availability, and the sustainability of the ecosystem as a whole.

There are serious issues with the reported dependence ratio of 66, which means that there are 66 dependents per 100 people of working age. A high level of dependency can put financial pressure on the provision of social welfare, healthcare, and educational services, among other necessities. Ghana's population carrying capacity depends on the working-age population's ability to sustainably support dependents. To maximise carrying capacity, effective policies and programs that improve youth productivity and skills are essential.

The changing proportions of children (0–14 years old) and young people (15–35 years old), along with the shift in demographics from a wide pyramid to an ageing pyramid, add complexity to the dependency dynamics. If properly managed, an ageing population can potentially result in a demographic dividend even though it may also put more strain on healthcare systems. When evaluating the capacity for growth

of the health care system, social assistance programs, and the economy as a whole, it is essential to comprehend how demographic transitions interact.

The carrying capacity is affected by the decreasing fertility rate, which dropped from 6.4 per woman in 1988 to 3.7 in 2021 per woman, especially in light of environmental sustainability. Reducing the fertility rate helps to preserve natural resources and increase the ecological carrying capacity overall. To guarantee a sustainable equilibrium, fertility trends must be balanced with economic and social factors. This therefore is a plus for the country in relation to its carrying capacity.

The Greater Accra Region is rapidly becoming more urbanised, which is causing issues with waste management, infrastructure, and housing capacity. The concentration of population in metropolitan areas may put pressure on the carrying capacity of certain places, necessitating efficient administration of resources and urban planning. Urban informal settlements and the scarcity of reasonably priced housing are two prominent instances of the problems that must be overcome in order to maximise carrying capacity.

In summary, a complex web of elements, such as exponential population growth, dependence ratios, demographic transitions, fertility trends, and urbanisation, are closely related to Ghana's population-carrying capacity. A comprehensive strategy that strikes a balance between social progress, environmental preservation, and economic development is needed to reach a sustainable carrying capacity. To ensure that Ghana's population can flourish within its ecological and socioeconomic bounds, policies that maximise the demographic dividend, manage urbanisation responsibly, and improve young skills are essential. Understanding these interrelated elements will help formulate sensible plans for Ghana's resilient and sustainable future.

## 5. Conclusion

### *5.1. Conclusion*

This study successfully assessed the limitations of Thomas Malthus' population theory, particularly its inability to foresee technological advancements and agricultural improvements that have helped mitigate the risks of a Malthusian crisis. By contrasting Malthusian perspectives with those of Cornucopian theorists, the study highlights the latter's positivity regarding human innovation and socio-economic development as solutions to rapid population growth. In the context of Ghana, the findings suggest that strategic investments in education, health, and technology could break the vicious cycle of poverty and population growth, aligning the country more closely with Cornucopian ideals. Therefore, the study's objectives—examining the relevance of classical population theories and evaluating the sustainability of Ghana's population—were effectively accomplished.

### *5.2. Limitation*

This study is primarily based on a literature review and secondary data, which may not fully capture the local distinctions and specific factors influencing population dynamics in Ghana. The reliance on existing data may have excluded recent developments or unique socio-cultural factors that could impact the applicability of Malthusian and Cornucopian theories in the Ghanaian context.

### *5.3. Suggestion*

Future research should consider incorporating primary data collection to gain a more comprehensive understanding of population dynamics in Ghana. This could include surveys, interviews, and field studies to explore local factors and recent developments that may influence the country's carrying capacity. Additionally, policymakers in Ghana should focus on integrating Cornucopian principles into national development strategies, emphasizing investments in education, health, and technological innovation. These efforts should be complemented by policies aimed at reducing environmental impact and enhancing resource management, ensuring that Ghana's population can grow sustainably within its ecological limits.

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