

Application of Science, Technology and Innovation (STI) in the Management of Population Growth and Human Capital Development

DR. I.D. CHOJI, mni
Research Directorate

National Institute for Policy and Strategic Studies, Kuru

Abstract:- The dangers about the ominous relationship between population growth and resources has been captured thus: *“Whether we accept it or not, this will likely be the century that determines what the optimal human population is for our planet. It will come about in one of two ways: Either we decide to manage our own numbers, to avoid a collision of every line on civilization's graph - or nature will do it for us, in the form of famines, thirst, climate chaos, crashing ecosystems, opportunistic disease, and wars over dwindling resources that finally cut us down to size”* Alan Weisman (2013).

I. INTRODUCTION

Indeed, population growth and its dynamics are intrinsically linked with patterns of human, economic and social development (Iammorino et al 2017). Population growth and its structure play a crucial role in the achievement of effective human capital development. According to a United Nations (UN) report, the world's population is expected to increase by two billion persons in the next 20 years, from 7.7 billion currently, to 9.7 billion in 2050 (UN, 2019). The continued rapid population growth presents challenges for sustainable development including human capital development. The 47 least developed countries happen to be the world's fastest growing. Many are projected to double in population between 2019 and 2050, putting pressure on already strained resources and challenging policies that aim at achieving human capital development (UN 2019). As a result, many countries are putting in place measures to control population growth and improve human capital development. In Nigeria a lot of efforts have been geared at managing and controlling population. These efforts include the application of Science and Technology among others like strengthening of policy, institutional and legal frameworks. The Nigerian government for example came up with different population policies over time. These include: The National Population Policy in 1988, and the National Population Policy for Sustainable Development of 2004. The goals of the policies were principally to reduce population growth rates, while improving standards of living and the quality of lives of Nigerians. Additionally, the policies were aimed at promoting the health and welfare of Nigerians, preventing the causes and spread of HIV/AIDS Pandemic amongst others.

In spite of all efforts made to control and/or manage Nigeria's population growth, the situation remains critical as the growth continues to show profound disproportion when analysed with development indicators such as: 21 doctors per 100,000 persons, an infant mortality rate of 112 per 1000 live births and a life expectancy at birth projected to be 50 years. The rapid population growth in Nigeria is equally associated with unemployment figures ranging from 23 percent per annum for the entire population to 55.4 percent for the youth (NBS 2020). The Human Capital Development Index (HCDI) ranks low (0.673) when compared with other countries like; Algeria (0.759), and Botswana (0.728). (UNDP 2019). This ominous situation calls for a radical approach through adopting Science and Technology in tackling the situation.

II. CONCEPTUAL CLARIFICATIONS

Population refers to a collectivity of persons that persists through time, even though its members are continuously changing through attrition and accession. Demography on the other hand focuses on enduring collectivity-changes in its size, growth rate and composition, as well as implications of processes for individuals. Population growth is the change in the population over time, and can be quantified as the change in the number of individuals of any species in a population using per unit time for measurement.

➤ Components of Population Growth

Population growth on the other hand according to the UN (2013), is an average exponential rate of growth of the population growth over a given expressed as percent.

The Components of Population Growth constitute the following:

- $P_t = P_0 + (B - D) + (I - E)$
 - Where P_t = Population at time t ,
 - P_0 = Population at time 0.
 - B = Natural Births
 - D = Natural Deaths
- } Natural increase

- I= Immigration (Arrivals)
 - E=Emigration (Departures)
- } Net Migration.

Population growth can occur if:

Natural increase is positive; births are greater than deaths which connotes increase or declines and/or; net migration is positive; Immigration increases or Emigration declines. Population growth can also be considered as being optimum, that is, population level at which the highest economic standard of living is achieved. The available resources are exploited effectively. On the other hand, under- population occurs if increases in the population level allows more effective exploitation of the resources available (food, energy, land etc) and lead to higher income per

capita. Finally, over-population occurs when increases in the population level pass the optimum point resulting in lower standard of living. Resources are shared among more people and the economic standard declines.

➤ *Population Structure (Composition)*

So many factors tend to influence the structures of population. Such factors as birth, deaths, and migration do not only affect the population structures but also predisposes it to other challenges that temper with the population structure. A worthy determinant in the strength for future growth in particular age group or even the entire population is the age-sex structure. Considering age as a population structure has significant implications for government policies, as a population of youths will require sufficient number of schools and jobs to accommodate them.

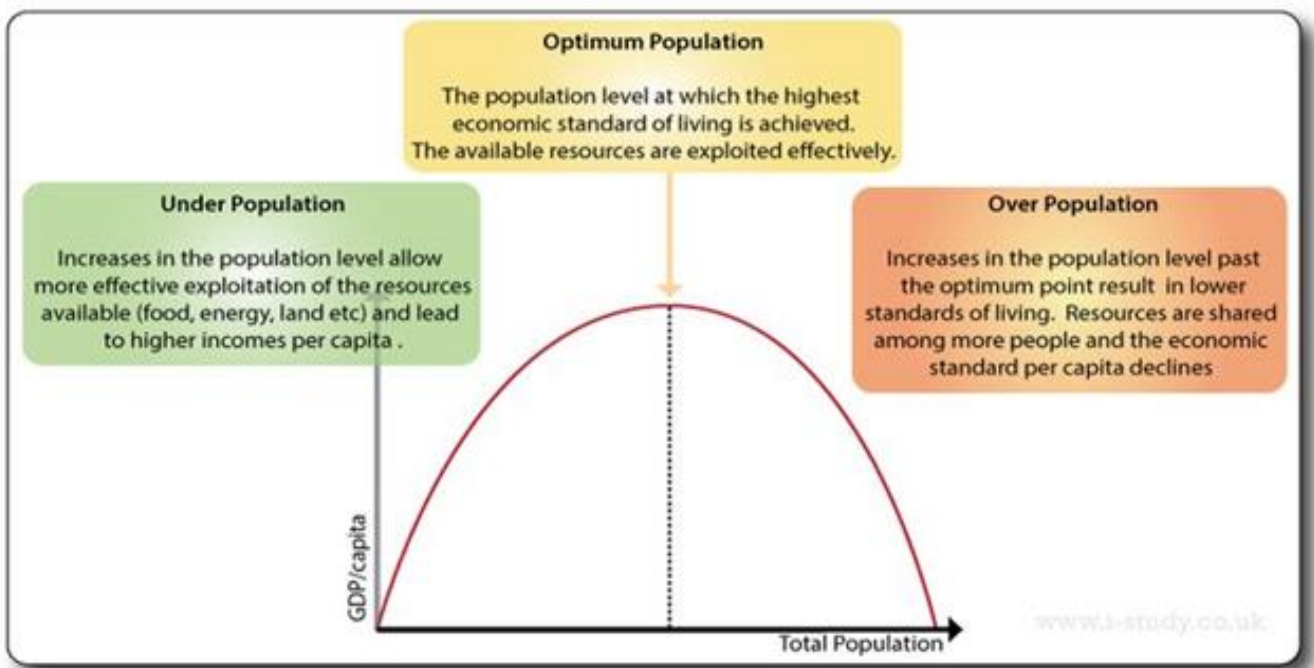


Figure 1.0 Types of Population Growth.

III. HUMAN CAPITAL DEVELOPMENT

➤ *Human Capital:*

Human capital hedges around but not totally limited to knowledge, skills, and health which a population accumulates throughout their lifetime, which helps them to realize their worth as a productive members of a society, World Bank (2017). Investing in people through nutrition, health care, quality education, jobs, and skills helps develop human capital and this is key to ending extreme poverty and creating more inclusive societies. According to World Bank 2018 index on human capital, Nigeria ranks 152 out of 157 countries, the results of under investment, which rates the countries human capital as weak from many view points. Education, on-the-job training and health are components of human capital and all have consequences for earnings and

economic productivity. Migration is important as it leads to addition of stock of human capital for the country of destination and depletion in country of origin. It is a well known fact that investing in human capital is decisive, since it's aimed at making sure that human resources are knowledgeable, skilled, productive and healthy. Obviously, this will facilitate the optimal exploitation and deployment of many resources to engender growth and development.

➤ *Nigeria's Population Growth Trends*

Nigeria has an estimated population of 200 million (The most populous country in Africa). Growth rate of between 2.6 – 3.2% per annum. The country is characterised by youthful population, with a broad-base (Youth Bulge).

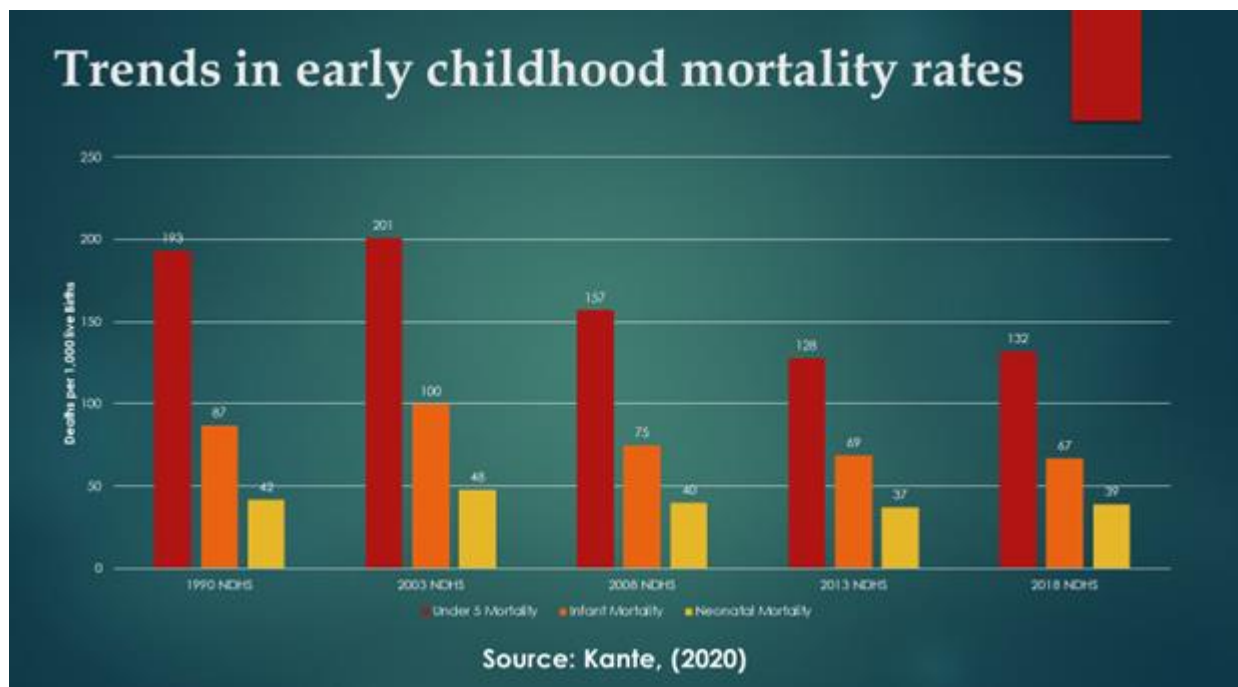


Figure 1.1 Trends in early childhood mortality rates

➤ *Fertility, Mortality and Migration*

There has been a general decline in four key mortality indicators: Infant, child, and under-five, as well as maternal mortality rates. (NDHS, 2018). Under 5 mortality declined from 157 deaths per 1,000 live births in 2008 to 132 deaths

per 1,000 live births in 2018. Infant mortality rate declined from 75 deaths per 1,000 live births in 2008 to 67 deaths per 1,000 live births in 2018. In terms of pattern, under 5 mortality rates is highest in the North West (187 per 1,000) and lowest in the South West that:

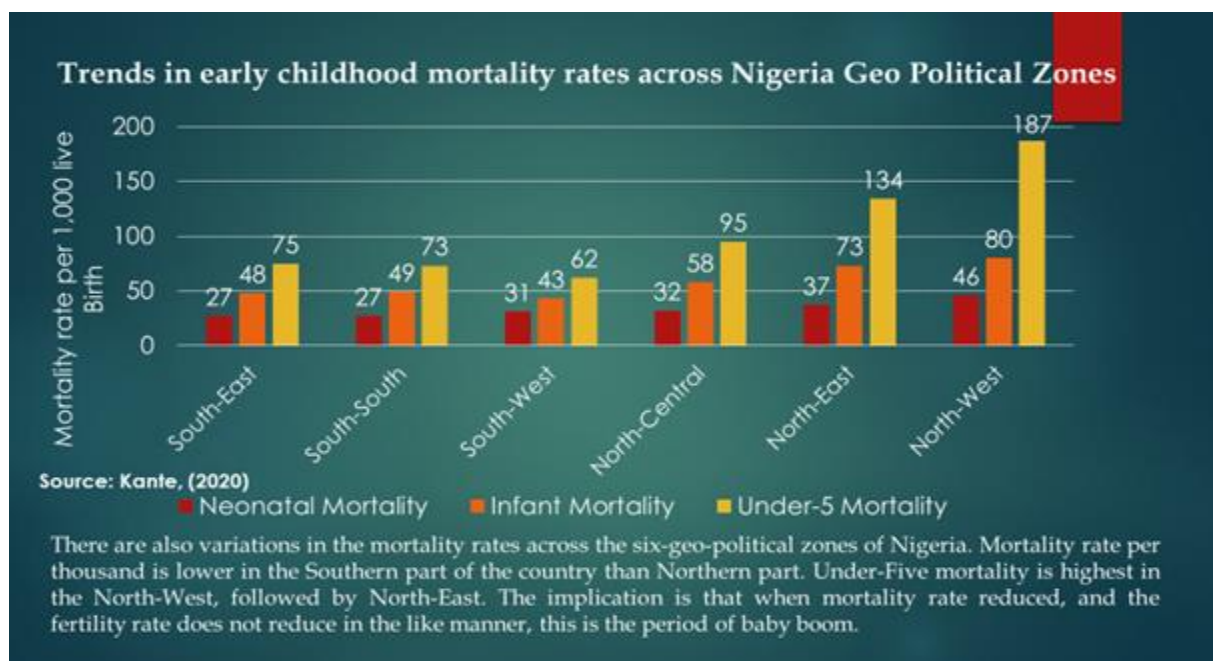


Figure 1.2 Trends in early childhood mortality rates across Nigeria’s Geo-Political Zones.

Under 5 mortality rates declined with increasing mother’s education from 170 deaths per 1,000 live births among children whose mothers have no education, to 56 deaths per 1,000 live births among children whose mothers have more than a secondary education. High child and maternal deaths in Nigeria have been attributable to availability and accessibility to health facilities and services,

characterised by systemic challenges and failure. Low uptake of immunisation with less than 60% national coverage. Poor uptake of maternal care with high patronage of quacks. Total fertility rate is 5.3 children per woman. Age-specific fertility rate in the 15-19 age group is 106 birth per 1,000 women.

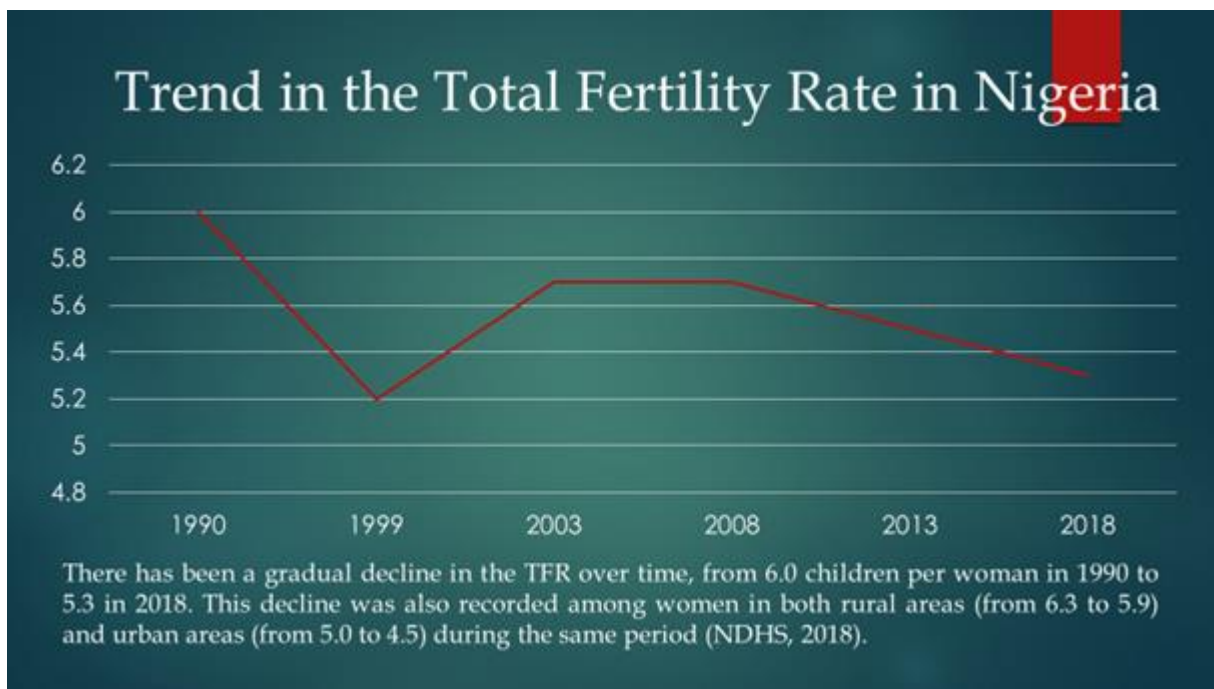


Figure 1.3 Trends in the Total Fertility Rate in Nigeria.

There has been a gradual decline from 6 children per woman in 1990 to 5.3 in 2018. Decline is noticeable in both rural (6.3-5.9) and urban (5.0-4.5) areas. Total fertility rate in highest in the North West (6.6. per woman), and lowest in the South West (3.9 per woman). The number of children per woman also declines with increasing education as

women with no education have 3.3. more children than women with more than a secondary education. (6.7 vs 3.4 children). The contraceptive prevalence rate remains low particularly in the northern parts of the country, leading to growing number of unwanted children. Along the geopolitical zones,

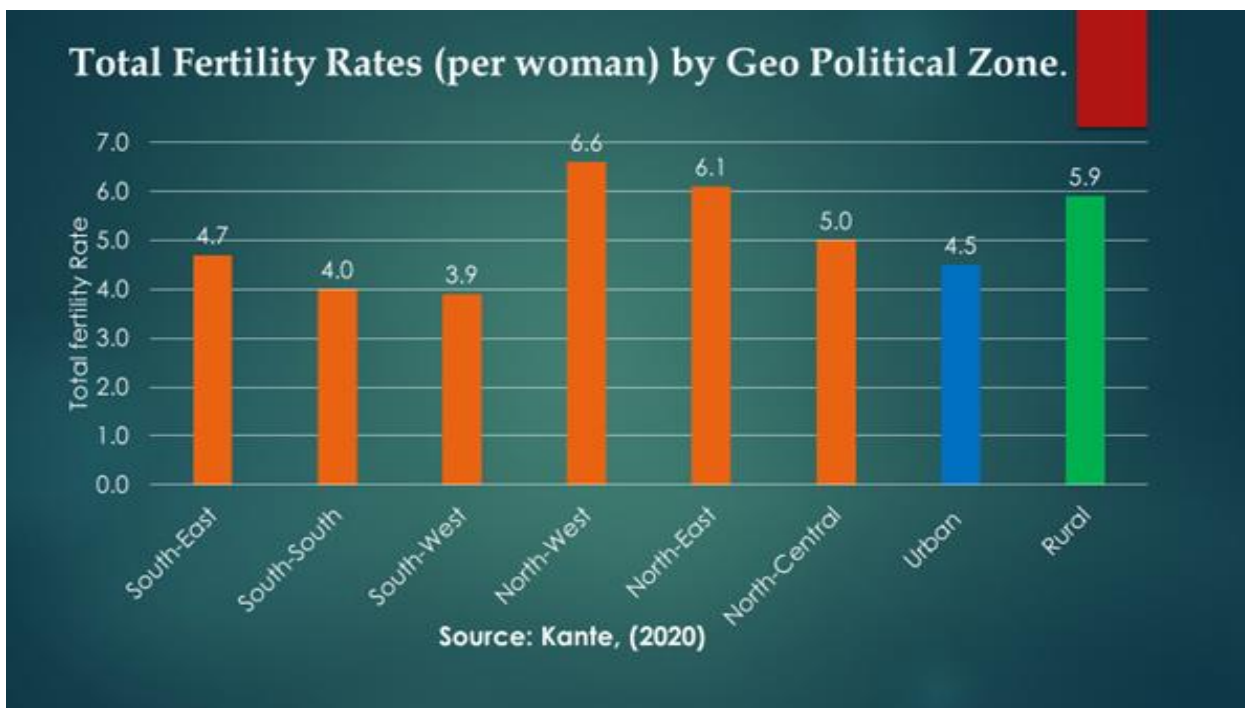


Figure 1.4 Totality Fertility Rate (per woman) by Geo Political Zone.

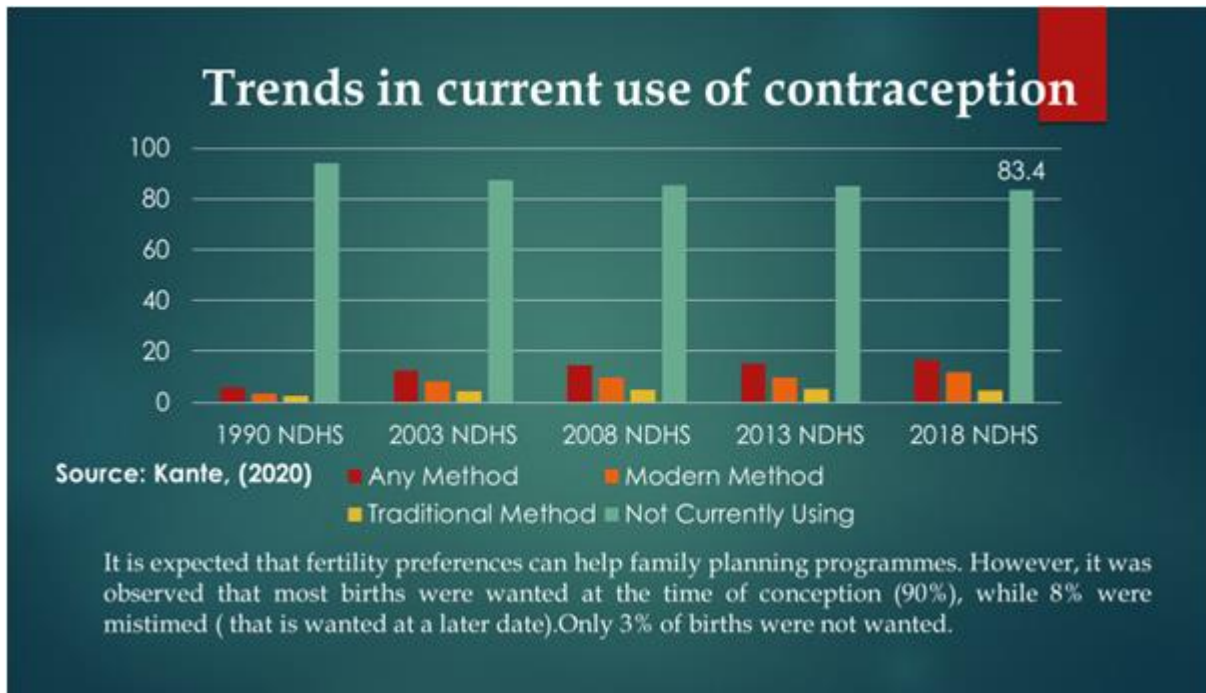


Figure 1.5 Trends in Current use of Contraception

As regards migration, the pattern, level and pace affect population growth and human capital development. Internal migration within Nigeria is characterised by high rate of rural-urban migration. New trends have however emerged as a result of conflicts, leading to the prevalence of internally displaced persons. International migration involves movements outside Nigeria, within and between members of ECOWAS sub-region and Africa/the world at large.

Characterised by the phenomenon of Brain-drain. Mass departure of educated young adults increases the expected rate of return to schooling for the upcoming younger cohort and reduces the human capital development. Inadequate jobs for the large number of persons entering into the working age population can generate benefits if quality persons can get jobs outside the country and the human capital is earned through remittances.

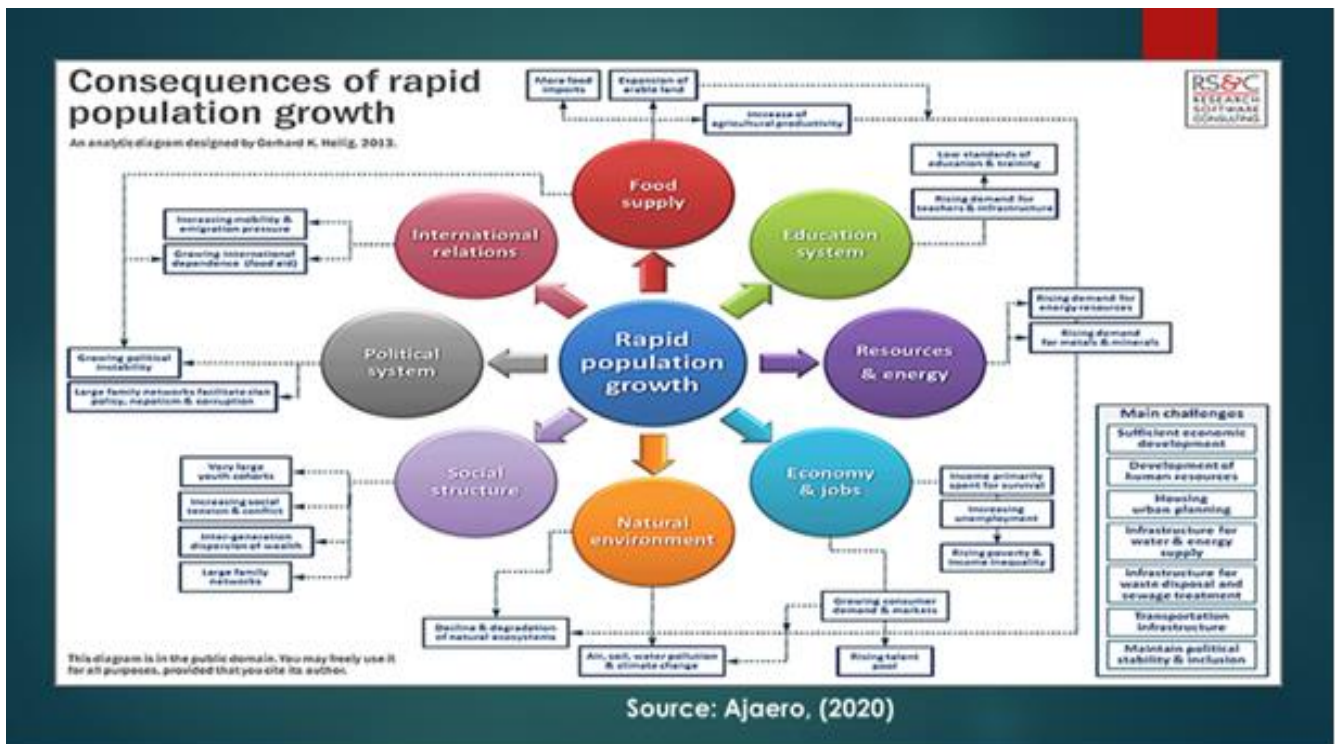


Figure 1.6 Consequence of Rapid Population Growth

➤ *Challenges Posed by Population Growth on Human Capital*

Education is one of the key components in determining human capital development. Education improves capabilities and is strongly associated with socio-economic variables like lifestyle, income, and fertility. The NDHS notes that one third of women aged 15-49 in Nigeria have no education, compared to 22% of men of the same age group. About 14% of the women and 13% of the men have attended Primary School. The gross school enrolment ratio, secondary (% of secondary school-age population in Nigeria was 56% in 2013 and dropped to 42% in 2016. Overall 36% of females and 27% of males in Nigeria have no education. More females (57.2%) and male (47.4%) within the North East zone of the country have no formal education. About 40% women and 48% men have attended secondary school. Only 11% of women and 17% of men have more than secondary school education. Nearly half of women (47%) and nearly a quarter (28%) of men are illiterate. On accessing health, 52% of women report at least one problem accessing healthcare themselves. Rural women are more likely to report at least one problem accessing healthcare than urban women (60% vs 42%). At the zonal level, the

North West and North East have the highest percentages of both females and males (54.7% and 57.2% respectively) with no education. A key element in calculating HDI is life expectancy – an index that determines how healthy an average citizen lives to contribute to his/her working life. The higher the life expectancy, the higher the HDI. Nigeria’s life expectancy was 54 years on average in 2018- male 53 years and female 55 years.

➤ *Population Policy*

Nigeria’s First National Policy on Population was prepared in 1988 and later revised in 2004. The overall goal of the 2004 policy was to improve the quality of life and standard of living by the year 2015.

The revised 2004 Policy had specific targets of: Reduction of **growth rate** to 2% or lower by 2015. Reduction of **total fertility rate** of at least 0.6 children every 5 years. Increase in **modern contraceptives** prevalence by at least 2% per year. Reduction in **infant mortality** to 35 per 1,000 live births by 2015. Reduction in **maternal mortality** to 125 per 100,000 live births by 2010, and 75 by 2015. Achieve 25% **reduction in HIV** adult prevalence (FRCN (2004:23).

Gap in the NPP National Targets			
2015 GOALS	2015	2013/2014	GAP
Reduce national population growth rate to 2% or lower by 2015	≤2%	3.2%	1.2% percentage point
Total fertility rate declines by at least 0.6 children every five years	4.38	5.5	1.12 children
Increase modern contraceptive prevalence rate by at least 2% points per year	30.2	9.8	20.4 percentage point
Reduce the infant mortality rate to 35 per 1,000 live births by 2015	35	69	34 deaths per 1,000 live births
Reduce the child mortality rate to 45 per 1,000 live birth by 2015	45	64	19 deaths per 1,000 live births
Reduce maternal mortality ratio to 75 per 1,000 live births by 2015	75	576	501 deaths per 1,000 live births
Achieve 25% reduction in HIV adult prevalence every five years	2.67%	3%	.33 percentage point
Eliminate gap between men and women in school enrolment by 2015			
Gender Parity Index (secondary)	1	0.86	0.14
Eliminate illiteracy by 2020 (literacy rate, those who did not complete primary educ.			

Female	100%	53.1 %	46.9 percentage point
Male	100%	75.2 %	24.8 percentage point
Achieve sustainable universal Basic Education prior to the year 2015 (net attendance ratio)			
Primary	100%	59.1 %	40.9 percentage point
Secondary	100%	48.8 %	51.2 percentage point

Source: NPC (2014)

Table 1.1 Gap in the NPP National Targets

➤ *Challenges Facing Population Control and Human Capital Development in Nigeria*

Population policies and human development strategies have not been effective because of: Inadequate funding; Lack of awareness; Lack of implementation of research results; Low rating in human capital indices; Brain-drain; Socio-cultural complexities and Religious beliefs. Others are: Low political will; Illiteracy; Inadequate and lack of disaggregated quality data on Nigeria's population to guide human capital development at all levels and protracted insecurity which have affected education and health. Kante, (2020)

➤ *The Role of Science, Technology and Innovation, (STI)*

STI is conceptualised as an integrated life cycle where science leads to new technologies from where innovations develop. Science is the systematic study of the physical or material world (natural) and of society (Social Science) that leads to the generation or creation of knowledge from which data and information are drawn. Technology is the application of scientific knowledge for practical ends, such as developing techniques to produce a product and/or deliver a service. Innovation is the implementation of a new, or significantly improved product (goods or services), or process. Nigeria's population is characterised by a youth bulge. Harnessing the demographic dividends using STI could be a viable and sustainable way of managing the population growth in order to ensure human capital development. There is a need for Nigeria to exploit the potentials of its rapidly increasing youth population, through the use of STI so as to strengthen economic development while also reducing widespread poverty and diverting the large number of unemployed youths into activities that are productive and away from crime. This can be done through creating opportunities for young people to enter the job market in the light of high unemployment rates.

➤ *Challenges:*

Budgetary constraints; limited access to Technical and Vocational Education (TVE); limited access to Information Communication Technology (ICT); limited access to libraries; Brain-drain of qualified Science and Technology professionals.

➤ *Way Forward*

Building the skills capacities of the youth in ICT, S&T if Nigeria is to become a global economy that is competitive, interconnected and highly digitised. Skill building aimed at tapping the full potential of the youth falls into 2:

- (i) Skills acquired through education, training and exposure to new technologies and
- (ii) Skills needed to turn innovative ideas into reality from R&D to product and distribution.

Skill building in ICT, S&T should be tackled through:

- (a) Mainstreaming formal education in technologies, by building the capacity of teachers to enable them incorporate technology into the curriculum,
- (b) Improving infrastructure of institutions with equipped laboratories enabling practical hands-on education.

- (c) Equipping higher educational institutions that specialise in innovation and technologies.
- (d) Government should encourage PPP to provide necessary environment for technology-based education.
- (e) Government should provide ICT infrastructure in order to promote R&D in Science and Technology,
- (f) Teaching computer literacy in early stages of education,
- (g) Developing mentoring initiatives through PPPs among ICT firms, and research institutions,
- (h) Government should build enabling environment/platforms for youth to share ideas, discuss challenges, exchange experiences and seek guidance through (PPP),
- (i) Intensify Science and Technology Expos where inventions and innovations by youths are show-cased and rewarded.
- (j) Government should support youth ventures by offering free vocational education, mentoring programmes incentives on production and programmes for commercialisation of innovations.
- (k) Create networks at community, national, regional and continental levels among young entrepreneurs and innovators as well as the wider business community.
- (l) Create youth-oriented incubation centres as outlets for developing their innovation and business ideas (N-Hub, I-Hub),
- (m) Government should provide young people with subsidised access to new technologies and to reliable communication services.
- (n) Government should develop a strong national framework for Research and Development which is imperative for innovation coupled with adequate funding and monitoring of quality.
- (o) Re-engineer Linkages between academia and industry gives students the opportunity to witness the practical application of theories they have studied.
- (p) Set up Youth – dedicated funds to provide young innovators with Seed money to help realise their aspirations.
- (q) Government should implement policies that support local production through subsidies, and tax breaks
- (r) Encourage STEM courses by offering annual businesses to eligible STEM undergraduates (Gender inclusive).
- (s) Intensify expansion and re-invention of Federal Technical Colleges and establishment of Vocational Centres,
- (t) Strengthen Federal and State Science and Technical Colleges across the country to train employable youths and create potential entrepreneurs.
- (u) Encourage and engage youth for development of creative media platforms to facilitate advocacy and awareness creation on the benefits of STI for National Development,
- (v) Strengthen health systems to deliver effective Primary Health Care and improve immunisation and Reproductive Health, and contraceptive use,
- (w) Above all immediately conduct a National Population and Housing census with a law promulgated to compel the use of census results, and the mandatory disaggregation of census data by all variables of inequality,

- (x) The 2004 National Population Policy should be reviewed/ revised to key-in the above recommendations,
- (y) A data bank that is effective in collection, analysis, and management of information should be created and adopted for proper monitoring and evaluation of policy implementation.

➤ *Rwanda Human Capital Development (Case Study)*

Pursued the policy of Science, Technology and innovation (STI) capacity building programme in the Rift Valley after the country's first democratic elections in 2003. Rwanda's long-term STI Vision, and accompanied agricultural projects, have increased annual income from \$1 a day to \$3,500 per household per year. In the past five years, the country has developed high-value-added export industries in diverse areas of the economy such as coffee and flowers. The country is set to be the first African country to manufacture Android phones as a source of employment and income.

IV. CONCLUSION

Nigeria's population is characterised by a youth bulge. The youth continued to face a number of challenges including unequal access of quality education, ICT, low levels of participation in Research and Development, weak youth empowerment and a lack of enabling environment that stimulates a culture of creativity and innovation. The sizeable youth population is both an opportunity and a challenge. Development can be accelerated when the majority of youth in the country are able to make significant contributions to the social, economic, and political life in a way that lifts the country out of poverty. This can be achieved through massive investment in STI. Nigeria can learn a lesson from the Asian Tigers who invested massively in Science and Technology education, Family Planning, and necessary economic reforms. To achieve these Nigeria needs to put in place a functional state, with an effective governance system sound health and educational policies, so that fertility can decline leading to improved human capital and a boost to economic development.

REFERENCES

- [1]. Ajaero, C.K. (2020); Comparative Analysis of Population Growth and the Challenges of Human Capital Development, Paper presented at a Roundtable on Population Growth and Challenges of Human Capital Development, 22-23 January, 2020.
- [2]. Ari, J.N. (2020); Frameworks for managing Population Growth and Human Capital Development. Paper Presented at a Roundtable on Population Growth and Challenges of Human Capital Development, 22-23, January, 2020.
- [3]. Choji I.D. (2020); Population Growth and Human Capital Development. Paper Presented at a Roundtable on Population Growth and Challenges of Human Capital Development, 22-23 January, 2020.
- [4]. Federal Republic of Nigeria (2004); National Policy on Population for Sustainable Development, Lagos, Federal Ministry of Health.

- [5]. Ghaji B. (2020); Framework for Managing Population Growth in Nigeria. Paper presented to Participants of SEC 42, NIPSS, Kuru 23/03/2020.
- [6]. Kante, M. (2020); Population Growth and Human Capital in Nigeria: Challenges and Options. Inauguration Lecture presented to Participants of SEC 42, 2020, 17/02/2020, NIPSS, Kuru.26
- [7]. NDHS (2018) National Population Commission, Abuja, Nigeria the DHS Program, ICF, Rockville, Maryland USA.
- [8]. NBS (2017); Demographic Statistic Bulletin
- [9]. NBS (2020); Data Analysis on Population Growth, 2020 Report, Abuja.
- [10]. UN (2013); Countdown: Our Last Best Hope for a Future Earth? Little Brown Book Group. Adam Grupper.
- [11]. UNDP (2013); Population Growth Rate: <https://www.un.org/en/development/desa/population/publications/pdf>. Retrieved 16/09/2020.
- [12]. Weisman A. (2013); Inequalities in Human Development in the 21st Century: Briefing Note for Countries on the 2019 Human Development Report: Nigeria.