ST. THERESA'S ARTS & SCIENCE COLLEGE FOR WOMEN

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DEPARTMENT OF MATHEMATICS

# TRACING THE GROWTH OF THE GLOBAL COMMUNITY

# A POPULATION FORECASTING ANALYSIS

**BY**

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# TRACING THE GROWTH OF THE GLOBAL COMMUNITY:

# A POPULATION FORECASTING ANALYSIS

## 1. INTRODUCTION

### 1.1 OVERVIEW

The world's population is more than three times larger than it was in the mid-twentieth century. The global human population reached 8.0 billion in mid-November 2022 from an estimated 2.5 billion people in 1950, adding 1 billion people since 2010 and 2 billion since 1998. The world's population is expected to increase by nearly 2 billion persons in the next 30 years, from the current 8 billion to 9.7 billion in 2050 and could peak at nearly 10.4 billion in the mid-2080s.

This dramatic growth has been driven largely by increasing numbers of people surviving to reproductive age, the gradual increase in human lifespan, increasing urbanization, and accelerating migration. Major changes in the fertility rate have accompanied this growth. These trends will have far-reaching implications for generations to come

### 1.2 PURPOSE

1. Method is used for the population forecasting.

Geometrical increase method (or geometrical progression method): In this method, the percentage increase in population from decade to decade is assumed to remain constant. This method gives higher values and hence should be applied for a young and rapidly increasing city, but only for a few decades.

2. The forecast for population growth.

United Nations projections

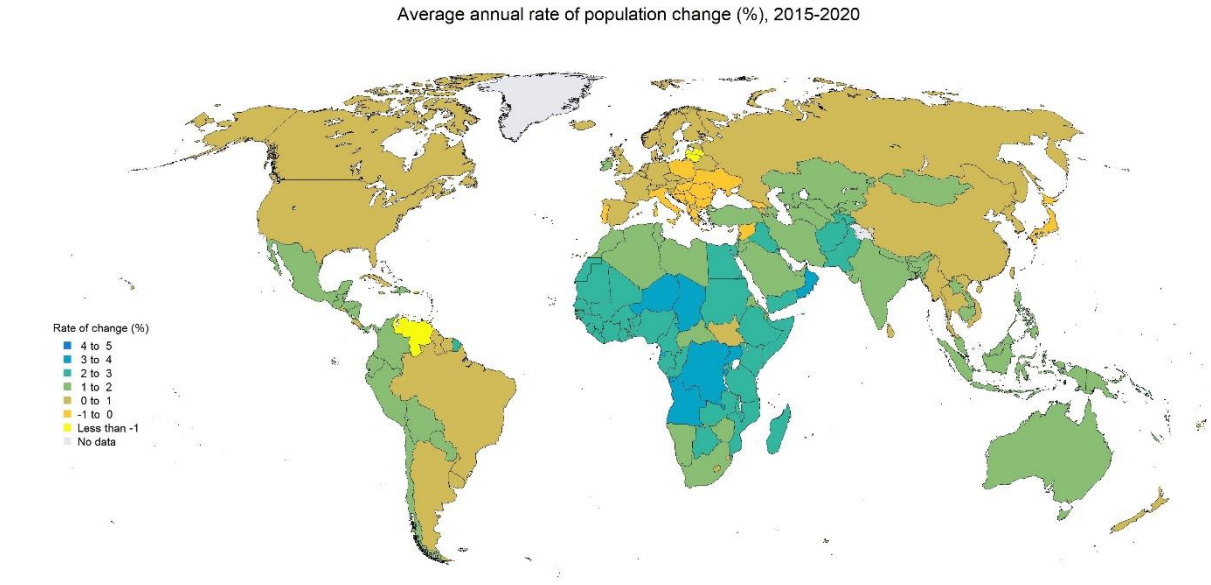
The UN Population Division report of 2022 projects world population to continue growing after 2050, although at a steadily decreasing rate, to peak at 10.4 billion in 2086, and then to start a slow decline to about 10.3 billion in 2100 with a growth rate at that time of -0.1%.

3.The purpose of the population forecasting.

A population projection gives a picture of what the future size and structure of the population by sex and age might look like. It is based on knowledge of the past trends, and, for the future, on assumptions made for three components: fertility, mortality and migration.

# 2. PROBLEM DEFINITION & DESIGN THINKING.

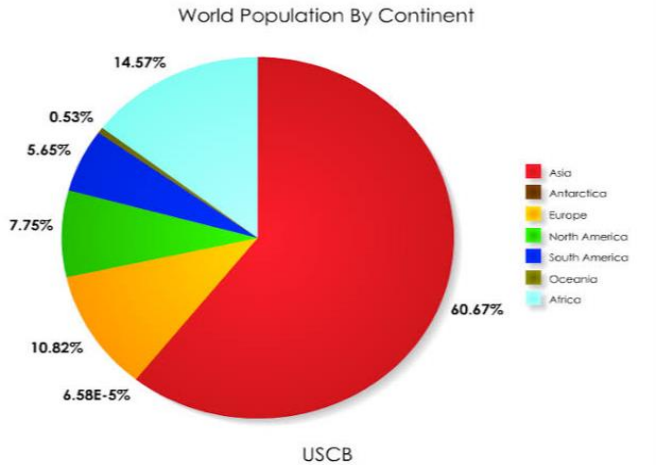
## 2.1. EMPATHY MAP






Data source: United Nations, DESA, Population Division. *World Population Prospects 2019*. http://population.un.org/wpp/

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

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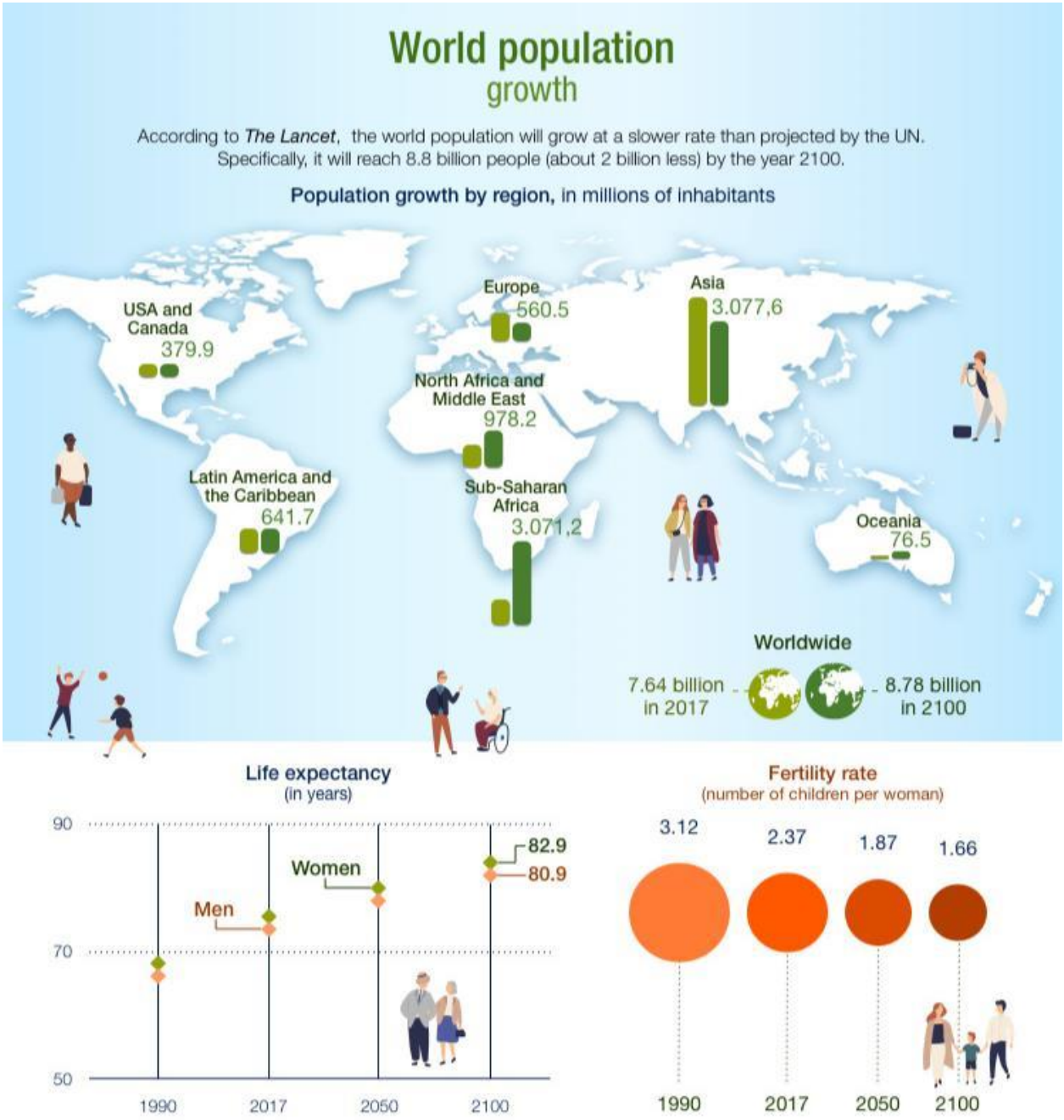
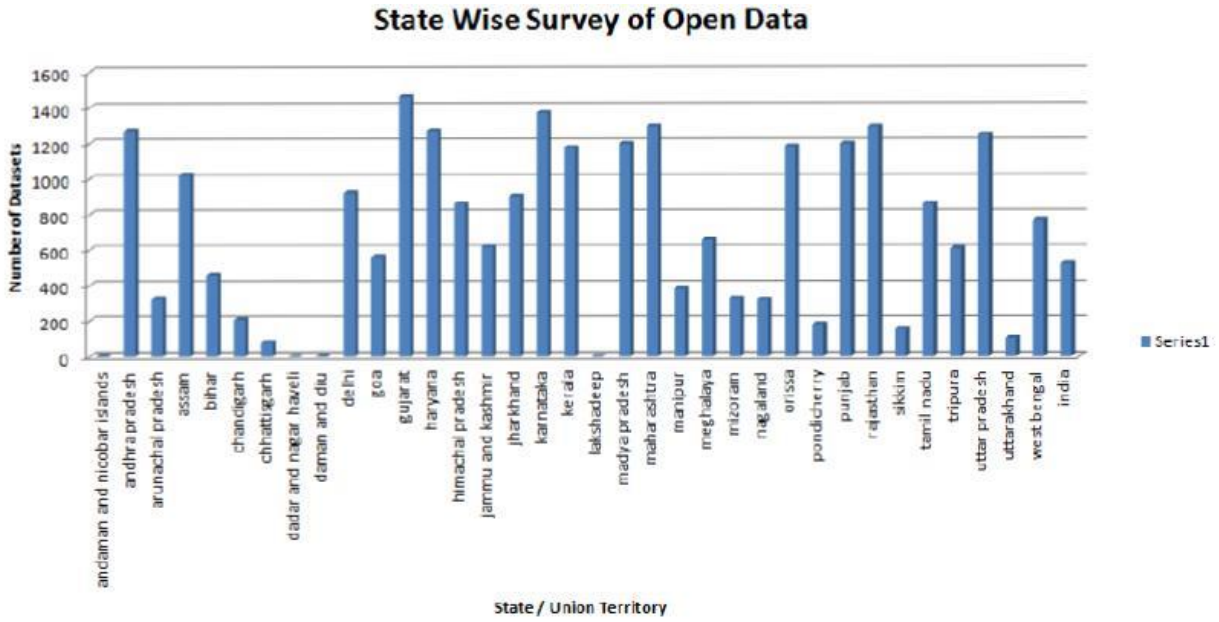
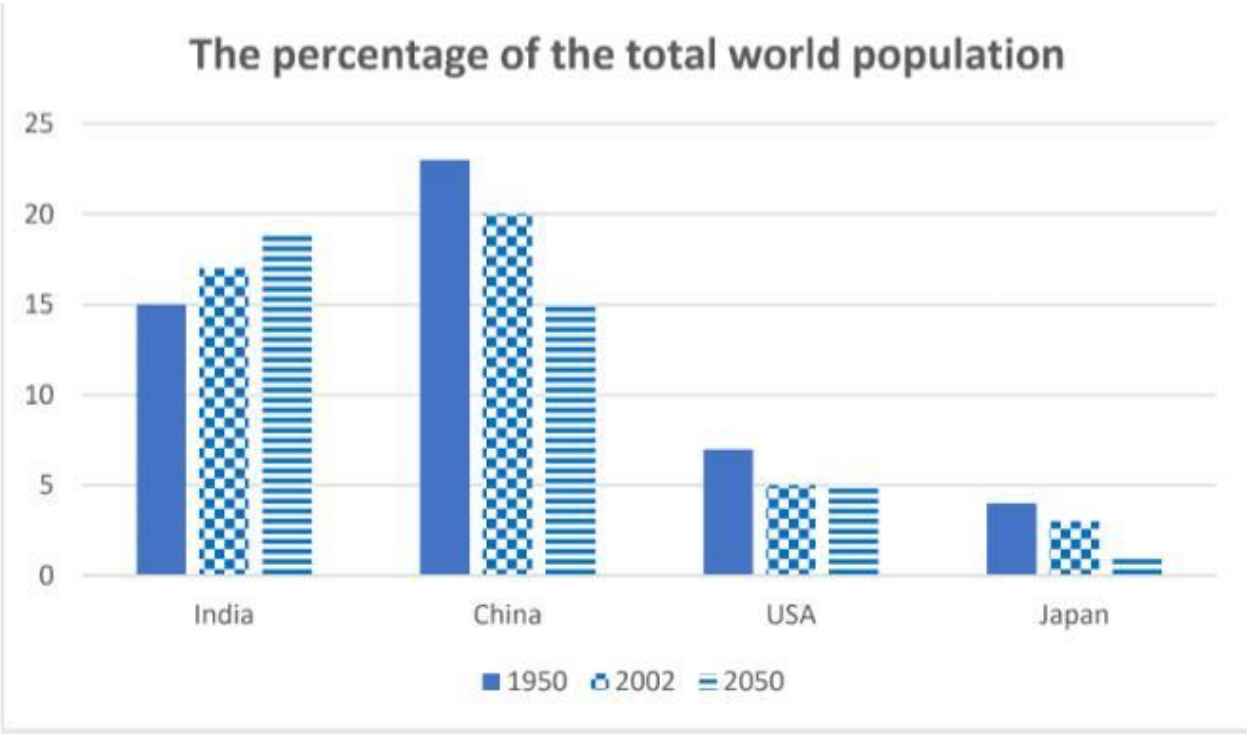
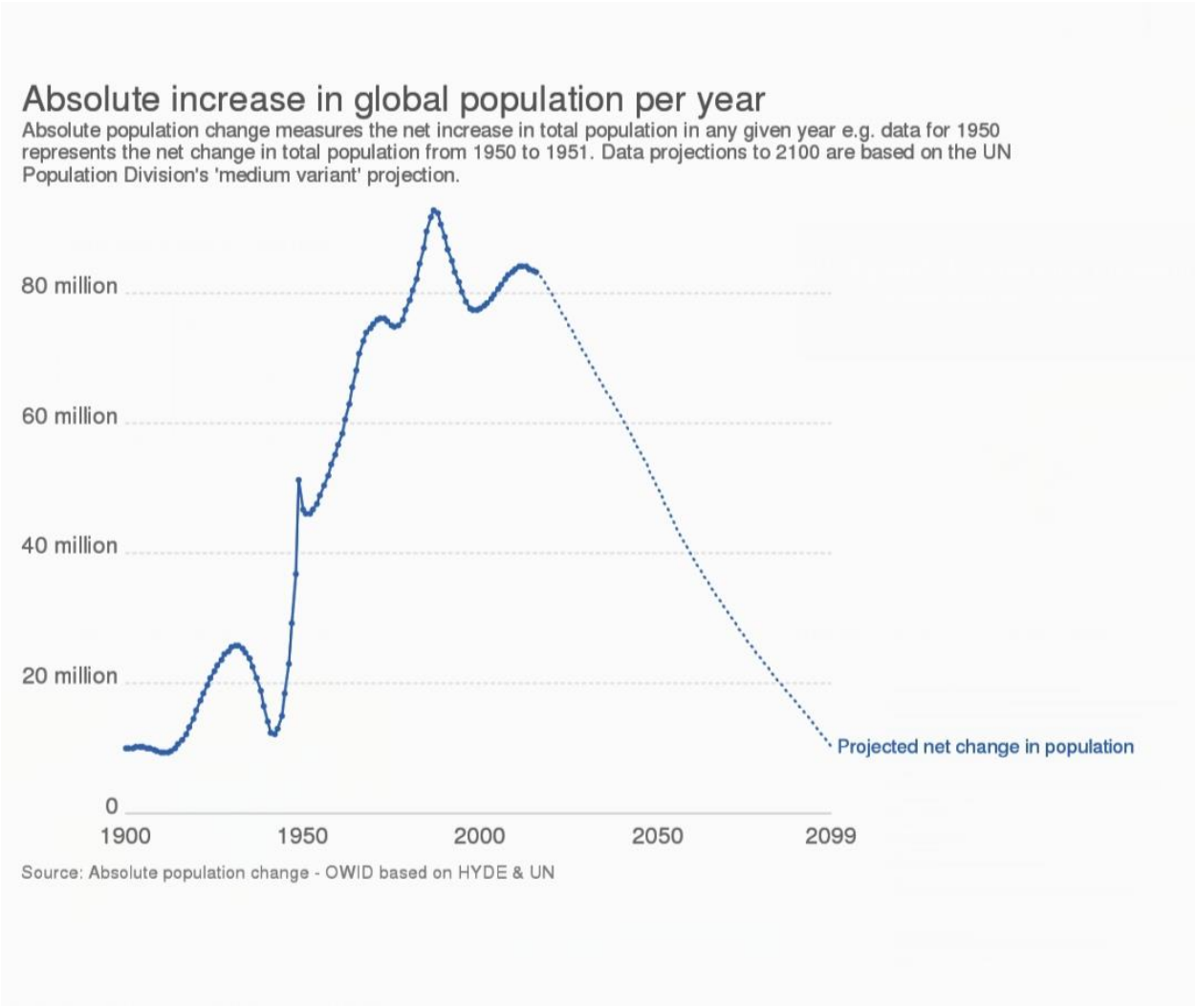

World population
growth
According to The Lancet, the world population will grow at a slower rate than projected by the UN.
Specifically, it will reach 8.8 billion people (about 2 billion less) by the year 2100.
Population growth by region, in millions of inhabitants
USA and Canada
379.9
Europe
560.5
Asia
3.077,6
North Africa and Middle East
978.2
Latin America and the Caribbean
641.7
Sub-Saharan Africa
3.071,2
Oceania
76.5
Worldwide
7.64 billion in 2017
8.78 billion in 2100
Life expectancy
(in years)
90
70
50
Men
Women
82.9
80.9
1990
2017
2050
2100
Fertility rate
(number of children per woman)
3.12
2.37
1.87
1.66
1990
2017
2050
2100

## 2.2 IDEATION BRAINSTORMING MAP






## 3. RESULT:

Tracing the growth of the global community: A population forecasting analysis.

**Base population of the town:**

An accurate population of the town is absolutely necessary since a town or city population determines water requirements for the different purpose of water supply system. It must be includes all peoples, who utilize water for drinking, washing clothes, cooking, bathing, cleaning utensils and watering animals. The base population of the Injibara town is 37718, 39654, 41735and 43777 in 2014, 2015, 2016 and 2017 respectively (CSA).

| **Year** | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| **Population** | 37718 | 39654 | 41735 | 43777 |

***Population Growth rate:***

The "population growth rate" is the rate at which the number of individuals in a population increases in a given time period, expressed as a fraction of the initial population. Specifically, population growth rate refers to the change in population over a unit time period, often expressed as a percentage of the number of individuals in the population at the beginning of that period (National population growth rate 2018). This can be written as the formula, valid for a sufficiently small time interval:

Population growth rate = $\frac{P(t_2)-P(t_1)}{P(t_1)-(t_{2-}t_1)}$, where

P = Population of town

$t_1$ = The beginning of the period

$t_2$ = The end of the period

A positive growth rate indicates that the population is increasing, while a negative growth rate indicates that the population is decreasing. A growth ratio of zero indicates that there were the same number of individuals at the beginning and end of the period a growth rate may be zero even when there are significant changes in the birth rates, death rates, immigration rates, and age distribution between the two times.

| Year | 2015 | 2018 | 2023 | 2028 | 2033 | 2038 | 2043 | 2048 |
|---|---|---|---|---|---|---|---|---|
| Annual growth rate | 4.3% | 4.4% | 4.1% | 4.0% | 4.2% | 4.1% | 4.0% | 4.2% |

***Calculation of population projection of the average increase per decade from base* population**

| **Year** | **Population** | **Arithmetic increase** | **Geometric increase** | **Incremental increase** |
|---|---|---|---|---|
| **2014** | 37718 | | - | - |
| **2015** | 39654 | 1936 | 0.05 | - |
| **2016** | 41735 | 2081 | 0.05 | 145 |
| **2017** | 43777 | 2042 | 0.05 | -39 |
| **Total** | 162884 | 6059 | 0.15 | 106 |
| **Average** | | 2019.67 | 0.05 | 53 |

**From the above table used population projection constants to calculate population by three methods are:-**

K1 =2019.67 G=0.05 K2=53

***Sample of calculation***

**For Arithmetic =(39654-37718)/1= 1936**

For Geometric= Arithmetic increase/population = 1936/37718 =0.05

For Incremental = the difference of Arithmetic increase =2081-1936 = 145

| Year | Arithmetic increase | Geometric increase | Incremental increase | Exponential |
|---|---|---|---|---|
| 2017 | 43777 | 43777 | 43777 | 43777 |
| 2019 | 47816 | 48348 | 47922 | 47804 |
| 2025 | 59934 | 64791 | 60358 | 61136 |
| 2030 | 70033 | 82691 | 70722 | 74672 |
| 2035 | 80131 | 105997 | 81085 | 92122 |
| 2040 | 90229 | 135870 | 91448 | 113081 |

**Sample calculation for each method**

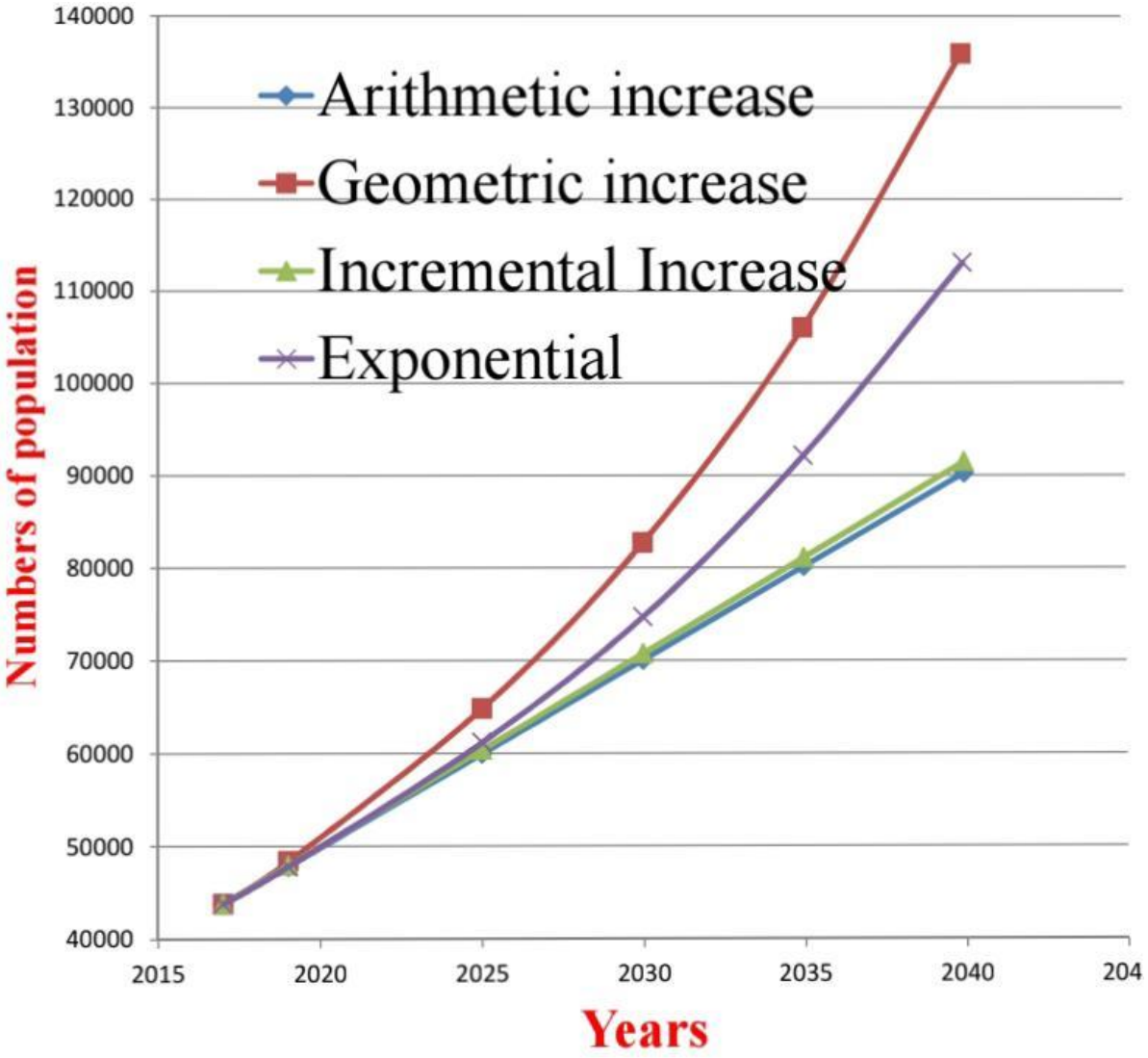
Where $p_o$ is number of population at base year (2017) is:-

For Arithmetic (P2019 )= P2017+kl*n = 43777 + 2019.67 *2=47816

For Geometric (P2018) =P2015 (16) $43777*(1+0.05)^2=48348$

For Incremental (P2018)=P2015 + (1+2)=43777 +3(2019.67 +53) = 47922

For Exponential (P18) P2015-e(nr)=43777*e(2* 0.044)= 47804




In the ancient period population growth was very less comparing with current population growth. But this time of years population growth is very high comparing with previous one..

## 4. ADVANTAGES & DISADVANTAGES:

The pace of population growth is alarmingly rapid; in some areas, the population is expanding rapidly. This population growth has led to more cultural variety, advanced technologies, and improved living standards. On the other side, population growth is becoming more and more expensive, especially for the environment. Some countries require population expansion

to maintain social equilibrium, while others must take immediate action to limit the numbers.

**ADVANTAGES OF POPULATION:**

1. ***Human Resources*** will ***Increase***.

One obvious advantage that a large population might offer is a larger supply of human resources. In locations where unemployment is a serious problem, this will likely not lead to more jobs, but it will boost the number of individuals willing to work for less pay.

**2.Increased productivity through specialization**

The demand for products and services will rise as the population grows, encouraging specialization. This indicates that some people concentrate on creating a single product or service. However, each person's efforts may merge into something amazing depending on their distinct abilities and talents.

Additionally, specialization enables countries to export and participate in globalization. Producers can export commodities to areas afflicted by natural catastrophes or artificial risks instead of only producing locally.

### 3 .Rapid population decreases Social Infrastructure

The government must spend a lot of money on necessities like housing, healthcare, and education. However, a rapidly growing population makes the load heavier

Higher population density efficiency

High population density locations are much more efficient than rural areas and regions with low populations in terms of the per capita carbon footprint. People are more likely to use public transportation and live in easier-to-heat apartment complexes when they reside in densely populated locations.

### 4. Diversity fosters creativity

Studies that examined the benefits of immigration as a crucial source of innovation have demonstrated increased diversity. Adding new cultures to the mix enables people from all backgrounds to approach problems creatively

### 5. Improved societal demographic structure

The population is declining in many western economies, which has led to a skewing of the population toward the elderly and retired. We are struggling to pay for health care & pensions, which is placing costs on

society. Moderate population increase contributes to rebalancing the population by increasing the proportion of young, working adults.

**6. Higher Industry Demand**

There will be greater demand for some industries in a nation with a higher population. As long as it can produce enough of an item or service to satisfy demand, a company that sells it will experience great success.

**7. Increasing military power**

If a country can administer its huge population, it can have a significant military advantage compared to smaller ones. The size of the military will increase, as will the number of military supplies if the economy remains stable and the government can successfully handle the expanding population.

Additionally, a population increase may stimulate technological advancement that would enable the production of more sophisticated military products.

**8. Critical mass.**

Higher populations can enable a critical mass of people to enable a sider, more vibrant society. With low populations, there is less scope for diversity. But, when the population grows, it can enable the support of a broader cultural range of activities

9.***Higher* economic *growth***.

*Population growth will lead to economic growth with more people able to produce more goods. It will lead to higher tax revenues which can be spent on public goods, such as health care and environmental projects.*

## DISADVANTAGES OF POPULATION :

### 1.Shortage of food due to population expansion

More people means more people to feed, which strains food availability. As a result, food shortages are common in developing countries with quickly growing populations. They cannot feed their expanding population despite their efforts to raise agricultural output.

There are two effects on the growth of the economy from food scarcity. First, a lack of food results in undernutrition, which lowers productivity. It further reduces the workers' capacity to produce. Second, food scarcity requires countries to buy grains, which unnecessarily depletes their foreign exchange reserves.

### 2.*Generating Non-biodegradable waste*.

We are now battling to process the non-biodegradable waste that we are producing. It usually ends up in a landfill, contributing to harmful issues like methane emissions.

### 3.*Increase Pollution*

More people will produce more air, water, and land pollution. Numerous health problems, including asthma and cancer, are linked to higher pollution levels. The pollutants also harm animals and vegetation.

### *4.Disturbance in Emergency Situation*

Cities with a high population density frequently have traffic problems. One of the drawbacks of the population is that locations with heavy traffic might be hard to access for emergency vehicles like fire engines and ambulances.

Emergency services are required when there is an accident or another natural disaster.

### *5.Infections Outbreaks*

The World Health Organization (WHO) asserts that areas with high population densities may see fewer disease outbreaks and lower infection rates. It is much simpler for germs and viruses to move from person to person when so many people live close to one another.

The Covid-19 pandemic provides a clearer explanation for why cities with large densities of people saw greater incidences of viral infection-related fatalities.

### *6.Effect on climate*

The consequences of climate change will also be seen because of rising greenhouse gas emissions, a major cause of global warming. As the population continues to increase, more damage is being done to our ecosystem.

The ecosystem is under stress due to human consumption and population density, which has reduced biodiversity and increased greenhouse gas emissions from processes like dairy production.

### *7.Low Quality of Life*

Most Indians have a poor quality of life due to the country's rapidly expanding population. According to Human Development Report, low quality of life is demonstrated by a lack of knowledge due to illiteracy, a lack of economic security due to the number of people without access to health care and clean water, and a high proportion of children under the age of five who are severely underweight.

### *8.A large population exacerbates unemployment*.

A fast-expanding population means that a sizable number of individuals will join the labor force, many of whom may be unable to find employment. The number of job seekers is increasing so quickly in developing countries that it will be difficult to employ everyone despite all attempts to promote planned growth. These countries frequently experience underemployment, unemployment, and covert employment. The rapid increase in the global population makes it practically impossible for economically developing nations to address their unemployment issues.

### *9.Water Shortage.*

The pressure that a growing population will place on limited water resources contributes to many small and large wars as nations struggle to solve the water crisis.

## 5.APPILCATIONS :

- ❖ Increased talent pool and human capital – Higher population guarantees an increased human capital pool, leading to growth in innovation and technological development. Population growth also increases the chances of getting geniuses like Marie Curie and Albert Einstein, leading to further technological and cultural development.

1.3 Increased economic growth – Rapid population growth leads to more production of goods due to the available labor, increasing tax revenue. This increased tax revenue can be used on environmental and health projects. The economy can benefit from economies of scale and increased specialization.

1.4 Better demographic structure – Countries are more likely to face a falling population when the population demographic consists of more retired individuals than working people because the country may struggle to pay for health care and pension when there is a decrease in working individuals. Rapid population growth is essential in restructuring the demographic population structures.

1.5 The Increase in population increases the demand for goods. This increase in demand increases the country's output, employment and income. As a result the economy will grow.

## 6.CONCLUSION:

The population is a complicated subject with benefits and drawbacks. Even though population density might be a sign of economic expansion, it has other negative environmental effects, including a lack of fresh water. It might boost economies and

industries while also encouraging greater innovation. Additionally, it can put food, property, and other limited resources like water at risk.

The advantages and disadvantages of how big or small the population should be for a country are fully explained in this article.

It cannot be over-emphasized that there are many varied factors influencing birth rates, migrations, and to a lesser degree, death rates. Unfortunately, much of the research necessary to isolate these various factors and to appraise their effects remains to be done. The planner in forecasting future population for his area may seek the aid of a demographer especially trained in the technical study of population. However, the planner must work closely with the demographer to constantly relate planning considerations to statistical manipulations. The planner, with his knowledge of the area and study of its economic potentialities and his proposals for future densities (and distribution of these), has insights into the developmental pattern of a community, which the demographer lacks.

Population projections, like master plans, must be revised quite frequently. It has been suggested in this report that several alternative projections be made on the basis of different sets of assumptions. It has also been recognized that in the last analysis, the planner must use as a working guide that population projection he considers most feasible. In making population projections, the planner need not be so much worried about errors in forecasting the numbers of persons (a five percent under or over-estimation of population should not disrupt a community!) but he should be concerned about an error in the kinds of anticipated persons. For example, in a community of anticipated 100,000 population, 5,000 additional persons could be absorbed; if all 5,000 additional persons were children of school age, however, the effects on community facilities might be disastrous.

There is no easy method to population forecasting. Some demographers feel that fertility and mortality rates are nearing some sort of stability. Should this actually happen, a series of formulae might be developed by which fertility and mortality might be projected, leaving migration as the field for most intensive scrutiny. The "stability" does not yet exist. Given though the planner of today must resort to "enlightened guesses", he must be aware of the many complex interacting forces that influence future population numbers, composition and place of residence.

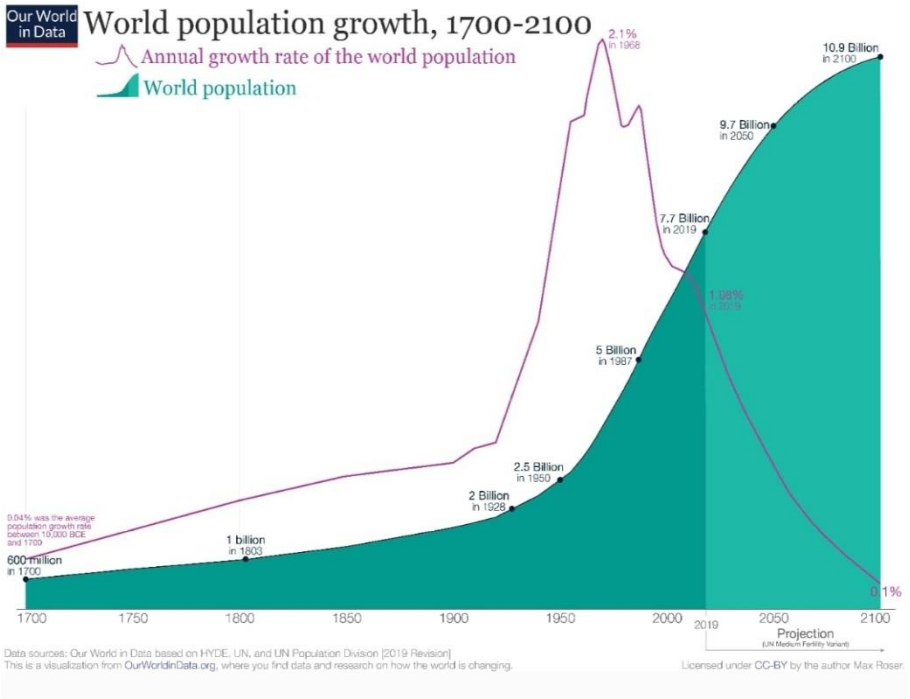
## 7.FUTURE SCOPE:

- The UN projects that the global population will increase from a population of around 8 billion in 2022 to 10.4 billion by the end of the century. By that time, the UN projects, fast global population growth will come to an end.

- Beneath the global level, there are of course big differences between different world regions and countries. While in some regions the world population will likely grow rapidly for the coming decades, other regions will continue to see declining population numbers.
- Global population growth is determined by the number of births and deaths. Improving health is increasing the size of the population as it is decreasing mortality. The countervailing trend is falling fertility rates – the trend of couples having fewer children is what brought rapid population growth to an end in many countries already, and what will bring an end to rapid population growth globally.

- The global population growth rate has already slowed down considerably: it reached its peak at over 2% in the 1960s and has been falling since.

- The UN projections for the global population growth rates, which have been produced since the 1950s, have a good track record in projecting the size of the global population.
- While the UN projections are most widely known, there are other very-carefully-produced projections. The demographers of WC-IIASA model what will happen according to different scenarios and make clear that the population growth rate tomorrow depends on what we do today. Rapid progress in getting children – and especially girls – into schools will result in a much smaller global population.
- The biggest disagreement between different projections Is concerning the future of Africa. While the UN projects an almost 3-fold increase of the population of Africa, other researchers find a much smaller increase more likely




## World population growth

This article is focusing on the history of population growth up to the present. We show how the world population grew over the last several thousand years and we explain what has been driving this change.

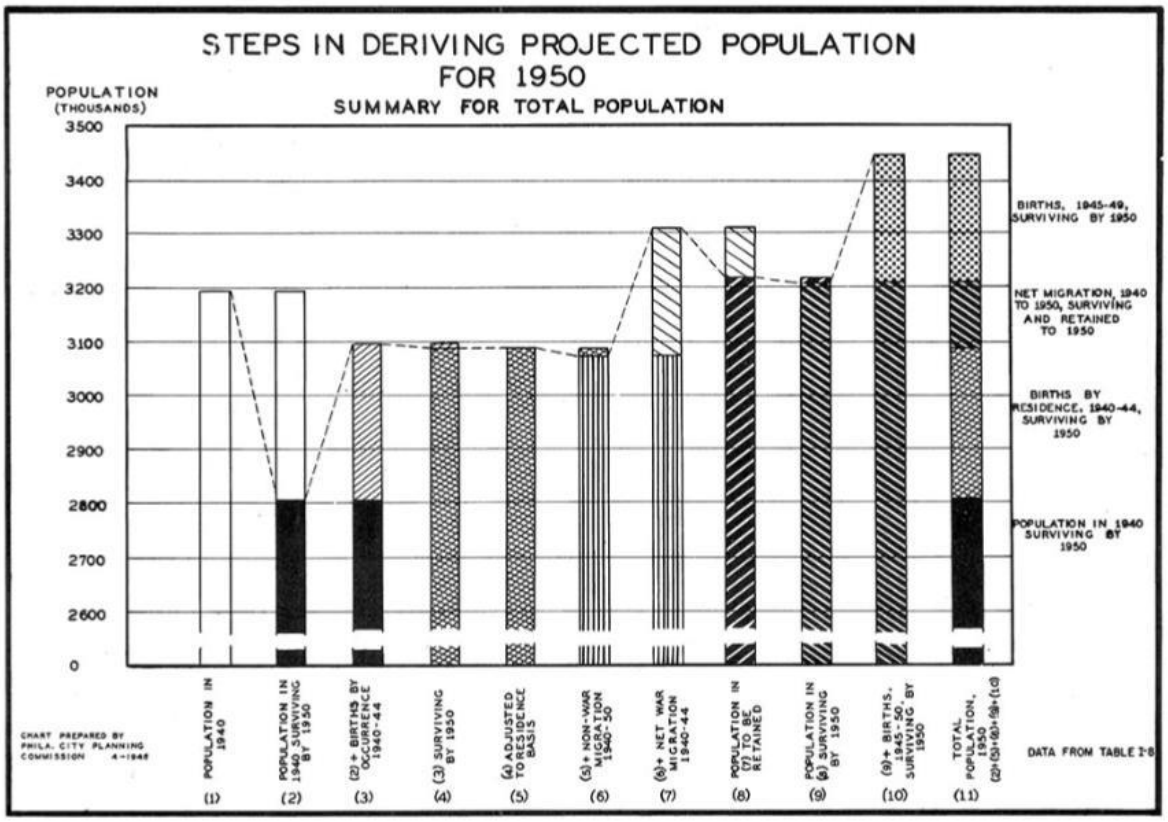
## Life expectancy

Improving health leads to falling mortality and is therefore the factor that increase the size of the population. Life expectancy, which measures the age of death, has doubled in every region in the world .

## Fertility rates

Rapid population growth has been a temporary phenomenon in many countries. It comes to an end when the average number of births per woman – the fertility rate – declines. In the article we show the data and explain why fertility rates declined.

## 8.APPENDIX:




1 .These stages of population growth are presented in Frank Notestein's "Population – The Long View." See Bibliography in Appendix for complete reference.

2 .The knowledge, much less the practice, of birth control varies in different social and economic groupings.

3 .This method of the city is used for illustrative purposes. However, the procedures mentioned are applicable to other types of jurisdictions and areas.

4 .The method of forecasting a future population for a small area from projections for the future population of a large area is meritorious in that assumptions for over-all social and economic conditions are made, and large scale changes may be taken into account. It has been used in Population Estimates 1950–2000, a study of the Philadelphia–Camden Area, Philadelphia City Planning Commission, 1948, and is of more value to a large city than smaller ones. Smaller cities (under one million population) cannot as easily be compared with regions, and the country, as a metropolis like Philadelphia, simply because the former are less representative than the latter.

5.Estimates of Future Population of the United States 1940–2000, U. S. National Resources Planning Board, Washington 1943; and Forecasts of the Population of the United States 1945–1975, U.S. Bureau of the Census, Washington, 1947.

6 .Two other measurements of fertility are the gross reproduction rate and the net reproduction rate. The "gross reproduction rate" is a "two-generation" concept or a ratio of the number of girl babies that will be born a generation later to a population of new-born girls, assuming that age-specific birth rates remain unchanged, and assuming further that none of the present new-born girls die before they reach the end of their child-bearing period. The "net reproduction rate" is the "gross reproduction rate" corrected to account for the number of new-born girls who are expected to die before they bear girl children. Assumptions about the age-sex distribution of a theoretical population are inherent in these measurements. it is difficult to use these measurements in the projection of an existing population with an age- sex distribution differing from the theoretical "standardized" one.

7.Analyzing issuance of building permits is a useful device for estimating new households in small areas.

8 .A good discussion of some of these factors may be found in Warren Thompson's Population Problems.

9.Population, Metropolitan Master Plan Study, City Planning Commission, Cincinnati, Ohio, December 1945.

10 .Birth figures taken from 1940 Census data had to be adjusted upward to account for births which were not enumerated or registered.

*Thank You...*