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Types and Significance of Population Pyramids

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Abstract
Population pyramid or age-sex pyramid generally represents the structure of population of a region on the basis of age and sex. This graphical representation provides a great deal of information about fertility, mortality and migration or population dynamics. Generally, demographers identify three types of population pyramids – expansive or rapid growth, stationary or slow growth and constrictive or contractive or negative growth pyramids. At a fix point of time different countries show different types of population pyramids and over the period of time the shape of pyramids also changes. The objectives of the present paper are – (i) to define population pyramid; (ii) to describe the types of population pyramids; (iii) to associate different stages of demographic transition with different types of pyramids; and (iv) to highlight the significance of population pyramids.

Keywords: Population, Pyramid, Age, Sex and Significance.

Population Pyramid
A population pyramid is popularly known as “age pyramid” or “age and sex pyramid”. It is a graphical representation of age structure or the distribution of population according to various age groups. It can be constructed on the basis of age group based population composition of a region or a country or world as a whole. It is most commonly used not only to show the age composition but also sex composition of the population. The population size is shown on the x-axis (horizontal) and age-groups on y-axis (vertical). Conventionally, females are depicted on the right side and males on the left side, and they may be shown according to total population (absolute number) or percentage share of male and females in successive age groups. Therefore, a population pyramid represents the age-sex structure of the population which is dependent on the birth, death rates and migration. It is noteworthy that the population pyramids intended for comparison should be constructed on the same scale should depict the same age groups and the bars should be of same height.
This representation of population on the basis of sex and age provides a great deal of information about fertility, mortality and migration or population dynamics. It is a visual display of the significant events like wars, famines, changes in CBR, CDR and immigration or emigration in the last about 85 years of a country’s or region’s demographic history. It not only indicates about the stage of demographic transition (from high fertility to low fertility) but also level of development of a region/country. Its vertical extent indicates about level of life expectancy and show the share of juvenile, adult and old-age population or dependents and working population or dependency ratio. The broad base of the pyramid means the majority of population lies in the juvenile age group and there is higher dependency ratio of younger population on working population.

Types of Population Pyramids
The population pyramids are of varied shapes. Different countries have unique population pyramids and for the same countries over the period of time shape changes. Therefore, there are spatio-temporal variations of population pyramids. As graphical representations the shape of population pyramids ultimately depends on the age and sex structure of a specific population. These shapes may take the form of a triangular pyramid, have a columnar or rectangular (with vertical sides rather than sloped sides), or have an irregular profile. The following are the major types of population pyramids:

1. **Expansive Pyramid:** The population pyramid with broad base and with successive decline in the share of population of higher age groups is known as expansive pyramid. This pyramid represents situation of high fertility, high mortality, low life expectancy, higher population growth rates and low share of old age persons. It indicates expansioia

of population because the size of each cohort gets larger than the size of the previous one. Expansive age pyramids are common for developing countries mainly in Africa and Asia

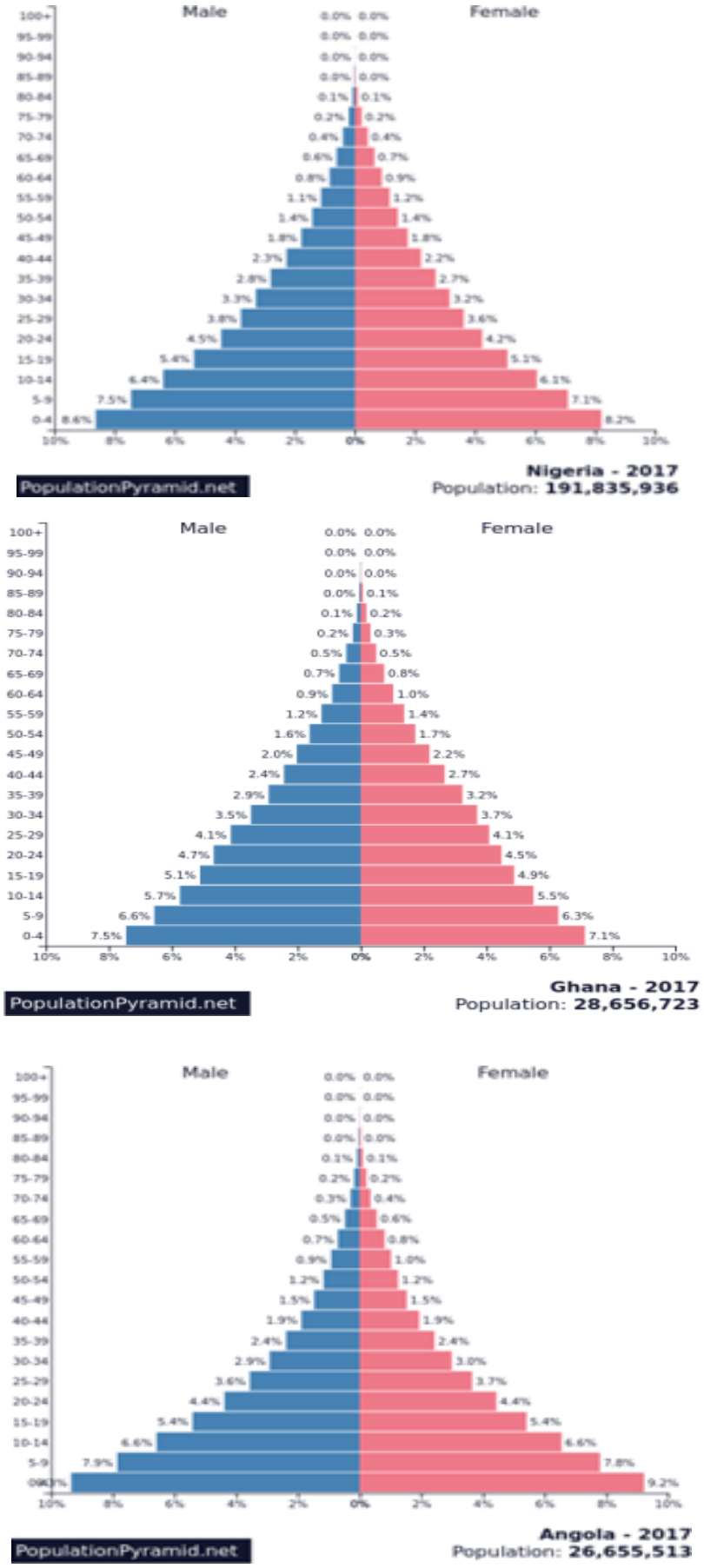


Fig.1: Expansive Pyramids of Nigeria, Ghana and Angola, 2017

Source: https://www.populationpyramid.net

2. Stationary Pyramid: A pyramid is described stationary when the share of population remains constant in different age groups over the period of time. It represents situation of low fertility, low mortality and high life expectancy. It indicates slow population growth or stable population. The stationary or near-stationary population pyramid displays somewhat equal share of juvenile and adult age groups**.**

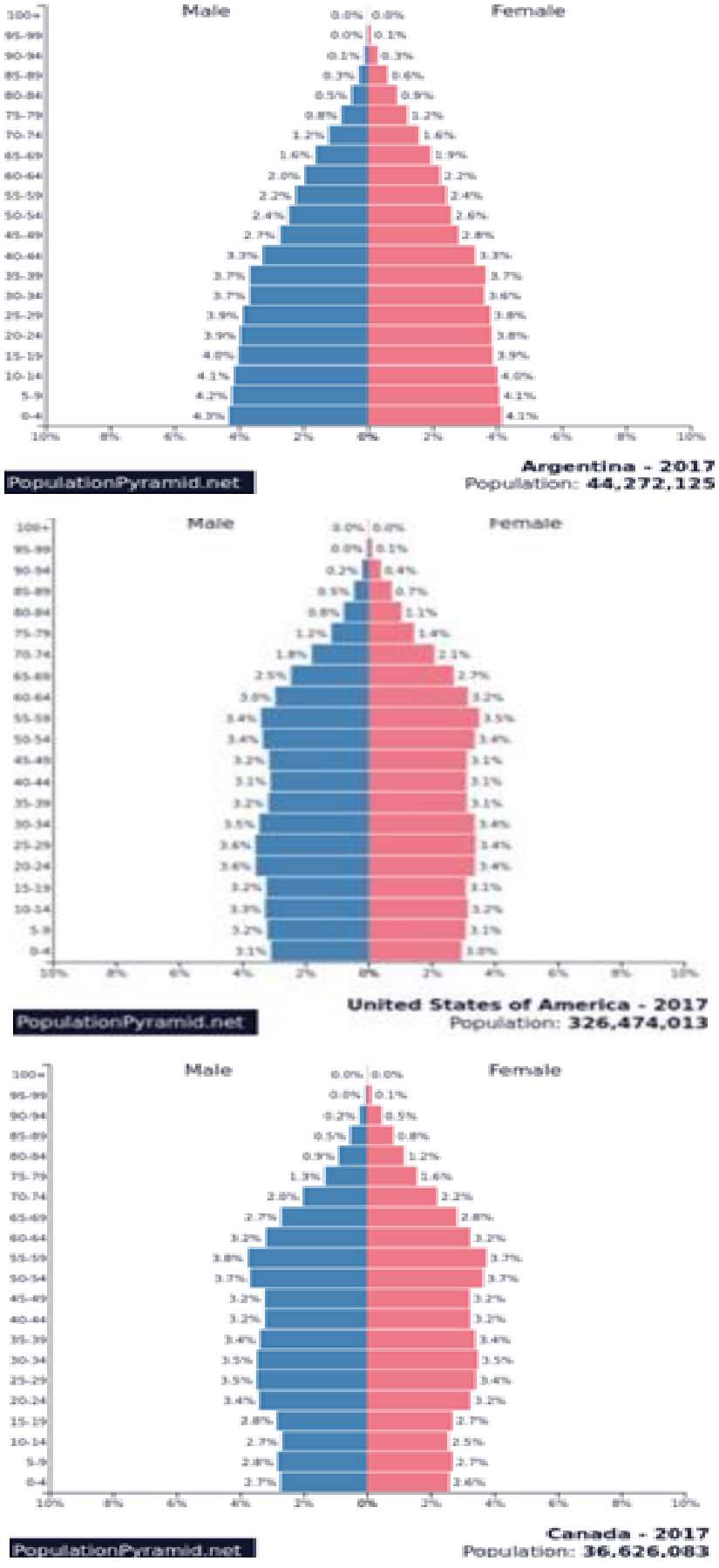


Fig.2: Stationary Pyramids

3. Constrictive Pyramid: A pyramid with a narrow base is called constricted pyramid. It represents low fertility, low mortality, high life expectancy and ageing of population. It is typically associated with very advanced countries which have a high level of literacy, east access to birth control measures and very good health and medical facilities**.**

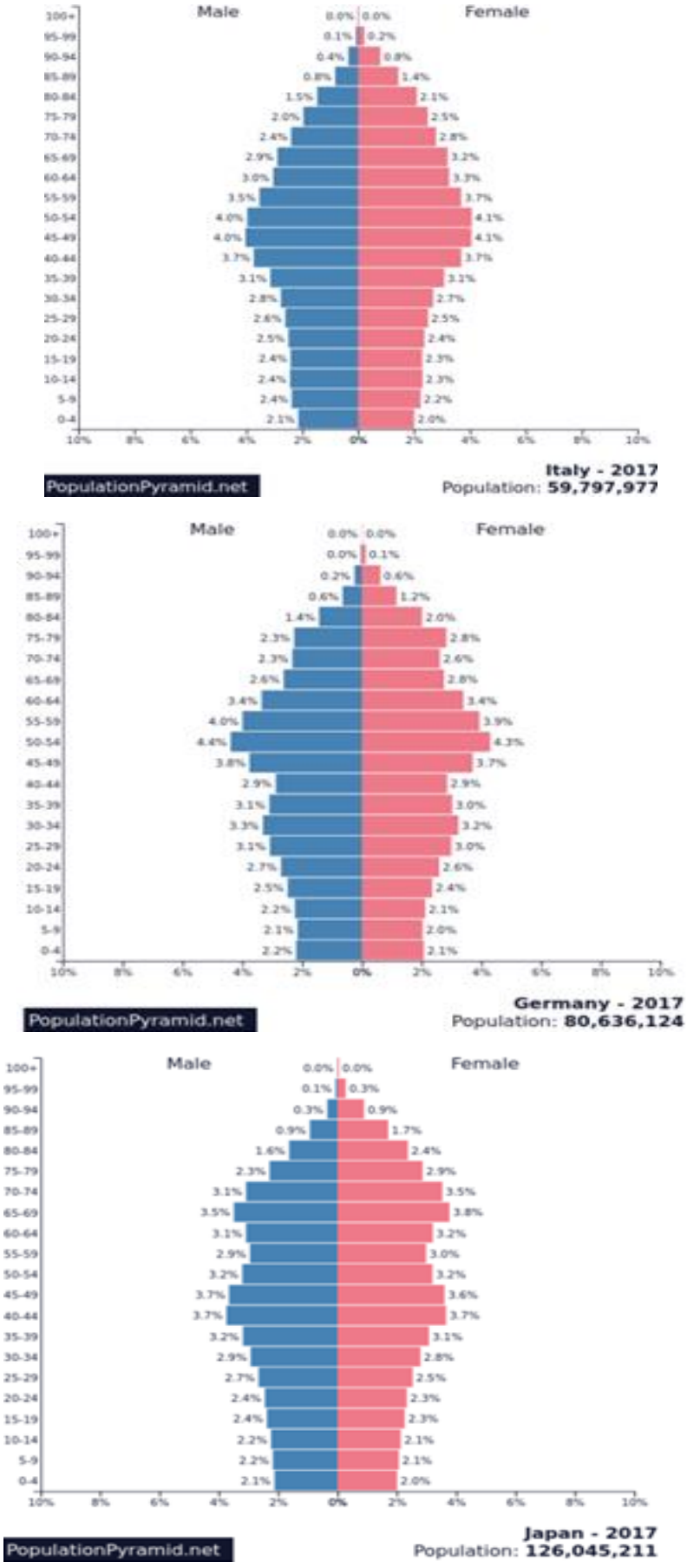


Fig.3: Constrictive Pyramids

Population Pyramid and Demographic Transition

Demographic transition model represents world population growth in past, present and future context on the basis of differential rates of fertility and mortality. This model provides a general useful approximation of the changes which take place in populations of different countries over the period of time. This model shows a particular pattern of demographic change from a high fertility and high mortality to a low fertility and low mortality and this transformation is associated with progress of a largely rural agrarian and illiterate society towards a dominantly urban, industrial, literate and modern and post modern society. The stages of demographic transition are – (i) high stationary stage; (ii) early expanding stage; (iii) late expanding stage; (iv) low stationary stage and (v) declining or negative growth rate stage.

These stages are represented by dramatically different population pyramids (Fig.4). The first stage is shown by a sharply tapering pyramid with a broad base. It reflects high fertility, high mortality rates among the younger age groups especially high IMR (infant mortality rates) and high CMR (child mortality rates). The high mortality rates in younger age groups give the pyramid side slopes concave appearance. Due to high death rates the population increases slowly and size remains relatively small and smaller vertical extent reflects low life expectancy. As the type of pyramid is generally identified on the basis of share of population in lower and middle age groups, therefore this stage pyramid is *expanding pyramid*. In case of Niger even at present (2017) 50 per cent population of the country is below 15 years and in Angola this share is 47 per cent and in Nigeria 44 per cent. These countries were in high stationary stage of demographic transition a few decades earlier.

In the second stage of demographic transition mortality rates decline at a faster pace, especially among younger age groups, but fertility rates remain still high. Therefore, the concave slopes of first stage become straight and due to increase in life expectancy height and share of population in older age groups improve slightly. As the share of pre-reproductive population is more than of the reproductive age group or simply the lower age groups are broader than middle age groups the type of pyramid is still known as *expanding* or *expansive* or *Christmas tree-shape* or simply *triangular shape* pyramids. Majority African countries have this shape of age-sex pyramids. In 1970s and 1980s the age and sex pyramid of India was of this type**.**

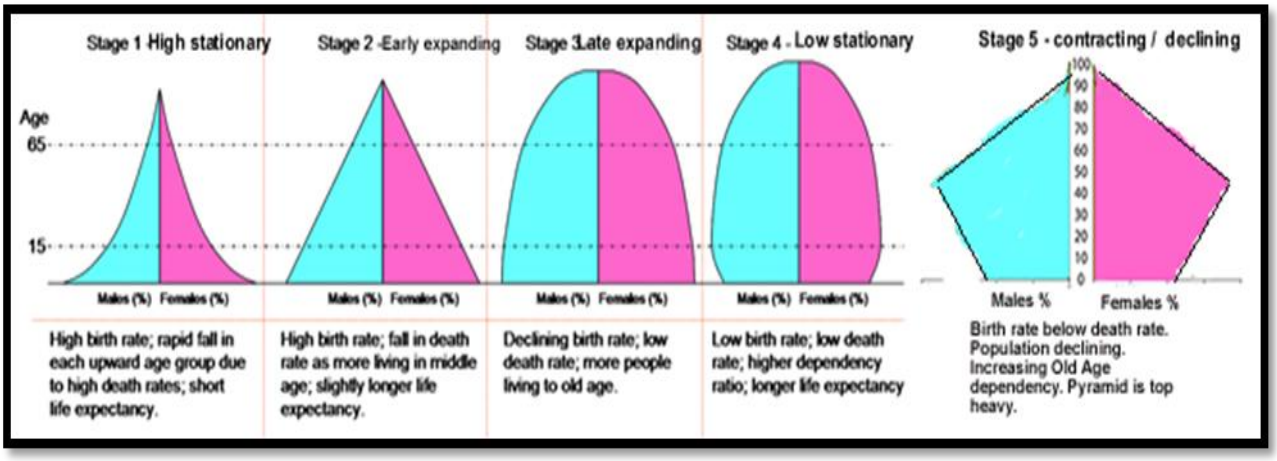
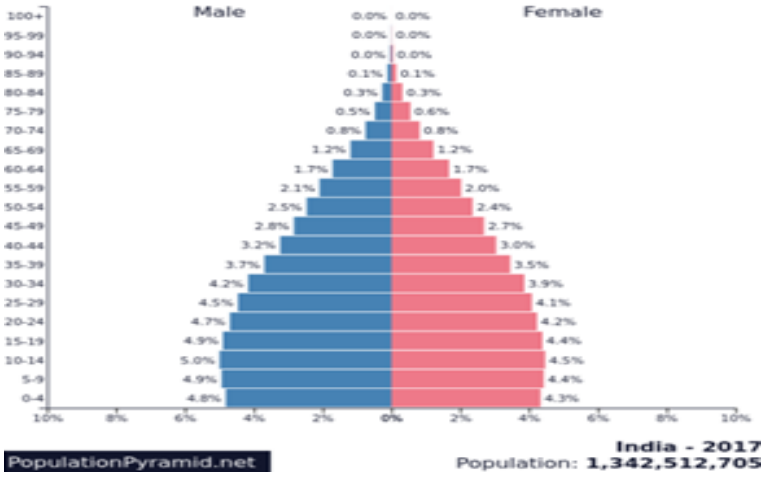


Fig.4: Demographic Transition and Population Pyramids

Source:http://ib-geography-vtcapatina.weebly.com/uploads/3/0/9/1/30918887/6638536_orig.gif

In stage 3 of late expanding stage the total population increases but with declining growth rates because due to decline in fertility rates the gap between births and deaths gradually decreases. This is reflected in the age pyramid by shrink in the lower or base parts age groups. Countries like India, Bangladesh, Mexico and Brazil are at present in late expanding stage of demographic transition. In case of these countries about 29 per cent population is less than 15 years age and about 6 per cent population is above 65 years of age. The world population as a whole is in the late expanding stage of demographic transition with 26 per cent juvenile population and 9 per cent senile population. The population growth rates decline and life expectancy increases and becomes about 70 years. Lower- middle portion slightly bulges out and the shape of the pyramid resembles dome or bell. Therefore, this stage pyramid is known as *dome-shape* or *bell-shaped* pyramid (Fig.5).



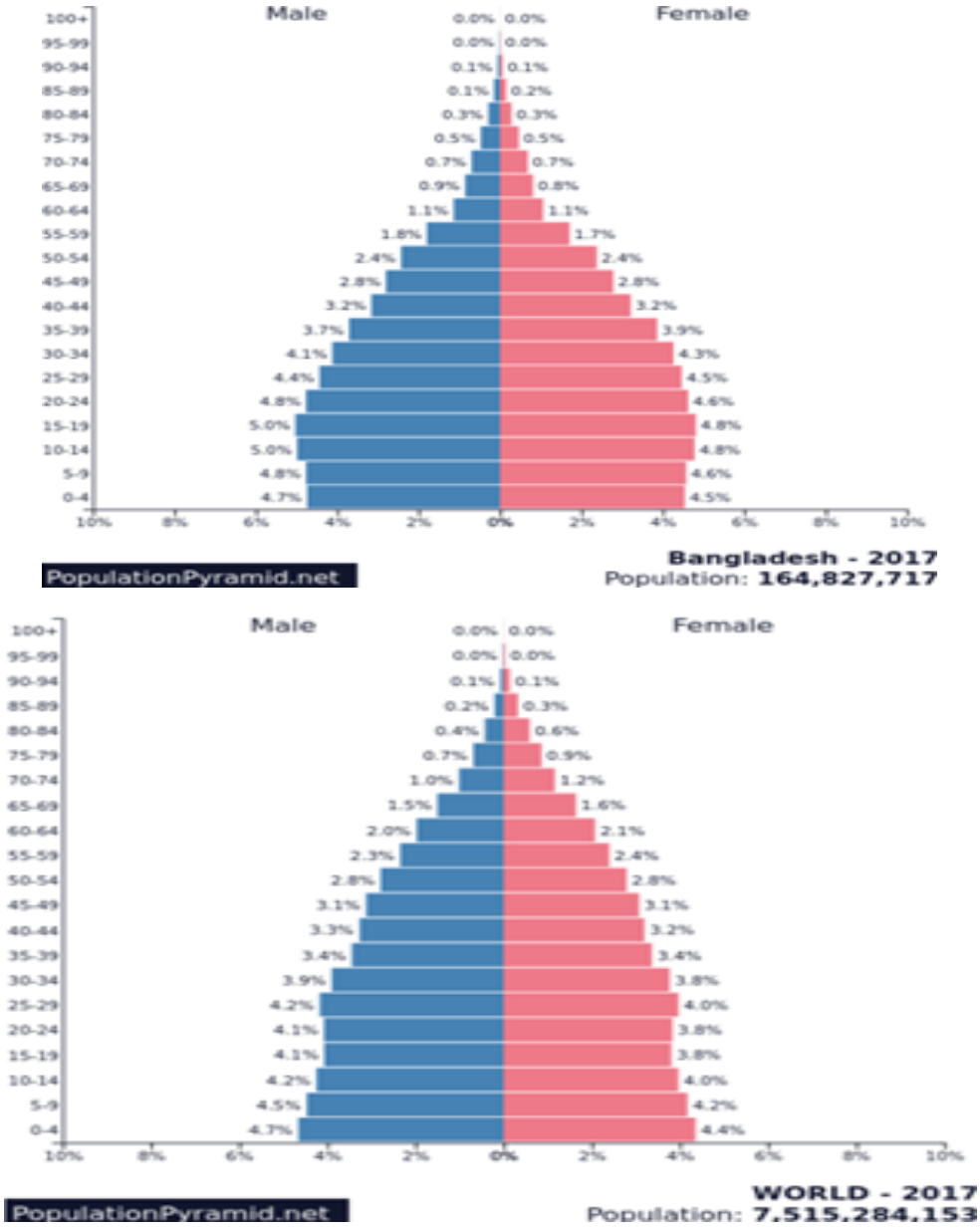


Fig.5: Dome-shaped or Bell-shaped Pyramids

The population pyramid in low stationary stage of demographic transition has nearly vertical sides; the width of the bars remains more or less same from bottom to top. This *barrel shape* pyramid or *stable* and *slow growth* pyramid or *stationary* pyramid represents low fertility, low mortality and high life expectancy. At present (2017) most of the MDCs are in this stage and have barrel shape pyramid. The share of population in juvenile population (16 per cent) and the senile population (18 per cent) is almost same. The female life expectancy is 82 years and male life expectancy 76 years.

In the last stage of demographic transition fertility rates become very low and less than mortality rates therefore, population growth rates become negative. In this declining stage of transition the base of the population shrinks and top becomes heavy reflecting the challenge of ageing or graying of population and high dependency of elderly population. This phase pyramid is known as *urn shape* or *bulb shape* pyramid or constrictive or contracting pyramid. Japan, Italy and Germany are examples of this stage and of this type of pyramids. In case of Japan the share of juvenile population is only 12 per cent and senile population share is 28 per cent. The life expectancy for female is 87 years and 81 years for males in Japan. In 1950 the population pyramid of Japan was expansive or triangular-shape or pyramid-type and by 2050 it is going to be inverted and become *kite-shape* pyramid (Fig.6).

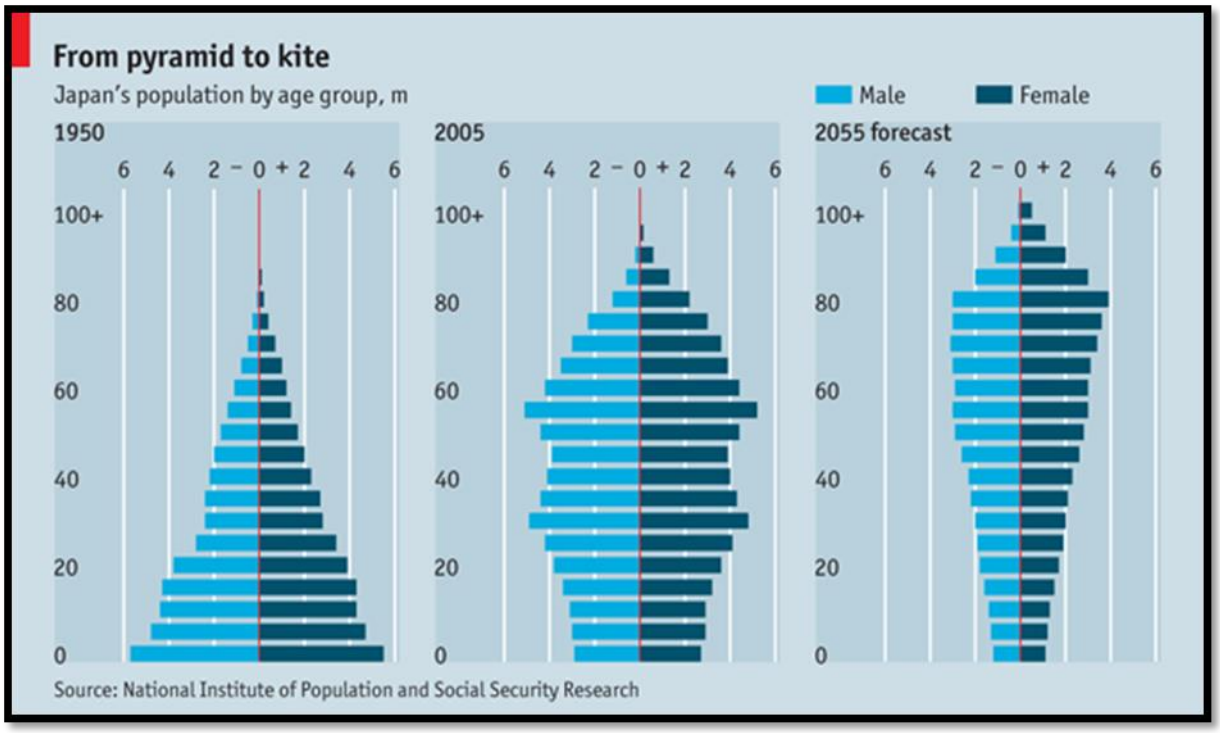


Fig.6: Japan: Pyramid to Kite

Source: https://cdn.static-economist.com/sites/default/files/20101120_WOC951.gif

Significance of Population Pyramids

The shape of the population pyramids effectively conveys information about the age-sex structure of a specific population. The width of the base represents birth rates. A broad-base pyramid indicates that birth rates are high and there is high concentration of population in the lower age groups. In case of expanding pyramids the base is broadest and this also indicates that in near future also population growth rates will remain high because this population will shift to reproductive age groups. A narrow or pointed top indicates that old age persons constitute a relatively small proportion of the population. For example, in case of Nigeria, Angola and Ghana the shape of pyramid is expanding type and share of juvenile population (< 15 years) is 44, 47 and 39 per cent whereas the old age population (65 years and above) is 3, 3, and 2 per cent respectively. In case of MDCs the pyramids show lesser share of juvenile population but higher share in senile population.

A broad base and sharply tapering sides represent high fertility and high mortality rates in the younger age groups of population such as high infant mortality rates and high child mortality rates. Population pyramids can be used to assess the number of economic dependents by calculating the ratio of sum of juvenile and senile population and working population. The pyramids of LDCs show more young dependents and of MDCs more elderly dependents. The population pyramid with higher share of young dependents is of very triangular shape (true pyramid type), the pyramid in case of almost equal share of juvenile and reproductive age groups and fair share in elderly population with falling birth rates and a rising life expectancy will change the shape from triangular type to barrel-type. With more and more ageing of population the structure would look like an upside-down pyramid.

Sex ratio imbalances according to age groups can also be easily detected in age-sex pyramids. They are reflected in the shape of the pyramid. In majority populations the number of females is much greater than the number of males in older age groups. It is reflected by the longer bars on the right side of the central axis (the female side) as compared to the left (the male) side. The life expectancy of females is more 74 years at world level as compared to 70 years for males, in MDCs it is 82 years for females and 76 years for male and in LDCs it is 72 years for females and 69 years for males in 2017. The median age of the population can be determined on the basis of the age group (bar) on the vertical axis which divides the area within the pyramid into two equal parts.

Irregular Population Pyramids

Irregularities in the profile of the population pyramid indicate about changes in the population or aberrations. A bulge or an indentation in the profile reflects unusual changes associated with high birth rates or death rates or changes in population because of immigration or emigration. Some of the irregularities are reflected in the following pyramids:

Baby boom

The phrase baby boom is used to show a noticeable increase in the birth rates. The term was used first to describe the population increase in post-second world war by increased birth rates mainly during 1946 to 1964. The Figure 7 shows the population pyramids of USA of past, present and future. It shows the progression of baby boomer cohorts from 1960 to 2040. By 2040 the pyramid becomes a column or barrel i.e. the end of pyramid, because the birth rates in all cohorts are less than death rates. Along with ageing of population it also shows relatively higher share of women in old age groups**.**

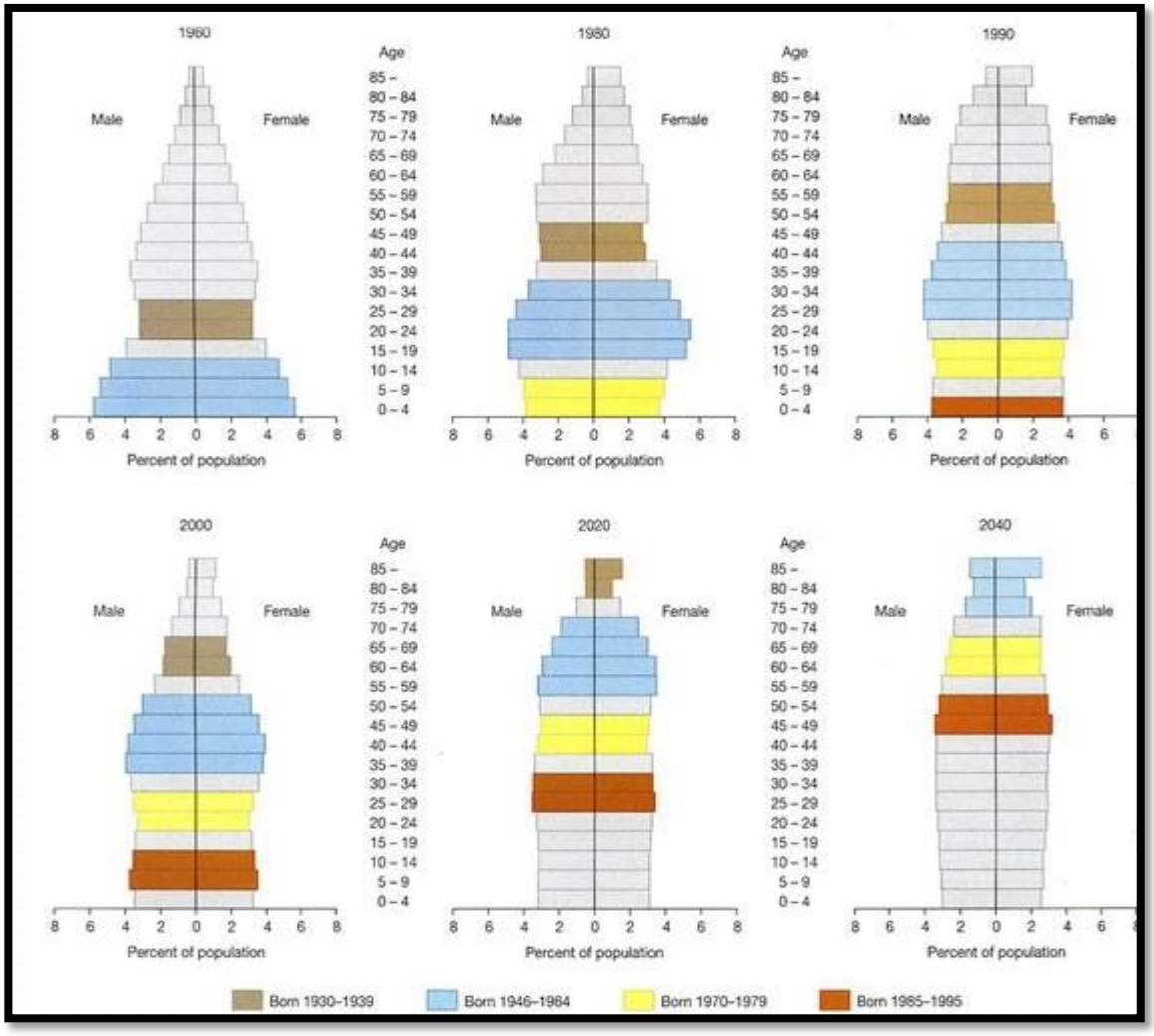
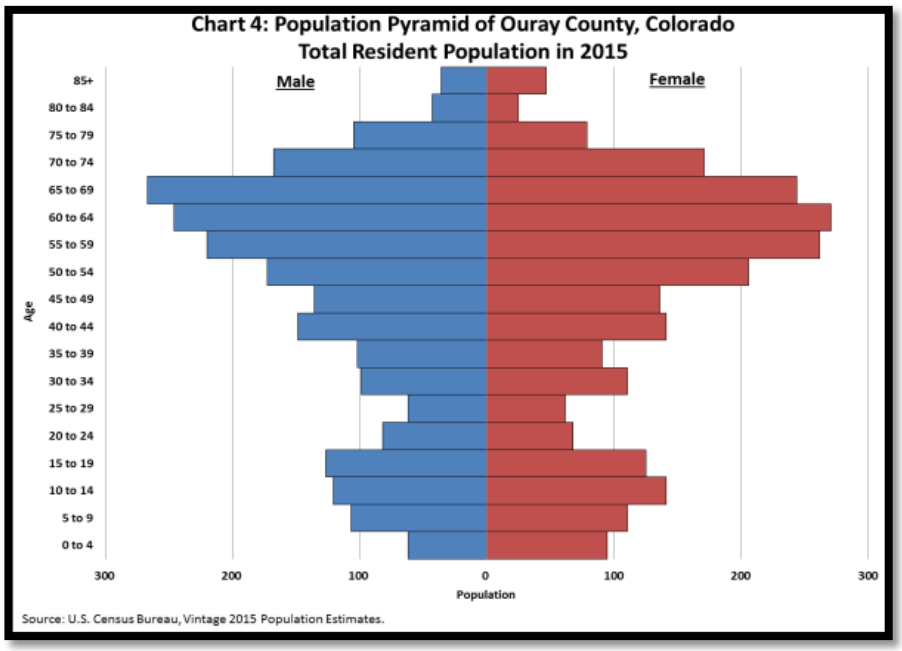


Fig.7: Population Pyramid of US Baby Boomers

Source: http://images.slideplayer.com/26/8454436/slides/slide_56.jpg

Migration: The population pyramid of Ouray County, Colorado of USA shows heavy concentration of population in the upper age groups because it is a recreational county and internal migration of old age persons have contributed in this. Likewise the concentration of population in the age group of 20 to 25 years in Centre County of Pennsylvania in USA is due to presence of many universities and colleges in this county **(Fig.8).**



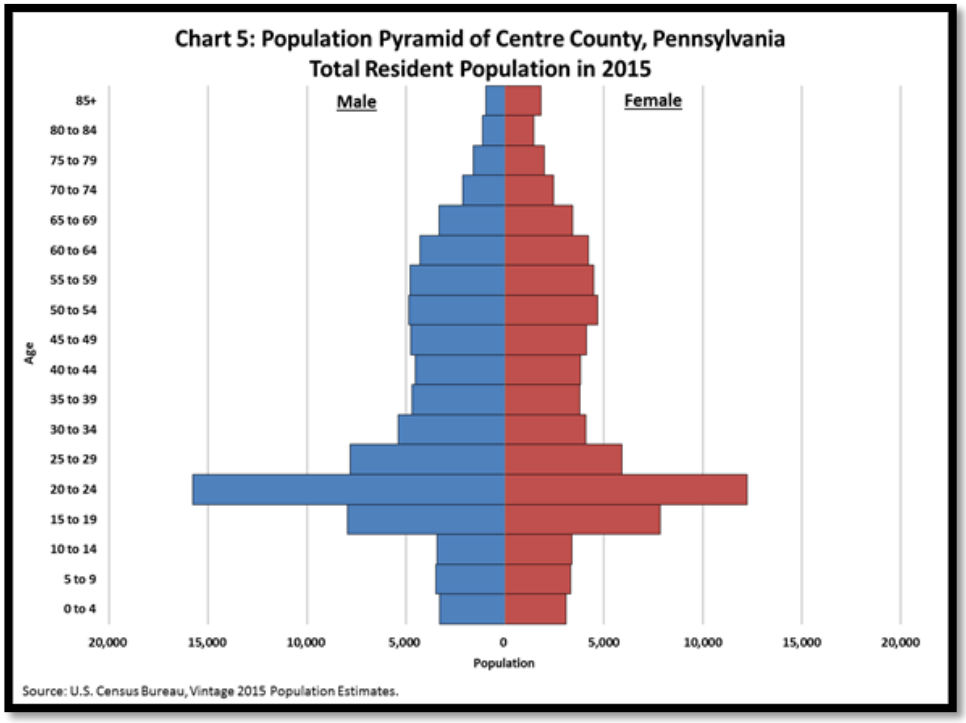


Fig.8: Migration and Population Pyramids

Source: https://www.census.gov/newsroom/blogs/random-samplings/2016/06/americas-age-profile-told-through-population-pyramids.html

The very high share of population in the male age groups of 20 to 50 years in Qatar is due to sex and age specific emigration of working population (Fig.9).

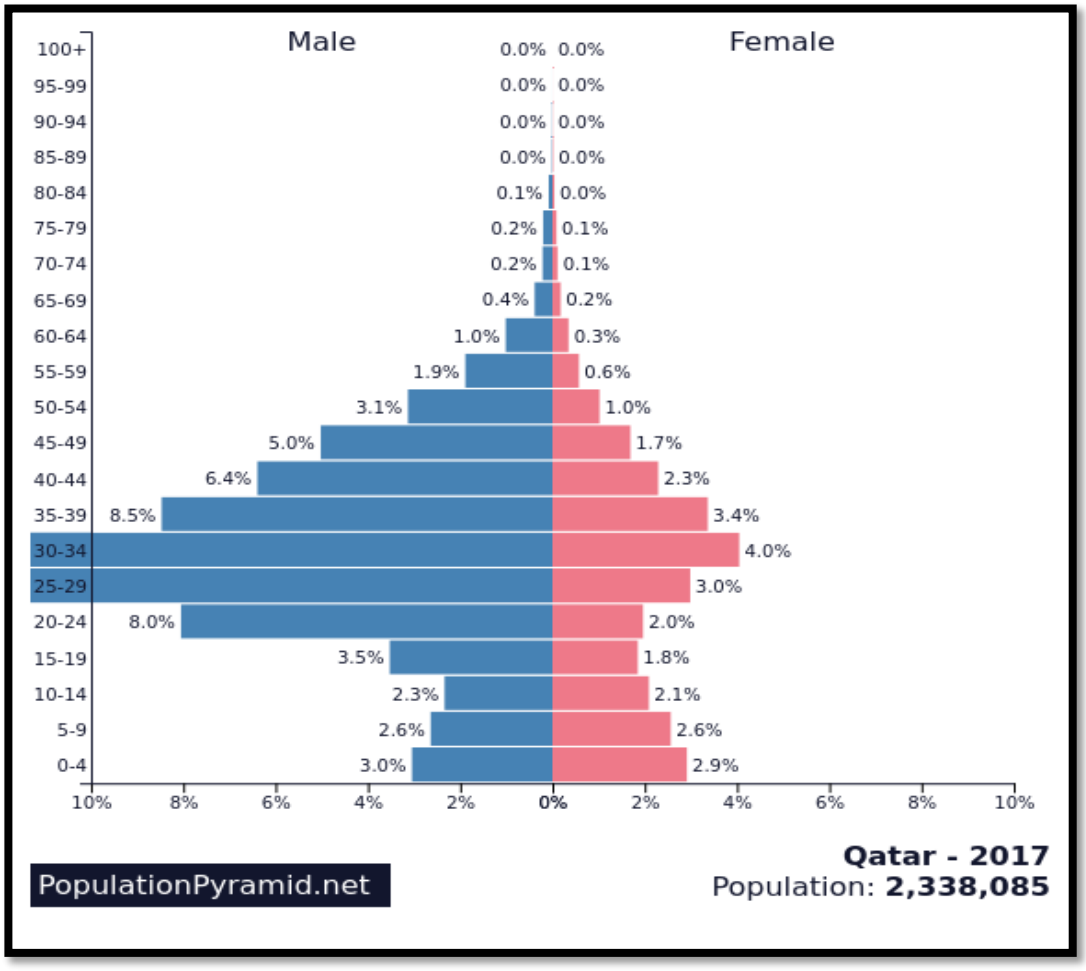


Fig.9: Emigration and Population Pyramid of Qatar

The age and sex pyramid of Indian immigrants in USA is "*diamond-shaped*" and it matches with other total foreign-born persons (Fig.10). This is due to immigration of working population in the economically active age of 20 to 54 years.

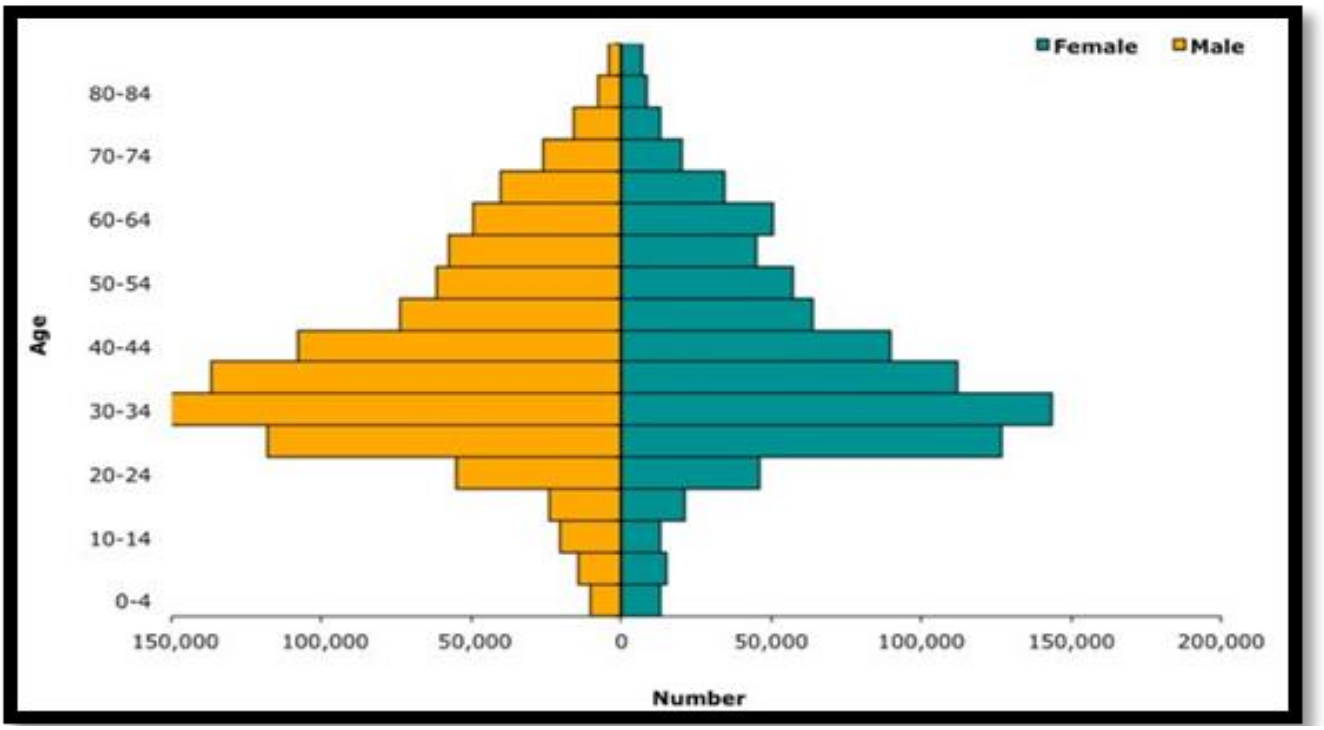


Fig.10: Indian Immigrants: Diamond - Shaped Pyramid

Source: https://www.migrationpolicy.org/sites/default/files/datahub/pyramid5-2011.jpg

AIDS and Population Pyramid: The epidemic of AIDS has significantly modified the shapes of population pyramids of many African countries like Botswana due to increased mortality in lower and middle age-groups population**.**

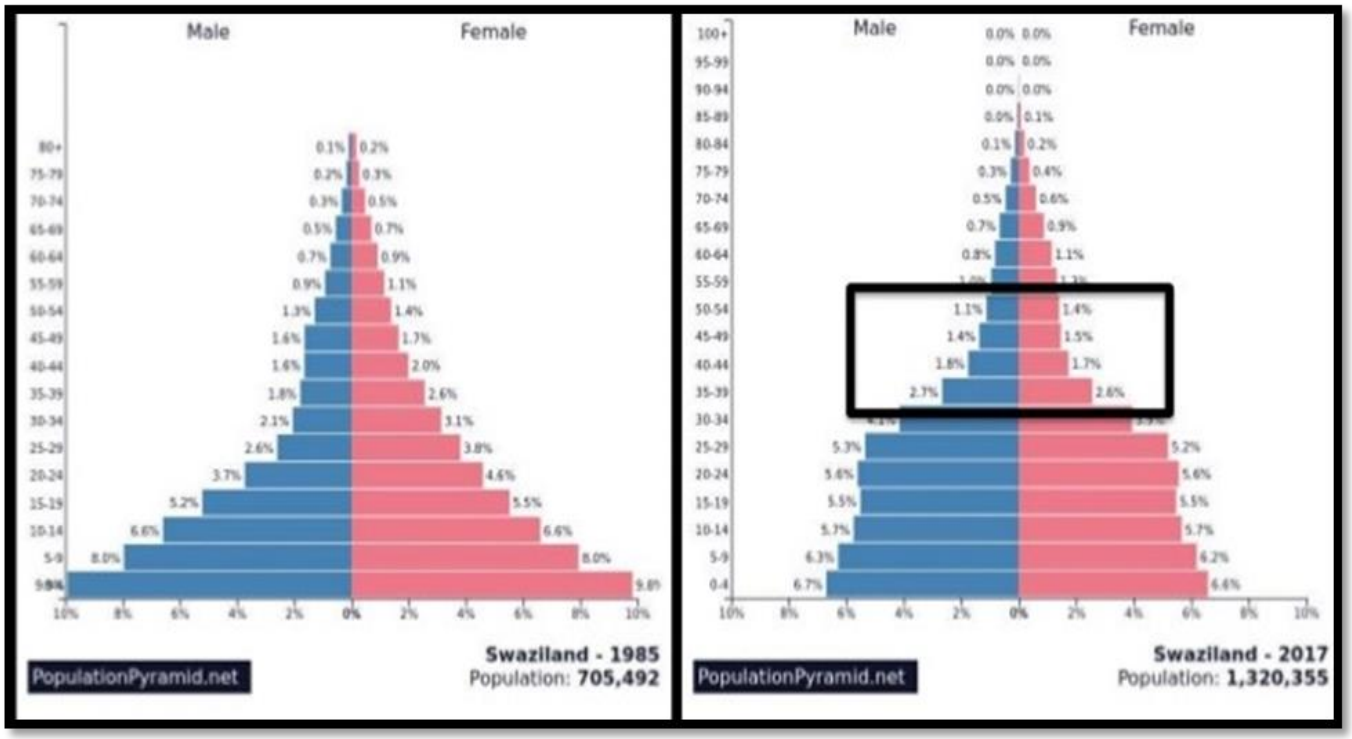


Fig.11: AIDS Impacted Population of Swaziland (1985 to 2017)

Source: https://image.slidesharecdn.com/poppyramidsgs-171011222148/95/population-pyramids-global-studies-16-638.jpg?cb=1507760530

The End of Population Pyramid: The process of demographic transition of world population in past, present and future projections indicates that the global demographics will change shape from Pyramid shape of 1970s and 1980s to bell shape at present and by 2050 age and sex composition will acquire the shape of a barrel. Therefore, the pyramid shape will fail to survive (Fig.12).

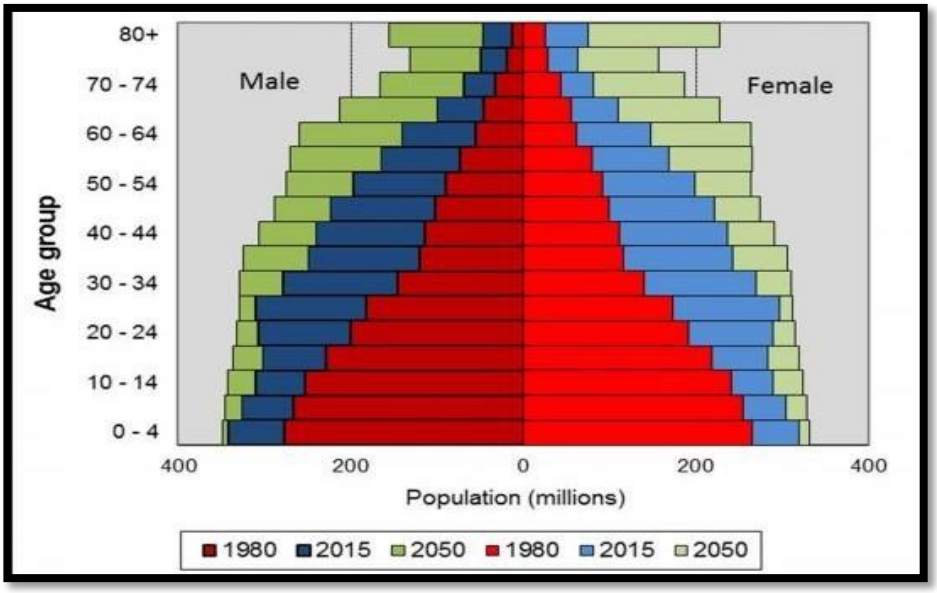


Fig.12: Global Demographics: From Pyramid (1980) to Bell (2015) to Barrel (2050)

Source: http://blogs.worldbank.org/futuredevelopment/files/futuredevelopment/AgePyramid1_0.jpg

Conclusion: Population pyramids generally represent the structure of population of a region on the basis of age and sex. This graphical representation provides a great deal of information about fertility, mortality and migration or population dynamics. Generally, demographers identify three types of population pyramids – expansive or rapid growth, stationary or slow growth and constrictive or contractive or negative growth pyramids. In addition to these common shapes many irregular shapes like kite-shape, diamond-shape and many other shapes are also found in specific contexts. At a fix point of time different countries show different types of population pyramids and over the period of time the shape of pyramids also changes. The global demographics are changing from pyramid to bell and finally to barrel i.e. the end of population pyramid**s.**

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