Math

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**Introduction**

The 18th-century economist Thomas Robert Malthus predicted in his book An Essay on the Principle of Population (1798) that London would run out of food as it increased arithmetically while the population grew geometrically. He was proven wrong because the food supply had rather increased. This increase in food supply was boosted by innovations in agriculture as well as the improved distribution of food. The current population growth rate of the world is 1.09% whereas the worldwide food supply is estimated to increase at 1.1%. Since the food supply is projected to increase at a rate greater than the current population growth rate, there is a debate that whether or not it is necessary to plan for future food shortages due to overpopulation over the next 10 years. This report has concluded that planning is indeed necessary. One reason for a call to planning is the fact that the population growth rate is greater than the estimated growth in food supply for lesser-developed countries excluding China and least-developed countries. Therefore, the population will exceed the available food in these two groups of countries by 2028. Moreover, the population growth rate trends of least and lesser developed countries are projected to increase further, thereby exacerbating the food supply shortage (Population Division of the UN Department of Economic and Social Affairs, 2017). Furthermore, the current situation of food distribution disparity already calls for action. The distribution disparity exists even today in regions such as Africa, South America and Asia (Food and Agriculture Organization of the United Nations, 2018). Therefore, there is a dire need to formulate policies keeping in view these facts. Planning will be of foremost importance to deal with the impending food shortages in these regions. The United Nations Food Distribution Agency must equip itself with all the essentials to ensure equitable distribution of food. Steps should be taken by the UN to decrease population growth rate in the Third World, increase food production further by fundings and introducing the latest techniques to increase yield per acre. Trade should be encouraged to promote the exchange of goods including food items. Moreover, with the looming threat of climate change, both the United Nations (US) and its Distribution Agency must equip themselves to minimize the adverse impact of climate change on food supply and to respond to any kind of emergency situations of food shortage. Without planning and implementing the said strategies, achieving the United Nations Sustainable Development goals will remain a distant dream.

**Discussion**

**Findings of the UN Agency**

As per the findings of the UN Agency, the world's population growth rate at present is 1.09% a year. The agency has also estimated that over the next 10 years the world-wide food supply will increase at a rate of 1.1% annually.

The table below shows estimated populations in 2018 and current estimated growth rates for different groupings of countries and for the world as a whole. The last column gives the agency’s estimate of the food supply in each region and the world in 2028, based on a 1.1% annual growth rate.

|  |  |  |  |
| --- | --- | --- | --- |
| Group | Population in 2018 (billions) | Current Annual Growth Rate  | Food Supply in 2028 (for billions of people) |
| More-developed countries | 1.33 | 0.61% | 1.48 |
| Lesser-developed countries excluding China | 3.85 | 1.23% | 4.30 |
| Least-developed countries | 1.01 | 2.51% | 1.27 |
| China | 1.44 | 0.05% | 1.46 |
| World | 7.63 | 1.09% | 8.51 |

Table 1

**Analysis of the Agency’s Findings**

The given data shows that the estimated increase in worldwide food supply (1.1%) is greater than the current population growth rate of the world (1.09%). However, the given table shows that the population growth rate is greater than the estimated growth in food supply for the following categories of countries:

1. Lesser-developed countries excluding China (1.23%)
2. Least-developed countries (2.51%)

Therefore, if the annual growth rate of these two categories of countries remains the same until 2028, the population will exceed the available food in these regions. Although some experts are suggesting that there no need to plan for future shortages, these findings warrant that a strategy needs to be devised to deal with food shortages in these two groups of countries.

In the given table, the projected population in 2029 is not mentioned. In order to compare the population in 2028 with food supply in 2028, we need to calculate the population 2028 first.

**The assumption for Making Calculations**

It is assumed that the given annual population growth rate will remain the same over the next 10 years. On the basis of this assumption, the current annual population growth rate has been used to calculate the population in 2028. It is to be noted here that in following pages, the real trend of population growth rate in the least and lesser developed countries has also been discussed.

**Calculations**

In order to find the population of each category/grouping of countries in 2028, the following formula can be used:

Population in 2028 = Current population x (1+ growth-rate% )10

For example:

World population in 2028 = Current population of the world in 2018 x (1+1.09%)10

 = 7.63 (1+1.09)10

= 8.5 billions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Population in 2018 (billions) | Current Annual Growth Rate  | Population in 2028(billions) | Food Supply in 2028 (for billions of people) |
| More-developed countries | 1.33 | 0.61% | 1.41 | 1.48 |
| Lesser-developed countries excluding China | 3.85 | 1.23% | 4.35 | 4.30 |
| Least-developed countries | 1.01 | 2.51% | 1.29 | 1.27 |
| China | 1.44 | 0.05% | 1.45 | 1.46 |
| World | 7.63 | 1.09% | 8.50 | 8.51 |

The second last column of Table 2 shows the population of each grouping of countries, calculated on the basis of the above formula.

Table 2: Comparison between Population and Food Supply in 2028

**Observations**

The table, thus, confirms that the population will exceed food supply in lesser-developed countries excluding China and least-developed countries. In lesser-developed countries, the population will be 4.35 billion while the food supply will be available for 4.3 billion. Likewise, in least-developed countries, the population will 1.29 billion whereas the food supply will be available for 1.27 people. Therefore there will be a shortage of food for 0.05 billion and 0.02 billion in lesser and least developed countries respectively.

However, since the overall food available in the world in 2028 will be for 8.51 whereas the population will be 8.50 as shown in Table 2. Hence there will be a food surplus for 0.01 billion (100 million people). Bu the difference is only marginal. Not planning food distribution will, therefore, be fatal. In order to plan distribution, the UN Distribution Agency should focus on the groups with food surplus (more developed countries and China). The surplus food of more developed countries and China will have to be transferred to the least and lesser developed countries in order to ensure food security and avoid malnutrition in the said food deficient regions.

**Growth Rate Trends of Least and Lesser Developed Countries in Future**

In the calculations, it was assumed that the current population growth rate of these groups of countries will remain same till 2028. However, practically that might not be the case. Therefore, this report has explained below the estimated trends of population growth rate in various regions.

The report titled World population Prospects published in 2017 by Population Division of the UN Department of Economic and Social Affairs provides estimations of future trends in population growth. According to this report, the population growth rate of the least developed countries will most likely increase in the near future. This increase will continue for several decades (Population Division of the UN Department of Economic and Social Affairs, 2017).

The information provided in this report suggests that planning for future distribution of food is essential to overcome future food shortages and least and lesser developed countries. The new Sustainable Development Goals can only be met if policies are made while keeping this information in mind.

The Food Distribution Agency must keep track of the growth rate of the groups of countries and plan its distribution strategy accordingly.

**Existing Distribution Disparity**

The current situation already calls for action. According to the Food and Agriculture Organization of the United Nations, hunger is on the rise. The number of undernourished people has increased from 804 million in 2016 to about 821 million in 2018 (Food and Agriculture Organization of the United Nations, 2018). This number has been increasing since 2014.

Most undernourished people live in Africa constituting nearly 21 percent of the total population. In South America, about 5.0 percent population remains undernourished. Although food shortage is on the decrease in Asia, the decreasing rate is slowing down over time. SDG target will remain unachievable without increasing efforts (Food and Agriculture Organization of the United Nations, 2018).

**Food Supply and Climate Change**

It cannot be easily predicted what effect the unprecedented changes in climate will have on food supply. Food production depends on favorable climate conditions. Keeping in view the existing food distribution disparity, the likelihood of adverse impact of climate change on food supply, efforts need to be made to ensure equitable distribution of food from regions where food is in surplus to regions where food is in short supply.

According to Table 1 and Table 2, the world food supply in 2028 will be only marginally greater (by 100 million) than the actual population. Therefore the uncertainty in food supply caused by climate change again warrants serious efforts to plan strategies for dealing with emergency food shortages.

**Recommendations**

The Un Food Distribution Agency needs to devise a strategy to deal with the threats that have been highlighted above. Planning will be of foremost importance since the world food supply will be only marginally greater than the world population.

The UN Food Distribution Agency should equip itself to transfer food from countries with a surplus to countries suffering from food shortage. According to Table 2, least and lesser developed countries excluding China will be suffering extreme food shortages in the future. Therefore the Agency must devise a timeline for transfer of food to these regions.

Trade should be encouraged to promote the exchange of food items. The industrial sector in lesser and least developed countries must be enhanced in order to enable them to exchange them with food-surplus countries for food items.

The Agency must also increase its transportation capacity. In order to deal with natural disasters, it should equip itself to deal with food shortages in emergency situations.

Although the food produced today exceeds the population today, yet there is an alarming number of people suffering from malnutrition. Our calculations and assessment have shown that the situation may not become any better if proper measurements are not taken. Keeping in view the regional food shortages, growing population growth rates in the least and lesser developed the world and the worldwide food distribution disparity, the United Nations and Food Distribution Agency should take appropriate measures.

The United Nations must take steps to reduce the population growth rate in the least and lesser developed countries. For that purpose, educating the masses and creating awareness about contraceptives are necessary steps. Moreover, employment opportunities should be provided to people to minimize the desire to give birth to more children for earning a living. Minimizing the gender gap in education is of paramount in this context.

The United Nations should also endeavor to introduce the latest agriculture techniques such as drip irrigation, use of fertilizer and pesticides, genetically improved seeds, etc. to increase yield per acre. Steps must be taken to combat water shortage. Loss of water can be minimized by building proper storages, managing timings of irrigation and using pipelines.

The United Nations also needs to identify regions more prone to climate change in order to devise strategies to minimize their impact on food production.

**Conclusion**

Although the estimated food supply worldwide will be greater than the world population growth rate in 2028, there will be a shortage of food in the least and lesser developed countries (excluding China), because the growth rate of the population exceeds the estimated increase in food supply for these two groupings of countries. In fact, the population growth rate for these two groupings will increase further over time in the coming few decades, thereby exacerbating the malnutrition and food shortages in regions such as Asia, Africa, and Latin America. Furthermore, the disparity in food distribution exists even today in these regions. Supply of food depends on several factors, the climate is the most important. With unprecedented changes in climate, it cannot be accurately predicted how the adverse climate conditions will impact food production. Therefore food security is under a severe threat from the climate. All these facts make it important to meticulously plan food distribution for the future. The UN Food Distribution Agency must build its capacity to transfer food from countries with a surplus to countries with food shortages. The UN must promote education and awareness to tackle population growth rate. It should sponsor the latest techniques to enhance yield per acre. Trade should also be encouraged between the developed and under-developed countries to promote the import of food items into food-deficient countries. Without taking serious measures, Sustainable Development Goals cannot be achieved.

**References**

Food and Agriculture Organization of the United Nations. (2018). *Food Security and Nutrition around the World.* FAO.

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