FOOD PRODUCTION AND POPULATION GROWTH

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1. The setting of the problem

One of the most discussed problem of our days is whether food production can, or cannot, keep pace with the rapid growth of human population. The problem is analysed at both the regional and the global levels and also, in perspective of past and future trends. The findings are clear and rather worrisome, but the interpretation of «cause and effect» and therefore the proposals for action, do not always meet a consensus of opinion on the international level.

Some of the major constituents of the problem, sometimes labeled as «the food dilemma» or «the protein crisis», may be summarized as follows : Actually (1976) the world population has reached the unprecedented number of 4.000 million persons, and it is growing by 84 million per year or 230.000 newcomers in every single day. The number was half that much, just forty five years ago (2.000 m. in 1930). More than a century ago, the population numbered 1.000 million (in 1820) and 500 m. in about the year 1680, that is taken as the eve of the industrial revolution.

Earlier estimates are rather dubious. According to the best judgements, the total population was about 250 m. at the time of the Roman Emperor Augustus, and not more than 10 m. some 8.000 years ago, when the newly discovered food producing economy made a good footing in certain regions of the old world. Prior to that time, when man was a primitive hunter and scavenger, there was room for only one person per km^2 at the most, or about one million at the best period of Homo Neandertalensis. It may therefore be deduced that the poorly equipped and slow breading human species, experienced two major upstarts of its number; first, after the so called agricultural revolution during the mesolithic-neolithic period and second, after the consolidation of the recent industrial or scientific revolution, which is still going on in our days.

An association between food production and population growth is clearly depicted in the above trends. For 99% of man's existance, the scarcity of food was brutally checking the numbers of population. The pressure was substantially

relieved after the introduction of tillage and farming of the soil and the domestication of wild animals. The new techniques provided immensely more food, produced almost at man's command, and the population began to grow rapidly, doubling its numbers in a matter of a few centuries, instead of many millenia in the past. However the benefits derived from the agricultural revolution could not last for ever. They hit the «law of diminishing returns» during the middle-ages, when a combination of wars, epidemics and famines began to erode the vital forces for further population expansion.

Soon after the dawn of the industrial revolution and the re-birth of the scientific thought, food supply along with general production increased substantially. The shift towards mass production and international trade, together with advancements in medicine and public sanitation, improved the status of nutrition, the health and the wellbeing of the average citizen. This gave the chance for a rapid population growth but, in spite of the gloomy predictions of Malthus, this growth was matched and often surpassed by the rate of food production. How then and why did the present riddle of food dilemma came about?

2. The ecological perspective

Life on Earth (the only living planet of our solar system) is found on its surface as an extremely thin film, the volume of which does not exceed $1/10^9$ of the planet that supports it. Life appeared some 1.000 million years ago and in the course of countless millenia, it differentiated into millions of species, though the living matter retains always exactly the same mass. The limiting factor is the amount of solar energy reaching the Earth, that can effectively be converted into living matter, through the process of photosynthesis.

Food is the most essential factor for day to day survival. With the exception of green plants that are fed on inorganic food, all other biological species consume living plants and animals, of those present in their particular ecosystem. The separation of life between feeders and those to be fed upon, implies a biological balance between the various species. For example, the population of a feeder can not grow beyond the limits of available food, and if the species upon which it is fed are heavily depleted, its own numbers will eventually dwindle or be annihilated. This explains the disappearence of some species and the emergance of others, better adapted to use whatever food was left in their environment.

Man makes no exception to this general rule. During the agricultural revolution, he embarked on a tedious but highly immaginative task to domesticate wild plants for cultivation, and wild animals for food reserve at home, or for extra muscular energy for his leisure. It is interesting to note at this point that,out of 250.000 plant species that exist on the Earth, only some 100 are used for man's food. Similarly out of about 2 million animal species, only 50 are domesticated. All these were selected by the primitive farmers or animal breaders of bygone ages, while modern science did not add even one new species of either.

Within these limitations, the agricultural man lived bearably well during the past 10.000 years. He certainly experienced crop failures and natural disasters, but he gradually learned to improve his methods of food production. When the land was exhausted, he moved to other fertile lands and green pastures, thus securing not only his survival, but also the diffusion of new techniques and the proliferation of the human species all around the world.

Was there enough food to cover the needs of an expanding population? Certainly not, for there always was a precarious balance between food produced and mouths to be fed. Collateral paleo-anthropological evidences indicate that the neolithic man, as well as the civilized societies of historical times, were poorly fed and exposed to periodic catastrophes, as a direct result of the perennial shortage of food. The only remedy against these adversities was a high birth-rate, in order to balance or better to exceed slightly the prevailing high death-rate. The harshness of life was then attributed to the will of God, but in the long run the total population was slowly growing and expanding in space. Only after the collapse of the ancient civilizations including the Byzantine Empire, the momentum gained by the agricultural revolution came to an almost complete standstill.

It was revived by the industrial revolution, which began in Europe and more precisely in England, some 200 years ago. Its main features were (1) the use of inanimate energy (fossil fuel, electricity etc.) and of metals (mainly iron and steel) (2) the invention of new machines and a new organization of work known as the factory system, a mass transportation and a world-wide network of communication, and (3) an increassing application of science to industry. These technological innovations and advancement of sciences,radically changed the course of development and gave man, not only new skills and better health, but also the confidence to be the master of his destiny.

Food became more plentiful and moved around more freely, together with the basic commodities and the knowledge for better living conditions. In response to these improvements, the death-rate entered a downward course and life expectancy doubled in the short interval of the last three generations. Infant mortality has also been drastically reduced, but the birth-rate did not react as speedily or as energetically as the death rate did. After a long delay, the birth-rate did come down, but only in the regions which profited the most from these innovations, those that attained an advanced level of economic and social organization. In most other regions of the world the birth-rate is still high, sometimes even higher than ever before, while the death-rate oscillates at substantially lower levels. These serious divergences of the vital rates resulted in huge population surplusses, first in Europe and recently in the other parts of the world.

The European population pressure of the 19th century was dissipated through a mass overseas migration towards the other four continents. It thus helped in the diffusion of the newly acquired technological skills and scientific advancements around the four corners of the world. But the transition from the agricultural

to the technological economy is not as yet completed. Less than one third of the world population accomplished this feat, while the majority (72 %) is still struggling along the laborious road towards modernization. The first group of countries, labeled as d e v e l o p e d, are richer and consume about two thirds of the world

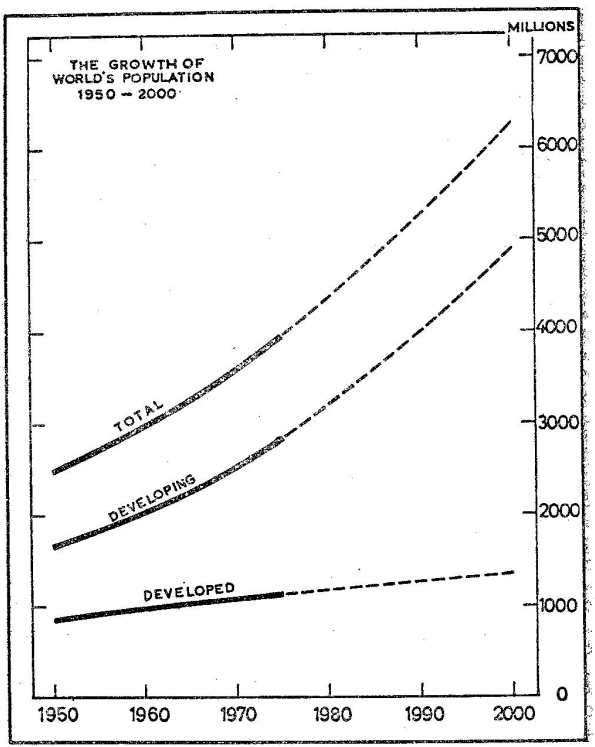

Fig. 1. Population estimates (1950 - 1975) and projections (1975 - 2000). World total, Developing and Developed Regions. (United Nations,1975).

production of food, energy etc. The others, euphemistically called d e v e l o p i n g countries, live under the antiquated regime of agricultural economy, with only a few patches of modernization. For example, the death-rate has come down, along the western patterns, but the birth-rate, now reinforced by longer survivorship trends is often higher than the customary agricultural level. This leads to an explosive expansion of the population in the developing regions, which conversely inflates the volume of human species on the Earth to alarming proportions.

It took man countless millenia to build-up a population of 2.500 millions, at it was in 1950. (Fig. 1). Yet, according to the latest United Nations projections, it will take only 37 years to double that number (5.000 m. in 1987). This is mainly due to the rapid population growth of the developing regions. Its proportion to the total, rose from 66 % in 1950 to 72 % in 1975 and will probably reach 78 % at the end of the century. Thus, in about one generation from now, four out of five persons on the Earth, will be hopelessly stranded on the way towards the much sought economic development and the general transition from agricultural to industrial economy will probably end in a pitiful stalemate.

The repercussions from an inpending stalemate are shown in the latest U.N. and FAO publications[1]. The volume of food production grows at an average rate of 4 % per year, almost identical in both the developed and the developing regions of the world (Fig. 2). Yet, at the level of p e r c a p i t a food supply, an ominous stagnation is depicted for the people living in the second region. Between 1936 and 1970 the per capita food production increased by 53 % in the developed countries, but only by 8 % in the developing regions. The discrepancy is due to the rapid population growth in the latter region, where some 200.000 newcomers per day chop away most of the extra food produced.

One way to compensate for the rapid population growth in devoloping regions, is to push the local food production to twice the present rate, or to approximately 8 % per year. It will then be possible to provide enough food, not only for the 70 million newcomers per year, but also to improve nutritional levels of the already existing population, two thirds of which live on a diet of chronic malnutrition. Their average ration corresponds to only 2.140 calories per person - day, as against 3.090 calories for those living in the developed regions of the world. But the doubling of the volume of food production, a Herculian task in itself, is almost out of reach for the developing world of to - day. Capital, skills and open land become progressively scarce and the old escaping door of emigration, is almost closed for everybody, because the entire Earth is already overpopulated.

A further complication is echoed in the following words. «The world food situation in 1973, is more difficult than at anytime since the years immediately following the devastation of the Second World War»[2]. Unfavourable weather

1. The Determinants and Consequences of Population Trends, United Nations 1973.
2. A. Boerma, the Director General of FAO, prefacing the State of Food and Agriculture 1973.

conditions or possibly a gradual climatic change along the Sahel zone of our planet since 1971, resulted in a heavy deterioration of food production, along with the exhaustion of the existing food reserves. As expected, the hardest hit are the developing countries, which are now caught in a trap of high fertility and relatively

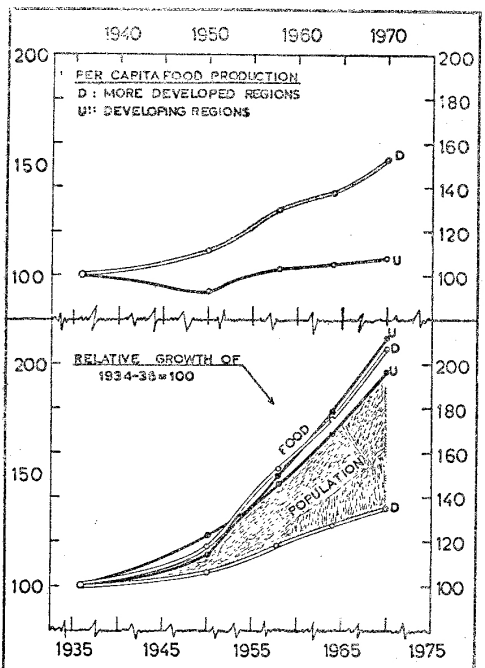

Fig. 2. Index numbers (1934 - 36 = 100) of population growth and food production, in developing (U) and developed (D) regions of the World. (United Nations 1973).

low mortality, an economic recession because of the current energy crisis and not much time left for an effective recovery.

3. Is there a way out?

If man can master his destiny and makes good use of the collective wisdom, as it is voiced in the United Nations and the family of International Organizations, the balance between food production and population growth can be re-established in the not too distant future. Much valuable time has already been lost, but if action replace discussions, an equilibrium between food and population, may be reached in about 10 or 20 years in the future. The course may be harsh and painful, as it always has been, but the vital rates have to come closer together at the most convenient level. Food production can also be increased, if the conventional sources are better exploited at a worldwide basis and new sources of food (such as farming of the sea, including fish and plankton, synthetic nutrients etc.) are put into action. The epic ascent of human intelligence, may be taken as a reassuring quarantee for future inventiveness, that will secure man's presence and wellbeing on the surface of this planet.