

***Population, Natural Resources,
Environment and Human Resources
in Development***

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A B S T R A C T

Based upon the theme presented in the Club of Rome's Limits to Growth, this paper examines the impact of population changes on natural resources and environment in contemporary developing countries in Asia. The discussion on population growth and natural resources covers such problem areas as food requirements and energy consumption. Furthermore, the relationship between population change and environment has been extensively analyzed with special reference to urbanization. As a partial solution to the shortage of natural resources required for development in many of the Asian countries, the authors discuss the possibility of augmenting human resources in their total developmental efforts, by referring to the Japanese long-term experience.

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I. Introduction

In recent years a number of studies have emphasized the concern about the effects of population on worldwide resource adequacy and the earth's ecological systems. The Limits of Growth, a Report for the Club of Rome, is one of the salient examples of these studies (Meadows, 1972). The main theme of these studies is that world population, coupled with the material well-being of the world, has been growing at such a tempo that natural resources and the environmental carrying capacity of the earth have been used up at rates faster than the ability of science and technology to find solutions for increasing scarcities and imbalances. One of the major conclusions of the Report for the Club of Rome is that global catastrophe in the form of dramatically increased death rates is likely within the next 100 years unless both population and material economic growth in the world is substantially reduced within the next few decades.

Although there has recently been an increasing number of indications that world population growth has started to slow down, it will continue to grow at a substantial rate for several decades to come. According to the United Nations projections prepared in 1978, it will fall from 1.81 to 1.56 percent (geometric) from 1975-1980 to 1995-2000 (United Nations, 1979). During the same time period, the population growth of the more developed region is expected to decrease from 0.67 to 0.51 percent, while that of the developing region from 2.21 to 1.84 percent. This implies that the difference in population growth rates between these two regions will remain almost unchanged for quite some time to come.

Among the developing areas, Asia will undergo a relatively rapid decline in population growth in the next two decades, from 1.98 to 1.54 percent per annum. Within Asia, however, there are pronounced intraregional differences in population growth rates and their prospects for future changes. For instance, over the period of 1975-1980, the population of East Asia has grown at a rate of 1.39 percent per annum, while that of South Asia grew at 2.54 percent. By the end of this century, the former will fall to 1.0 percent and the latter to 1.93 percent.

In the next section of this paper, we will briefly discuss future prospects of population changes in Asia and their impacts upon re-

sources and environment. In Section III the Japanese experience in dealing with these problems will be presented as a successful case in Asia, with special emphasis upon the role of human resources in overcoming numerous difficulties arising from the imbalance between her population growth and the availability of resources. In the final section of this paper, various policy aspects of population, resources and environment will be considered, with stress upon the importance of developing appropriate mechanisms for closer regional cooperation in solving the problems of the imbalance between population and resources in Asia.

II. Population Changes, Resources and Environment in Asia: Current and Future Trends

A. Sources of Pressure of Resources and Environment

Both resource requirements and environmental pressures are linked to various factors. Population growth is certainly one of them. At a given level of living, higher population increases require larger material flows. Secondly, per capita income or GNP affects the severity of resource and environmental problems. The higher the per capita income, the larger the resource requirements. For this reason resource and environmental problems are likely to be aggravated as a country becomes richer. On the other hand, environmental problems are also related to poverty. For instance, most of the low-income countries suffer from a lack of adequate health and sanitation facilities, and other infrastructure-related investments. Thirdly, the composition of the material goods produced and consumed determines the nature and type of resource and environmental problems. For example, as a country develops, different types of resources are required and new pollution problems arise. Fourthly, the spatial distribution of both population and economic activities are closely associated with the seriousness of these problems. Even a country with low population density has the problems of urban crowding due to skewed locations of industrial plants. Fifthly, the state of technologies in use determines the characteristics of both resource and environmental problems. Technologies enable today's wasted products to be transformed into tomorrow's vital resources.

It should be also stressed that all of these factors are strongly influenced by the institutions, tastes, and policies of each country. Government regulations with regard to the importation of fuel and minerals are one of the examples. The public investment policies and the operation of the price system are directly related to the problems of environmental resources.

In order to consider the relationship between population and resources, one should deal with all these factors simultaneously. In this paper, however, for the sake of simplicity we will concentrate on the impact of demographic changes upon resources and environment, leaving out other factors from consideration.

B. Demographic Changes

As evidenced by an increasing number of recent population-related surveys, including the World Fertility Survey, the rate of decline in fertility, particularly in the developing regions of the world has been considerably faster than anticipated earlier (Salas, 1981). This is reflected in a series of assessments of world population trends prepared by the United Nations. Table 1 illustrates substantial differences between two assessments, one in 1973 and the other in 1978. According to the 1973 assessment, global population was supposed to lower its growth rate from 1965 to 1970, and then to recover it in the following decade. In the 1978 assessment, however, global population growth started to fall in 1965 and would decline continuously until the year 2000.

Although the comparison of these two United Nations' assessments clearly indicates a quickening of the rate of decline in world population growth, the current population growth rate in the developing countries is still very high. It should be also noted that even in the case of the 1978 assessment, annual increments to global population will increase from 83 to 93.2 million from 1980-1985 to 1995-2000. This implies that the pressures derived from the annual net addition to world population will intensify problems arising from high population growth. More importantly, because most of these increments will occur in the developing regions of the world, the population problems in developing countries will persist and may be even aggravated in the coming years.

Table 1. Population Trends for 1960-2000,
as Assessed in 1973 and 1978

Year	Assessed in 1978		Assessed in 1973	
	Population (millions)	Annual Rate of Increase (percentage)	Population (millions)	Annual Rate of Increase (percentage)
World Total				
1960	3,027	1.95	2,986	1.85
1965	3,344	1.99	3,288	1.93
1970	3,678	1.90	3,610	1.87
1975	4,033	1.84	3,968	1.89
1980	4,415	1.81	4,374	1.95
1985	4,830	1.80	4,817	1.93
1990	5,275	1.76	5,280	1.84
1995	5,733	1.66	5,763	1.75
2000	6,199	1.56	6,254	1.64
More Development Regions*				
1960	945	1.27	945	1.27
1965	1,003	1.19	1,003	1.19
1970	1,050	0.91	1,048	0.88
1975	1,093	0.81	1,093	0.84
1980	1,131	0.67	1,139	0.82
1985	1,169	0.67	1,186	0.81
1990	1,206	0.62	1,230	0.73
1995	1,240	0.56	1,270	0.64
2000	1,272	0.51	1,308	0.59
Less Developed Regions*				
1960	2,082	2.27	2,041	2.13
1965	2,341	2.35	2,285	2.27
1970	2,628	2.31	2,562	2.30
1975	2,940	2.24	2,875	2.31
1980	3,284	2.21	3,235	2.36
1985	3,661	2.17	3,630	2.32
1990	4,069	2.12	4,050	2.20
1995	4,493	1.98	4,492	2.09
2000	4,926	1.84	4,946	1.94

* More developed regions include Northern America, Japan, Europe, Australia-New Zealand and Eastern Europe-USSR. Less developed regions include all regions other than the above.

Source: Department of International Economic and Social Affairs, United Nations, World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment, New York (1979).

Table 2. Population Trends in Asia, 1960-2000, as Assessed in 1978

Year	1960	1965	1970	1975	1980	1985	1990	1995	2000
	Population (millions)								
Asia Total	1,683	1,878	2,092	2,318	2,558	2,810	3,077	3,345	3,611
East Asia	816	899	981	1,063	1,136	1,204	1,274	1,340	1,406
South Asia	867	979	1,111	1,255	1,422	1,606	1,803	2,005	2,205
	Percentage Change								
Asia Total	2.22	2.18	2.07	1.99	1.90	1.83	1.68	1.54	
East Asia	1.94	1.75	1.62	1.32	1.16	1.14	1.01	0.95	
South Asia	2.44	2.52	2.45	2.49	2.44	2.31	2.13	1.91	

Source: Same as Table 1.

Within the developing regions, there are differences in fertility levels and in the rates of decline, which would, in turn, result in differences in the timing of attaining population stabilization in the future. Among all the regions of the world, South Asia is expected to absorb the largest increments before its population is stabilized at a total of 4.1 billion in the year 2100. In contrast East Asia, which has already achieved relatively low population growth, will reach a stable population of 1.7 billion in the year 2090. Table 2 illustrates the differences in likely future population growth paths for these two regions of Asia.

To clarify inter-country differences in demographic change in Asia, we have shown in Tables 3 and 4 changes in population size and growth for selected Asian countries over the period of 1960-2000. Within Asia a wide variation of changes in population growth rates can be observed. Among these selected countries, Japan's population growth rate has already become low and will continue to decline. China, which has the world's largest population, has been recently showing a rapid decrease in its population growth and is expected to continue to do so. Another populous country in Asia, India, is also expected to slow down its population growth. All of the ASEAN countries are anticipated to undergo a substantial decrease in population growth by the end of the century. It should be emphasized that although all of these selected countries will have lower population growth for the remaining period of this century, their annual net increments will differ considerably. At the end of this century, the net annual addition to the population of China will be 11.3 million, 17.4 million to the population of India, and 6.5 million to all the ASEAN countries combined. These net increments are likely to be a crippling burden upon resources and environmental conditions of these countries in many years to come.

To illustrate the seriousness of these prospective resource and environmental problems in Asia, let us select the following three important problem areas: energy consumption, food requirements, and urban environment.

C. Energy Consumption

As mentioned earlier, an increase in population size gives rise

Table 3. Total Population for Selected Countries in Asia, 1960-2000

	Population (millions)									
	1960	1965	1970	1975	1980	1985	1990	1995	2000	
Bangladesh	--	--	68.12	76.58	88.71	102.83	118.65	135.60	153.33	
Burma	22.36	24.73	27.58	31.24	35.29	39.86	44.74	49.87	55.12	
China	560.00	700.00	771.84	895.34	956.85	1,014.97	1,076.37	1,133.06	1,189.57	
India	429.02	486.65	538.88	618.70	693.89	775.74	861.59	949.61	1,036.66	
Indonesia	93.51	104.88	121.20	135.23	151.89	169.66	187.72	205.42	221.63	
Japan	93.22	97.95	104.34	111.52	116.36	119.73	122.77	125.85	128.90	
Korea, Rep. of	24.70	28.38	31.30	34.66	37.98	41.33	44.66	47.87	50.79	
Malaysia	8.11	9.42	10.40	11.98	13.64	15.41	17.12	18.71	20.18	
Nepal	9.25	10.10	11.23	12.73	14.26	15.96	17.92	20.11	22.43	
Pakistan	--	50.19	59.99	70.27	82.44	96.51	112.08	128.37	144.97	
Philippines	27.41	32.35	36.85	43.84	51.00	58.83	67.09	75.29	83.43	
Singapore	1.63	1.87	2.07	2.25	2.43	2.61	2.80	2.96	3.10	
Sri Lanka	9.89	11.16	12.51	13.60	14.87	16.20	17.56	18.87	20.06	
Thailand	26.39	30.74	36.22	41.36	47.67	54.74	62.15	69.44	76.06	

Source: For the period of 1960-1970, United Nations, Demographic Year Book, various issues. From 1975 to 2000, Department of International Economic and Social Affairs, United Nations, World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment (Medium Variant), New York (1979).

Table 4. Average Annual Rate of Total Population Growth for Selected Countries in Asia, 1960-2000

	Growth Rate (percentage)									
	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000		
Bangladesh	--	--	2.37	2.94	2.96	2.86	2.67	2.46		
Burma	2.04	2.20	2.52	2.44	2.44	2.31	2.17	2.00		
China	1.49	1.97	3.01	1.33	1.18	1.17	1.03	0.97		
India	2.55	2.06	2.80	2.29	2.23	2.10	1.95	1.75		
Indonesia	2.32	2.93	2.21	2.32	2.21	2.02	1.80	1.52		
Japan	1.00	1.27	1.34	0.85	0.57	0.50	0.50	0.48		
Korea, Rep. of	2.82	1.98	2.06	1.83	1.69	1.55	1.39	1.18		
Malaysia	3.03	2.00	2.87	2.59	2.44	2.11	1.77	1.52		
Nepal	1.79	2.14	2.54	2.26	2.25	2.32	2.30	2.19		
Pakistan	--	3.63	3.21	3.20	3.15	2.99	2.71	2.43		
Philippines	3.37	2.64	3.53	3.02	2.86	2.63	2.31	2.05		
Singapore	2.68	2.11	1.68	1.51	1.48	1.40	1.11	0.87		
Sri Lanka	2.45	2.30	1.68	1.78	1.71	1.61	1.44	1.22		
Thailand	3.10	3.33	2.69	2.84	2.76	2.54	2.22	1.82		

Source: Same as Table 3.

Table 5. Energy Consumption in Selected Asian Countries, 1960-1975

	(unit: million metric tons of coal equivalent)					Average Annual Rate of Growth (percentage)		
	1960	1965	1970	1975		1960-1965	1965-1970	1970-1975
Burma	1.18	1.25	1.59	1.39		1.16	4.93	-2.65
India	60.51	83.68	98.46	127.56		6.70	3.31	5.32
Indonesia	12.56	10.55	13.51	25.05		-3.43	5.07	13.14
Japan	108.49	175.08	332.37	403.72		10.04	13.68	3.97
Korea, Rep. of	6.44	12.70	24.97	35.23		14.55	14.48	7.13
Malaysia	1.67	3.36	4.94	7.05		20.55	8.01	7.37
Nepal	--	0.09	0.16	0.14		--	12.20	-2.64
Philippines	0.31	6.66	10.75	13.08		10.68	10.05	4.00
Sri Lanka	--	--	1.88	1.60		--	--	-3.17
Thailand	0.05	3.46	8.81	11.89		15.82	20.55	6.18
Pakistan	2.25	9.21	12.30	13.15		7.75	5.96	1.35

Source: United Nations, Statistical Yearbook, various issues.

to an expansion of material flows. Not only to meet the diversified demand for material goods but also to improve the standard of living of each country, government development planners in Asia have attempted to encourage the growth of industrial sectors. Industrial development requires a vast amount of physical capital and natural resources, and the latter includes a variety of energy sources. In the contemporary world, energy problems arise, not from insufficiency of energy resources, but mainly from their distribution, environmental consequences, and from transitional problems in moving from one energy region to another (Ridker, 1979).

A comparison of Tables 4 and 5 shows that over the period of 1960-1975, population growth rates of the Asian countries selected in Table 5 are, by and large, substantially lower than the growth rates of energy consumption of these countries. In order to quantify the impact of population growth rates upon per capita energy consumption growth rates, we have undertaken the following empirical analysis:

$$\text{PEC} = - 3.30 + 0.97 \text{ PG} + 1.70 \text{ GPC}$$

(13.3) (4.31) (1.10)

$$R^2 = 0.26$$

In the above equation we have regressed the growth rate of per capita energy consumption (PEC) on that of population (PG) and that of GNP per capita (GPC) on the basis of the data for all the countries listed in Table 5 for the period of 1970-1975. Standard errors are listed in the parentheses beneath the coefficients of the variables. Statistically, none of the explanatory variables are significant in this inter-country data analysis. However, we have obtained a different picture in terms of country-specific time-series data analysis. For instance, we have applied the same analysis to the Japanese data over the period of 1956-76, the result of which is as follows:

$$\text{PEC} = 5.69 - 4.43 \text{ PG} + 1.12 \text{ GPC}$$

(3.2) (2.7) (0.11)

$$R^2 = 0.90$$

In this equation it clearly shows that per capita GNP growth, not population growth, is the main determinant of energy consumption. It should be noted, however, that both population and economic growth generate an increased demand for resources and put increased pressures

on environment. Thus, rapid population growth does make energy problems more difficult to solve (Ridker and Crosson, 1975). Slower population growth facilitates the tasks of development planners in formulating and implementing policies to cope with energy problems. Some of the Asian developing countries have chronic shortages of energy. Since they also have a serious balance of payment problems, lowered population growth would tend to alleviate economic constraints on access to sources of energy.

D. Food Requirements

In most of the countries in Asia, agriculture is by far the largest single economic sector, and its future development is very likely to have significant resource and environmental implications.

According to one of the recent reports prepared by the Worldwatch Institute, there have been increasing long-term food deficits in Asia, Africa, and some other areas (Okita, 1980). North America is currently the major supplier of food grains. However, a recent study by the U.S. National Academy of Sciences on the long-range prospects of U.S. food production shows that there will be limits to future U.S. agriculture production. Thus, there will also be limits to surpluses available for shipment to the rest of the world. Given this dismal prospect, it is urgently required that Asia increase its food production to cope with meeting the needs of its increasing population. It is necessary for Asia to become less dependent upon grain imports from North America.

At present, rice and wheat account for 66 percent and 17 percent, respectively, of the total grain production in Asia. Although the share of rice in total grain output dropped from approximately 69 percent in 1961-1965 to the present level, rice is still the principal grain crop in Asia and will continue to be the staple food in the developing countries in Asia at least until the year 2000. Moreover, rice is considered to be the most suitable crop for monsoon Asia. Because of the importance of rice in Asians' daily lives, let us now look at recent changes in the balance between population growth and rice supply growth in Asia, by referring to one of the authors' research findings (Okita, 1980). Over the period of 1960-1975, paddy production in sixteen Asian countries rose about 43 percent from 114

to 163 million tons, as indicated in Figure 1. However, the total population of these sixteen countries increased by 42 percent during the corresponding period, from 790 million to 1.13 billion. Consequently, per capita paddy production grew only from 143 to 145 kilograms.

In Table 6 we have listed ten of these countries and their level of rice production during the time period considered. One can easily notice from Table 6 that the production of rice varies with time periods for each of these countries. In many of these countries, population growth was substantially higher than increases in rice production in one period or another. Among these countries only the Republic of Korea, Malaysia and Thailand were able to meet their needs for rice on a consistent basis.

The observed period-to-period differences are considered to be attributable primarily to differences in climatic and other natural conditions. As a consequence of such fluctuations in rice production, the calorie intake in most of the developing countries in Asia varied from one year to another with resultant undernourishment problems (Iio, 1979).

What is the prospect of these Asian countries meeting their future demand for rice? Can they produce the main staple food at a rate faster than their prospective population increases? One of the recent studies founded by UNFPA answers these crucial questions, although it deals with Asia's future demand not for rice but for food in general (Iio, 1979). None of the Asian developing countries have prepared economic development plans up through the year 2000. As a result, the study has drawn upon economic growth paths in developing countries, considered in the United Nations' study, The Future of the World Economy (Leontief et al., 1977). The Leontief study presents various scenarios for future food demand. Scenario A envisages a 3.1 percent growth of per capita GDP between 1970 and 2000, while Scenario X assumes a 4.9 percent growth. Assuming these economic growth paths and population changes projected by the United Nations, Asia's food demand was calculated. The results based on Scenario A show (i) that the average per capita calorie intake in Asia will increase from 2,057 to 2,691 calories over the period of 1975-2000, and (ii) that the total calorie demand in Asia as a whole will increase at an annual rate of 3.5 percent. These results suggest that if the demand for

Table 6. Rice Production in Selected Asian Countries, 1960-1975

	(unit: thousand metric tons)						
	Quantity of Rice Production				Average Annual Rate of Growth (percentage)		
	1960	1965	1970	1975	1960-1965	1965-1970	1970-1975
Bangladesh	--	--	16,715	19,143			2.75
Burma	6,989	8,055	8,162	9,208	3.48	0.26	2.44
India	51,589	45,742	63,338	73,352	-2.38	6.73	2.98
Indonesia	14,003	14,103	19,331	22,340	0.14	6.51	2.94
Korea, Rep. of	3,193	4,867	5,476	6,485	8.79	2.39	3.44
Malaysia, Peninsular	1,094	1,252	1,671	1,996	3.12	5.94	3.62
Nepal	2,690	2,207	2,305	2,605	-3.88	0.87	2.48
Philippines	3,705	4,073	5,343	6,160	1.91	5.58	2.89
Sri Lanka	--	455	1,616	1,154	--	16.45	-6.51
Thailand	9,488	11,164	13,270	15,300	3.31	3.52	2.89

Source: United Nations, Statistical Yearbook, various issues

food increases at an average of 3.5 percent per annum due to qualitative improvements and population growth, and if Asia's supply of food remains unchanged, the discrepancy between supply and demand will become larger and the possibility of improving nutrition standards will be extremely limited.

What can Asian countries do to fill in this future gap between food supply and demand? Because most of the Asian developing countries cannot afford to import food from food-surplus regions, they should attempt to step up their grain production or increase their dependency on international aid from more wealthy industrialized countries.

What measures should be taken to augment Asia's grain production? In a draft plan for the "Doubling Rice Production Programme in Asia," proposed by a group of experts headed by one of the authors, an "irrigation revolution" was strongly recommended as a breakthrough in expanding the rice production of South and Southeast Asia (Okita, 1980). As a result of the well-known "Green Revolution," modern high-yielding varieties have been spreading throughout Asia since the late 1960s. By 1973 they prevailed in 20 percent of all rice paddies and two-thirds of irrigated paddies in Asia. The impact of the "Green Revolution" will eventually reach a limit. Therefore, unless irrigated paddies are further developed, rice production will not be able to rise in proportion to the increasing demand for rice induced by prospective population increases in Asia.

Besides irrigation, there are many other factors contributing to increased rice production. These factors include plant species, fertilizers, agricultural chemicals, and other technical developments. It is generally considered, however, that among these factors, irrigation is the most important in increasing rice production. Based upon the prevalence of irrigation systems, Asian countries can be classified into three groups. The first group consists of only Japan with an irrigation rate of 98 percent and rice production of six tons per hectare. The second group includes the Republic of Korea and some other areas with 70 percent of the paddies irrigated and rice production amounting to four to five tons per hectare. The third group comprises all other areas with an irrigation rate of 35 percent and rice production of two tons per hectare. Hence, most of the Asian countries still have a vast number of paddies to be irrigated with

considerable potential for expanding their rice production.

Experience indicates, however, that a massive expansion of irrigation in developing countries tends to pose serious environmental threats (Ridker and Crosson). A listing of a few of them includes, "soil erosion, laterization, alkalization, silting of canals and reservoirs, endemic diseases, the disruption of aquatic ecosystems, and the destruction of certain species and the proliferation of others." These environmental threats have all been suggested "as possible consequences of increased irrigation, particularly if irrigation projects are not planned well."

An increase in irrigated areas calls for a corresponding expansion of fertilizers and pesticides. According to an estimate prepared by FAO in 1970, the consumption of fertilizers in developing countries would rise by a factor of seven or eight between 1962 and 1985. Even if per hectare consumption of fertilizers continues to grow beyond 1985, the consumption levels of developing countries would be still considerably lower than those observed in contemporary developed countries. Even if the absolute amount of fertilizers used in developing countries were relatively modest, the anticipated growth of fertilizer consumption might constitute serious environmental threats if fertilizers were employed without knowledge of, or concern about, environmental side effects among development planners. The environmental side effects of the use of fertilizers in developing countries vary with a host of factors including climatic and soil conditions.

In summary, although new agricultural technologies must be increasingly used in order to expand the agricultural production in the developing regions of Asia, they carry the potential for serious environmental threats. At the same time, development planners should be aware that the threat from large-scale irrigation works could be more severe than that from increased consumption of fertilizers and pesticides. To minimize the likelihood of environmental damage is another reason for curbing population growth to keep the demand for food at a low level. Moreover, lowered food requirements would facilitate qualitative improvement in food intake.

E. Urbanization

Only relatively recently has attention been focused on urbaniza-

tion in relation to development. Urbanization, that is an increase in the proportion of the population living in large agglomerations, has been both an antecedent and consequent of increased productivity and higher levels of living in the more developed countries of the world (MDCs) (Hauser, 1979). This has been the case in the more developed regions because increased population clusters have permitted a greater division of labor, increased specialization, easier application of non-human energy, economies of scale, external economies and minimization in the frictions of time and space. In the less developed countries (LDCs), however, urbanization has been the product of forces not necessarily associated with increased productivity.

Developing countries are generally characterized by the presence of a "primate" city, usually the capitol of a nation of size of which greatly exceeds that of all other cities. The size of the primate city in the LDCs, in contrast with the great cities in the MDCs, was the product not of internal national economic development but, rather, of its role as an entrepot or liason between the mother country and the LDC as a colony in an imperial economic system. With the dissolution of empire after World War II accompanied by disruption of economic ties, the economic base of primate cities was undercut; and increased national economic growth was necessary, by the standards of cities in the MDCs, to justify the primate city size. Thus, unlike the case of great cities in the MDCs, the colonial heritage of the cities in the LDCs was an important factor in urbanization.

A second factor in the growth of cities in the LDCs was a troubled countryside which led rural population to flee to urban centers for security. Internal disorder produced during World War II both by invasion and liberation of LDCs, was followed by further conflict and disorder generated by diverse racial, ethnic, religious and linguistic population elements, following the disappearance of external imperial coercive control. In many LDCs populations were pushed from troubled rural areas to urban places rather than pulled by the force of better economic opportunities.

A third factor contributing to the size of urban areas in the LDCs was the rapid decline of mortality after World War II and explosive population growth as a result. Mortality declined much more rapidly in the LDCs after World War II than it did in the MDCs in the early stages of their development. Mortality decline in the LDCs was

the product of exogenous factors--the availability of modern medical practices, including the antibiotics, imported from the more developed regions. The piling up of rural population which followed the decrease in death rate also served to push population to urban areas rather than be pulled by the prospects of higher levels of living.

Finally, also a consequence of decreased mortality, greatly increased natural increase by reason of continued high fertility became an important factor in increased urban growth. In contrast with the situation in the MDCs, natural increase was a more important factor than migration in the growth of cities in the LDCs.

Because the forces producing urbanization in the less developed countries were in large part noneconomic, urbanization often served as a barrier rather than stimulus to development. The fact that central governments were located in the large urban areas often meant that the capitol city populations received more than their share of scarce funds available for investment in development. Moreover, early development programs generally allocated the scanty investment funds available to various forms of urban development at the expense of rural and agricultural development.

In recent years migratory flows from rural to urban areas in the LDCs have been generated by increasing disparity in urban and rural levels of living, partly created by governments favoring public and social investment in urban areas to the neglect of rural areas. It has been stated that "as a result, rural-urban differentials in income and employment opportunities have been increasing and have encouraged further migration" (Oberai, 1981). Such migratory flows have been so enormous that the absorptive capacity of urban areas have been greatly exceeded. This has resulted in high unemployment and under-employment and the proliferation of squatter settlements in an urban environment characterized by acute shortages in urban amenities such as piped water, sewerage, housing and transportation.

It has become increasingly recognized that the squatter settlements make up a transitional economic sector, the "informal sector," between the traditional and modern economic sectors. Policies initially directed at the bulldozing and elimination of the informal sector are changing to finding ways and means of utilizing the entrepreneurial and other skills of in-migrant squatter population as positive elements in development programs.

Because Asia's pace of urbanization has been so rapid and is expected to remain high in the 1980s, it will pose a serious threat to the balanced growth of each national economy in Asia. Although the importance of migration as an effective mechanism for solving population distribution problems has been increasingly recognized by these governments, there have been only a few successful migratory movements in Asia. The rural settlement scheme by the Federal Land Development Authority (FELDA) of the Malaysian Government is representative of these successful policies now being administered in Asia (Ogawa and Cheong, 1981). A recent study has found that between 1957 and 1970 the urban population of Malaysia grew at the same pace as the rural population. It should be noted that India, Nepal and Sri Lanka also have rural resettlement projects.

In some of the Asian countries direct measures have been taken to stop or reduce inflows of migrants from rural to urban areas. For instance, through one of the population redistribution programmes in China, 10 to 15 million urban secondary graduates were resettled in rural areas. At the same time the flow of migrants from rural to urban centers was prevented through administrative controls. Everyone was required to have a pass to leave a rural area and to enter and secure accommodation in an urban area (Oberai, 1981).

Another example is the Jakarta case. In 1970 the entry of migrants into Jakarta was limited by imposing conditions upon prospective migrants. They first apply for a "short visit" card and deposit money equivalent to twice the amount of the fare to Jakarta. If he cannot find a job within six months, his deposit is refunded, and he must return to his original place.

Japan and the Republic of Korea provide an example of redistributing the population by developing "counter-magnets". This approach is typical of the efforts made along the line of the "growth pole" theory.

To cope with various problems arising from rapid urban development, each of the Asian countries has been implementing a different set of population redistribution policies, partly depending upon the magnitude of the pressure of its population growth, in order to reduce the severity of urban overconcentration problems. Again, slower population growth, particularly in rural areas, will lead to the diminution of numerous side effects related to urban development.

At present Asia has a total of approximately 2.6 billion persons or 58 percent of the world population. Slightly more than one quarter of the Asian population is in urban areas while the remaining three quarters are in rural areas. Although the majority of the Asian population is considered rural, there has been a massive transfer of population from rural areas to urban centers, and as a consequence, most of the cities in the region of Asia are now facing numerous side effects of rapid urbanization.

In a recent report (United Nations, 1970) the United Nations Department of Economic and Social Affairs has recognized the significance of dealing with problems of urbanization as a prerequisite to development. It includes the statement emanating from a United Nations Seminar as follows: "The process of urbanization must be understood as a basic condition for and a functional consequence of economic, social and technological development. Indiscriminate efforts to avoid urbanization may only serve to delay development."

It would be well for governments to consider the following propositions in the UN recommendations.

1. Urban development itself must be recognized as a major factor in national and regional economic development plans.
2. Urban development and housing authorities or relevant departments must be endowed with powers to control land use and to improve conditions in slum and squatter developments so that residents of such areas can contribute to the process of modernization under way.
3. An urban and regional development strategy should be adopted in which urban location and form would be used to stimulate the most productive and diversified use of the nations' resources.
4. Appropriate proportions of national income (the UN recommends the equivalent of five percent of national income) should be allocated for direct public programs and publicly stimulated private actions to finance urban development.
5. Savings and credit institutions should be established to mobilize capital and to channel investments into urban developments.
6. Urban studies and research centers should be established or expanded and interdisciplinary efforts increased to develop

better urban strategies at the national and regional levels.

III. The Role of Human Resources in Development: the Japanese Experience

A. Human Resources as a Base for Technological Progress

It is impossible to define "resource" without assuming some technological basis. As asserted in the Report for the Club of Rome, population and economic growth will deplete some of the vital natural resources and exceed the global carrying capacity in the foreseeable future. The validity of this global "running out" thesis is subject to human technological ability to transform one resource into another. When this thesis is applied to any specific country, especially a poor, densely-populated country, it is likely to be valid. If the country is too poor to import needed resources to strengthen a material and human capital base as a substitute for insufficient endowment of resources, sustained high population growth may drive the country into a Malthusian trap.

As is widely known, Japan is poor in both land and natural resources, in relation to which her population is vast. In spite of these adverse conditions, Japan succeeded in building up a strong economic foundation in the last 100 years. One of the major factors attributable to this great achievement is the augmentation of human resources which has lent itself to absorbing, adapting and improving advanced technologies borrowed from the Western World. Moreover, Japan has become an important technological innovator. With the acquisition of these modern technologies, Japan managed to overcome many difficulties arising from the shortage of natural resources. In this section of the paper, therefore, we will briefly review the process of the accumulation of human resources in Japan's national economic development. Because there is currently a considerable number of Asian countries with a shortage of natural resources and high population growth, it is hoped that the description of the Japanese experience will be useful to these countries.

B. Historical Evolution

The modernization of Japan started in 1868 when the feudal system was replaced by a more outward-looking and modernization-oriented government. Although this is broadly correct, we must not forget that the new authorities inherited from the past a lot of factors favorable for economic growth and modernization. For example, during the feudal age, many private educational institutions already taught elementary reading, writing, and arithmetic rather systematically. Although such education had never been obligatory, it was considered that these "three R's" were the basic necessities of human life, even in the traditional society. The literacy rate at the time of the initiation of the new educational system in 1872 was already about 30 percent. Note that the present literacy rate is 99.9 percent (World Bank, 1980).

The education policy followed by the new Meiji authorities strengthened and complemented this traditional tendency. While high-level education--at the university level--was given comparatively less emphasis, a lot of resources were allocated to improve primary and vocational education.

The relative neglect of higher education and the emphasis on elementary education characterized the Japanese education system for a long time. On the negative side, the Japanese were noted for their lack of creativity, and intellectuality. On the positive side, they became rather pragmatic, being able to catch up with and improve advanced technology in order to develop the economy. In short, Japan developed, during the early stage of modernization, a pyramid-shaped education structure, with a broad base of primary and vocational education, rather than a pillar-shaped one.

Higher education in Japan spread widely and rapidly after World War II. The percentage of students reaching high school rose from 52 percent in 1955 to today's high figure of 93 percent. Higher education has even reached the rural areas in Japan.

C. Investment in Human Resources

The formation of human resources through education is crucial in socio-economic transformations. Various aspects of human resources

such as scientific innovations, technical skills and other human abilities are greatly determined by the pattern of diffusion and intensification of the educational system. Table 7 presents the growth of the following economic indicators: (i) national income, (ii) labor force (gainfully employed population), (iii) physical capital (national wealth), and (iv) educational capital.

While the labor force increased by 1.7 times, from 25.6 to 43.7 million over the period of 1905-1960, physical capital increased by about 7 times, from 5.8 to 39.8 trillion yen during the same time period. The national income showed a more pronounced increase by nearly 10 times, from 1.2 to 12 billion yen. Most important, educational capital expanded by about 23 times from 0.31 in 1905 to 7.1 trillion in 1960, thus exceeding the growth rate of all other indicators. These statistics show that Japan has been placing an enormous emphasis upon education in the allocation of her resources.

D. Mobility of the Educated Population

During the take-off period (1880-1900), Japan was not only far behind European countries, but also suffered from a scarcity of natural resources and from overpopulation. The principal factor contributing to the solution to these problems was the diffusion of elementary education among rural farmers who were the majority of the labor force in those days. Hence, the dissemination of elementary education was extremely effective in improving the quality of the surplus labor in rural sectors. It should be noted that the Japanese economy at the early stages of modernization was characterized by the dual structure: rural, agricultural sectors and urban, modern sectors. As the economy developed, the latter absorbed the high quality surplus labor from the former.

Through this migration mechanism, from 1878 to 1911, there was an increase of only 610,000 persons employed in the primary industries. Although the population had increased by 12.79 million and the number of employed by 7.42 million, during the corresponding period the number of persons employed in secondary industries rose by 3.06 million and tertiary industries by 3.75 million. As the Japanese economy developed, the economic structure shifted from light industries to heavy and chemical industries, and was transformed from a labor-

Table 7. Increase of National Income, Labor Force, Physical Capital, Educational Capital

Year	National Income		Labor Force		Physical Capital		Educational Capital	
	Amount billion yen	Index	Amount million yen	Index	Amount trillion yen	Index	Amount 10 billion yen	Index
1905	1.210	100	25.6	100	5.8	100	31	100
1910	1.559	129	26.2	102	8.0	138	47	152
1913	2.045	169	26.4	103	8.6	148	59	188
1917	2.035	168	26.6	104	8.5	147	73	236
1919	2.761	228	26.6	104	10.1	174	81	260
1924	3.026	250	28.2	110	17.6	304	110	367
1930	4.054	335	29.3	115	23.1	398	186	600
1935	5.234	433	31.4	123	25.9	447	256	831
1955	7.189	594	39.2	153	21.7	374	538	1,731
1960	11.822	979	43.7	171	39.8	686	711	2,286

Source: Ministry of Education, Growth and Education in Japan--Development of Education and Economic Growth (in Japanese) (November 1962) p. 11.

Remarks: National income, material capital (national wealth), and educational capital are expressed in 1960 prices.

intensive model to a capital- and technology-intensive model.

Although there was discontinuity in production and human mobility due to the outbreak of World War II, the rural-urban migration of the labor force resumed after the end of the war.

Through the process of post-war high economic growth, migratory flows continued from rural to urban areas, particularly to the following three large metropolitan areas: Tokyo, Osaka and Chukyo. The Tokyo metropolitan area, largest among them, for example, increased its population by about three million every quinquennium, but in the last intercensal period, 1975-1980, it increased by only 1.6 million persons. The population in the Tokyo metropolitan area was 28.7 million in 1980, constituting 24.5 percent of the total population in Japan.

It is important here, however, to point out that a much higher proportion of highly educated college graduates than that of the total population is absorbed in the Tokyo metropolis. In 1980, it was 37.0 percent, as compared with 24.5 percent for the whole country. It may indicate that the imbalanced distribution of highly educated population tends to create severe disparity of regional development. Moreover, because higher educational institutions are concentrated in the Tokyo metropolitan area, the numbers of students receiving higher education in this area are 185,000 or 45.0 percent of the total student population in higher education in Japan in 1980.

In the recent past, however, there has appeared a newly emerging trend in migration of young persons (Kuroda, 1978). During the 1970-1975 period, the population of males 20-24 years old declined in the Tokyo, Osaka, and Chukyo metropolitan areas by 9.3, 7.1 and 0.2 percent, respectively. The same group increased in all other regions. Even more noticeable was the decline in the number of males aged 30 to 34 in 1974, as compared to those who were aged 25 to 29 in 1970. The other regions in Japan, except for Hokkaido, showed increases. This indicates a shift of the age group of migrants to local areas from the 20-to-24-year-old group to the 25-to-29-year-old group. It seems that these changes may be expected to be more accentuated in 1980. This new pattern of the so-called "U-turn" of the young labor force became even more pronounced by expanded job opportunities in local areas promoted by regional development policies, both national and local.

In connection with the "U-turn" migrants, it should be pointed

Table 8. Distribution of Population
that Finished Higher Education by Region

Region	Percentage		
	1960	1970	1980
Total	100.0	100.0	100.0
Tokyo Metro.	37.8	39.6	37.0
Osaka Metro.	16.3	16.6	15.6
Chukyo Metro.	8.2	8.8	9.8
Hokkaido	3.6	3.4	3.6
Tohoku	5.6	4.9	5.0
Kita-Kanto	3.1	3.1	3.7
Hokuriku, Tosan	5.2	4.6	4.9
Higashi-Kinki	2.1	2.3	2.8
Chugoku	5.7	5.5	5.7
Shikoku	2.7	2.5	2.7
Kyushu, Okinawa	9.7	8.7	9.2

Source: Population Censuses for various years

Remarks: Tokyo Metropolitan including 4 prefectures of Chiba, Saitama, Kanagawa, and Tokyo; Osaka Metropolitan 3 prefectures of Kyoto, Osaka, and Hyogo; Chukyo Metropolitan 4 prefectures of Gifu, Shizuoka, Aichi, and Mie.

out that higher educated people are included among the "U-turn" migrants who might be expected effectively to contribute to their home-town development. Between 1975 and 1980, the percentage distribution of higher educated people declined in the Tokyo metropolitan area from 39.6 to 37.0 percent, and in the Osaka metropolitan area from 16.6 to 15.6 percent. All other local regions, characterized by excessive out-migration including highly educated people, have been showing more pronounced trends. It should be stressed that this new redistributive movement has been facilitating the more balanced dis-

tribution of highly educated and qualified population among regions.

IV. Conclusion

In recent years, not only an increasing number of developing countries but also the United Nations, its Specialized Agencies and other international organizations concerned with population and development, have become more aware of the serious challenge of rapid population growth to social and economic development. Yet, population factors have been integrated into development planning schemes only to a limited extent, primarily because of inadequate knowledge of various important interactions among population and socio-economic variables (Ogawa and Suits, 1981). In particular, natural resources, environmental, urbanization and human resource aspects are grossly omitted from most of the existing development planning frameworks. Therefore, many of the problems associated with population and development arise as a consequence of poor or inadequate planning.

To rectify this situation political leaders, government development planners, and scientists of various disciplines should jointly tackle problems arising from rapid population growth. As regards natural resource problems, for instance, sudden disruptions in supply in one country in Asia may do substantial harm not only to the particular country, but also to other major consuming countries in the same region. To cope with these likely difficulties, it can be strongly recommended that a regional or subregional mechanism involving the participation of political leaders be developed to (i) monitor the most up-dated trend in the demand and supply of resources in this region, (ii) promote a regional cooperation in stabilizing the supply of resources, and (iii) exchange information on technological improvements pertaining to resource, environmental and urbanization problems linked with population and development. In order to implement this proposed plan, initiatives taken by political leaders are absolutely required. Moreover, as supportive activities for this proposed mechanism, further intensive and extensive research on the inter-relationship among population changes, resources, environmental and urbanization pressures should be encouraged in each Asian country as well as in the region as a whole. At the same time the interaction among policy-makers, development planners and population researchers

should be urgently arranged on an intra- and inter-country basis. Interaction of this nature will be facilitated by holding regional conferences for policy-makers and other parties concerned, conducting inter-institutional or inter-country collaborative research projects, and strengthening existing training facilities in the field of population, resources, environment and urbanization in Asia.

A significant supportive activity would be to promote an exchange of research findings and country experiences on natural resources, environmental problems, and urbanization developments related to population. In view of the fact that many population-oriented institutions have been newly established in ASEAN countries and the People's Republic of China, a closer link among these new institutions as well as old ones should be established. It is urged that appropriate action for the implementation of these proposed activities be taken by UNFPA and other concerned international bodies.

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