Rev

ADDRESS to the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

by

ROBERT S. McNAMARA

PRESIDENT, WORLD BANK

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I. INTRODUCTION[a]

Nearly a dozen years ago, in the city of Montreal, I delivered an address—as the U.S. Secretary of Defense—on the problems of international security.

My central point was that the concept of security itself had become greatly oversimplified. There was an almost universal tendency to think of the security problem as being exclusively a military problem, and to think of the military problem as being exclusively a weapons-system or hardware problem.

"We still tend to conceive of national security," I noted, "almost solely as a state of armed readiness: a vast, awesome arsenal of weaponry."

But, I pointed out, if one ponders the problem more deeply it is clear that force alone does not guarantee security, and that a nation can reach a point at which it does not buy more security for itself simply by buying more military hardware.

That was my view in 1966. It remains my view in 1977.

Let me be precise about this point.

In a volatile, violent world, it is of course necessary for a nation to establish defense forces in order to protect itself. Such forces are always expensive, but if the funds are wisely used there is a reasonable ratio between the amount of money spent and the degree of protection acquired.

One can graph that ratio as a curve. In the initial stages the curve arches upward, and security expands with expenditure. But as the spending grows larger and larger the curve inevitably begins to flatten out.

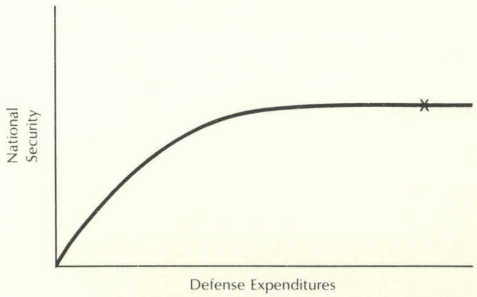
There is a point at which an additional dollar of defense simply no longer buys an additional dollar's worth of security.

[a]I am indebted to a long list of distinguished scholars and specialists for much of what follows. Their research and insights have assisted me immensely. In particular I want to thank the members of the External Advisory Panel on Population who, at my request, recently reviewed the World Bank's work in the population field. They are: Bernard Berelson, Chairman; Ronald Freedman; Goran Ohlin; Frederick T. Sai; and A. Chandra Sekhar.

Expenditures beyond that point are not only wasted on defense but will erode the funds available for other essential sectors.

And by denying that dollar to other essential investment, the process may in the end diminish security rather than bolster it.

Now, if we examine defense expenditures around the world today—and measure them realistically against the full spectrum of components that tend to promote order and stability within and among nations—it is clear that there is a mounting misallocation of resources. We are far out on the flat of the curve.



That is true in the industrialized world. It is true as well in many parts of the developing world.

Global defense expenditures have become so large that it is difficult to grasp their full dimensions.

The overall total is now in excess of $350 billion a year.

The United States and the Soviet Union together account for some 60% of that—and for 75% of the world's arms trade. They possess more military power than all the other nations of the world combined.

And yet it is not in the industrialized countries, but in the developing countries that military budgets are rising the fastest.

As a group, the governments in the developing world are now spending as much for military programs as for education and health care combined.

If we are concerned—as all of us must be in this thermonuclear age—about international security, then we would do well

to reconsider our present priorities. Do we really believe that we can turn the earth into a less violent place to live by an ever increasing factor of force?

Is the ultimate objective somehow to armor-plate the entire planet?

The question is grotesque. And yet, not any more so than the premise on which much of the world's thinking about security appears to be based.

I want to discuss with you tonight a subject that has nothing whatever to do with military phenomena—but a very great deal to do with global tranquility.

It is the issue of population growth.

Short of thermonuclear war itself, it is the gravest issue the world faces over the decades immediately ahead.

Indeed, in many ways rampant population growth is an even more dangerous and subtle threat to the world than thermonuclear war, for it is intrinsically less subject to rational safeguards, and less amenable to organized control.

The population growth of the planet is not in the exclusive control of a few governments, but rather in the hands of literally hundreds of millions of individual parents who will ultimately determine the outcome.

That is what makes the population threat—even more than the nuclear threat—diffuse and intractable. And that is why it must be faced—like the nuclear threat—for what it inevitably is: both a central determinant of mankind's future, and one requiring far more attention of the world community than it is presently receiving.

What, then, I would like to do this evening is this:

- Examine the background of the population problem;
- Analyze its current trends;
- Evaluate the measures available to deal with it;

- And suggest the actions that governments and others can and must take to help solve it.

Let me turn first to where we now stand.

II. THE POPULATION BACKGROUND

Last year the world's total population passed the four billion mark.

On the face of it, the event was not very dramatic. It marked, of course, the largest number of human beings ever to have been alive simultaneously on the planet—and thus was a record of sorts. But that particular record is broken every year. And will continue to be broken every year long beyond the lifespan of anyone alive today.

Barring a holocaust brought on by man or nature, the world's population tonight—as we sit here—is the smallest it will ever be again.

How did it reach a population of four billion?

For the first 99% of man's existence, surprisingly slowly. For the last 1% of his history, in a great rush.

Table I—The Rate of Growth of the World's Population

Year	Total Population	Rate of Growth Per Year Since Previous Date	Doubling Time
1,000,000 B.C.	a few thousand	—	—
8,000 B.C.	8 million	.0007%	100,000 years
1 A.D.	300 million	.046	1,500
1750	800 million	.06	1,200
1900	1,650 million	.48	150
1970	3,600 million	1.0	70
2000	6,300 million	2.0	35

Man has been on earth for a million years or more. For most of those millenia, his life was largely a search for a secure food supply. During the period that he was without pastoral or agri-

cultural technology, adequate tools, or much protection against a harsh environment, he had a birth rate that only barely kept pace with the death rate.

As a consequence, until the dawn of agriculture around 8000 B.C., the population, after ten thousand centuries, had reached only an estimated eight million. During this immense interval, the average annual rate of increase was only about one additional individual for every 150,000 persons.

With the advent of agriculture and the domestication of animals, the food supply became more dependable, and the eight million population of 8000 B.C. rose to about 300 million by the beginning of the Christian era. This meant an average annual rate of increase of 65 persons for every 150,000—or as demographers would express it today, a growth rate of .046%.

From A.D. 1 to the middle of the eighteenth century, the population ebbed and flowed, gaining in prosperous periods, and falling back sharply in times of trouble. The bubonic plague —the Black Death—struck Europe suddenly in the mid-fourteenth century, and in four years cut down one person in every three. By the year 1400, under the onslaught of further epidemics, the European population had fallen to little more than half what it had been only 50 years earlier.

Thus by 1750, the total had reached only about 800 million. Then, as the industrial revolution gathered momentum, population growth began rapidly to accelerate. By 1900 it had doubled to 1.6 billion; by 1964 it had doubled again to 3.2 billion; and by the end of the century it is projected to double again to about 6.3 billion.

Now these numbers—as abstract as they may seem—illustrate an important point about population dynamics. The doubling time is extremely sensitive to very minor increments in the average annual growth rate.

It took mankind more than a million years to reach a population of one billion. But the second billion required only 120 years; the third billion 32 years; and the fourth billion 15 years. If one postulates that the human race began with a single pair of

parents, the population has had to double only 31 times to reach its present huge total.

At the current global growth rate of about 2%, the world's population will add a fifth billion in about 11 years.

But these global totals, of course, obscure wide demographic differences between the developed and developing countries.

During the period from 1750 to 1850, the two groups of countries grew at similar average annual rates: .6% for the developed, .4% for the developing. From 1850 to 1950, the rates were .9% and .6%. From 1950 to 1975 the rates changed dramatically and became, respectively, 1.1% and 2.2%. The recent growth rates in the developing countries are not only twice as great as those in the developed countries today, but exceed by an equally large margin the most rapid growth ever experienced by the developed countries.

Translating these growth trends, and relative population sizes, into absolute numbers of people demonstrates the historical pattern even more graphically. From 1750 to 1850 the developed countries grew annually by 1.5 million people and the developing countries by 3 million; from 1850 to 1950, by 5 million and 7 million respectively; and from 1950 to 1975, by 11 million, and 48 million.

Demographic Dynamics

To grasp fully what is happening here it is helpful to recall the fundamental dynamics of population increase. On the surface they seem simple enough: population growth for any given society is the excess of births over deaths, as modified by migration.

If we disregard, for the moment, the influence of migration, it is apparent that so-called stationary, or steady-state, populations are those in which births and deaths are in balance.

For thousands of centuries the world had something very close to just that.

To achieve a steady-state population there must be a stable age structure and replacement-level fertility: a child must be

born to replace each person in the parent generation. That seems obvious enough, but since some females die before or during childbearing age, the average number of children that parents in a given society must have to keep the population stationary is a function of the mortality conditions in the society.

In the Ivory Coast, for example, the death rates in the late 1960s of potential childbearing women were such that 3.5 births per woman would have been required to replace the parent generation; whereas in the United States, where death rates were much lower, only 2.1 births per woman were needed. In actuality, of course, fertility in the Ivory Coast, as in almost all of Africa, is much higher than that; and fertility in the United States has, since 1972, been below the replacement level.

Replacement is measured by the net reproduction rate (NRR), which technically refers to the number of daughters born per woman who could survive to childbearing age, assuming the prevailing levels of fertility and mortality. An NRR of 1.0 is the exact replacement level, and means that on average each woman would have one daughter who could be expected to live to the mean age of reproduction.

When female death rates prior to the end of the reproductive age are high, it clearly requires greater total fertility per woman to maintain a stationary population. When such death rates fall, it requires proportionately less.

We know, too, what are the outer limits of the various female mortality-fertility combinations that can produce a stationary population.

Today in the developed countries over 95% of women survive through childbearing years. Under such conditions, a total fertility rate of only 2.1 children per woman suffices for replacement.

On the other hand, average female life expectancy of 15 is the highest feasible mortality rate any large population could sustain, since in such a case only about 25% of women live to have children, and they would have to have an average of almost 9 children apiece to keep the population from declining. While it is, of course, physiologically possible for individual women to

give birth to more than that number, no large grouping has ever been observed with a total fertility rate much higher than 8 to 9 births per woman.

This explains how near zero growth prevailed in the world's population for thousands of centruries. Life expectancy at birth was very low, probably about 20 years. This meant that only about a third of the females born survived to the mean age of childbearing, and that those who lived to the age of menopause had an average of about 6.5 children: a birth rate of 50 to 55 per 1,000.

Even as late as the eighteenth century, mortality in Europe remained very high. In France, for example, almost a quarter of the population died before they reached their first birthday, and nearly half before the age of 20. By the early 1960s, only 2% died in their first year, and only 4% died before reaching 20. It is these low mortality rates that permit population levels to be maintained with only 2.1 children per female (a crude birth rate of roughly 14 per 1,000). In actual fact, women throughout the developed world today have an average number of children ranging from less than 2 to about 3.

Developing countries today typically have a female life expectancy at birth of about 55; total fertility rates averaging about 5.3 children per woman; and crude birth rates of about 37 per 1,000.[a] This combination results in a growth rate of approximately 2.3%, doubling the population every 30 years. To reach replacement level fertility, at current mortality rates, would require a reduction in the total fertility rate to 2.6, and the crude birth rate to about 20 per 1,000.

But when a net reproduction rate of 1.0—replacement-level fertility—is reached in a society, it does not mean that the population immediately ceases to grow. It will continue increasing for decades. That is a function of the society's age structure.

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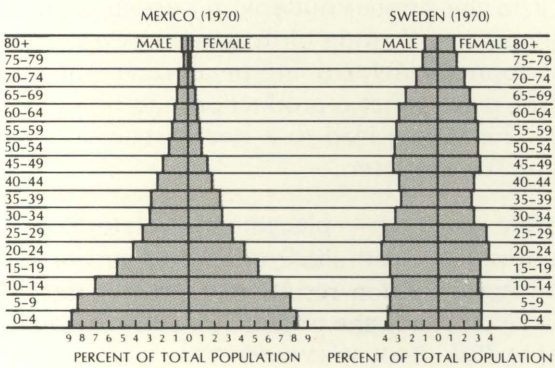
[a]There is, of course, a great range of differences between developing countries. Some have average life expectancies as low as 38; crude birth rates as high as 50 per 1,000; and annual growth rates as much as 3.5%, which double the population every 20 years. Women throughout these countries have an average number of children ranging between four and eight.

The population will continue to grow because the higher birth rates of the past have produced an age distribution with a relatively high proportion of persons currently in, or still to enter, the reproductive ages. This in turn will result in more births than deaths until the population changes to the older age distribution intrinsic in the low birth rate. Thus, even at replacement-level fertility, the population does not become stationary until the age structure stabilizes, which takes 60 to 70 years.

The difference in age distribution between a society that is in a period of high birth rates and falling death rates, and one that has been experiencing low birth rates and low death rates for many years, can be seen by comparing the population profiles of Mexico and Sweden.

Comparison of Mexican and Swedish Age Distributions



Because of Mexico's very young age distribution, even after that country reaches and maintains replacement levels of fertility,[a] approximatey 70 additional years will pass before its age profile will approximate the Swedish pattern. During that entire 70-year period, Mexico's population will continue to increase.

[a]Total fertility levels in Mexico now exceed 6.0 children per female, compared to the replacement level of 2.3. Several decades of emphasis on population planning are likely to be required before replacement levels of fertility are reached.

Mexico's case is typical of the developing countries. And therefore the time lag of something like 70 years applies to that entire group of countries. But the 70-year countdown cannot even begin, of course, until the replacement level of fertility is actually reached.

And here we come to a point of immense importance—one that is not well understood, and one that I want strongly to emphasize: the speed at which fertility in the world declines to the replacement level will have a very significant effect on the ultimate size of the stationary population.

For every decade of delay in achieving a net reproduction rate of 1.0—replacement level—the world's ultimate steady-state population will be about 15% greater.

The significance of this statement can be understood by applying it to the present outlook. If current trends in fertility rates continue, i.e., if crude birth rates in developing countries decline by approximately 6 points per decade, it appears that the world might reach a net reproduction rate of 1.0 in about the year 2020. This would lead to a steady-state population of 11 billion some 70 years later.

If the date at which replacement-level fertility is reached could be advanced from 2020 to 2000 (by following, for example, the suggestions made later in this paper), the ultimate population would be approximately 3 billion less, a number equivalent to 75% of today's world total.

This reveals in startling terms the hidden penalties of failing to act, and act immediately, to reduce fertility.

If global replacement levels of fertility were to be reached around the year 2000, with the world ultimately stabilizing at about 8 billion, 90% of the increase over today's levels would be in the developing countries. As shown in the table below it would mean, if each country followed the same general pattern, an India of 1.4 billion; a Brazil of 275 million; a Bangladesh of 245 million; a Nigeria of 200 million; and a Mexico of 175 million.

Table II—The Ultimate Size of Stationary Population in Selected Developing Countries
(in millions)

Country	Pop. 1975	Ultimate Stationary Population[a] NRR of 1.0 Achieved in Year 2000	NRR of 1.0 Achieved in Year 2020	% Increase Caused by Two Decades of Delay
India	620	1,400	2,000	43
Brazil	110	275	390	42
Bangladesh	76	245	400	63
Nigeria	65	200	320	60
Mexico	62	175	270	54

Source: Frejka, Tomas, *The Future of Population Growth; Alternative Paths to Equilibrium*, Population Council, New York, 1973.

But as I have pointed out, given today's level of complacency in some quarters, and discouragement in others, the more likely scenario is a world stabilized at about 11 billion. Populations in the developing countries would be 40 to 60% greater than indicated above because of two decades of delay in reaching replacement levels of fertility.

We have to try to comprehend what such a world would really be.

We call it stabilized, but what kind of stability would be possible?

Can we assume that the levels of poverty, hunger, stress, crowding, and frustration that such a situation could cause in the developing nations—which by then would contain 9 out of every 10 human beings on earth—would be likely to assure social stability? Or political stability? Or, for that matter, military stability?

It is not a world that anyone wants.

[a]The Stationary Population level will be reached about 70 years after the date on which a NRR of 1.0 is realized.

Even in our present world of 4 billion, excessive population growth severely penalizes many of the developing nations.[a]

It drains away resources, dilutes per capita income, and widens inequalities. At the national level, the government must devote more and more investment simply to provide minimal services to an ever-increasing number of children. At the family level, the same needs press in on the parents of large families.

During their early years, most children are primarily consumers rather than producers. For both the government and the family, more children means more expenditure on food, on shelter, on clothing, on health, on education, on every essential social service. And it means correspondingly less expenditure on investment to achieve the very economic growth required to finance these services.

As children reach adulthood, the problem is compounded by mounting unemployment. There are not enough jobs to go round because the government—grappling with the daily demands of the increasing numbers—has been unable to invest enough in job-producing enterprises. Thus the cycle of poverty and overpopulation tightens—each reinforcing the other—and the entire social and economic framework weakens under the weight of too great a dependency ratio.[b]

The sudden global surge in population over the past quarter-century has, of course, been a function of two opposite trends:

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[a]I should stress that in choosing to speak on population, I do not mean to imply that it is the sole or predominant cause of social injustice and poverty. On several previous occasions, most recently in Manila last October, I have discussed the policy measures that governments of developing countries need to take to tackle poverty in both rural and urban areas. I have also reviewed the role that the developed nations must play through additional stimulus to international trade and higher levels of foreign assistance. To my mind, as later sections of this paper will demonstrate, policies to solve the poverty problem and to reduce the rate of population growth are complementary to each other: an effective attack on poverty is essential if population problems are going to be fully solved; and effective population policies are essential elements in the attack on poverty.

[b]A typical example is the case of Algeria, as contrasted with Sweden. In Algeria, with its high birth rate, every 100 persons of working age in 1970 had to support 98 children under the age of 15. In Sweden, with its low birth rate, every 100 persons of working age had to support only 32 children under 15.

the gradual slowing down of the growth rate in the developed nations, and the rapid acceleration of the growth rate in the developing countries.

The experience of the developed countries gave rise to the theory of the demographic transition.

The Demographic Transition

The theory holds that societies tend to move through three distinct demographic stages:

1. High birth rates, and high death rates, resulting in near stationary populations;
2. High birth rates, but declining death rates, producing growing populations;
3. And finally, low birth rates and low death rates, reestablishing near stationary populations.

If one examines the history of the developed nations, the facts support the theory. Preindustrial societies grew very slowly. Birth rates and death rates generally were both high, and very nearly in balance.

But with the advent of industrialization, more adequate nutrition, and improved public health measures, death rates gradually began to fall, and growth rates to increase.

The process continued in the industrializing societies into our own century until birth rates in turn began to diminish, and growth to level off.[a] Today in all but two or three developed countries fertility rates are near, or at—and in some cases even below—replacement levels. As a consequence, in 1975, the total fertility rate for the developed countries as a group was 2.1, exactly at replacement level.

It has taken the developed world as a whole about 150 years to pass through the demographic transition.

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[a]Recent research indicates there were some exceptions to the typical pattern of demographic transition. In some cases, the decline in fertility preceded the fall in mortality.

But most of the developing countries remain today in the second stage of the transition. Their birth rates range between 30 and 50 per thousand, and their death rates between 10 and 25 per thousand. The result is that as a group their population is growing at about 2.3% a year, and at that pace it will double in about 30 years.

Now, if the developing countries were to require 150 years to complete the transition, the world's population would grow from its present 4 billion not to 8 or 11, but to 15 or 16 billion.

No one believes it will actually reach that magnitude. But no one is very certain what precisely is going to avert it, short of a major catastrophe brought on by human folly, or by nature's revenge.

The fundamental question is: what, if anything, can rationally and humanely be done to accelerate the demographic transition in the developing world?

Some serious observers say nothing can be done.

I do not share that view.

And to explain why I do not, I want to turn now to a more detailed examination of the current demographic situation in the developing countries.

III. RECENT DEMOGRAPHIC TRENDS

One, as always, must begin with the most recent data.

And one, as always, must begin with cautions about the data.

They are preliminary, they are not very precise, and they are at best only suggestive of trends.

But the trend they suggest is cautiously encouraging.

What appears to have happened in the developing world over the six-year period, 1969-1975 (see Table III) is that the crude birth rate (CBR)—the number of births per thousand of population—has declined 3.9 points. The crude death rate (CDR)—the number of deaths per thousand—during the same period has

declined 1.9 points. The result is that the rate of natural increase (NI) declined slightly.

Table III—Birth Rates and Death Rates in Developing and Developed Countries

	Developing Countries[a]			Developed Countries			Total World[b]		
	Crude Birth Rate	Crude Death Rate	Rate of Natural Increase	Crude Birth Rate	Crude Death Rate	Rate of Natural Increase	Crude Birth Rate	Crude Death Rate	Rate of Natural Increase
1969	42.9	17.0	2.6	18.0	9.1	0.9	32.0	13.3	1.9
1975	39.0	15.1	2.4	17.3	9.3	0.8	30.0	12.3	1.8

Source: United Nations, *Selected World Demographic Indicators by Countries, 1950-2000,* May 1975; and Population Council Data Bank.

If we expand the six-year period to a two-decade period, 1955-1974, as in Table IV, the birth rates appear to have declined an average of about 5.6 points in 20 years, or nearly 13%. By major region, the decline has been 6.5 points in Asia; 5.4 points in Latin America; and 2.3 points in Africa.

Table IV—Crude Birth Rate Trends in Developing and Developed Countries

Region	No. of Countries	1975 Pop. (Millions)	Crude Birth Rates (per thousand) 1955	1960	1965	1970	1974
Africa	38	366	48.5	48.3	47.9	47.1	46.2
Latin America	21	289	43.0	42.2	40.8	39.4	37.6
Asia[a]	34	1,318	44.6	44.8	43.5	41.9	38.1
Total—LDC[a]	93	1,973	45.1	45.1	44.1	42.4	39.5
Total—DC	35	1,124	22.3	21.3	18.9	17.3	16.6

Source: UN data as revised by Parker Mauldin of the Population Council.

Further, this decline of the CBR was general and widespread. It occurred in 77 of the 88 developing countries for which estimates are available.

[a]Excludes People's Republic of China (PRC).

[b]Includes rough estimates of data relating to PRC.

Significantly, the decline appears to be gathering momentum: in the developing countries it is less for the earlier years, and greater for the more recent years as shown in Table V.

Table V—Trends in the Percentage Decline in Crude Birth Rates in Developing Countries

	1955-60	1960-65	1965-70	1970-74
Africa	0.4	0.8	1.7	1.9
Latin America	1.9	3.3	3.4	4.6
Asia[a]	−0.4	2.9	3.7	9.1
Total[a]	0.0	2.2	3.9	6.8

Source: UN data revised by Parker Mauldin of the Population Council.

But even if the higher rates of decline were to continue into the future, it would mean only 6 points off the CBR in a decade. And that is only about half of the generally accepted target of 1 point a year. Thus, though the trend in birth rates is encouraging, its pace is still far too slow.

Moreover, the overall CBR decline obscures wide variations among individual countries as shown in Table VI.

[a]Excludes People's Republic of China.

Table VI—Reductions in the Crude Birth Rate in Selected Developing Countries: 1955-1974

Country	1975 Pop. (in millions)	% Decrease in CBR	CBR in 1974
Group I (over 50 million)			
India	598	17	36
Indonesia	132	13	42
Mexico	60	11	40
Brazil	108	7	39
Pakistan	70	5	47
Bangladesh	79	0	47
Nigeria	63	0	50
Group II (20 to 50 million)			
South Korea	35	30	28
Thailand	42	25	37
Turkey	39	25	33
Colombia	25	25	32
Egypt	37	25	35
Burma	31	5	40
Philippines	42	5	36
Iran	34	5	43
Zaire	25	5	45
Ethiopia	28	5	48
Group III (under 20 million)			
Africa—Mauritius	0.9	37	25
Tunisia	5.6	21	36
Americas—Costa Rica	2.0	42	30
Barbados	0.2	35	21
Chile	10.3	33	23
Trinidad & Tobago	1.1	30	24
Panama	1.7	24	31
Asia—Singapore	2.3	55	18
Taiwan	16.0	47	23
Hong Kong	4.4	44	18
Fiji	0.6	37	28
Sri Lanka	13.6	27	27
Malaysia	10.5	27	30

Source: The Population Council, *Population and Family Planning Programs: A Factbook, 1976*. UN data on birth rates revised by Parker Mauldin of the Population Council.

Among those nations with populations of more than 50 million, India achieved the greatest CBR reduction, possibly as much as 17%; and Indonesia the second best, possibly 13%. Bangladesh, on the other hand, and Nigeria, registered no decline at all.

In countries with populations of 20 to 50 million, several demonstrated very large reductions: Korea, 30%; and Thailand, Turkey, Colombia, and Egypt, 25% each. But the Philippines, Iran, Burma, Zaire, and Ethiopia—all countries with very high birth rates—showed only slight declines of less than 5%.

Finally, among the smaller developing countries, the CBR went down by more than 40% in two, and by more than 20% in all the others listed in Table VI. Most of the larger declines occurred in the last decade, again suggesting the existence of a genuine trend, rather than merely an insignificant statistical aberration.

But, to repeat: statistics in this field are fragmentary, and the situation they describe varies widely from country to country.

It is, then, too soon to be fully certain, but the indications do suggest that crude birth rates in the developing world—outside sub-Saharan Africa—have at last begun to turn downward.

Now, if this conclusion is confirmed by the various censuses scheduled for 1980, then what we are witnessing here is a historic change of immense moment.

Its importance lies in this. Experience illustrates that once fertility turns definitely downward from high levels, it generally does not reverse direction until it has fallen quite low. Further, the higher the level at which it starts down, the more rapid is its descent.

All of this is obviously a welcome development—if it is in fact taking place. And a reasonable interpretation of the admittedly incomplete data indicates that it is. It is welcome particularly because it is far easier to expedite a declining fertility trend once it has really begun, than it is to initiate it in the first place.

But it is essential that we remain realistic. The truth is that at best the current rate of decline in fertility in the developing

countries is neither large enough, nor rapid enough, to avoid their ultimately arriving at steady-state populations far in excess of more desirable—and attainable—levels.

And I repeat: for every decade of delay in achieving a net reproduction rate of 1.0—replacement-level fertility—the world's ultimate steady-state population will be approximately 15% greater.[a]

Current trends, as I have noted, point to a finally stabilized global population of about 11 billion. If we accelerate those trends sufficiently to save two decades of time, it would reduce that dangerous pressure on the planet by approximately 3 billion: 75% of the world's current total.

Is that acceleration realistically possible?

It is.

How, then, can we achieve it?

Let me turn to that subject now, and begin by examining the causes and determinants of fertility decline.

IV. CAUSES AND DETERMINANTS OF FERTILITY DECLINE

The task of understanding the factors leading to fertility decline is difficult. The complexities greatly outweigh the certainties. But it is at least possible to draw a number of tentative conclusions from recent research.

We can start with the basic fact that the demographic transition in the industrialized countries demonstrates that socioeconomic development and mortality declines were accompanied by significant reductions in fertility.

That is clear enough. But what is not clear is this: which of the many elements of general development led to that specific result, and with what relative effectiveness? Must the developing countries reach the current levels of income per capita in the developed nations before they reach their fertility rates?

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[a]As Table II indicates, in many developing countries the effect of a decade of delay in achieving a NRR of 1.0 would not be a 15% increase in the steady-state population, but a 25 or 30% increase.

The question is further complicated by the evidence that certain culturally similar regions—those, for example, with a common language or ethnic background—moved through the fertility transition at the same pace, even though their economic conditions differed substantially. This suggests that in these instances cultural considerations were more decisive than economic advance. Further, there is ample evidence that vastly different fertility rates exist in developing countries with the same income levels, and that rates of change in fertility rates appear to bear little correlation with changes in income per capita.

The truth appears to be that a complicated mix of variables is at work, some economic, some not. Mortality decline, urbanization, educational advance, higher aspirations for one's self and one's children—all these elements appear to be involved in differing combinations.

Though we can learn from the experience of the developed nations, we must recognize that their historical circumstances were quite dissimilar to those in the developing countries today.

The developed nations entered their fertility transition with lower birth rates, lower growth rates, and much more gradual mortality declines. By the time their death rates had fallen substantially, their industrial infrastructure was already in place. Expanding job opportunities were available either in the cities, or in the New World overseas, which received tens of millions of European immigrants. Further, the age of marriage was relatively late, and the literacy rate relatively high.

The developing nations are confronted with a very different set of circumstances, some of them unfavorable, but some of them advantageous.

Their mortality decline has been the most precipitous in history: five times faster than in the developed nations. In the eight years between 1945 and 1953, Sri Lanka, for example, had as great a decline in mortality as had occurred in Sweden in the entire century between 1771 and 1871. That phenomenon has rapidly driven up growth rates all over the developing world. On the other hand, both individual families and government

policymakers can directly perceive that the number of surviving children is much greater than in the recent past, and this may well move them to consider a smaller family norm.

Compared to the last century, the means of controlling birth are far more numerous, more effective, and more easily available.

Modern mass communications are both more pervasive, and more influential. The elite in the developing countries, and increasingly the mass of the people as well, are becoming more aware of living standards in the developed world, including smaller family size and less traditional life styles. Exposure to alternate possibilities stirs their imaginations, and affects their aspirations.

Governments have much greater ability now to reach across subnational barriers of linguistic, ethnic, and cultural differences, and can stay in touch with villagers, if they choose to do so.

Debate about education policy continues, but most developing countries regard basic literacy for both males and females as essential for development goals, and greater national unity.

Finally, there are an increasing number of governments in the developing world committed to lowering fertility, and an even larger number supporting family planning programs. In 1969, when as President of the World Bank I spoke on population, at the University of Notre Dame, only about 40 developing countries officially supported family planning, and only 20 of those had specific policies to reduce fertility. By 1975 there were 63 countries with official family planning programs, and 34 with explicit policies to reduce the growth rate.[a]

Now all of this is encouraging.

And in view of it, what are the conclusions we can draw about the linkages between socio-economic development and fertility? More specifically, which are those key elements that can be deliberately managed so as to accelerate fertility reduction?

[a]Mexico, for example, has moved since 1971 from a pro-natalist attitude on population to a vigorous family planning program with explicit demographic objectives.

Linkage of Fertility Decline to Social and Economic Development

We still cannot be as certain as we would like in this matter, but we do know that the following factors are important:

Health: Improving the level of health, particularly of children, insures the survival of a desired minimum of offspring, and provides parents with greater incentive for planning and investment for both their children and themselves. Since 1950, all substantial fertility declines in the developing countries have been preceded by substantial declines in mortality.

Education: Broadening the knowledge of both males and females beyond their familiar and local milieu enables them to learn about and take advantage of new opportunities, and to perceive the future as something worth planning for, including personal family size.

Broadly Distributed Economic Growth: Tangible improvement in the living standards of a significant proportion of the low-income groups in a society provides visible proof that aspirations for a better life can in fact be realized, and that a more compact family size can have economic advantages.

Urbanization: Despite the many problems connected with migration from the countryside to the city, it generally does offer greater accessibility to health services and education; increased familiarity with the more modern economic sector; and new savings and consumption patterns: all of which tends to alter attitudes towards traditional family size.

Enhanced Status of Women: Expanding the social, political, occupational, and economic opportunities of women beyond the traditional roles of motherhood and housekeeping enables them to experience directly the advantages of lowered fertility, and to channel their creative abilities over a much broader spectrum of choice.

Now let me sum up here what we have been discussing.

The central issue is: which are those specific elements of economic and social development that bear most effectively on reducing fertility?

I have suggested several. But how can we be sure they are likely to work?

One way is to examine carefully the available data for any apparent correlations with indicated levels of the crude birth rates.

Table VII—"Correspondence" in 1970 between Crude Birth Rates and Selected Development Indicators[a]

	No. of Countries	CBR Over 45	CBR 40 to 44	CBR 30 to 39	CBR Less Than 30
Health					
Infant mortality (rate per thousand)	34	128	84	61	20
Life expectancy (years)	43	46	57	64	68
Education					
Literacy (percent of population over 15 years of age)	39	33	57	78	80
Urbanization					
Adult male labor in agriculture (percent of total male labor)	46	77	64	45	15

Source: Population Council Data Bank.

The data demonstrate that there are such apparent correlations. What they do not prove conclusively is an ironclad causal connection.

But the figures in Table VII above, and those in Table VIII below, do establish that fertility levels and levels of certain specific socio-economic indices tend to move together.

[a]The values shown for the development indicators at each level of CBR are median values for the countries in the sample.

Table VIII—Trends of Crude Birth Rates and Selected Development Indicators: 1960-70

	Number of Countries[a]	Median Value of CBR and Devel. Indicators 1960	1970	Percentage Change
Crude birth rate	26	46	42	− 9%
Health				
Crude death rate (per thousand)	22	11.8	9.8	−17
Life expectancy (years)	17	57	61.4	+ 8
Infant mortality rate (per thousand)	15	80	68	−15
Inhabitants per physician	46	7,730	6,212	−20
Nutrition				
Calorie consumption (per capita per day)	34	2,110	2,310	+ 9
Protein consumption (grams per capita per day)	33	55.9	61.3	+10
Education				
Literate as % of population (age 15 and over)	14	61	74	+21
Urbanization				
Adult male labor in agriculture (%)	24	60	54	−11

Thus declining levels of infant mortality, and rising levels of nutrition, literacy, and nonagricultural employment appear to be accompanied by lower birth rates.

In 1970, for example, countries with a crude birth rate greater than 45, had on average an infant mortality rate of 128 per 1,000; an adult literacy rate of 33%; and 77% of the male labor force in agriculture.

Countries with a crude birth rate about 5 points less—a CBR of 40 to 44—had on average an infant mortality rate of 84; a literacy rate of 57%; and 64% of the male labor force in agriculture.

[a]All developing countries for which data are available for both 1960 and 1970. The data are derived from the data banks of the UN Research Institute for Social Development.

But for countries with CBRs in the range of 30 to 39, infant mortality on average had fallen to 61; literacy had climbed to 78%; and only 45% of the male labor force was in agriculture.

Finally, for countries with crude birth rates of less than 30, the infant mortality rate on average was down to 20; literacy was at 80%; and only 15% of the male labor force was in agriculture.

The correspondence in these examples is clear. The higher levels of health and education and nonagricultural employment are associated with lower levels of fertility.

But I want to repeat again. The correlation appears to be with specific elements of development—literacy, for example, and nutrition and infant mortality—rather than with the general level of economic wealth.

Consider the examples of Korea and Mexico.

Both countries have achieved impressive gains in their gross national products: Mexico since 1940, and Korea since the early 1960s. But by 1973, Mexico had reached a GNP per capita of $890, whereas Korea stood at less than half of that, at about $400.

Korea, however, had managed to distribute that much smaller income much more evenly than Mexico. In 1969, the poorest 40% of the households in Korea received 21.4% of total income, whereas the same group in Mexico received only 10.2%.

The infant mortality rate in Korea was at a considerably lower level: in 1970 it was 38, compared to 61 in Mexico.

Adult literacy, in the same year, was greater in Korea: 91% versus 84% in Mexico.

And by 1970, Korea had decisively entered her fertility transition with a crude birth rate of 29; whereas Mexico, with a CBR of 45, had not.

This, then, was a case of substantially higher overall national income failing to correlate with either fertility reduction, or other socially desirable factors.

A similar example is the state of Kerala in India.

In terms of average per capita income, it is one of the poorer Indian states. But its distribution of income is more equal; its literacy rate, particularly for women, is the highest in the country; and its infant mortality rate is the lowest.

In 1974 its crude birth rate was 28: lower than that of any other Indian state.

What these cases, and others, indicate is that gains in overall national economic growth are most related to fertility declines when they are associated with a broad distribution of the fundamental elements of social advance. A study of 40 developing countries revealed that an increase of $10 in the income of the lower 60% of the income strata, carrying with it advances in nutrition, health, and literacy, was associated with a crude birth rate decline of 0.7 per 1,000; but that a $10 increase in the overall average income of everyone was associated with a CBR decline of only 0.3 per 1,000.

If the growth in national income does not result in improvements of the living conditions of the lower income groups, it will not help to reduce fertility throughout the society.

Extrapolating the Data

The correlation, then, in developing countries between certain social changes and fertility reductions is persuasive, and is supported by the trends from 1960 to 1970. During that decade, literacy and education advanced; infant mortality declined; life expectancy increased; and the crude birth rate fell.

Assuming that the social indicators continue to change at the rate of that decade, and that their relation to fertility patterns remains the same, the crude birth rate in the developing countries as a whole would drop approximately half a point per year.

What this means is that without additional intervention, the current population in the developing world is going to continue to grow at rates very substantially in excess of those that would facilitate far more economic and social progress. It is these rates which would lead to an ultimate steady-state population in the world of 11 billion.

That is clearly undesirable.

Governments, then, must intervene. But how precisely? Let us examine the choices available.

V. POSSIBLE INTERVENTIONS TO REDUCE FERTILITY

The range of possible interventions divides into two broad categories:

- Those designed to encourage couples to desire smaller families;
- And those designed to provide parents with the means to implement that desire.

Both approaches are, of course, necessary. The first sets out to alter the social and economic environment that tends to promote high fertility, and by altering it to create among parents a new and smaller norm of family size, and therefore a demand for birth control.

And the second supplies the requisite means that will make that new norm attainable.

Thus family planning services are essential, but in the end can succeed only to the extent that a demand for lower fertility exists.

That demand apparently does not now exist in sufficient strength in most of the developing countries.

There are a number of policy actions that governments can take to help stimulate the demand. None of them is easy to implement. All of them require some reallocation of scarce resources. And some of them are politically sensitive.

But governments must measure those costs against the immeasurably greater costs in store for societies that procrastinate while dangerous population pressures mount.

What, then, are those specific social and economic actions most likely to promote the desire for reduced fertility?

Governments should try to:

- Reduce current infant and child mortality rates sharply.
- Expand basic education and increase the proportion of girls in school.
- Increase the productivity of smallholders in the rural areas, and expand earning opportunities in the cities for low-income groups.
- Put greater stress on more equitable distribution of income and services in the drive for greater economic growth.
- And above all else, raise the status of women socially, economically, and politically.

Let me comment briefly on each of these.

Reducing Infant and Child Mortality

We know from the experience of both the developed and developing countries that a decline in fertility rates can be expected to follow a reduction in infant and child mortality. The current rates in the developing world remain up to 20 times higher than they are in the developed nations.

Over half of all the deaths in Egypt, for example, occur before the age of five. Comparable and even higher rates are common in other developing countries. In Mexico, Cameroon, and Colombia about 30% of all deaths occur in the first year, and 15 to 20% of all deaths in the second through the fourth year. In contrast, in Sweden, the United States, and Japan the deaths of infants and children below the age of 5 make up less than 5% of the total number.

Average rates of infant mortality—deaths per 1,000 in the first year—are 142 in Africa, 121 in Asia, and 60 in Latin America. In the developed countries they average about 20.

Why are they so high in the developing world? Largely because of low nutritional standards, poor hygienic conditions, and inadequate health services.

In most developing countries health expenditures have been excessively devoted to supplying a small urban elite with expen-

sive curative health-care systems—highly skilled doctors and elaborate hospitals — that fail to reach 90% of the people. What are required are less sophisticated, but more effective, preventive health delivery systems that reach the mass of the population.

Even quite poor countries can succeed in this, provided sound policies are pursued. Some 20 years ago, for example, Sri Lanka decided to improve rural health facilities.

The result over the past two decades has been a decline in infant mortality from 78 per 1,000 to 45 per 1,000, an increase in life expectancy from 56 to 69 years, and an associated decline in the crude birth rate from 39 to 29.

Korea has followed a similar policy, with similar results.

But many other countries—countries even with a much higher per capita national income than either Sri Lanka or Korea —have spent as much or more on health, and by failing to stress simple, inexpensive, but effective rural health systems, have reaped much poorer results.

Turkey, for example, had a GNP per capita of $860 in 1975, compared to Korea's $550 and Sri Lanka's $150, but has concentrated on urban health, with conventional facilities, and today has an infant mortality rate of 119 per 1,000, as compared to Korea's 38 per 1,000; life expectancy of 60 years, compared with Korea's 64 years; and a crude birth rate of 39, as compared with Korea's 28.

Infant and child mortality rates can be brought down relatively simply and inexpensively, if the national health policies are carefully designed. The return in lowered fertility, and healthier children, and more equitably served families is clearly worth the effort.

Expanding Basic Education

Education, like health, has often been a casualty of inappropriate policies, and there is wide debate over what ought best to be done. But there is no question that expanding the educational opportunities of females correlates with lowered fertility.

In Latin America, for example, studies indicate that in districts as diverse as Rio de Janeiro, rural Chile, and Buenos Aires, women who have completed primary school average about two children fewer than those who have not.

Schooling tends to delay the age of marriage, for girls, and thus reduces their total possible number of childbearing years.

Further, education facilitates, for both men and women, the acquisition of information on family planning. It increases their exposure to mass media and printed material, and enables them to learn about modern contraceptives and their use.

Schooling, too, clearly enhances a girl's prospects of finding employment outside the home that may compete with raising a large family. In a comparative study of 49 countries, the level of female education in each nation demonstrated a significant impact on the proportion of women earning wages or salaries, which in turn had a strong association with lowered fertility.

While children are in school, they do not contribute much to the support of the family, and thus parents tend to perceive them as having less immediate economic utility, but more long-term earning capacity. Both these factors are likely to lead parents towards a more compact family norm, since a large family is more expensive to educate, and a small, well-educated one will be in a better position to aid parents in later life. Fertility rates are substantially higher in those countries in which children under 15 are economically active, rather than in school.

Parents with an education themselves typically desire an even better education for their children, and realize that if these aspirations are to be achieved, family size will have to be limited.

Education leads to lowered fertility, too, by reducing infant and child mortality. In Northeast Brazil one of the chief motivations for school attendance was found to be the nutritious school lunch program. Further, a parent who has had some schooling is likely to be more careful about basic sanitation, and the value of innoculations and antibiotics. Such a mother is more confident that her own children will survive, and is less likely to want additional children merely as insurance against some dying.

Finally, perhaps the greatest benefit of education to both men and women in heavily traditional environments is that it broadens their view of the opportunities and potential of life, inclines them to think more for themselves, and reduces their suspicion of social change. This creates an intellectual environment in which important questions such as family size and contraceptive practice can be discussed more openly.

There is little likelihood that governments in developing countries—or for that matter, in developed countries—will soon agree over the competing strategies for more effective school systems. But one principle is beyond dispute: in the face of perennial budgetary pressures, it is far better to try to provide a basic minimum of practical and development-oriented education for many, than to opt for an expensive, formal, and overly academic education for a few.

A basic learning package, for both men and women, including functional literacy and numeracy, some choice of relevant vocational skills for productive activity, family planning and health, child care, nutrition, sanitation, and the knowledge required for active civic participation is an investment no nation can afford not to make. The very nature of the educational process imposes a relatively long time lag for the economic return on that investment. But if the basic package is right, the return will be huge. And not the least component of that return will be the benefit of reduced fertility.

Increasing the Productivity of Small Farmers, and Expanding Earning Opportunities in the Cities

As a generality, small farmers in developing countries are among the lowest income groups in the society. Their agricultural productivity is often at bare subsistence levels. Perhaps the only poorer individuals in the countryside are the landless, whose sole source of income is seasonal on-farm employment.

The fertility of both groups is characteristically high.

Typically the smallholders are reluctant to sell their land, but their holdings tend to become even smaller and more frag-

mented as the land passes through the inheritance process to their surviving sons.

The landless are the most likely candidates for migration to the squatter settlements of the city, since they have no tangible assets to hold them in the rural areas. But, increasingly, the dwindling size of the redivided holdings forces the inheriting sons as well to sell their uneconomic parcels of land, and join the procession to the urban slums in search of a job.

For the small farmers who remain on their land their only hope to escape poverty—with its poverty-related fertility levels—is government policy deliberately designed to assist them to increase their productivity.

There is, in fact, great potential for this, but it requires a comprehensive program of fundamental elements such as land and tenancy reform; better access to credit; assured availability of water; expanded extension of facilities; greater participation in public services; and new forms of rural institutions that can act as effective intermediaries between the appropriate government ministries and the individual subsistence farmers.

I have discussed in detail the essential components of such a program elsewhere,[a] and need not repeat them here, except to point out that our early experience with such rural development projects in the World Bank confirms their feasibility. We have over the last three years initiated 210 such projects, calculated to at least double the incomes of 8 million farm families, or about 50 million individuals.

It is through this increase in income that such farm families will almost certainly experience a beneficial decline in their traditionally high fertility. For the income will give them access to better health and education and living standards, which in turn are likely to lead to smaller families.

There is, then, a sound policy formula that governments can implement for the poor farmer that both reduces poverty, and its attendant fertility.

[a]Address to the Board of Governors of The World Bank, Nairobi, 1973.

But what of the growing millions of poor who migrate to the cities, and take their propensity for large families with them?

This is a considerably more complex policy problem since urban socio-economic relationships are by their nature both more varied and more complicated than traditional rural situations.

But the basic principle remains the same.

Policies must be shaped that will assist the urban poor to increase their productivity. In practice this means a comprehensive program designed to increase earning opportunities in both the traditional and the modern sectors; provide equitable access to public utilities, transport, education, and health services; and establish realistic housing policies.

Again, I have dealt with this subject at length in another context[a] and I need not reiterate the issues here. What is clear is that urbanization has usually been associated with low fertility.

In Latin America, for example, studies have indicated that family size in rural areas and small towns is nearly twice as large as those in major urban cities. The correlation has been found in countries as diverse as India, Lebanon, Hungary, the Soviet Union, and Japan.

In the urban setting there are fewer opportunities for children to do useful work, and hence more rationale for them to be in school. In general, cities offer relatively better access to the modern socio-economic system, and its attendant attitudes.

Moreover, migration from the countryside tends to loosen some links with the extended family. If parents cannot expect to dwell with their adult children, there is less incentive for them to have large families for the purpose of support in their old age.

Finally, the very act of leaving the traditional family home may lead to other breaks with tradition, such as the age of marriage and family size.

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[a]Address to the Board of Governors of The World Bank, Washington, D.C., 1975.

But one must enter a word of caution. From a policy point of view, most governments in the developing world have little practical capacity either to regulate urbanization or to retard it. It simply happens, and it is happening far more rapidly than almost any major city can possibly cope with in an orderly way.

Populations in the countries themselves are doubling every 25 to 30 years, but their large cities are doubling every 10 to 15 years, and the urban slums and shanty towns in these cities every 5 to 7 years. By 1990 Lima, Peru, is expected to have six million inhabitants, 75% of whom will live in what were originally squatter settlements.

Fertility may or may not decrease in such potentially huge and squalid surroundings. And if it does decrease, it may decrease for the wrong reasons: inhuman crowding, unbearable stress, or dysfunctional family relationships. What must be countered in exploding cities is the desperate poverty that fuels them, which is itself, in part, the tragic legacy of rampant population growth in the countryside and city alike.

More Equitable Distribution of Economic Growth

While economic growth is a necessary condition of development in a modernizing society, it is not in itself a sufficient condition. The reason is clear. Economic growth cannot change the lives of the mass of the people unless it reaches the mass of the people.

It is not doing so with sufficient impact in most of the developing countries of the world today. Typically, the upper 20% of the population receives 55% of the national income, and the lowest 20% receives 5%.

In the rural areas, this is reflected in the concentration of land ownership. According to an FAO survey, the wealthiest 20% of the landowners in most developing countries own between 50 and 60% of the cropland. In Venezuela they own 82%; in Colombia 56%; in Brazil 53%; in the Philippines, India, and Pakistan about 50%. The roughly 100 million small farms in the developing world—those less than 5 hectares—are concentrated on only 20% of the cropland.

What this means is that the lower 40% of the income strata is neither contributing significantly to economic growth nor sharing equitably in its benefits. They are the poor, and they are virtually outside the entire development process. It largely passes them by.

It is little wonder, then, that national economic growth in itself has had less than optimum effect on the fertility patterns of the vast mass of the population. Their nations have been progressing, but large numbers of the people have advanced at rates far below the average.

Even the conventional measurements that governments have at hand to trace economic progress can be misleading. The growth of the gross national product, for example, is generally regarded as a key index. And it is, for it measures the total value of the goods and services of the economy. But it does not, and cannot, serve as a measure of their distribution.

Since the upper 40% of the population in a developing country typically receives 75% of all income, the growth of the GNP is primarily an index of the progress of these upper-income groups. It tells one very little about what is happening to the poorest 40%, who collectively receive only about 10 or 15% of the total national income.

The implication of much of what was said at the World Population Conference in Bucharest in 1974 was that a sufficient rate of development will solve any population problem in time.

But what precisely is a "sufficient rate of development"? It clearly is not overall average economic growth, which so frequently benefits the few and bypasses the many.

Most countries in Latin America, for example, have considerably higher per capita income than countries in Asia and Africa. And yet fertility rates are not proportionately lower. That, in part, is a function of the serious inequalities in income distribution in the Latin American region.

A study of various characteristics in 64 countries from both the developed and developing areas of the world, for which data are available, confirmed that more equitable income distri-

bution, with the resultant broader distribution of social service, is strongly associated with lower fertility. The analysis suggested that each additional percentage point of total income received by the poorest 40% reduces the general fertility rate by about 3 points.

Governments everywhere in the developing world are, of course, striving to accelerate economic growth. Excessive fertility is itself a serious obstacle to this growth. But unless the benefits of the growth are directed more equitably to the lower 40% of the income groups, where in fact fertility rates are likely to be the highest, then economic growth as such will not move the society forward at an optimum rate of progress.

Enhancing the Status of Women Socially, Economically, and Politically

The importance of enhancing the status of women is critical, and there is a great deal that governments can do in this matter. In some societies even simple legislative changes—such as establishing the legal right of a woman to refuse to marry the mate picked out for her by her parents, or the right to own property herself—are important first steps in improving her position in society.

Of all the aspects of social development, the educational level appears most consistently associated with lower fertility. And it is significant that an increase in the education of women tends to lower fertility to a greater extent than a similar increase in the education of men.

But in most developing societies women do not have equitable access to education. The number of illiterate females is growing faster than illiterate males. Nearly two-thirds of the world's 800 million illiterates are women, and virtually everywhere males are given preference both for general education and vocational training.

One reason for this is that the prevailing image of women distorts their full contribution to society. Women are esteemed —and are encouraged to esteem themselves—predominantly in their roles as mothers. Their economic contribution, though

it is substantial in a number of developing societies, is almost always understated.

The fact is that in subsistence societies women generally do at least 50% of the work connected with agricultural production and processing, as well as take care of the children, and the housekeeping. They rise earlier and retire later than anyone else in the family, often working 18 hours a day.

But despite this contribution, women generally suffer the most malnutrition in poor families. Men are given first claim on such food as is available; children second; and the mother last. This, in itself, tends to lead to high fertility through a self-perpetuating cycle of events.

Malnourished mothers give birth to weak and unhealthy infants, and have problems nursing them adequately. Such infants often die. This leads to frequent pregnancies. The mothers, constantly pregnant or nursing infants, are unable to play a larger role in the outside-the-home work force. This diminishes their occupational and economic status, which in turn reinforces the concept that males are more important. This makes sons more desirable than daughters. When only daughters are born, another pregnancy must ensue in order to try again for a son. Repeated pregnancy not only increases the family size, but exhausts the mother, weakens her health—and thus the whole cycle begins again.

Though governments sometimes recognize that encouraging women to enter the off-farm and urban work force reduces fertility—since it tends to delay the age of marriage, and increase the interval between children—policymakers are often tempted to conclude that this would only exacerbate unemployment among men, and hence diminish family income.

But that objection is a short-term view of the matter. In the longer run, a family with two wage earners, and a smaller number of dependents—due to the related decreased fertility—can contribute more to public revenues through taxes, and more to capital formation through increased savings.

In contrast with a large and poor one-wage-earner family, the smaller two-wage-earner family helps accelerate economic

growth, and thus increases the demand for labor, male and female.

The truth is that greater economic opportunity for women—and the greater educational opportunity that undergirds it—would substantially reduce fertility. And in societies in which rapid population growth is draining away resources, expenditure on education and training for boys that is not matched by comparable expenditure for girls will very likely be diminished in the end by the girls' continued high fertility. More education for women in developing countries is a very good buy.

Instruction on nutrition, child care, family planning, and home economics are all, of course, important. But women need market-oriented training and services as well: access to credit, extension services, the skills necessary for participating in a cash economy.

Schools must make the point to young women that the ideal role of a girl is not be the mother of a large and poor family, but rather to have a double role as mother of a small family, and as a wage earner who contributes to the well-being of her family by economic employment.

Women represent a seriously undervalued potential in the development process. And to prolong inequitable practices that relegate them exclusively to narrow traditional roles not only denies both them and society the benefits of that potential, but very seriously compounds the problem of reducing fertility.

Public Information Programs

Those, then, are the specific socio-economic interventions calculated to encourage smaller families.

They must, of course, be paralleled and supported by a continuing public information program.

There is a need to inform, educate, and persuade people of the benefits of a more compact and manageable family size. This is essential, but it has not been an easy task. The significance of the population problem dawned slowly on an unprepared world. There was not only ignorance and skepticism, but

in many instances strong opposition against even discussing the subject.

That is not surprising.

Since reproduction is essential for the survival of society, it is understandable that every society has had strong views about family size.

Norms in this matter have always existed, and there has always been strong group pressure to see that they were followed. Until very recently, childless women in some societies have been regarded with open scorn. And for males not to father a large family has tended to be a reflection on their masculinity.

Norms are patterns of expected behavior, rules of what is appropriate and what is not. And we know, from surveys on desired family size, what those norms are today in various societies. In the developed world the average desired number of children ranges from 2 to 3. In the developing world the average is between 4 and 6, with a majority wanting at least four children.

This is a critical point, since one of the main objects of intervention in population is to create a set of circumstances in which people will change their norm of desired family size.

And there is simply no hope of succeeding at that unless one first clearly understands the reasoning behind their present norms.

To design an effective public information program, to set up a persuasive person-to-person communication scheme, to draft and establish a successful population education plan, it is imperative to comprehend the mind-set that you are attempting to change.

And the reasons for fertility reduction that may be persuasive to planners sitting in distant capitals may not be persuasive at all to parents sitting in remote villages.

Village couples rarely worry about the progress of the gross national product.

What they may well worry about is the progress of a sick child, or how they are going to accumulate enough savings to

secure their old age, and whether the signs are auspicious that the next pregnancy will finally give them a second son, rather than a third daughter.

As we have said, it is the poor, as a generality, who have the most children. And it is the poorest countries, as a generality, that have the highest birth rates.

But it is a mistake to think that the poor have children mindlessly, or without purpose, or—in the light of their own personal value systems—irresponsibly.

Quite the contrary.

The poor, by the very fact of their poverty, have little margin for error. The very precariousness of their existence habituates them to be cautious. They may be illiterate. They are seldom foolhardy. To survive at all, they are forced to be shrewd.

What we must grasp is that poverty does not make people unreasonable. What it does do is severely reduce their range of choice. They often do what they do because there is little real opportunity to do otherwise.

Poor people have large families for many reasons. But the point is they do have reasons. Reasons of security for their old age. Reasons about additional help on the land. Reasons concerning the cultural preference for sons. Reasons related to the laws of inheritance. Reasons dictated by traditional religious behavior. And reasons of personal pride.

Demography measures people. It cannot always measure their inner feelings.

And yet understanding poor people—and the narrow range of options that poverty offers them—is the key to assisting them to broaden their choices.

In a good public information program, that is precisely what happens. Alternative choices become evident.

The mass media can be helpful, particularly radio, television, and film since they do not depend exclusively on literacy for comprehension. But all the media can be creatively utilized:

newspapers, signboards, leaflets, exhibits, village posters, songs, and plays.

Communication research concludes that the mass media, while influential with people who are already in general agreement, or at least neutral, can rarely—through direct messages—persuade people to reverse deep-seated convictions, or long-standing behavior.

But what the media can do, and do very well, is help people to change their views indirectly by putting them in contact with another world, expanding their horizons, stimulating their curiosity, and introducing them to new ideas, including the idea of attractive alternative life styles, with fewer, but more advantaged children.

But in the end, no form of media information is as effective as person-to-person communication. Messages can be sent electronically thousands of miles, but it is ultimately people talking to one another in a classroom, on the street, at the village market, or in the village home where the essential questions are discussed, and the essential answers are explored.

Door-to-door field work, discussion groups, study clubs, civic organizations, town and village meetings: all of these are important, and all of them can be made stimulating, informative, and persuasive.

There is a whole spectrum of formal and informal learning situations that can be utilized. Population education as a component of the school curriculum is obvious and essential. Mobile vans visiting villages with films, exhibits, and talks can combine entertainment with instruction. Political leaders, national celebrities, and religious authorities can endorse national population goals in their speeches and public appearances. All of this is possible, given leadership, imagination, and drive. And all of it is very worthwhile.

But beyond these information and educational efforts, there is a whole range of additional measures available to governments that can serve as incentives to postpone the age of marriage, undertake family planning, or adopt new norms of family size and disincentives to retaining inappropriate norms.

Incentives and Disincentives

Housing and job opportunities, maternity benefits, tax deductions, dependency allowances, pension provisions, school admission priorities: these and similar government benefits and policies can be redesigned to encourage parents to have small families, and to dissuade them from having large ones.

Incentives can range from immediate cash payments to family planning acceptors to elaborate programs for future payment, at the end of the childbearing years, for fertility restraint. Disincentives can limit the allocation of various public services on a graduated scale: more to parents with few children, less—or none at all—to parents with many children.[a]

Incentives, of course, widen rather than restrict choice, and are less likely to penalize children, who, through no fault of their own, happen to get born into large families. But the fact is, of course, that disincentives or not, children born into large families in the developing world today are likely to be penalized in any case, simply by the pressures of poverty that the population problem has exacerbated in developing societies.[b]

Experimenting with incentives is still relatively limited, but the prospects are promising. Deferred-payment schemes, which would reward parents financially at the time of retirement, or at the end of the childbearing age, for their fertility restraint are particularly worth exploring.

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[a]One scheme proposed for Malaysia would make public assistance for the elderly available only for those parents with less than three children. Taiwan is experimenting with a bond system that will provide support for higher education of students in families with no more than three children. Singapore —a high-density island community—has designed a whole series of measures. In 1970, Prime Minister Lee Kuan Yew pointed out: "Beyond three children, the costs of subsidized housing, socialized medicine, and free education should be transferred to the parent."

[b]From a child's point of view there can be few benefits in having many siblings. The close spacing of children and large numbers of children are likely to increase infant and maternal mortality, and to worsen nutritional deficiencies and related health problems. This may in turn reduce a child's opportunity to benefit from whatever educational opportunities he has received. And in matters of inheritance, which in rural areas of some of the land-scarce countries is likely to be of critical importance even among very poor families, children from large families are at an obvious disadvantage.

Such schemes attempt to provide parents with an alternative source of financial security for their old age, in place of the traditional one of large families. And they encourage the creation of a society in which parents can put their resources and energies into providing a small number of children with the best possible start in life, rather than merely hoping to find security in a large number of children—each one of whom must face a proportionately more precarious future.

Promoting a Social Consensus

Governments have considerable capacity, as well, to help create a generalized atmosphere of social consensus in an antinatalist direction. Villages and local communities, just as individual families, can be rewarded by government policies for good performance in fertility restraint. Allocations of central government funds for community improvements—roads, electrification, public works—can be conditioned on evidence of community commitment to new-style family norms.

India, for example, recently adopted a measure which provides that both the political representation of local areas, and their allocation of national financial resources, will no longer increase simply as a function of their population growth. In the future, additional numbers will not automatically mean additional votes or additional claims on tax revenues.

But it is not only the central government in a society that can apply disincentives to high fertility. Community authorities can do the same.

In preindustrial Japan, for example, a strong tradition of social cooperation and consensus at the village level maintained severe constraints on the number of households in the village, often permitting no increase at all. These social pressures were transmitted to heads of households, who in turn exerted authority over individual household members in matters of marriage, divorce, and adoption. This tradition appears to have been a significant influence in holding population increase during the last 150 years of Tokugawa Japan to less than 0.2% a year.

It is obvious that the interest of a local community in the fer-

tility of its membership will be proportional to the social costs of population increase that it is called upon to bear. If schools and other public services are in part locally financed; if pressures on the land lead to local deforestation and erosion; and if local unemployment becomes serious, then communities may well become conscious of the adverse social effects of excessive population growth.

It is clear that there are many different approaches to the task of promoting a new social consensus on population problems within a society, and the choice of one over another—or any particular mix of actions—must, of course, be guided by the cultural context of the society in question.

But the truth is that most of the approaches, and all of the actions, are difficult to implement.

And we must face the reality that if these approaches fail, and population pressures become too great, nations will be driven to more coercive methods.

Coercion

A number of governments are moving in the direction of coercion already. Some have introduced legal sanctions to raise the age of marriage. A few are considering direct legal limitations on family size, and sanctions to enforce them.

No government really wants to resort to coercion in this matter. But neither can any government afford to let population pressures grow so dangerously large that social frustrations finally erupt into irrational violence and civil disintegration.

That would be coercion of a very different order. In effect, it would be nature's response to our own indifference.

Now let me underscore what we have been analyzing here.

We have been discussing those kinds of interventions that governments can make to help stimulate the desire among parents for a smaller family size.

But those efforts must, of course, be accompanied by corresponding interventions that provide parents with readily available means to do so.

Family Planning Services

Governments must improve the access to the modern means of fertility control both qualitatively and quantitatively: more and better services to greater numbers of people.

In practice, that requires:

- Providing a broad selection of the current contraceptives: pills, condoms, IUDs; as well as sterilization, and—where the society desires it—abortion.
- Establishing a broad spectrum of delivery services and informational activities utilizing: physicians in private practice; paramedical workers; professional field workers; community-based local agents; the commercial sector; widespread distribution of contraceptives; sterilization centers; mobile clinics; postpartum arrangements; and the integration of contraceptive services into the maternal and child-health system, the general health system, and the community development system.
- And, finally, improving the acceptability, continuity, and effectiveness of the means of fertility control by accelerating research on such possibilities as: a contraceptive vaccine; a better implant; an IUD free of side effects; a safer and more convenient pill (a once-a-month pill, or a once-a-year pill); a nonsurgical means to terminate pregnancy; or a currently unknown "ideal" contraceptive.

To put the matter succinctly, governments need to provide a broad choice of present contraceptive techniques and services to parents; they need to improve the delivery system by which parents can get the services they wish; and they need to support continuing research for better techniques and services.

The majority of the world's population lives in countries with family planning programs that now have as their explicit objective the reduction of fertility. And yet the programs themselves often do not reflect much political conviction that they can and must succeed.

Many of these programs are small, and rely on foreign sources

for much of their finance. All governments, of course, have resource constraints. But fertility reduction, as a priority, seldom commands even 1% of national budgets. Further, governments have often failed to give the programs the status and national attention that would attract top managerial talent. For these, and related reasons, the world's total family planning acceptors did not measurably increase in the period 1972-1975, despite the increase in the number of national programs.

I listed above a number of actions that governments—both developed and developing—can take to strengthen family planning programs.

One of the most urgent needs is a much greater effort in reproductive biological research and contraceptive technology.

Reproductive Biological Research

The requirement for a substantial expansion in reproductive research is obvious. Though by the early 1970s some 46 million women throughout the world were using the IUD or the pill, this did not begin to meet the need. Of the approximately 500 million women around the globe in their childbearing years, and facing the risk of an unwanted pregnancy, an estimated 70% are using no contraceptive method at all.

The current estimate is that for the world as a whole, one out of every three of four pregnancies ends in abortion, and the vast majority of the women seeking abortion are married. The fact is that abortion, even though it is still illegal in a number of countries—and remains ethically offensive to millions—appears to be the most widespread means of fertility control there is. That is, in itself, a cogent argument for better contraceptive methods.

Cultural, religious, and personal preferences in contraception differ widely, and must, of course, be taken into account if adequate levels of acceptability and continuity are to be achieved. While it is true that there may never be an "ideal" contraceptive for all circumstances, it is clear that there should be a broader spectrum of methods which are safer, less discomforting, and more convenient; and which require less complex and costly distribution systems.

Such methods are well within the reach of biomedical science and adaptive technology, but will require sustained investigation and effort. Traditionally, reproductive research has been grossly underfinanced. Worldwide expenditures in 1975 were less than $130 million. Simply to maintain this wholly inadequate level of funding in the face of current inflation would mean approximately $200 million in 1980.

But this is far below what is required. Two to three times that amount is needed, not merely because of the importance of the population issue itself, but because of the intrinsic time lags involved.

There are a number of promising avenues for improved fertility regulation that have emerged from the basic research of the past fifteen years.[a] But even after a potential method has been developed, at least three to five years are required for testing before the method can be practically applied. And a wholly new discovery requires a full decade to reach the stage of a usable product.

What we must understand is that a variety of safe, effective, and acceptable methods of fertility regulation is not just needed now, and ten years from now, but in the years 2000, 2010, 2020 and so on. If new methods are to be available then, the research effort must be expanded now.

And yet the field has been so starved for funds in recent years that more than half the approved grant applications for reproductive biological research have simply failed to be financed. Both the pharmaceutical industry and philanthropic foundations have been active in supporting such research, but they cannot be expected to carry the major funding expansion that is now urgently required. Governments must be prepared to direct substantially more effort in that direction.

The fruits of such research will result not only in better methods of contraception, but in the reduction of many other

[a]Among these are better contraceptive methods for use by males. These could substantially improve the ability to regulate childbearing by giving husbands greater responsibility for contraception. Further, it would make it possible for couples to alternate methods, and thus further reduce the risk of cumulative undesirable medical side effects.

adverse medical and social effects of unwanted or abnormal pregnancy: prematurity, infant mortality, congenital defects, mental retardation, maternal morbidity and mortality—as well as illegitimacy, early marriage, family disruption, educational disadvantage, and the exacerbation of poverty.

The investment in reproductive research is immensely worthwhile. And there is simply no question that more of it is needed.[a]

But, as I have indicated, this expanded research will require years of effort before it can be translated into radically different methods of contraception. Governments cannot afford simply to wait for that. Rather, they must in the meantime take action to improve present family planning programs and make broader use of current contraceptive technology. Such programs are necessary in all countries with rapidly expanding populations, regardless of the particular stage of economic and social development.

Family Planning in Relation to the Stages of Development

In some countries, widespread use of contraception precedes a change in desired family size, and may help it occur. In others, contraception becomes popular only after other factors have reduced family norms. But in either pattern, family planning is important, and indeed ultimately essential to meet the demand of parents for reduced family size.

In the lower-income developing countries, where absolute poverty is endemic, family planning programs should be shaped to service those parents who already desire to reduce their fertility; to urge others to consider that option; to increase local awareness of the damaging consequences of rampant population growth; and to recognize that by improving the health of the local community—and particularly of mothers and children —the program is in fact laying the foundation for a change in fertility norms.

Such an approach ensures that as the demand for family

[a]The same need exists for additional social science research in the population field. There is a clear requirement to define more precisely those particular elements of social and economic development that most directly affect fertility.

planning service increases, the supply is there to meet it. In the absence of more fundamental social and economic improvements, one cannot, of course, expect such a program to "solve" the population problem. But it would be equally naive to assume that it can have no effect on fertility whatever.

Indonesia, for example, is a particularly interesting case of a country with strong political commitment to fertility decline, and a vigorous family planning program, that appears to be off to a good start in spite of immense development problems.

In any event, the view that development in and by itself can take care of the fertility problem in the developing world is an unfortunate oversimplification as applied to most of the countries, and a dangerous error as applied to others.

Even for the better-off developing countries, such a "development-only" strategy would be wasteful. The fall in fertility, without a strong family planning program, is likely to come later in the development process than it need to: per capita income would grow more slowly, and the ultimate size of the population would be larger.

But for the lower-income countries, a "development-only" strategy would be disastrous. In these countries it would take a much longer time to reach the socio-economic levels that normally correspond with significantly lower birth rates. Indeed in some of them, it is the very magnitude of the population pressures themselves that is retarding that progress. Were the fertility problem not dealt with directly, the progress would simply be too slow.

At the rate at which literacy has been increased and infant mortality and fertility reduced during the last decade, it would take India, for example, until the year 2010 to reach the literacy levels that normally correspond with crude birth rates of 30; and it would take until the year 2059 to reach the infant mortality levels that correspond with a CBR of 30.

If Nepal were to do nothing about its fertility directly, it would take it 170 years to reach the literacy level associated with a CBR of 30.

India and Nepal—and many other countries—simply do not

have that kind of time to experiment with a "development-only" strategy. And, happily, they have no intention of attempting it.

Whatever the rhetoric at Bucharest in 1974, no country has abandoned the anti-natalist policies it held then, and several have strengthened them.

Competent observers do argue about the relative importance of social development and family planning efforts in reducing fertility rates. Some say the former is too indirect. Others say the latter is too inefficient.

But the truth is that the latest reviews of the experience of individual countries—reviews completed within the past twelve months—clearly support the conclusion that significant reduction of birth rates depends on both social development and family planning.

The reviews suggest that family planning programs have a clear, substantial, and independent effect on country performance.

Virtually all of the countries with reductions of 20% or more in their crude birth rates during the decade 1965-1974 had strong family planning programs.

But the research also confirms what common sense itself would suggest: that the effect of family planning programs is greatest when they are joined to efforts designed to promote related social goals.

Raising Population Consciousness

The real problem—for all of us—is to try to grasp the complexity of the population issue.

Population problems are not simple; they are not straightforward; and they are certainly not very clear. They are like man himself: complicated.

If we are to get down to solutions that really work, we have to try to see the problem in all its ramifications, and in all of its tangled interrelationships.

I recently asked a panel of distinguished experts to review our activities in the population field within the World Bank.

They took a hard look at everything we have been doing since 1969, and they rightly reproached us for a tendency to treat population too much in isolation from our other activities.

They pointed out that we have been prepared to lend for population projects, and were ready to bring specialized analysis to population issues when they were of obvious immediate importance.

But too many of us in the Bank had proceeded as if population issues could be left to specialists, rather than considered automatically in all aspects of our investment and development programs.

In short, they asked us to think about the problem in a more comprehensive way—and deal with it accordingly.

They were right. And that is exactly what we plan to do.

Let me, now, summarize and conclude the central points I have made this evening.

VI. SUMMARY AND CONCLUSIONS

The argument I have made is this.

It now appears that a significant decline in fertility may have at last begun in the developing countries. The data are not yet fully conclusive, but the indications are that the crude birth rates have fallen over the past two decades by an average of about 6 points, or nearly 13%.

By major region, the decline has been 6.5 points in Asia; 5.4 points in Latin America; and 2.3 points in Africa.

Further, the decline appears to have been general and widespread. It has occurred in 77 of the 88 countries for which estimates are available.

If these indications are confirmed by the censuses scheduled for 1980, then what we are seeing here is something of historic

importance. It would mean that the period of rapid acceleration in the rate of growth of the world's population has finally reached its peak and is now definitely moving downward towards stabilization.

But as welcome as this is, the fact remains that the current rate of decline in fertility in the developing countries is too slow to avoid their ultimately arriving at stationary populations far in excess of acceptable levels.

Unless governments, through appropriate policy action, can accelerate the reduction in fertility, the global population may not stabilize below 11 billion. That would be a world none of us would want to live in.

But governments can take action, and can accelerate the process, given the resolve and determination to do so.

The critical point is this: for every decade of delay in achieving a net reproduction rate of 1.0—replacement-level fertility—the ultimate steady-state world population will be approximately 15% greater.

Governments, then, must avoid the severe penalties of procrastination, and try to hasten the process forward.

But how?

The causes and determinants of fertility reduction are extremely complex, but it appears likely that there are a number of key linkages between that reduction and certain specific elements of socio-economic development.

The factors that appear to be the most important are: health, education, broadly distributed economic growth, urbanization, and the enhanced status of women.

These factors are at work in the developing world today, but their progress is too slow to be fully effective.

Without additional intervention on the part of governments, the current population in the developing world is going to continue to grow at rates very substantially in excess of those that would permit far more economic and social progress.

There are two broad categories of interventions that governments must undertake: those designed to encourage couples to desire smaller families; and those designed to provide parents with the means to implement that desire.

The first set of interventions sets out to alter the social and economic environment that tends to promote fertility, and by altering it to create a demand among parents for a new and smaller family norm.

And the second set of interventions supplies the requisite means that will make that new norm attainable.

To create the demand for a change in family norm, governments should try to:

- Reduce current infant and child mortality rates sharply.
- Expand basic education and substantially increase the proportion of girls in school.
- Increase the productivity of smallholders in the rural areas, and expand earning opportunities in the cities for low-income groups.
- Put greater stress on more equitable distribution of income and services in the drive for greater economic growth.
- And above all else, raise the status of women socially, economically, and politically.

To satisfy the demand for a change in family norms, governments and the international community should:

- Provide a broad choice of the present contraceptive techniques and services to parents.
- Improve the delivery systems by which parents can get the services they wish.
- And expand present levels of research seeking better techniques and services.

Both categories of interventions are necessary.

Recent studies confirm that the effect of family planning pro-

grams is greatest when they are joined to efforts designed to promote related social goals.

We know that eventually the world's population will have to stop growing. That is certain.

What is uncertain is how. And when. At what level. And with what result.

We who are alive today can determine the answers to those questions. By our action—or inaction—we will shape the world for all generations to come.

We can avoid a world of 11 billion, and all the misery that such an impoverished and crowded planet would imply. But we cannot avoid it by continuing into the next quarter century the ineffective approach to the problem of population that has characterized the past twenty-five years.

Man is still young in cosmic terms.

He has been on earth for a million years or so. And our modern ancestor, *Homo sapiens,* for a hundred thousand years.

But the universe of which he is a part is some twenty billion years old.

And if we represent the history of the universe by a line a mile long, then modern man has appeared on that line for only a fraction of an inch.

In that time perspective, he is recent, and tentative, and perhaps even experimental. He makes mistakes. And yet, if he is truly *sapiens*—thinking and wise—then surely there is promise for him.

Problems, yes. But very great promise—if we will but act.

GLOSSARY

Crude Birth Rate (CBR): The number of live births, per year, per 1,000 of population.

Crude Death Rate (CDR): The number of deaths, per year, per 1,000 of population.

Rate of Natural Increase (NI): The difference between the crude birth rate and the crude death rate, usually expressed as a percentage.

Rate of Population Growth: The rate of natural increase, adjusted for migration, and expressed as a percentage of the total population in a given year.

Infant Mortality Rate: The number of deaths, per year, of infants aged 0-12 months, per 1,000 live births.

Life Expectancy at Birth: The average number of years newborn children would live if subject to mortality risks prevalent for the cross section of the population at the time of their birth.

General Fertility Rate: The number of live births per year, per 1,000 women, aged 15-49 years.

Total Fertility Rate (TFR): The number of children an average woman would have if during her lifetime her childbearing behavior were the same as that of the cross section of women at the time of observation. The TFR often serves as an estimate of the average number of children per family.

Gross Reproduction Rate (GRR): The number of daughters a woman would have under prevailing fertility patterns.

Net Reproduction Rate (NRR): The number of daughters a woman would have, under prevailing fertility and mortality patterns, who would survive to the mean age of childbearing.

Replacement Level Fertility: A level of fertility equivalent to a Net Reproduction Rate of 1.0—the level at which childbearing women, on the average, have enough daughters to replace themselves in the population.

Stationary Population: A population that for a long time has had a constant replacement-level fertility and therefore also has a growth rate equal to zero and a constant age composition.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
1818 H Street, N.W., Washington, D.C. 20433, U.S.A.

Telephone number: (202) 393-6360
Cable address: INTBAFRAD WASHINGTON D.C.

European Office:

66, Avenue d'Iéna, 75116 Paris, France
Telephone number: 723-5421
Cable address: INTBAFRAD PARIS