Institute for
FUTURES STUDIES

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Heavy trends in global developments.

Arbetsrapport/Institutet för Framtidsstudier; 2000:1
ISSN 1652-120X
ISBN 91-89655-08-7

Summary

The main object of this report is to identify the "heavy trends" that will come to characterize the development of society in the 21st century. Methodologically, we have chosen a demographic explanatory approach. Based on population prognoses showing shifts in the global age structure, we present prognoses over expected income development in various parts of the world, up until the year 2050. In our opinion, these prognoses constitute the basic scenarios that every discussion on the future must take a stand on. A later discussion in the report concerns global demographic and economic trends and what they may come to mean from an environmental perspective. Possible connections between age structure, income level, and environmental impact are analyzed, and an attempt is made to identify the central challenges of environmental work in the 21st century.

The UN's population prognoses show that today's developing countries will acquire a more favorable age structure during the 2000s. When the proportion of children in the population decreases, the proportion of actively working adults increases. At the same time, the populations of today's rich countries in the world are aging. Globally, we are undergoing an age transition, from a youthful to a more mature age composition.

The main finding of this report is that the age transition leads to a period when many of the world's regions will come to experience an accelerated increase in income. The most rapid economic progress will take place in East and South Asia. In just 2015, according to the scenario presented in the report, East Asia's economic strength will be larger than North America's, with South Asia established as a central hub in world economy. West Asia, North America, and Southeast Asia, too, will all experience a rapid increase in income. Countries in East, West, and Central Africa are predicted a later economic "take-off," but from the year 2030, they, too, will experience a period of rapid economic growth. In 2050, our picture of the global economy will be radically new. Today's developing countries will dominate the economic world map, and South Asia will have established itself as the economic center of the world. The traditional Western World, North American and Europe excluding Eastern Europe, will have decreased its share of the world's accumulated income from 60 to 20 percent.

The conclusion drawn in the report is that these income developments signify both risks and possibilities. In the long view, we can look forward to a century when a series of poverty-related environmental problems, including soil erosion and the cutting down of rainforests, will diminish in extent. On the other hand, environment problems like toxin spread, greenhouse gas emissions, the exploitation of raw materials, and unsanitary health conditions may reach previously unimagined levels, when populous economies like China's and India's begin to urbanize and industrialize. Even aging in the Western World could pose a threat to the environment, insofar as stagnating growth may weaken an aging country's interest in, or capacity for, maintaining an ecologically sustainable environment.

The report ends with some conclusions that we hope will spark off a discussion of the effects of the presented scenario on strategic environmental work.

A first conclusion is that the global dimension in environmental work calls for even greater attention than that which it receives today. A central issue for humanity in the coming century is to prevent rapid economic growth in the newly industrialized countries from leading to environmental disasters or long-term irreparable damage to the local and global environment.

A second conclusion is that it is possible to develop environmental strategies in a longer perspective, if demographic changes are taken into account. By learning more about how demographic structure interacts with the environment, we can intervene at an earlier stage in the social processes that generate environmental degradation.

A third conclusion is that technological development is a necessary but insufficient prerequisite for protecting the environment during the coming century. Building up global, national, and local institutions that are well-adapted to their purpose is just as important, and in this respect, today's industrialized countries could well have an important function to fill.

A fourth conclusion is that the technologies and institutional structures aimed at addressing environment problems must be modeled with a view to the demographic situation in which they are to be implemented. It is not only the nature of the environmental impact that changes with the population's age structure but also the capacity to handle institutions and technical systems.

A fifth conclusion is that the demographic scenario underlines the significance of well thought-out priorities in Swedish environment work. The upcoming ten to twenty years mark a critical phase, both at home and on the international scene. When aging sets in seriously in Sweden, our scope for action will be reduced.

Future society is created through a complex change process, whose character and direction can never fully be predicted. Based on modern historical and social science research, however, some of the heavy trends that will influence our lives in the next few decades can be identified.

The starting point for this report is a demographic analysis of societal development from 2000 to 2050. The focus of our interest lies in the global shift toward an ever-aging population, a process that has already begun in the industrialized world and which is about to occur in South America, Asia, and Africa. The main objective of the report is to analyze the socioeconomic consequences of this ongoing global age transition, among other things with respect to the challenges that the Swedish society will be confronted with. Environmental aspects of the outlined development will be given especial attention. In this respect, however, the analysis is of a tentative nature.

Demographic trends carry considerable weight as prognostic instruments, for several reasons. First of all, their progress is sluggish and therefore more predictable than other social trends. Population prognoses belong to the few trend projections that we can rely on with reasonable security. This applies especially to prognoses for the older population segment.[1]

Secondly, empirical social science research shows that a population's age structure has powerful and systematic effects on the society's economy and mode of function. This means that, using knowledge of age structure development, we can create scientific and informed future scenarios.[2]

Thirdly, demographic prognoses make it possible to formulate hypotheses on future trend shifts in societal development. In this respect, the demographic approach is superior to traditional futures-studies methods, which are often very good at capturing the latest tendencies but less good at predicting surprises lying ten to fifteen years ahead of time.

For environmentally strategic work, the demographic approach is particularly important. The relationship between population changes and the environment have long been a subject of interest in social science and environmental research. An Internet search for the words "population" and "environment" now yields almost a million matches. Common to most of the studies to date, however, is that they have been limited to the effects of total population size on the environment. In this report, the focus is instead on changes in the population's age distribution.

As with other types of prognoses, demographically based future scenarios should be applied with caution. They show a possible development and thereby increase our preparedness for meeting future social changes, but they do not spare us the responsibility of dealing with uncertainty and risk. The ultimate outcome of human action and human interaction is by no means predictable. For all planning aimed at the

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[1] See, e.g., W. Lutz (ed.), *The Future Population of the World. What can we assume today?*, London, 1996.

[2] There is now an extensive body of literature on future population developments and their effects. For more information, see, e.g., D. E. Bloom and J. G. Williamson, *Demographic Transitions and Economic Miracles in Emerging Asia*, Cambridge, MA: National Bureau of Economic Research, working paper 6268, 1997; D. E. Bloom and J. D. Sach, "Geography, Demography and Economic Growth in Africa," *Brooking Papers on Economic Activity* 1998:2; Eser Boserup, *Population and Technology*, Oxford, 1981; and Thomas Lindh and Bo Malmberg, "Age Structure and Growth in the OECD, 1950-1990," *Journal of Population Economics*, vol. 12, 1999.

future, it is therefore imperative that the futures strategies we arrive at are sturdy enough to handle many different development courses.

Technological development and institutions – challenges for the future

A common objection to demographically based prognoses is that they overlook two other central factors in societal development, namely, technological development and institutions/values (e.g., laws, customs, and religious traditions). The response to this objection is that institutional dynamics and technological change are without a doubt of great importance to long-term social transformation but that they nonetheless are of limited value in constructing meaningful, long-term prognoses. In this connection, several difficulties must be considered:

According to institutional theory, the particular institutional model is vital to a society's development.[3] A crucial problem that arises when this research is to be used in futures studies, however, is that we lack deeper knowledge of when and why established institutional structures crumple and are replaced with new ones. While the research to date has been able, on the one hand, to show a certain sluggishness in the developments of institutional structure, so-called *path dependency*, history offers many examples, on the other hand, of unexpected and dramatic institutional trend shifts. We speak of *formative moments*.[4] Without greater insight into when and why formative moments occur, it is difficult to predict the extent to which future institutional trend shifts will come about.

Another problem in using institutional theory in analyses of the future is that we do not yet have reliable and generalizable knowledge about the importance of institutions in social transformation. A central issue here is whether institutional models affect economic developments. Many claim that there is a connection between institutional structure and economic growth, but it has been difficult to specify the exact nature of growth-promoting institutions. The reasoning often comes tottering close to being circular: a country that has had economic growth has by definition also had growth-promoting institutions. The connection can only be confirmed after the fact.[5]

As for the technology factor, the problems from a prognoses point of view are similar, even if we are slightly more experienced in studying technological development from a futures perspective. To predict technology breakthroughs, it is common to use expert panels who give their opinions regarding the potential of their own field of technology. One example of this method is represented by the recently completed Swedish futures study *Teknisk Framsyn (Technological Foresight)*, which was built up on the basis of

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[3] Douglass North, *Institutions, Institutional Change, and Economic Performance*, Cambridge, 1993; and Nathan Rosenberg and L. E. Birdzell, Jr., *How the West Grew Rich. The Economic Transformation of the Industrial World*, New York, 1996.

[4] The concept of formative moments has been introduced in Sweden by Bo Rothstein, *Den korporativa staten*, Stockholm, 1992, chap. 4.

[5] Bo Malmberg and Lena Sommestad, "Vad sätter igång tillväxten?" ("What starts off growth?") *Svenska Dagbladet* (Samtider), Oct. 18, 1997, and "Det kan inte råda någon pluralism om resultaten" ("There can be no question of pluralism regarding the findings") (reply), *Svenska Dagbladet*, Nov. 22, 1997.

eight expert panels.[6] Prognoses on future technological developments can be of great interest, at least in the time perspective of one or two decades, but it is still very difficult to predict with any certainty the technological innovations that will come to be implemented and that will have the greatest impact. In this respect, it is a question not only of being able to predict what may be technically possible but also to have a reasonable conception of the shape of the society in which the new technology will be introduced.[7]

What is even more difficult to predict is how new technology will affect the development of society in general. Nonetheless, it is exactly this issue that many technology-based futures studies venture an opinion on. An underlying belief in most of the historical theories that have inspired today's futures debate is that the technology's strength and design are decisive to the organization of the entire society. This concept unites, for example, Karl Marx's classical work *Capital* with Manuel Castell's recently published *The Information Age* (1996). The problem, from a scientific point of view, is that there is little support for the hypothesis of a direct relationship between technological development and social organization. On the contrary, similar technologies occur in quite disparate socioeconomic contexts, and the social implications of new technology are seldom automatic.[8] The more comprehensive idea that technological development forges history along in specific and distinct stages has also long been abandoned in serious historical research.[9] Another problem with technology-focused historical theories is that they are often one-sidedly concentrated on production and working life. Other areas of social life, such as housing and building families, tend to be overlooked.[10] This is problematic, especially from an environmental point of view, since many environmental changes originate in changed conditions within the reproduction sphere rather than changes in the production sphere. The close interaction between population development and the environment, which is the focus of this report, is perhaps the clearest example.

In summary, there is much that speaks in favor of putting the focus of long-term futures prognoses on the one aspect of social transformation that we have a reasonable chance of understanding and interpreting, namely, demography. The fact that we have chosen this approach in the following analysis does not mean, however, that we are uninterested in institutional and technological factors. On the contrary, the significance of successful technological and institutional development is a recurring theme in the report, and particular attention is given to identifying the institutional and technological challenges facing us in the 21st century. Viewing technology and institutions as primarily open to influence, rather than static trends, is, in our opinion, the most fruitful perspective from the viewpoint of environmental research. It is precisely this desire, to develop and influence tomorrow's technology and institutions in a positive direction, that should guide today's environment-strategic research.

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6 The project's findings are summarized in the report *Det framsynta samhället (The far-sighted society)*, Stockholm, 2000.

7 This problem area is discussed in, among other works, Nathan Rosenberg, *Den tekniska förändringens ekonomi (The technological change economy)*, Stockholm, 1997, e.g., pp. 15-17.

8 The role of technology in historical change processes constitutes an extensive field of research, and complexity is a theme throughout. See, for example, Gertjan de Grott and Marlou Schrover, *Women Workers and Technological Change in Europe in the Nineteenth and Twentieth Centuries*, London, 1995.

9 The standard work in the field is Karl Popper's *The Poverty of Historicism* (1957).

10 Cf. Lena Sommestad, "Human reproduction and the rise of welfare states: an economic-demographic approach to welfare state formation in the United States and Sweden," *Scandinavian Economic History Review*, no. 2, 1998.

2. Demography and social change: an introduction

The idea that population development is a decisive factor in societal development has a tradition that goes as far back as the 18th century, with the British economist Robert Malthus as perhaps the most well known advocate. Malthus is noted for his theory that population growth leads to poverty, a conception that received renewed interest in the postwar debates on "the population explosion."[11]

For a long time, research on the importance of demography in societal development was impeded by seemingly contradictory research findings. While many researchers, in conformity with Malthus, argued a connection between population growth and poverty, many others, like the economists Esther Boserup and Simon Kuznets, felt quite the opposite, that population growth was beneficial to economic development. Malthus and his followers in "the pessimistic school" emphasized the lack of resources, while Boserup and other "population optimists" claimed that population growth and increased population density stimulated the distribution of labor and technological developments. Similarly conflicting findings have characterized the research on population and environment. Some studies, on the one hand, show that population growth leads to poverty and a severe exploitation of natural resources, while at the same time, there is other research that comes to the conclusion that a high population density can very well be compatible with far-reaching environmental considerations.

It is only recently that this deadlock in demographic research has been transformed into rapid advances. The change has been effected due to the increased interest in the population's age distribution, which has shown that the socioeconomic effects of a growing population depend on which age group it is that is growing. While an increasing number of adults of working age, especially middle age, heightens a country's productive capacity and thereby improves its economic growth, a rising number of children and senior citizens exposes the nation's economy to heavy economic stress. The reason for these age effects on the economy is that consumer needs, production capacity, and economic behavior vary over a person's life cycle.

Up to now, research on age effects has been concentrated on the relationship between age structure and macroeconomic variables such as economic growth, inflation, and current account balances. Age effects are estimated using econometric models. More systematic testing of the age hypothesis in regard to environmental impact is still lacking, but there are indications that the age approach could settle some of the contradictory empirical results in that field, too. It is expectable that the pressure on the environment and the ability to pay heed to environmental values would vary according to the population's age structure. We will have reason to return to this subject later.

From a futures perspective, the new research on age effects is, of course, extremely interesting. Since an individual's aging is to a large extent a predictable process, it is possible, assuming that the mortality patterns are fairly stable, to develop well-founded prognoses for the future population structures of various

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[11] The historical survey in the following section has been based on Bo Malmberg and Lena Sommestad, "The Hidden Pulse of History. Age Transition and Economic Change in Sweden, 1820-2000," *Scandinavian Journal of History* 25, no. 1-2, 2000.

countries. This kind of population prognosis is already being produced today by organizations like the U. N., which has published age-distributed population projections for up to 2050 for all countries with over a million inhabitants. With the aid of the new knowledge of age-specific effects, the next step is to translate these demographic prognoses into scenarios of future economic and social developments.

How accurate are demographically based future scenarios? Their reliability depends on two factors: first, the extent to which the U. N.'s population prognoses will come true, and second, the stability over time of the statistically estimated age effects.

As for the U. N.'s prognoses on changes in the composition of the world's population in the upcoming decades, they must be considered fairly certain with respect to the older adult population. There, changes in age structure are decided mainly by the aging of the cohorts that were born during the 20th century. Uncertainties regarding these older cohorts have to do primarily with whether mortality will differ from the one the U. N. is expecting, either positively, through decreased mortality, or negatively, if, for example, the AIDS epidemic grows more serious than the U. N. experts had assumed. Greater uncertainty surrounds the future birth rate. Fertility is strongly influenced by such factors as the degree of urbanization, the educational level of women, and family policy. Depending on political priorities and the concrete course of economic development, the conditions for building a family can differ. It is entirely possible, for example, that the downturn in fertility anticipated for certain countries in Africa will take place earlier than specified in the U. N. report, upon which our report is based. To deal with these instabilities, the common practice is to imagine alternative scenarios, using a different supposition for, as in this case, future fertility. In this report, however, we have refrained from discussing alternative scenarios, partly because the U. N. has not itself presented alternative scenarios regarding age structure specifically and partly because the instability margins in the U. N.'s alternative scenarios for the total population development are not significant enough to affect the main features of the prognosis presented here of future "heavy trends" in societal development. Uncertainty pertains to the speed of the course of events, but not its direction.

As for the statistically estimated age effects, it is above all the stability in people's behavior during the life cycle that makes it possible to expect approximately the same correlations between the population's age structure and future societal development as the correlations in historical data. Even if there are variations in the age for starting school, entering the labor market, moving away from home, or retiring from work, over time and from society to society, there remains a fundamental stability in the life cycle pattern.

In summary, the future scenario presented in this report can be seen as a base scenario, consistent with the knowledge we now possess of age development and age effects on economy and society. This base scenario can with advantage be used in more elaborate analyses as a starting point for forming alternative pictures of the future.

3. Demographic trends, 1950-2050

At present, there are dramatic differences in age structure from country to country and from continent to continent. While many countries south of the Sahara in Africa have populations of over 40 percent children, most of the industrialized countries are already on their way into a phase of rapid aging. The main explanation for these differences in age structure is that the countries have entered the process called demographic transition at different points of time. In Sweden, demographic transition was already in

progress in the early 19th century, while the countries of Southern Africa did not enter the demographic transition until after World War II.

A demographic transition means that a country goes from a situation with a high birthrate and a high mortality rate to a situation with a low birthrate and low mortality. All countries thus far that have industrialized have also undergone a demographic transition. In the first stage of demographic transition, the mortality rate begins to fall, especially infant mortality. This results in a quick growth in population, since the birth rate remains high. After a time, the birth rate begins to drop as well, that is, it adjusts to the lower rate of infant mortality. This puts a check on the population growth. In the long run, changes in the total population lead to shifts in age distribution. The development goes from a dominance of children in the population to an increased element of the middle-aged and elderly. This process, which can extend over more than 100 years, is called *the age transition*. It is the age transition that is the basis for the following analysis.

The age transition

A cluster analysis of global demographic data (U. N., 1998) shows that the countries of the world are now to be found in five phases of the age transition (see Figure 1a).

The first phase, *the rejuvenation phase*, is characterized by a rising number of children. The age structure becomes more and more skewed, with a predominance of the very young. Three impoverished regions are now in the midst of this phase: West Africa, East Africa, and Central Africa.

Characteristic of the second phase, *the family phase*, is that the first large groups of children have reached fertile age, and since the birth rate in this early phase of demographic transition has not yet been adjusted downwards, the increase in the fertile population leads to an ever-greater rise in the number of births. The family phase is the phase in the age transition where we find a majority of the people of the world right now. It distinguishes Southern Africa, North Africa, Central America, Western Asia, South Asia, and Southeast Asia.

After the family phase, a third phase in the age transition follows, *the modernization phase*. During the modernization phase, the middle-age population also begins to expand at a quicker pace, and at about this time, fertility begins to drop. The result is that the population increase, which has previously been centered around children and young people, now primarily concerns the working-age population. Not seldom is the drop in fertility so sharp that the number of children actually begins to decrease. The age structure begins to acquire the convexity in employable ages that is so characteristic for the more developed economies. The Caribbean, East Asia, and South America are the regions in the world that are now in the modernization phase.

After the modernization phase, often characterized by a high expansion rate and rapid social transformation, comes *the middle-age phase* and then the *maturity phase*. The population's center shifts toward middle age. Today, North America, Oceania (including Australia, among other countries), Western Europe, and Eastern Europe have all reached the middle-age phase, with a growing number of people in the lower middle ages, while Northern and Southern Europe have entered the maturity phase, characterized by a rise in the number of older middle-aged people and younger senior citizens.

The last phase, *the aging phase*, comes when the large cohorts, that were born during the age transition's first stage, reach old age (Figure 1b). The heaviest focus of population increase may now be in the very oldest age groups, while the working population remains constant or even diminishes. No country in the world has yet entered this phase. From a futures perspective, however, it is of immense and imminent interest.

If we study individual countries, naturally we will find variations in the course and speed of the age transition, as well as a certain amount of overlapping between phases. In most cases, however, if the demographic transition is allowed to carry on without serious disturbances, such as war, the phases can be readily differentiated from each other.

The significance of the age transition lies in the fact that it can systematically influence a country's age development over time periods that can be calculated in half centuries. Along with the age transition, however, a country's age structure is influenced by more short-term fluctuations in fertility and mortality. In countries that have established low birth rates, for example, fertility demonstrates markedly cyclical ups and downs. These variations in birth rates give rise to cohorts of varying size that, as they grow older, continue to reflect the fluctuations in age structure. Another factor is the occurrence of war, epidemics, or other disasters that can heavily reduce particular cohorts. As opposed to the effects of the age transition, it can be difficult to provide more generalized descriptions of such cases, since the pattern of short-term fluctuations may differ considerably from country to country. This applies, for example, to the so-called "baby booms" of the postwar period, which, even though they have affected most of the countries of the Western World, have undergone different time patterns in the United States, Great Britain, France, and other countries. A current disturbance in demographic development is the AIDS epidemic, whose effects on the future demographic structure are difficult to foresee.

Global shifts in population structure during the next fifty years

Figure 2 shows how global aging over the next fifty years will lead to a situation where various parts of the world will gradually acquire an increasingly aged population.

The most important change up to 2015 is that most of the regions that are now in the family phase – North Africa, Central America, and West, South, and Southeast Asia – will pass, according the U. N., into the modernization phase. The only exception is Southern Africa. This means that, if the patterns we have seen during the 20th century continue, these countries will soon enter a phase of rapid economic growth. By 2030, they will have passed the modernization stage and will, together with South America, be in the middle-age phase.

During the same period, East Asia will have gone from the modernization phase, over the middle-age phase and into the maturity phase, which means that it will have the necessary conditions for attaining a high and stable level of average incomes. Europe in 2030 will have reached the aging phase. In the period up until 2050, Eastern Europe, North America, and East Asia are also expected to have arrived at this phase of heavy aging, whose equivalence we have never previously observed in an entire country (only in certain depopulation regions, such as the inner part of northern Sweden).

In Figure 3, the global demographic development up to the year 2050 is summarized in a diagram showing how many people there will be at particular points of time in countries aging at different levels. As evident in the figure, a majority of the current world's population now lives in relatively young countries. In 2050, the world's population will instead be concentrated to countries with a mature or aging population.

In the following, we will discuss what effects this dramatic change in the world's age structure may come to have. We begin with an analysis of the global income development and then discuss possible scenarios for societal development and environmental impact during the age transition of the 21st century.

4. Global income development, 2000-2050

To outline future income development, we have taken our starting point in the population phases described above. We have then used the database of income development in the world called *Penn World Tables* to analyze the relationship between these population phases and per capita income. A total of 131 countries and nine points of time (every five years from 1950 to 1990) are incorporated in the analysis. An average of 7.1 observations for every country has been made. The model we estimated contained only two variables: year and population phase. Nonetheless, more than 50 percent of the variations in real per capita income between countries and over time can be explained. When a control was made for temporal effects, we could see that there is a strong connection between the population phase and the income level. This is clear from Figure 3, which shows the expected income level in 1990 for countries in various population phases.

Research on the connection between age structure and economic growth indicates that the connection is not only statistical but also reflects a causal process. An increasing percentage of the working-age population and an increasing percentage of middle-age groups that generate a high level of saving tend to speed up economic growth.[12] Therefore we have good reason to believe that the demonstrated relationship will apply even into the 21st century. This means that, with the help of the figures in Figure 4, the age development of different parts of the world shown in Figure 2 can be directly translated into an income prognosis. Such a prognosis is presented in Figure 5.

As Figure 5 shows, there will be an accelerated increase in income in many of the regions of the world during the first decades of the 21st century. This will take place in conjunction with former developing countries entering the later phases of the age transition. The regions that will lag behind will be chiefly East, West, and Central Africa, which now have the youngest populations and which will not, if the U. N. population prognosis is correct, reach a stage of rapid per capita growth until after 2030.

The maps that follow show the geographic distribution of the world's accumulated production as it stands at present (according to the World Bank's *World Development Report*) and as it is predicted during the years we selected for our prognosis. For the years 2015, 2030, and 2050, we calculated the income level by multiplying per capita production by the total population. The map series clearly shows that there is reason to expect a far-reaching shift in concentration regarding economic activity around the world. Beginning with the present situation, we see that the picture is dominated by three regions: North America, Europe,

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[12] Bloom and Williamsson, 1997; Lindh and Malmberg, 1999.

and East Asia. The reason for this is that the level of the per capita incomes in these countries is so much higher than in most developing countries. From the point of view of the environment, we know very well that this distribution of income means that these three regions represent the lion's share of the global usage of natural resources.

As the next map shows, important changes in this pattern may take place as early as 2015. The greatest change is predicted for East and South Asia. East Asia's collected economic strength, according to this scenario, may come to exceed North America's, and South Asia is now establishing itself as one of the important hubs in world economy. But even in West Asia, North Africa, Southeast Asia, and Latin America, a marked increase of collected incomes is expected. Taken together, these changes signify a period of global economic growth, calculated in dollars, that has never before been witnessed in history.

If we look at the situation for 2030, we see continued growth in approximately the same areas as earlier. At this time, even South Asia may have surpassed North America in collected income. Latin America will have reached a total income near equivalent to Western Europe's, whose economic strength is now less than Southeast Asia's.

In 2050, finally, South Asia will have been established as the world's economic center, while the traditional Western World – North America and Europe excluding Eastern Europe – will have reduced its share of the world's collected incomes from 60 to 20 percent.

Is this development possible?

The scenarios of income development presented above are based on the assumption that, as their age structure changes in a more favorable direction, today's developing countries will reach the same income levels as the Western World. As always is the case with statistically-based predictions, there is of course a margin of error in these calculations. In the model we have used, this margin of error is on the order of plus or minus 25 percent. Compared to the doubling in per capita income that can be expected at the point of, for example, the transition from the rejuvenation and family phase to the modernization phase, or from the modernization phase to the middle-age or maturity phase, a 25% margin of error is not a sizeable figure.

But are there any guarantees that this development will come to be? Could it be that this is a correlation that applies to the 20th century only and that the 21st century will be witness to completely new ties between aging and income development? Evidence that we are in fact on the brink of a global income shock is the growth that is already accelerating in many previous developing countries. This applies not only to the East-Asian "tiger economies" of Hong Kong, Singapore, Taiwan, and South Korea. Growth has also begun to speed up in China and India, for example. However, these developments contain a number of uncertain factors and the new growth countries face two major problems.

The first problem involves technological development. In a world of limited quantities of natural resources, growth can only increase if we are able to develop more efficient methods for extracting raw materials and energy. To the extent that this fails, the result is a decline in returns from capital and labor. This makes it uncertain that the developing countries will attain the same high income levels that the mature, industrialized countries are now experiencing.

The second problem has to do with the social institutional model. For a society to make the most of the productive potential held by its growing and aging population, it is imperative that it succeeds in bringing about social transformation without creating inner crises or ending up in conflict with other expansive growth countries. The modernization phase, when economic growth begins to gain momentum in earnest, is a critical moment in this respect.

Will the new growth countries be able to handle these challenges? As regards technological development, a good deal of evidence speaks in favor of this being the case. To begin with, the aging and growth process itself implies an increased potential for the development of new knowledge and technology. There can be increased resources for research and development, while growing markets stimulate both the development and the implementation of new technology. One factor that might especially contribute to rapid technological development is the increase in demand volumes that would be expected to follow from increasing incomes in countries with large populations. If we look, for instance, at iron ore production, we see that it is often possible to lower expenses per ton as new, large-scale technology gradually comes into use. Similarly, the production costs of oil have remained reasonably stable even after work began on the more inaccessible deposits of, e.g., the North Sea and Alaska. If the new growth countries choose large-scale technological development, this would constitute something of a continuation of the enormous waves of change that characterized the Western World up until 1970. At that time, the demand for goods rose rapidly while large-scale technology was being developed. In the Western World, this course of events came to a halt in the 1970s and 80s, when the demand for certain goods, such as steel, began to reach saturation point. If the world soon reenters a period of strong and widespread rises in income, this situation may change.

The most critical resource issue in countries about to enter the modernization phase is the supply of biological resources such as farmland, forest, and water. The ability to deal with this resource problem is to some extent a question of technology (such as finding methods for desalinating sea water) but an equally important factor could well be the capacity to develop a global division of labor. Many countries now in the family phase base their economies on agricultural production, which requires large land areas and a good deal of water, not seldom in the form of artificial irrigation. At the same time, population density is high, which puts a great strain on natural resources. When countries of this kind secure an increased economic potential, they can turn the focus of their economies to labor-intensive industrial production, for example, or labor-intensive services. They can then buy agricultural products, such as water-demanding grain, from the regions of the world where the supply of natural resources is greater.

If open world trade endures, it is possible that rapid economic growth in densely populated countries in West and South Asia will lead to a development similar to that of England in the nineteenth century, when a combination of substantial income growth and a high population density led to a rapid loss in importance for domestic agricultural production. England became "the workshop of the world" – and the world's leading importer of food at the same time. Beginning in the mid-nineteenth century, England became the center of a global system for the trade of farm products, in which different regions were given certain positions according to distance and natural conditions. Butter and wood products were delivered from Scandinavia, cheese and pork from the United States, grain from Australia, wheat and meat from Argentina, tea from India, etc. Now it is another densely populated country with high incomes – Japan – that is the world's leading importer of agricultural goods. In the coming century, the hub of the world's food trade may instead turn out to be the South Asian growth economies, like India and Indonesia.

As for institutional development in the new growth nations, and on the international scene, the future seems more uncertain. Historical experience tells us that the modernization phase of the age transition, when the working population is expanding rapidly, is a period full of difficult economic and political challenges. Large cohorts of young people and a rapidly growing economy subject established traditions and social institutions to enormous pressure. Characteristic elements of the phase are hunger for land, urbanization, migration, growing economic divides, and social unrest. In Europe, the nineteenth and twentieth centuries did not only involve the attainment of an exceptionally high level of welfare. Harsh class conflicts, emigration, imperialistic conquests, and two world wars were other effects. Even Japan, which is now one of the world's wealthiest countries, has seen its path to welfare interrupted by imperialistic expansion and devastating wars. Will India and China be able to avoid a similar development?

An especially critical problem involves building up the international institutions that regulate capital flow, trade, and migration between countries so that they can address the new economic and political situation that will characterize the global economy of the 21st century. Successful development of international institutions is a prerequisite for the new growth countries to be able to build up their comparative advantages in world trade. Moreover, effective international institutions are enormously important, of course, in developing cooperation and regulations in the field of the environment. The significance of international institutions can hardly be overestimated. Historical experience shows that demographically generated shifts in economic trends require institutional development and adaptation, and that failure on the international arena can have devastating results. An illustrative historical example is the breakdown of international economic institutions during the period between the two world wars, when the fruitless attempts to deal with new economic and demographic challenges in the existing international financial system, the gold standard system, contributed to economic collapse and the failure of peaceful, international collaboration.

How great a risk is there that the economic developments outlined in our scenario will come to naught due to political and military conflicts? Here, we must admit to dealing with genuine uncertainty. We should note, however, on the positive side of the scale, that one advantage the new growth countries have over the earlier industrialized nations, is precisely that they *come after*, that is, that they can benefit from the technological advances and political experiences of their predecessors. As opposed to the situation in the latter half of the 20th century, there is now a considerable number of democratic, wealthy, and stable countries that, in some measure, are in a position to influence developments. Helping out in various ways to facilitate the modernization phase of the new growth countries is without a doubt one of the most important matters on the agendas of the mature and aging countries of the 21st century, but also one of the most difficult. It means cooperating in a world where previously established economic and political power relations may suddenly be toppled over. This requires insight, cooperative know-how, and a willingness to compromise, not only in the new growth nations but in the old as well.

5. Scenarios for social development and environmental impact during the coming age transition

In what way will the age transition come to influence the environment, globally and locally? And what challenges does it bring to environmental work and environmental research in Sweden? In the following analysis, we offer some tentative answers, by which we hope to instigate further debate.

We begin with a discussion of principle on the question of what rapid, global income development might mean in terms of resource consumption and environmental impact. We base our discussion on the hypothesis that the relationship between income development and environmental impact changes when countries go from one phase in the age transition to another. The most important phase from an environmental point of view is the modernization phase.

In the next section, we present some concrete, historical experiences of the interaction between population and environment and use them to suggest the type of concrete environmental problems that may appear in the future. Lastly, we discuss Sweden's role in the future global economy.

Growth and environment – a changing interaction

There is good reason to say that the rapid global income growth that may materialize in the next fifty years will have considerable environmental consequences. In all, this involves almost a doubling of production, incomes, and consumption, and the main share of the income increase will end up in countries that are presently relatively poor and therefore lacking in modern systems of environmental protection. How great the environmental strain caused by economic growth will be is still, however, an open question. What is decisive to the outcome is if the populous countries in Africa, Latin America, and Asia, who stand in turn for modernization, will be able to hold out against the overhanging danger of resource exploitation and environmental degradation that, historically, has afflicted countries going through the first phase of an industrialization process.

The relationship between economic growth and environmental impact has long been a controversial scientific and political issue. Considering the resource exploitation and increased consumption that followed in the wake of developing industrial capitalism during the 20th century, many people have claimed that there is a fundamental conflict between economic growth and environmental care. This concept of a fundamental conflict between growth and environment has recently been called to question, however, as highly industrialized countries have showed signs of developing toward less resource exploitation and increased environmental awareness. There has been talk of "ecological modernization," i.e., a development whereby economic growth and environmental considerations no longer need to stand in conflict with each other.[13]

From a demographic analysis perspective, the interpretation immediately presents itself that these attitudes to the interaction of growth/environment are scholarly perspectives that emanate from different economic-demographic experiences. There is a good deal of evidence that the modernization phase, when the population grows rapidly while resources are still limited, is a period when great efforts are needed to prevent economic growth from becoming exploitative. The population is young, and the society is in a period of rapid transformation. Urbanization in combination with intense population growth means that available resources must be prioritized to meet the most urgent needs: food, housing, and infrastructure. There is little room for long-term environmental considerations. It can be especially difficult in this situation

[13] For an account of this discussion (in Swedish), see Lennart J. Lundqvist, "Ekologisk modernisering håller inte globalt sett (Ecological modernization doesn't hold globally)," *Svenska Dagbladet* Aug. 18, 2000.

to stir up interest in global environmental problems, such as the greenhouse effect or the thinning out of the protective ozone layer. If the new growth countries follow in the footsteps of the old, interest in the global problems will be put on their agendas even later than local and national environment problems.

In the long run, however, growth creates the conditions for a change in attitude. In pure economic terms, an increased demand for agricultural and industrial goods also leads to an increase in the economic value of the natural resources required to produce these goods. Increased incomes can therefore sway people, for economic reasons, to stand up for the natural resources used in the production of necessities. When a society ages and matures, it improves the conditions for addressing environmental problems. Social institutions grow more sophisticated and stable, and the experience of handling a modern, industrial economy matures. In institutional economic analyses of environmental issues, it is often pointed out that a sustainable use of resources calls for well-defined rights of ownership, i.e., for economic actors who do not choose short-term profits at the cost of long-term income opportunities. Moreover, well-functioning systems are needed that regulate activities with disadvantageous effects on other actors. Looking at the mature industrialized countries, we see that they have been able to model institutions that meet these demands better than the developing countries, which still lag behind.

A conclusion from the analysis above is that we now face a precarious transitional phase in the global environmental development. The world's most populous countries, among them China and India, are on their way into the modernization phase of the age transition, with the serious risk of detrimental environmental impact that it brings with it. For today's industrial countries, this future scenario is a great challenge. How much environmental harm the newly industrialized countries will cause depends on how quickly institutional regulations can be established in various areas that can curb destructive processes and encourage sustainable production methods. There is thus a potential for positive influence in this area. Through openness, dialog, support for educational campaigns, and cooperation, we can help see to it that measures towards sustainability in the countries now being industrialized will take effect faster than they did in our own part of the world.

Hopefully, it will be easier for the older industrial economies to contribute in this way, knowing that the need for support is of a transitory nature. As their own aging process advances, the countries in question will be able to successively strengthen their own capacity for handling environmental problems. An aggravating circumstance, on the other hand, is that today's mature economies may falter in their commitment to the global environment, when the aging process in their own countries in just a few decades has led to waning economic growth and thereby greater internal problems. This further emphasizes how important it is for the industrialized countries of today to take their responsibility for the global environmental issues seriously, while they can.

Environmental issues in view: our future in retrospect

What will be the most serious, concrete environmental problems in the 21st century? One way of approaching that question is to study historical experiences of environmental impact during various stages of the age transition.[14]

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[14] For background and references to this section, see Malmberg and Sommestad, 2000.

Both historical and social science research show that the first phase of the age transition, the rejuvenation phase, is closely associated with poverty and local exploitation of resources. When a fast-increasing number of children have to be supported in a farm economy with an unaltered number of adults, the burden of support becomes markedly heavy, while the capacity to develop new technology or alternative support models remains small. The economy concentrates on basic needs like food and clothing. Children play an important role as labor, shepherding animals, for instance, or collecting wood, while the local resource base in the form of water, forest, land, etc., is exploited intensely. Poverty-related, local resource exploitation is a major environmental problem today, since large regions in Africa are still in the rejuvenation phase. In the 21st century, however, this type of problem will become less significant, as the population ages, even in Africa. From an environmental-strategic perspective, it is of great importance that environmental work in areas characterized by population rejuvenation be pursued using techniques that are easy to handle and with the help of institutional solutions that have been adapted to the demographic situation. The children themselves must be central actors in the work of protecting the local resource base.

When the expansion of the number of children in the family phase is combined with an expansion in the young adult population, the pattern of environment impact becomes somewhat modified. In countries that have access to areas that have not previously been exploited for farming purposes, we often witness an extensive colonization process during the family phase. Forest areas and outlying lands will be requisitioned for traditional farming. During the 19th century, when the Western European population was in the youth phase, this colonization took place to a large extent in the form of emigration, especially to the inland of North America, where large land areas were put to the plow for the first time. In Sweden, too, the youth phase coincided with extensive new clearings of land. Since World War II, however, it has been above all in Latin America, Africa, and Asia that this combination of an expansion in the numbers of young people and children and an extensive period of colonization, pioneering, and clearing of land is to be found. Some of the areas that are now extensively exploited for agricultural use include former rainforests, mountain regions, and semi-arid parts of Africa, for example. As with the type of environmental impact that characterizes the rejuvenation period, we can expect that environmental problems due to population growth and colonization will decrease over the coming decades, when the populous countries of Asia pass into the modernization phase. On the other hand, there is a risk that this kind of environmental harm will spread in large parts of Africa.

In the following phase of the age transition, the modernization phase, there is a surge in the environmental problems associated with rapid urbanization and industrialization. One aspect that is especially important in this development is the efficiency of transportation systems. It is doubtful that the megacities now emerging in the Third World will be able to build up their transportation systems using the same technical solutions as in the big cities of the Western World. Another difficult area is the sanitation and waste problem. In sparsely populated communities, these problems can often be solved using relatively simple methods, but with greater concentrations of populations, the problems become that much more difficult to handle. The relative lack of capital that characterizes societies with a young population means that waste problems are often tackled using major contributions of manpower. It is often the women in individual households who are responsible for keeping the absolute nearest environment from contamination from hazardous waste. When the capital supply increases, successive room for investments in sewage systems, water supplies, and waste collection is created, which eases the need for manual labor. However, what often happens, as we know, is that the environmental problems are shifted from the local environment to

recipients around and beyond the city. As with the question of transportation systems, it is not self-evident that the technological solutions to problems in the Western World will also work in the significantly larger cities that are going to be part and parcel of Asian industrialization. Some of the obstacles may be technical, but there is also the question of political and cultural barriers. For example, centralized and decentralized technical systems may function more or less well depending on geographic, institutional, and demographic situations.

Besides the environmental problems created by urbanization, budding industrialization also implies larger and larger amounts of materials being set in motion, such as raw materials like coal and oil, limestone, stone, iron, etc., and comestibles, textiles, and other consumer goods. As we know, moving such quantities of materials impacts seriously on the environment, whether it be resource exploitation itself or the whole cycle from extraction and transportation to usage and dumping. The increased use of energy, toxic emissions to air and water, and exploitation of natural and cultural environments constitute major problems in this field. As with the urbanization problem, these problems must also be tackled by developing technical solutions that work in the specific local, geographical, institutional, and demographic situation. A simple process, distributing innovations from today's industrialized countries, cannot be assumed.

During the phases of the age transition that come after the modernization phase – the middle-age and the maturity phases – developments to date indicate that it begins to become possible, as mentioned above, to overcome many kinds of environmental problems. Population growth declines, and the most intensive industrialization phase is followed by a conversion to service production. At this time, the capacity to handle environmental problems increases. Even if there are many obstacles left, the middle-age and maturity phases often have the financial resources to address the many injuries to the environment that arose during the early industrialization phase. Now, there is also an opportunity to begin a reorganization of the economy towards an ecologically sustainable society. However, high incomes and a continuing scientific development also mean a constant risk that new and difficult environment problems will turn up.

From a futurological point of view, the critical question is the extent to which the highly industrialized countries will stand up for environmental objectives in their political processes. Judging from experiences to date, environmental issues have been given high priority on the political agendas of most countries once the most immediate needs, like housing and education, have been provided for. The question is whether this interest can be maintained to the extent that is necessary to deal with today's environmental problems and to develop a long-term sustainable economy, for instance, on a level of ambition as high as the one outlined by the Swedish parliament's Environmental Objectives Committee. As environment work becomes successfully institutionalized, there is a risk of dwindling involvement and interest on the part of the general public. As for the new growth countries, for example in Asia, we can hardly assume that they will in every respect follow in the footsteps of the West regarding the weight and direction they give environmental policy. When all is said and done, the priorities a country gives to nature and the environment <u>is</u> a question of values.

A central problem for Sweden and other mature economies is, lastly, what continued aging will come to mean from an environmentally strategic point of view. In this area, no historical experience is available. What we do know is that aging is associated with population stagnation and diminishing economic growth. This means that in an aging economy, we no longer have to worry about intensive resource exploitation or environmental degradation of the kind that characterizes young, rapidly growing economies. On the other

hand, there is reason to fear that an aging society may find it difficult to uphold and support various kinds of environment-protective systems and institutions. Just as during the child period, the maturity phase is characterized by the society's consumer needs exceeding its productive capacity. A dramatic example of what can happen to a country that no longer has the financial resources to uphold existing systems can be seen in the environmental problems of Russia today.

A strategic judgment regarding Sweden is that the measures that must be taken to restore the harmed environment and to create long-term sustainable systems should be completed before the aging process begins in earnest. With this perspective, the time horizon of the Environmental Objectives Committee, which aims at achieving today's environmental objectives in one generation, indeed seems reasonable. For environmental-strategic research, it is urgent to make good use of the generous resources now available for environmental research. In a decade or so, the resource situation may be less advantageous.

Sweden's place in a new global economy

Our prognoses of future income developments show that even in just fifteen years, the world's economy may be radically different from the one today. For Sweden, being a small and open economy, this poses a major challenge. We know from historical experience that the emergence of new growth regions tends to push certain sectors of the Swedish economy more or less out of business. This happened, for instance, to Swedish grain production in the late 19th century, when new areas of production opened up in the United States. Another example is the Swedish textile and clothing industry, which, from the 1950s and onward, lost its position first to low-wage countries in Europe and then in Asia. In a similar fashion, Swedish shipbuilding and radio and television manufacturing were eliminated in the 1970s, when Japan and Korea entered the competition. The conclusion is that we must be prepared for similar events in the coming decades, when new growth nations in Asia, Africa, and Latin America will make their mark on the world market. The risk of a new structural crisis in the Swedish economy is enhanced by the fact that the Swedish '40s generation stands to leave working life in a decade or two. When these members of the '40s generation retire, many sectors risk a drain on competence, thereby heightening the risk that entire businesses will wiped out by new growth countries.

But new growth countries also offer a new opportunity, since they hold such large markets. The question we should be asking is therefore in which sectors Sweden might have a comparative advantage in the future global division of labor. One possibility could be that Sweden's traditional export sectors, based on their excellent availability of raw materials, now stand a new chance. If we go back 30 years in time, we see that raw material based industries stood for almost 50 percent of Sweden's exports. Looking at the situation today, that percentage – for exports outside the European Union – has dropped to 25 percent. Instead, it is now vehicles and machines (including telecommunications) that constitute the greater share of Swedish exports. If we imagine a scenario in which the vehicle, machine, and telecommunications sectors were eradicated as a result of the upswing in the new growth countries, there would once again be reason to direct interest toward Sweden's comparative advantages vis-a-vis natural resources. A possible scenario could be, for example, that the demand for metals rose so intensively that it would be profitable to initiate extraction of some of them in Sweden. Another scenario could be that an increased livestock consumption as a result of increased incomes drove up the demand for meat so high that old Swedish meadowlands could once again be used for production – now for the export of lamb to fast-growing Muslim countries. Even if these scenarios may seem extreme, they are nonetheless entirely in line with the

type of new demands that could emerge if there is an intense growth of income in countries with a high population density. An interesting aspect of such a renaissance for raw-material-based industries, from a Swedish point of view, is that it could lead to a shift in regional population tendencies. The export companies that have grown in Sweden over the last 30 years are namely almost exclusively urban-based, while natural-resource-based industries are mainly to be found in smaller towns and villages. From an environmental point of view, such a development would mean that we would be afforded much better conditions for achieving the Swedish environmental objectives, which now stand out as rather utopian. For example, the goal of preserving a rich cultural landscape, or the goal of a living coast and archipelago and a good housing environment, may seem less impossible from this perspective.

Another question is how Swedish society in general will be affected by a shift in the world's economic focus. During the past fifty years, the main influence for the development of Swedish science, culture, and technology has been, alongside European contacts, the exchange with the United States. Lately, there has been an increase in exchanges with East Asia, but these contacts have by no means reached the same intensity as those with, for example, the United States. This may be due partly to physical distance, but cultural gaps and the absence of previous contacts may also play a part. Opportunities for economic and cultural exchange may, however, improve in the next half century, the period when the growth of many countries that we have already established a certain amount of contact with, such as India, the Muslim countries, South America, and Africa, will begin. It is therefore conceivable that the exchange will be even more intensive and the influences stronger that they were with the late 20th century's growth countries. One consequence could be that the Swedish trade exchange with the new growth countries will establish itself on a broader front than has been the case in East Asia.

With a more intensive exchange, the opportunity rises for greater mutual influence. This means that if Sweden would like to influence the handling of the natural resources of the world, there is reason to intensify the contacts with these countries straight away. This would pay off both in better resource management and in the strengthening of Swedish competitiveness.

6. Concluding words

From an environmental perspective, the heavy demographic and economic trends of the 21st century hold both risks and possibilities. In the long-term perspective, we can look forward to a century in which many poverty-related environmental problems, such as soil erosion and the destruction of rainforests, could be reduced. With increased incomes, hopefully a large part of the world's population will leave poverty, rural living, and farming behind them. On the other hand, environmental problems of unforeseen proportions could develop when populous economies like China's and India's increase their productive capacity and begin to demand on an increasing share of the world's natural resources. The aging in the Western World, too, could pose a threat to the environment, insofar as stagnating growth can reduce the aging countries' interest in and capacity for helping to maintain an ecologically sustainable environment.

What are the environmental-strategic implications of the scenario presented above? We would like to say a few closing words about which conclusions we feel are central.

A first important conclusion is that future environmental problems have a global dimension. The central environmental issue for humanity in the coming century is to prevent rapid economic growth in newly

industrialized countries from causing environmental disasters or long-term irreparable damage. The crucial research questions in this context are related to the problems of urbanization and industrialization. They involve how it will be possible to develop ecologically sustainable transport systems and effective waste management in the new megacities that will soon spring up, and how to deal with the growing demand for energy and raw materials, while holding back, as much as possible, the increased emission of toxins and greenhouse gases that can result from rapid and intense industrialization processes.

A second conclusion is that environmental work must be more preventive and long-range. By learning more about how demographic structure interacts with environment, we can make early interventions in the social processes that generate environmental degradation. In the development of land, for example, the interplay between demographic structure and land exploitation shows that the exploitation of the rain forest is especially intensive during the family phase. This means that if we want to avert further depletion of the world's rain forests, we should turn our focus to Africa, which is beginning to enter the family phase.

A third conclusion is that technological development is a necessary but insufficient prerequisite for protecting the environment during the coming century. When it comes to managing the huge environmental problems that could arise in the wake of modernization in today's developing countries, the existence of suitable institutional structures is equally important. It is very much an open question, however, how much today's industrialized nations will be able to help to stir up environmental interest and spur on environmental work in the new growth countries. Cooperation in a world, where the old industrialized countries no longer dictate the conditions, calls for partnerships and respect for the priorities that people in different economic and demographic situations make from their own experiences. The challenges presented to us here can hardly be underestimated. The sooner we work for cooperation in the new economic and political situation that lies in store for us, the better. It should be especially urgent that we establish cooperative efforts with the new, populous growth economies in Asia.

A fourth conclusion is that the technologies and institutional structures developed to handle environmental problems must be modeled with a view to the demographic situation in which they are to be implemented. It is not only the nature of the environmental impact that changes with the population's age structure but also the capacity to deal with institutions and technical systems. We cannot expect that existing technical systems in the Western World in a simple and straightforward way can be spread to and implemented in other places in the world. We need more knowledge about how existing technological systems can be integrated into new institutional contexts, and what kind of adaptations and developments are needed.

A fifth conclusion is that the demographic scenario shows how important it is to ponder over the priorities of Swedish environmental work. There is hardly reasonable to count on the Swedish society as being able to invest as much money and manpower in environmental research and environmental work in the future as it does today. When a quickly aging population lays claim to resources for pensions, health care, and other age-related measures, there is a great risk that there will be less political support for costly environmental investments. In Swedish environmental work, it is thus a good idea to use the resources now available for strategic – and why not large-scale – investments in building up knowledge and developing technology. In twenty years, the opportunities to do this will be significantly fewer. Moreover, we in Sweden must decide to what extent there is reason to give even greater priority to measures on the international arena than those of today. The coming ten to twenty years may be a critical phase in cooperation between the old growth countries and the new.

Figure 1a

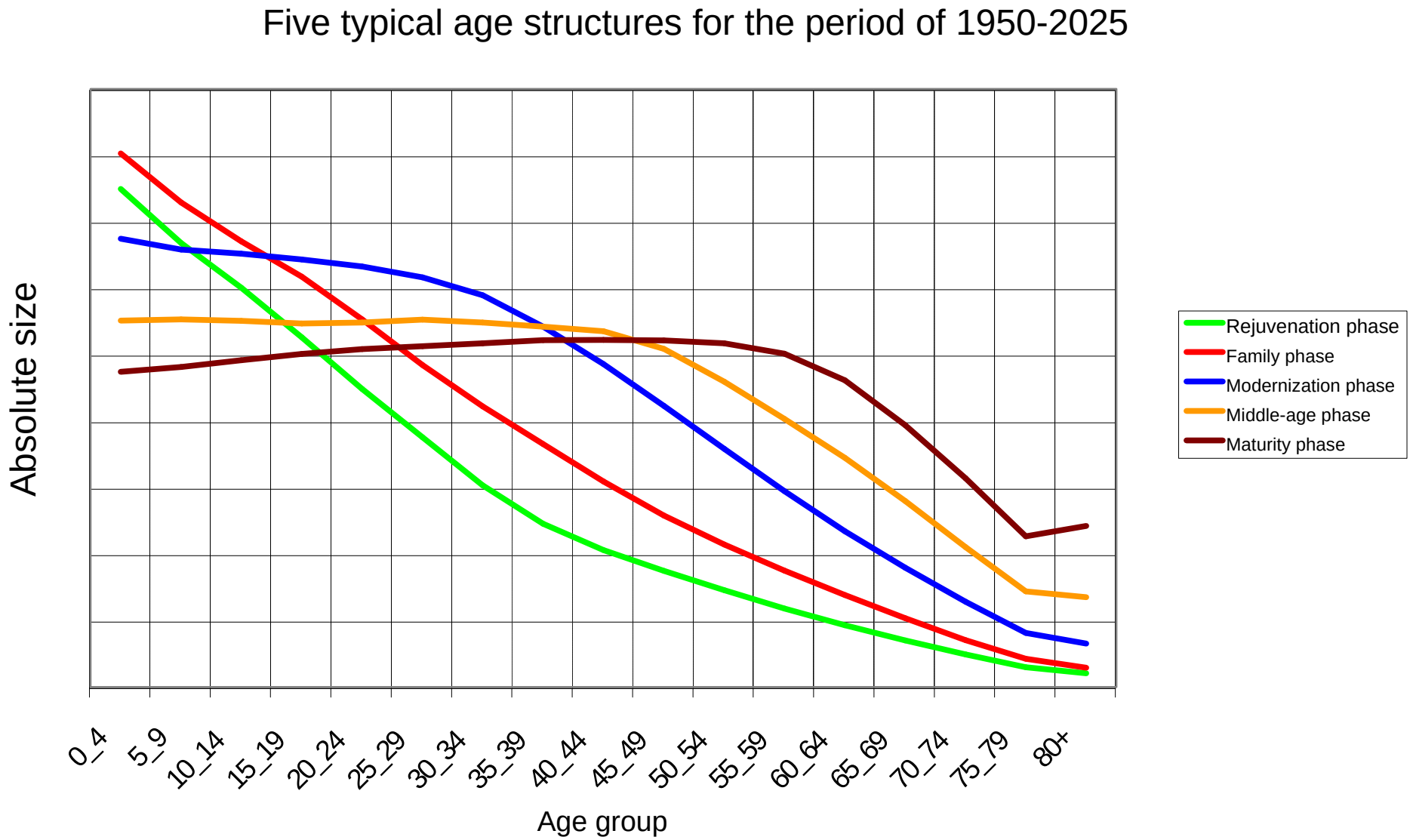

Five typical age structures for the period of 1950-2025
Absolute size
0_4
5_9
10_14
15_19
20_24
25_29
30_34
35_39
40_44
45_49
50_54
55_59
60_64
65_69
70_74
75_79
80+
Age group
Rejuvenation phase
Family phase
Modernization phase
Middle-age phase
Maturity phase

Figure 1b


Age structure of the aging phase
8%
7%
6%
5%
4%
3%
2%
1%
0%
0_4
5_9
10_14
15_19
20_24
25_29
30_34
35_39
40_44
45_49
50_54
55_59
60_64
65_69
70_74
75_79
80+
Age group

Figure 2

World Regions by Age Structure

Region	2000	2015	2030	2050
East Africa	Rejuvenation phase	Rejuvenation pha	Family phase	Modernization pha
Central Africa	Rejuvenation phase	Rejuvenation pha	Family phase	Modernization pha
West Africa	Rejuvenation phase	Family phase	Family phase	Modernization pha
Southern Africa	Family phase	Family phase	Modernization pha	Middle-age phase
West Asia	Family phase	Modernization pha	Middle-age phase	Middle-age phase
Central America	Family phase	Modernization pha	Middle-age phase	Maturity phase
North Africa	Family phase	Modernization pha	Middle-age phase	Maturity phase
South Asia	Family phase	Modernization pha	Middle-age phase	Maturity phase
Southeast Asia	Family phase	Modernization pha	Middle-age phase	Maturity phase
South America	Modernization phase	Modernization pha	Middle-age phase	Maturity phase
Caribbean	Modernization phase	Middle-age phase	Maturity phase	Maturity phase
East Asia	Modernization phase	Middle-age phase	Maturity phase	Aging phase
Oceania	Middle-age phase	Middle-age phase	Maturity phase	Maturity phase
Eastern Europe	Middle-age phase	Maturity phase	Maturity phase	Aging phase
North America	Middle-age phase	Maturity phase	Maturity phase	Aging phase
Western Europe	Middle-age phase	Maturity phase	Aging phase	Aging phase
Northern Europe	Maturity phase	Maturity phase	Aging phase	Aging phase
Southern Europe	Maturity phase	Maturity phase	Aging phase	Aging phase

World Population by demographic phases

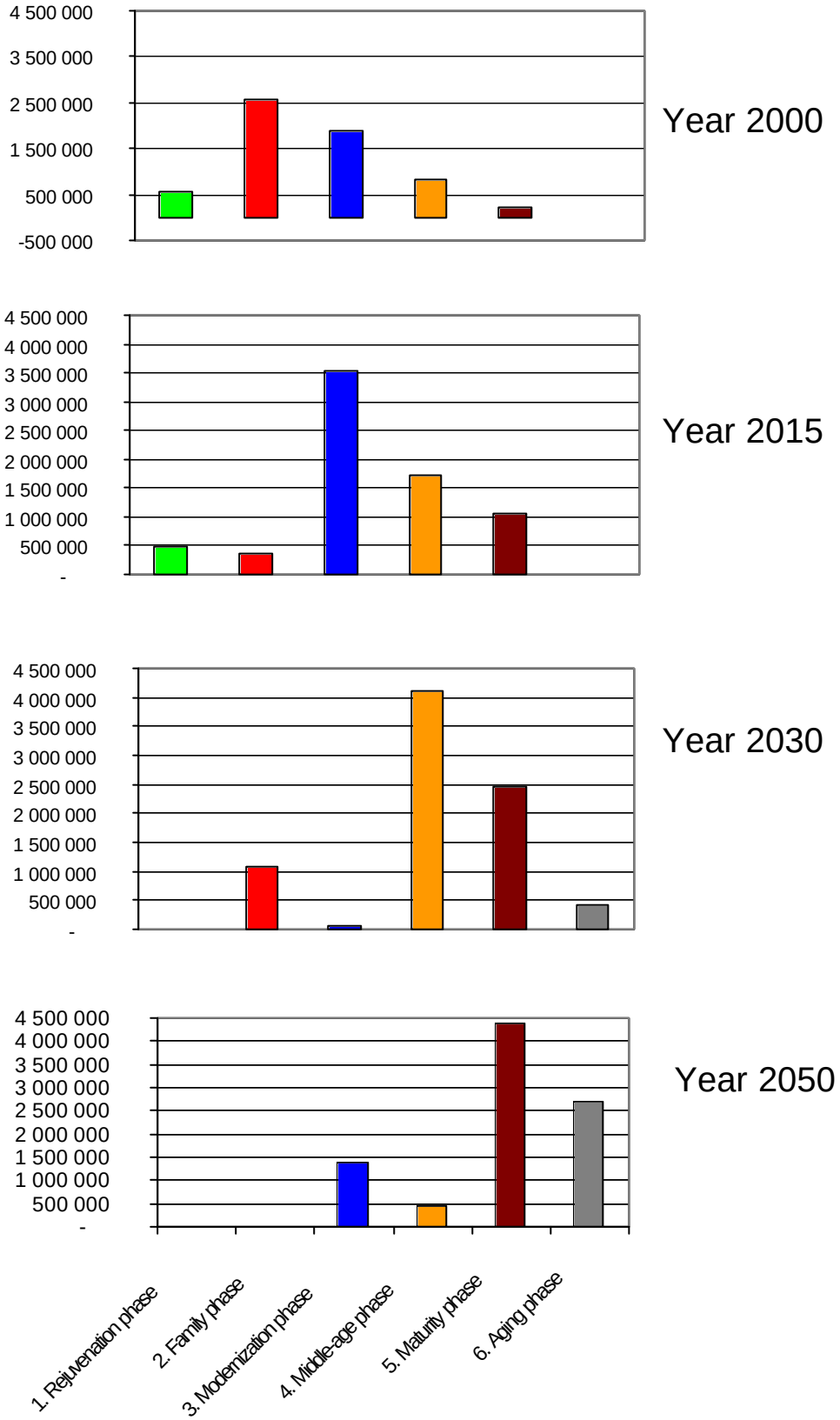


Figure 3

Figure 4

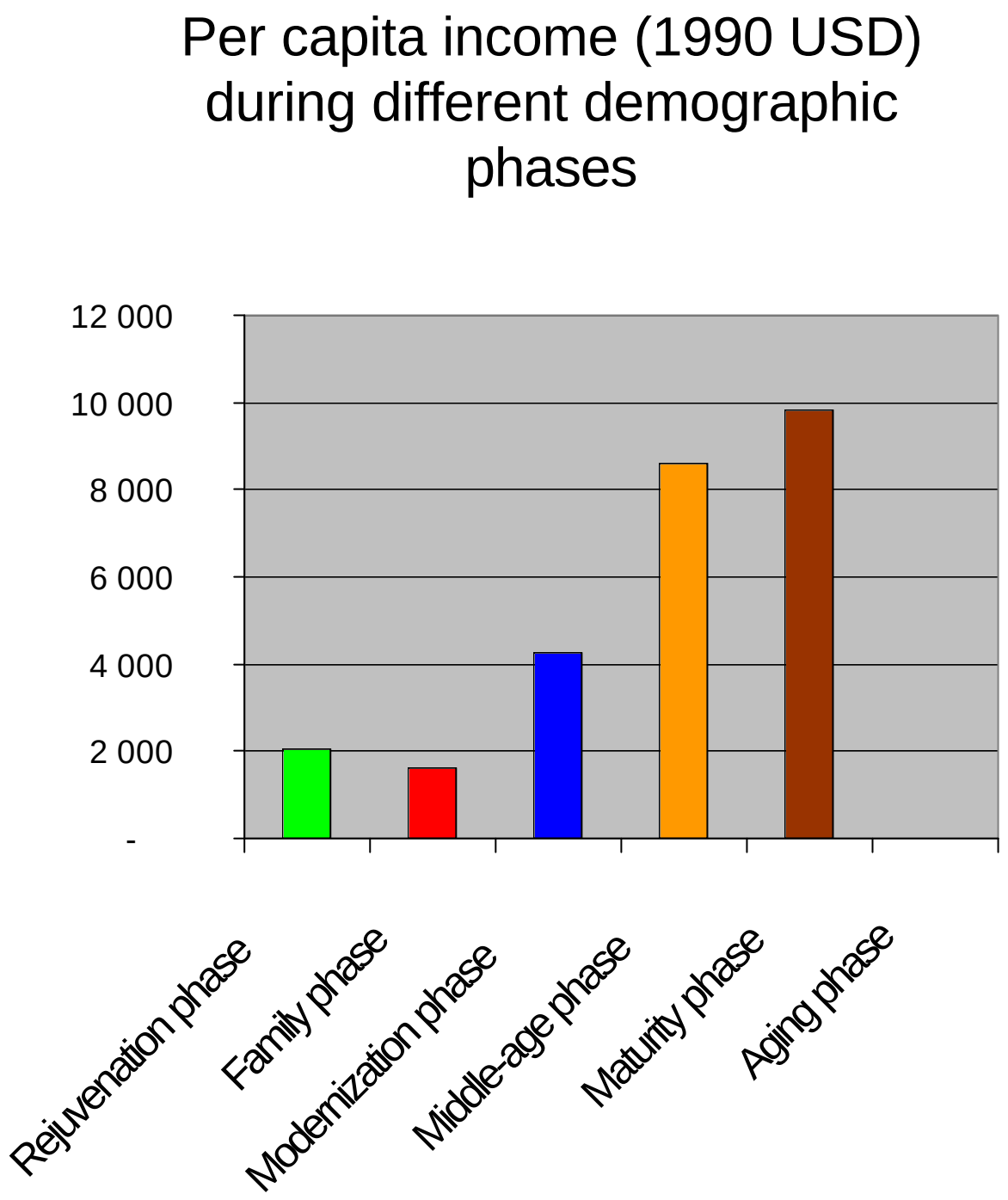
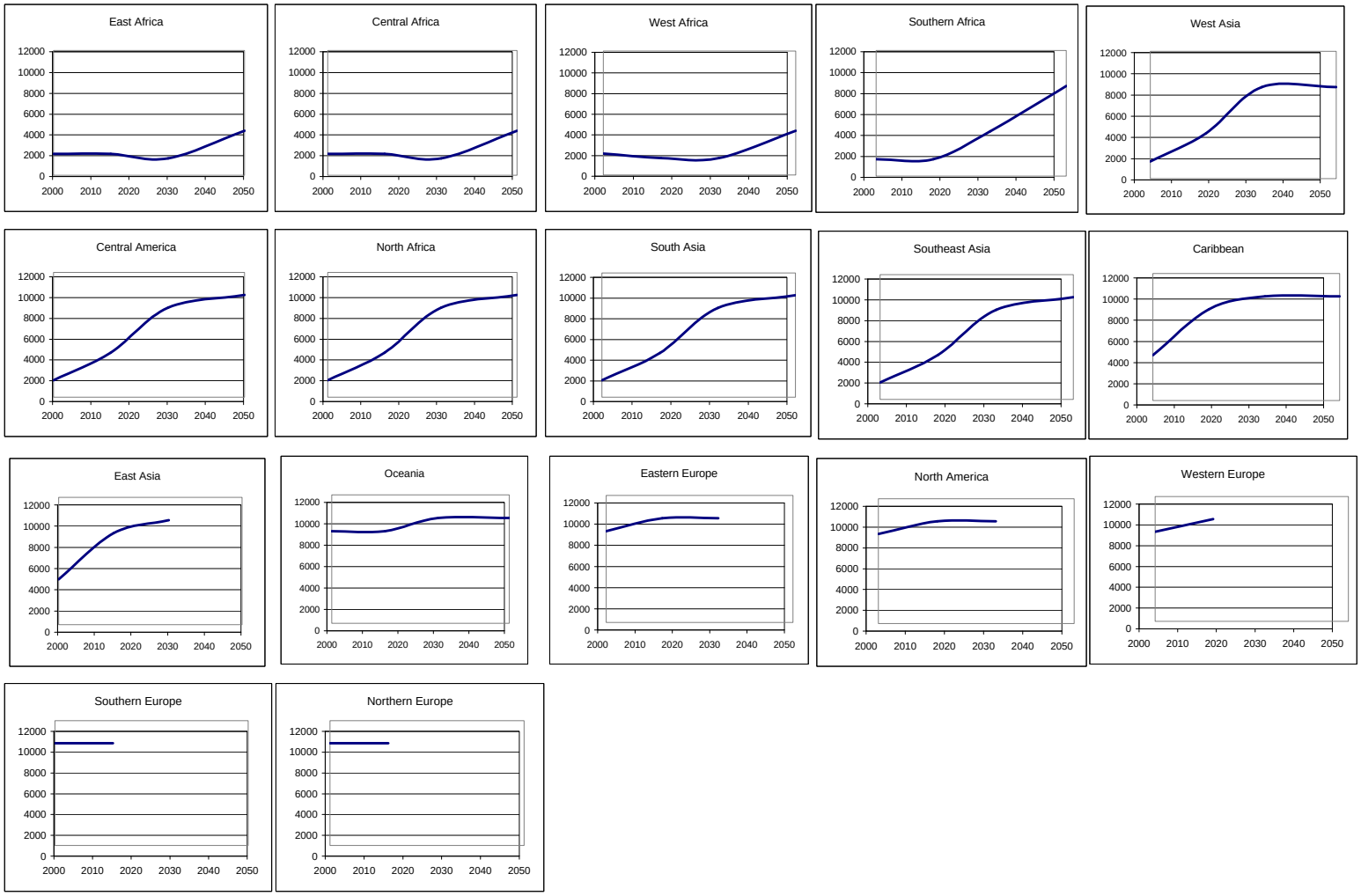

Per capita income (1990 USD) during different demographic phases
12 000
10 000
8 000
6 000
4 000
2 000
-
Rejuvenation phase
Family phase
Modernization phase
Middle-age phase
Maturity phase
Aging phase

Figure 5



GNP per capita 1990 US $

ISSN 1652-120X
ISBN 91-89655-08-7