2020 Vision

In Little More Than Twenty-five Years Eight Billion People Will Share Our Crowded Planet. Science and Technology Will Be Their Brightest Hope.

By Jesse H. Ausubel
MY PREMISE IS EIGHT BILLION PEOPLE. THE year is thus 2020. The question is Ameri-
cal engagement with the eight billion.
Let me set aside how numbers do not matter. In 1950 Americans made up 6 percent of the world population. Of the eight billion, about 4 percent, or 300 million, will dwell in the United States. In 1800 sixteen million resi-
dents of the United States were already transforming a world of a billion. As the peak of British influence in the nine-
teenth century, the British numbered only about 2 percent of the world population. Their edge came from technolo-
y and new forms of social organization.
The fundamental question is not numbers but the pow-
er of the cultural message. The question for America is whether its cultural message has been effectively expressed. I be-
lieve that America has more to say, and a crucial part of America's message is science.
The subject of global development is timely. A conjunc-
tural fluctuation—a time of simultaneous economic, politi-
cal and technological change—is restructuring the world in the profound way that takes place only about every fifty years. Historically, people often experience the interswitching of restructuring as depressions. During such periods the growth potential of one pit of organizational arrangements associated with a given cluster of technologies is exhaust-
ed and a new one is gestating. Jerusalem, Johannesburg, Los Angeles, Rome and Tokyo, as well as Havana and Moscow, are feeling the painful birth of the new.
The developing countries piously call the recent pe-
riod the Lost Decade. Eastern Europe and the former So-
 viet Union are experiencing armistice as high as the West did in the 1930s. They suffer intensely for the Vierte-
rarian economy in which they froze themselves. The ad-
vanced industrialized countries evaded economic crisis in the 1990s largely by creating credit, both private and pub-
lic. Now that strategy is played out. The debts go bad, bankruptcies surge, firms cut jobs and consumers hesitate.
The last resort advocated by Schumpeter and others un-
derstood the cause and cures of conjunctural fluctuations as early as 1939. The present period of "creative destruction," as Schumpeter would have called it, will continue through the mid-2000s to a new model of economic growth and be
gin. The structural changes accomplished in this decade will frame the prosperity of 2020. As the world economy emerges from the present "depression of saturation," new tech-
nologies, industries, institutions and geopolitical configura-
tions will appear. So the time is right for articulations of U.S. development policies and programs consistent with new re-
alities, for organizational renewal, and for communication with the U.S. electorate and the people of cooperating coun-
tries in the purposes of global development.

EMPATHY AND ENVY INTERACT WITH OUR SHRINKING PLANET. Quick, cheap transpor-


tation and communications make large dis-
crepancies among the world's people dangerous, both socially and politically. The tension that arise from the gaps, both within and between nations, spread like an epizu-
ed, infecting all societies. The wealthy are unable to in-
ulate themselves from the troubles of the poor, even from their diseases. Stahn and Trofimov argued whether socialism in only one country is possible. Today I would say, with Trofimov, that development in only one country, at least a large one, is not possible.

Moreover, poverty elsewhere in the world hurts domes-
tic interests in the industrialized countries. It threatens to pre-
vent health, illegal immigration, cheap labor competition, and financial institutions and asset markets. The U.S. wants to sell airplanes and satellites, pharmaceuticals and software, and the experience of nature in the Rocky Moun-
tains. Buyers are scarce in the market, devices are sold.

Interdependence is clinched by planetary ecological con-
science such as ozone depletion, global warming and the loss of biodiversity. Indeed, the urgency of cooperative global development rests on the emergent of ecological sustainability as an indispensable and feasible criterion for action. Only widespread global prosperey can meet the challenge to collective security posed by the deterioration of the environment.

The challenge is the long run is the multiplication of needs. If many people are to eat, dwell and move better than they do today, meeting the needs of 2020 will entail at least $ doubling of agricultural production, energy ser-
vices, industrial production—and a billion new jobs. If such growth is achievable, it might not be sustainable, at least with current technologies.

ENVIRONMENTAL NEEDS MEET WITH MONETARY OPPORTUNITY. In a torrent of events the ice of post-World War II politics has broken and cleaved, largely elected governments and market-friendly autonomies, which are also parts of America's message, are appearing in most areas of the world. Significant measures of health, education and well-being have shown improve-
ments in these countries.

Science and engineering have given birth to computers, lasers, jumbo jets, cellular telephones and gene therapy. In-
dustries, systems research and development is fueled partly a creation of the modern era. The industrialized democratic societies have demonstrated the feasibility of generating goods and services on an exponential scale. Does anyone doubt that those countries could double the world manu-
facture of automobiles, telephones, pharmaceuticals or PCs? For the industrialized countries, production is largely a solved problem. Extraordinarily high quality and reliability have been attained, though new frontiers always open.

A minority of Developing countries has combined inno-


cations in the production of goods and services with sound economics to industrialize rapidly and creatively. Strength in the newly industrialized countries and in major parts of virtually all the large countries—Brazil and India, for ex-
ample—points toward on which to build. Extensive in-
vestment in education and health has improved the capac-
ities of many countries to take advantage of technological

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boon to development, although economic depression, emigration and armed conflicts undermine these efforts.

At the same time, scores of developing countries have lapsed into an underclass. They cannot apply science and technology to meet the basic needs of their people or to enhance the efficiency of their domestic production and services to compete in world markets. Real gaps in human progress persist, both within and among countries, even as the idea of progress itself is redefined.

A TASK FORCE of the CARNEGIE COMMISSION on Science, Technology, and Government, chaired by the former president Jimmy Carter, argued in a December 1992 report that the changes now in process allow the world to move away from merely preserving a truce and toward sustainable eco-

nomic growth and improvement in the quality of life, peace and democracy. Cooperative global development is the theme for the new international order.

In optimistic moments I speculate that human societies are approaching a planetary "hypercycle," the term used by the biochemist Manfred Eigen to describe a process that unifies several otherwise competitive entities into a coherently evolving unit. Within that unit the advantages of an individual can be used by all members.

Military budgets still drain both industrialized and developing nations. Perhaps the era is finally dawning when many societies can diminish the expenditures on their city walls. Peace could liberate more dollars in the U.S. than anywhere else.

A redefinition of the U.S. posture begins with the reintegration of historically separate policies toward its industrialized allies, the Soviet bloc and the Third World, respectively, into the overall concept of cooperative global development. Cooperative global development implies:

• With low-income countries, U.S. interests are now mainly humanitarian rather than strategic.
• With middle-income and advanced developing countries, U.S. interests are growing, along with the capacity of the countries to progress without direct financial aid. U.S. cooperation should primarily facilitate private technical, commercial and investment relations.
• With Central and Eastern Europe and the former Soviet Union, U.S. interests will be served by the achievement of the economic and, in most cases, political progress to which the countries aspire.
• With the advanced industrialized nations, the U.S. must cooperate to restart the global economy. The obsession with national competitiveness, linked to the saturating markets of the 1980s, must be replaced with joint approaches to create confidence and technical visions that will elicit productive investment.

Looking forward to 2020, the challenge is to create the jobs and income that can provide the majority of human-ity with the current level of amenity enjoyed by the affluent industrial societies, without corresponding damage to the environment.

In the past 200 years technological and social transformations have enabled about two dozen societies to develop levels unimaginable at the outset of the industrial revolution. For satisfactory global development's scientific, technological and social transformations are as great as the first industrial
revolution is required. For all nations, including the U.S., the future must bring markedly more efficient use of land, energy and materials—short, a superior "industrial ecology.”

T HE ONLY WAY TO MEET THE CHALLENGE OF the multiplication of needs is to substantially enhance the contributions of science and technology to development and to enhance the cooperation between the science-rich and the science-poor. Both new ways of doing things and the rapid spread of good ideas are urgently required. Major developmental goals—economic growth, environment protection, improved health, better farming, population management—depend on the ability of countries to absorb and use science and technology.

Interwoven with the ability to absorb and use, much less generate, science and technology, is institutional pluralism. The main institutional forms are the private sector, with its emphasis on the marketplace and the bottom line; the public sector, with its emphasis on stable and codified process; and the independent sector, with its tradition of critical thought and the checking of inequalities of wealth, status, power and knowledge.

Cooperation for development must encourage a balanced development in societies of the knowledge, organizations and decision-making processes that underlie each of the main sectors, as well as a creative interaction among them. It must build an enterprise culture, sound public administration and a lively independent sector. Science and technology are critical to all three sectors. Propulsion for the enterprise culture comes from science and technology. A modern public sector cannot operate without massive applications of science and technology—handling the flows of data required for social security systems or air traffic control, for instance. Science and technology are indispensable to a healthy independent sector, providing expertise to balance that retained by otherwise more powerful interests and fostering a culture that probes at received wisdom and seeks humane innovation.

To an increasing extent, technology, economic and social development are indissoluble in the long run in increasing equity and democracy. Nevertheless, history does not prove that development requires equity and democracy in the short or even medium term. Equity and democracy have often followed development, as in post-World War II Europe; and it is likely that democracy will come later for Egypt. Development creates a large enough class of people with the leisure and security to think beyond the next day’s need, as well as the social conditions in which the demand for more democracy can be satisfied.

Yet a central characteristic of the U.S. since its origins has been institutional pluralism. Already in 1833, in the classic Democracy in America, the French traveler and politician Alexis de Tocqueville noted vividly the profusion and significance of organizations in our nongovernmental sector, both for-profit and not-for-profit. What distinguishes an inventive and innovative society from one that imitates is cultural freedom in the broadest sense: a faith in the virtue of rebellion against accepted knowledge and social control. Among the indexes of such freedom are independent universities and small-business creation.

It may be helpful to give some examples of the ways science and technology can spur a new wave of global development. An extremely serious problem is the need to improve communication and share information without the written word. Literacy, adult literacy above 40 percent of adults in most industrialized societies remain functionally illiterate, and that fraction may grow. To communicate with illiterate people, we would have to come up with audio-visual devices that exceed extraordinary potential to empower all people. Another key challenge is to continue the decarbonization of the energy system. Carbon foods are the culprits in acidification, on spills and global warming. For more than a hundred years the world energy system has gradually decarbonized by moving from wood and coal to fuels lighter in carbon, especially liquid gas. Further decarbonization measures rely increasingly on gas and the eventual adoption of carbon-free hydrogens as a fuel. Many countries, including the poor developing countries and China, can keep a

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coal and oil and begin to rely on natural gas. If the nations of the North wish to listen to concerns about the environment and development, technologies for exploration and drilling for natural gas, as well as on sharp geopositioning, are likely to be high priorities for development cooperation.


Since this time, lively new intermediary institutions have emerged to develop the countries. These institutions include businesses of all kinds and sizes, cooperatives, unions, associations of professionals, civic groups and in some areas, local governments. The growth of nongovernmental organizations (NGOs) in Eastern Europe, the former Soviet Union and the nations of the South is a historic development. The North has changed as well. It has more open economies, a larger number of potential partners, new capacities and even greater wealth. Yet the institutional and legal framework of U.S. government cooperation for development has not changed since the early 1960s. The last major U.S. law on foreign assistance was passed in 1961. The complex ecology of organizations associated with development is now more fully appreciated. This ecology includes entrepreneurial firms quick to seize opportunities.
large national and international agencies characterized by stable behavior, considerable resources and relatively cen-
tralized operations; and flexible networks and coalitions able to mobilize large numbers of people and public opin-
ion, even without an assured funding base. The diversity of
groups is a tremendous asset, indeed a necessity, if one
wants to balance rapid and efficient growth with equality
of participation in the fruits of that growth.

The Carnegie Task Force concluded that
the overarching need within the U.S. is to bar-
ner the full power of pluralism for global
development. To foster creative cooperation among the
for-profit, governmental and independent sectors for develop-
ment, the task force recommended the creation of a nation-
al action roundtable for international development. The
roundtable would link people, assets and ideas in tempo-
rary organizations to get particular jobs done.

Within the U.S. government the charter for develop-
ments needs to be rewritten. Given the entrenched inter-
ests, institutional rivalry and organizational complexity
created over four decades, the White House must strongly
support the change. The Carnegie task force recommend-
ed joint presidential and congressional actions leading to
major reform of foreign-assistance legislation and over-
sight. Current legislation impedes all but marginal im-
provements in cooperation for development. The Foreign
Assistance Act of 1961 has now been amended more than
seventy times and includes thirty-three objectives and sev-
entry-five equal priorities for U.S. programs.

The complexity of the ways development funds are au-
thorized and the requirements for reporting also create a
legal and managerial superstructure that consumes re-
sources that might otherwise be spent on development it-
self. The critical elements of legislative reform are vastly re-
duced earmarks on appropriations to allow flexibility in
programs, a sensibly limited set of objectives toward which
cooperation for development is applied, and measures of
effectiveness against which cooperation is accountable.

Foreign aid of the kind that AID offers is just one means
by which the U.S. government can influence development.
Constructive, explicitly international policies can also be
defined on stable, environment, immigration, visas for for-
enig students, and intellectual property rights. Equally im-
portant are domestic policies that affect savings, investment
and economic growth. Those policies profoundly affect the
interactions and behavior of the U.S. and world economies.

In fact, debate over direct aid, or Official Development
Assistance, may attract too much attention. U.S. ODA for
long-term investment and humanitarian goals in developing
countries totaled about $2 billion in 1992. ODA matters less
for its absolute level than for its symbolism and leverage on
the much larger flows of people, information, technology
and goods that are part of normal commerce. The U.S., al-
though about $120 billion annually in manufactures de-
developing countries. An increase in trade of 2 percent, a typ-
cical five-to-year change, can have a larger financial impact
than a doubling of the ODA budget.

One of America's strongest levers is its universities.
America is the university for the world. For the one mil-
lion students who seek access to superior education,
the U.S. is by far the preferred destination. More than
400,000 foreign students came to the U.S. in 1991; science
and engineering were the strongest attractors.

Many of the major multilateral agencies were also cre-
ated in the era following the Second World War. Few have
deeply reexamined their mandates and modes of operation,
while the world has moved from Yalta to Rio via the
moon. One hundred fifty leaders, rather than three, are
needed to address the direction of the planet.

One area of particular need—and also evident in the discussions
at the UN Earth Summit held in Rio de Janeiro last year—is
coordination among donors supporting environmental re-
search. The Carnegie Commission proposed the formation of
a coordinating group for research on environment (CGREEN).
CGREEN would include private industry and foundations, as
well as governmental and intergovernmental organizations.

More broadly, I believe there is a need to examine the
global and regional arrangements, both intergovernmental
and nongovernmental, for the support and performance of
research. The present international infrastructure of science
will not suffice for the science of the eight billion people in
2020. A thorough look at the International Council of Sci-
entific Unions and at the scientific components of OECD,
the UN and other organizations should begin soon.

The present appears a rare moment for
almost all nations to promote global
prosperity, peace and liberty through coop-
eration. It is a time for creativity comparable to that im-
mediately after the Second World War, with a greater

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tive and dynamic global economy.

should be given by European governments and industry as the European Science Foundation, Academia Europaea and other bodies that connect European science. In any case, science will remain strong in America and Europe.

The hard question is, Will science truly sink itself in more lands or continue to spread only from the few metropolises? Science is an expensive game. The late historian of science Derek J. de Solla Price conjectured that scientific growth is like the cube root of the expense of research, a discouraging price for all but the Mellon and the Rockefellers.

The most successful scientific effort in history has been realized in the U.S. in the past few decades. One reason is sheer wealth. But perhaps equally important is the entrepreneurial, market-oriented culture, and the general truculence noted by de Tocqueville: America supports the heterogeneity of preferences, competencies and expectations needed to keep pushing the frontiers of science. The same verve, same individualism, experimental spirit that supports new business supports new science. That spirit will still infuse America in 2020.

But developing countries may prove slowly to tolerate and encourage the qualities that make science flourish. Science may continue to be the comparative advantage and contribution of the West, and the U.S. in particular.

Can the developing countries catch up by 2020? The scramble to join rich will certainly continue. In the next three decades more countries will successfully climb on our wagons, as others have in the past fifty years. The average ratio of rich to poor, however, will not change greatly by 2020. The best short-run prospect for "catch-up" is that the rich will hit a ceiling. In fact, the ceiling may be near for several measures of human development: infant mortality, life expectancy, share of population served with clean water. Although the middle class will become sizable in many countries, the diffusion processes that set the clock for development will probably take until 2050 for the next group of fast-growing, late-starver nations to pull close. After all, it has taken a half-century for the late-starting OECD nations such as Finland and Spain to reach the peak of leaders.

I have spoken mostly of America. Will Europe take much unified action before 2020? Current events suggest that the political division of Europe will require generations more to be erased down. The collective impact of European nations on world development will be enormous, but Europe will rarely act collectively. More than a century passed from the formation of France to the political coherence and aggressiveness of Louis XIV. The economic unification of Europe is probably the most significant, and bloodless, political achievement of the twentieth century, but I doubt Europe will be ready when the eight billion are.

A THOUGH POLITICAL, EUROPE MAY NOT BE ready, I think its scientists and engineers and those of America and the rest of the world will be. The world of the eight billion could be nearer and more continuous, made to by crowding, epidemics, vast migrations, resource depletion and rapidly changing climate. But science, humanity's most powerful invention, is a vigorous, vigorous. Science and technology, if they continue to be dynastic, can provide clearly and comfortably for eight billion people and more. The period of major restructuring now under way is an excellent time to gain feasibility and to set in place the innovations that will fill the next stage.

Perhaps the most subtle challenge is to convey to the world that the cultural climate that makes science flourish is also what creates an innovative and dynamic global economy. That may be America's most important message for the eight billion.

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