Pergamon

World Development, Vol. 25, No. 10, pp. 1561–1568, 1997

0305–750X/97 $17.00 + 0.00

PII: S0305–750X(97)00109–5

Editorial: Development, Knowledge and the Baconian Age

FRANCISCO SAGASTI
FORO Nacional/Internacional and AGENDA: Peru

1. INTRODUCTION

World Development was launched a quarter of a century ago, when the international development community was paying much more attention than at present to the role that science and technology play in the process of development. Indeed, at that time this journal appointed two associate editors, Victor Rabinowitch and Geoffrey Oldham, to assist the main editor in securing contributions on this subject. Motivated by that initial orientation, in this editorial I would like to share with you some ideas on the relationship between development and the emerging knowledge society.

2. THE BACONIAN PROGRAM

Our times are the product of a particular set of historical processes that have unfolded over the last five hundred years, and which witnessed the rise and worldwide spread of Western civilization. With the benefit of hindsight, it is possible to argue that what gave this period of human history its unique character was the articulation and implementation of the "Baconian Program" whose main architect was Sir Francis Bacon, Lord Chancellor of the British Crown. Even though the specific methodological and scientific contributions of Bacon have been the subject of debate, during the late 16th and early 17th century he was the first to put forward a coherent view on how to use the power of modern science for the benefit of mankind.

The Baconian program was designed "...to aim knowledge at power over nature, and to utilize power over nature for the improvement of the human lot."[1] Three key features distinguished this program from other views on the production and use of knowledge that were current in Bacon's time: an awareness of the importance of appropriate research methods (scientific methodology), a clear vision of the purpose of the scientific enterprise (improving the human condition), and a practical understanding of the arrangements necessary to put the program in practice (scientific institutions and state support). All of these were closely related to the idea — so essential to Francis Bacon's thinking — that human beings (he used the word "Man") occupy a privileged and central place in the order of things.[2]

The idea of indefinite, linear and cumulative human progress became the driving force of the Baconian program during the Enlightenment. The worldwide expansion of Western civilization would proceeded hand in hand with the realization of Bacon's program, which was considerably enriched with the contributions of many other philosophers and scientists. Through its application, standards of living have improved in ways that Bacon and his contemporaries could hardly imagine. Moreover, the powerful character of the ideas put forward by Bacon allowed them to withstand the test of time and endure until our days.

The resounding success of the Baconian program also had a darker side. The benefits of scientific advances and technological progress would largely accrue to a small minority, and most of the world's population would not benefit from the fruits of scientific and technological progress. Immersed in a set of Western institutions that accompanied the rise of nation states, capitalist economies and the expansion of European empires, modern science and technology also caused severe environmental disruptions and large scale social dislocations. From this perspective, it could be argued that a rather costly Faustian bargain (which culminated in the creation of means of destruction capable of eliminating the human species as a whole) has tarnished the triumph of Western Man over nature.

The 20th century witnessed the emergence of several challenges to the Baconian program, as well as to the privileged place it awarded to "Man" as the center of creation. In addition to environmental disruption, which has forced us reevaluate the costs of overpowering nature, the rise of artificial intelligence has made us reflect on what attributes are unique to human beings. Advances in informa-

tion and communications technologies are multiplying and transforming human interactions, with consequences we are just beginning to realize. Discoveries and innovations in genetic engineering and biotechnology may soon force us to become responsible for guiding the biological evolution of our species, regardless of our readiness to accept such awesome responsibility. Last, but not least, we have been compelled to accept strange notions regarding the probabilistic nature of the physical world, and even stranger conceptions that postulate the possible existence of "multiple universes." As a result, we are now confronting a host of ethical, psychological, social, cultural, environmental and economic consequences of the extraordinary scientific advances and technological innovations associated with the success of Bacon's program.

Yet, in a paradoxical way, the triumphs of the Baconian program have began to undermine its own foundations and are making us question its basic premises. The conduct of scientific research has been altered in profound ways as a result of technological innovations (instrumentation, information processing), of methodological advances (from reductionism to systems thinking and chaos theory), and of a variety of scientific discoveries that have modified our conceptions of physical, biological and social phenomena. New problems have emerged as a consequence of our attempts to improve the human condition, which require that we adopt a broader perspective on the aims and purposes of our efforts to generate knowledge. The institutional arrangements that were gradually built over a period of decades, and even centuries, to carry out the Baconian program (universities, academies, research institutes) are now in need of a major overhaul. Finally, our faith in progress through the accumulation of knowledge has been badly shaken.

All of this suggests that we are now embarking in a transition to a post-Baconian age. We are just beginning the search for a new program to mobilize human efforts, whose outlines cannot, as yet, be discerned — at least not with the clarity that we can attribute to the Baconian program nearly 400 years after it was first advanced.

3. PROGRESS AND DEVELOPMENT

A belief in the unending, linear and steady advance of humanity — the idea of progress — mobilized human energies during the Baconian age. Beginning with the Hellenistic and Roman notions that knowledge can be acquired step by step through human actions, the idea of progress has evolved over the whole history of Western civilization. Cyclic conceptions of the universe, in which events repeated themselves over the course of a "great year," had to be overcome before embracing a belief in the open-ended, cumulative and indefinite character of advances in human history.[3]

Faith in a divine design for the cosmos played a major role in the evolution of the idea of progress during the Middle Ages. The Renaissance added a revaluation of the individual and of human actions as means to improve the human condition, while the scientific and geographical discoveries of the 16th and 17th centuries would lay the ground for a belief in the inevitability of progress through the accumulation of knowledge.

With the emergence and subsequent triumph of rationalism in the 17th and 18th centuries, the idea of progress gradually lost its religious underpinnings. During the Enlightenment it became a thoroughly secular idea in which divine providence played no role. Through the whole 19th century, the idea of progress would remain firmly ingrained in Western mind as the positive driving force for improvements in the human condition, as the engine that made the Baconian program run.

The events of the first 40 years of what Eric Hobsbawm has called the Short Twentieth Century,[4] challenged our beliefs in any notion of continuous and indefinite human progress.

> The decades from the outbreak of the First World War to the aftermath of the Second, was an Age of Catastrophe for [Western] society. For forty years it stumbled from one calamity to another.

This stands in stark contrast to Hobsbawm's Long 19th Century (from the 1780s to 1914) "which seemed, and actually was, a period of almost unbroken material, intellectual and *moral* progress" (his emphasis).

The four decades that saw the carnage of WWI, the emergence of Communism, the rise of Fascism, the Great Depression, WWII and the creation of the Atom Bomb, could hardly be considered conducive to harboring and nurturing the idea of progress. Together with the waning belief in the inevitability of progress, the achievements of the Baconian age also began to be seen as suspect.

The end of WWII changed the mood of gloom and despair of the Age of Catastrophe. The triumph of the Allied forces over the Axis brought it a new sense of optimism, satisfaction and euphoria to the victors. The belief that purposeful interventions could improve the human condition was reinstated, considerably helped by the availability of new techniques for managing the economy, planning investments and production, and organizing large-scale enterprises. Wartime advances in science and technology also found many civilian uses, and spilled over to private enterprises that profited from

them. The Age of Catastrophe was left behind and a renewed faith in human progress took hold.

One key expression of the renewed belief in progress was the emergence of the concept of *development*, which can be considered as the latest incarnation of the idea of progress within the framework of the Baconian program. The implicit notion in the various definitions of development that were offered at that time could be stated as follows:

> to achieve, in the span of one generation, the material standards of living that the industrialized West achieved in three generations or more, but without incurring in the heavy social costs they had to pay or inflicted on others.

Development was also supposed to guarantee a minimum material comfort to all human beings.

The onset of the Cold War hijacked the concept of development and made it hostage to East/West rivalries. Two alternative ways of achieving development were put forward: one based on market economies and liberal democracy, and the other on central planning and a single party system. In the decades that followed, each trumpeted its successes and sought to enlist the poor countries, many of which were emerging from decades and centuries of colonial rule, in their camp. The East/West struggle became the lens through which practically all political, economic and social events taking place anywhere in the world would be filtered and seen.

During the period from the late 1940s to the early 1970s, the world economy grew at an unprecedented pace, and it grew everywhere: East and West, North and South. Jump-started by the financial resources, capital and consumer goods, and technical assistance of the Marshall Plan, European economies recovered and grew at nearly 5% per year. Led by Japan the economies of Asia registered an average annual growth rate of 6%, while Eastern Europe grew at 4.7%, Latin America at 5.3%, and even Africa showed a growth rate of 4.4% per year.[5]

This was also a period of considerable international generosity. Following the success of the Marshall Plan, the United States launched the Point Four Program to expand bilateral aid to developing countries in 1949 and created the Technical Cooperation Administration to implement the Point Four Program.[6] What may be called the "development cooperation experiment" was launched and for the next two and one-half decades resources for development assistance increased continuously and a large array of bilateral and multilateral institutions was created to channel and administer these resources. As the Soviet Union also expanded its financial and technical cooperation programs, developing countries became contested ground on which to try one or another set of recipes to promote economic growth and improve living standards.

Ideas of how to bring about development have changed and evolved over time, at least in the West. Several schools of thought emerged to organize these ideas and competed with each other during this period, even though at any given time there has usually been one dominant idea orienting the efforts of development agencies and institutions. From investment promotion in the 1950s, through strengthening public agencies and import substitution in the 1960s, trough basic needs and redistribution with growth in the 1970s, through export promotion and structural adjustment in the 1980s, ideas are now shifting in the direction of poverty reduction, social development and building capable states.[7]

The development efforts of the past five decades have been neither a great success nor a dismal failure. On the positive side, a handful of low-income countries, particularly in East Asia, have achieved the standards of living of the industrialized nations; life expectancy and educational levels have increased in most developing countries; and income per capita has doubled in countries like Turkey, Brazil, South Korea and China in less than a third of the time it took to do so for the United Kingdom or the United States a century or more earlier.[8]

On the negative side, poverty has increased throughout the world; income disparities between rich and poor nations, and between the rich and the poor in both developed and developing countries, have become more pronounced; the environment has been subjected to severe stress, both in developing countries that have remained poor and in those that industrialized rapidly; and social demands have grown many times over throughout the developing world.[9]

At the same time, successes and failures have given us valuable insights and several lessons on how to accelerate economic growth and improve social conditions. Consistent with the view that development can be considered as a reinterpretation of the idea of progress within the framework of the Baconian program, perhaps the most important of these lessons is that *the capacity to acquire and generate knowledge in all its forms — including the recovery and upgrading of traditional knowledge — has been the most important factor in the improvement of the human condition*. The development experience of the past half-century has shown that this capacity is critical to the lasting success of nations and communities.

4. DEVELOPMENT, THE KNOWLEDGE SOCIETY AND THE TWO CIVILIZATIONS

During the Baconian age science became the

superior and dominant method for generating knowledge about the world that surrounds us, about ourselves and about human interactions. Scientific advances, the evolution of technology and the transformation of productive and service activities became closely intertwined in the dynamic sectors of the world economy, which are an almost exclusive preserve of the rich nations. In the rest of the world, knowledge, technology and production remained wide apart, with local forms of knowledge generation relegated to a marginal role at best.

The enormous impact that advances in science and technology have on all aspects of human life — including on the very conception of human nature — are making it abundantly clear that, as we move into the post-Baconian age, the world is witnessing the rise of the "knowledge society."[10]

This has both positive and negative consequences. Modern science and technology have always had an ambiguous character, but the cultural context in which they developed from the early 17th to the mid-20th century never really treated their promises as threats to survival of mankind.

During the Baconian age we learned that science and technology do not always bring about improvements to those areas of human activity which they affect. Despite what was promised by the Rationalism of the Enlightenment and even more by the Positivism of the 19th century, scientific and technical progress does not necessarily coincide with moral, social or even economic progress. The complex and rapidly shifting context of an emerging fractured global order[11] is making this point in a painfully obvious way as the world takes its first uncertain steps into the post-Baconian age.

The great divide between those peoples who have the capacity to generate and utilize knowledge and those who do not, which emerged gradually over centuries, could rapidly become an impassable abyss. Accepting that there is a great variety of national and local situations, to focus sharply on this divide it may be appropriate to speak metaphorically of the emergence of "two civilizations."[12] These two civilizations interact with each other in an asymmetric manner: the second civilization (largely non-Western) is dependent and deeply affected by the first (largely Western), but lacks the capacity of influencing it to the same degree.

The first civilization is based on the growth of science as the main knowledge-generating activity, the rapid evolution of science related technologies, the incorporation of these technologies into productive and social processes, and on the emergence of new forms of working and living deeply influenced by the worldview of modern science and science-related technologies. Most of the high-income countries, in which science, technology and production are closely intertwined to constitute an endogenous scientific and technological base, would belong to the first civilization which includes the nations of the Western "North."

The second civilization is characterized by a low capacity to generate scientific knowledge, a broad traditional technological base on which a thin layer of modern imported technologies is superimposed, and a productive system with a rather small modern segment closely linked to the economies of high income nations and a larger traditional segment that is relatively isolated from the international economy. Most of the low income countries of the developing world, in which scientific research, technological development and productive activities remain apart, have an exogenous scientific and technological base and would belong to the second civilization which includes most countries of the non-Western "South."

Even though the distance between the first and second civilizations may be widening as a consequence of the knowledge explosion, during the past three decades a handful of developing countries have began to establish the foundations for the development of an endogenous scientific and technological base. In parallel, some high-income Western nations and several former socialist economies, which had their own endogenous science and technology capacity have been losing ground in scientific research, technological development and the linkage of these two to productive activities. As a result, it is possible to find some nations that have features of both the first and second civilizations.

The developing nations of the second civilization are characterized by the coexistence of disjointed and even contradictory cultural forms. They face difficult choices regarding the importance attached to tradition, with its hierarchies, codes and rites, in relation to the weight placed on reason — the foundation of modern science — with its capacity to create order and disorder, and to transform and destroy. Taken to extremes, scientific and technical thinking threatens to reduce human beings to purely instrumental rationality. Conversely, attacks on rationality, levelled from particular faiths or traditions, threaten to retard or prevent change and may lead to stagnation.

The challenge faced by the nations of the second civilization — with our legitimate diversity of cultures, perspectives and viewpoints — is how to integrate harmoniously the pursuit of modern science and technology, as well as its material intellectual manifestations, with the social and cultural heritage that provides us with a sense of identity. Advancing toward development — whichever meaning may be ultimately assigned to this word as we move into the post-Baconian age — implies a determination to prevent the knowledge fracture from leading to a fractured global order with two diverging civilizations.

From a broader perspective, however, the challenge we face is to prevent the multiplicity of fractures of the emerging global order from creating self-contained, partially isolated pockets of mutually distrustful peoples, ignorant and suspicious of the viewpoints, aspirations, potentials and capabilities of each other. Left unchecked, these fractures may lead to inward-looking societies — both between and within rich and poor countries — that relate to one another only through tenuous symbolic links forged by mass media or through narrowly circumscribed economic transactions, and that interact in ways that are fraught with conflicts that may threat human and environmental security.

Efforts to meet this challenge imply a commitment to build bridges across the multiple fractures of the emerging global order, so as to give all human beings the opportunity to realize their full potential. Chief among these will be the efforts to bridge the knowledge divide that separates the rich countries of the first civilization, which were able to fully put in practice the Baconian program and to benefit from its results, and the developing countries of the second civilization, which have largely been passive consumers of the scientific knowledge and the technical innovations produced by others.

5. INTERNATIONAL COOPERATION AND SOCIAL INNOVATION

How have efforts to build bridges across the knowledge divide fared during the last three decades? Not very well, I am afraid. Despite many exhortations and policy pronouncements, differences in science and technology capabilities between developed and developing countries, which have persisted over a long time, still remain a distinguishing feature of the emerging fractured global order.

Scientific and technological capacities are distributed in an even more lopsided way than economic power. During the early 1990s, the high-income countries of the Organization for Economic Cooperation and Development (OECD) accounted for about 85% of total world expenditure in science and technology, India, China and the newly industrializing countries of East Asia accounted for a further 10%, while the rest of the world accounted for only about 4%.[13] Moreover, while the average income *per capita* of the 24 rich countries of the OECD is about 60 times greater than that of the about 50 poorest countries classified as "low income economies" by the World Bank, average science and technology expenditures *per capita* in the former are 250 times greater than those of the latter. By and large, these figures are not too different than those that prevailed 30 years ago.

During the 1960s a large number of researchers, both in developed and developing countries, began to focus their efforts on the ways in which modern science and technology could be put to the service of development objectives. Many developing countries established National Science and Technology Councils, cooperation programs were established in several bilateral and multilateral development cooperation agencies, and following the Geneva 1963 United Nations Conference on Science and Technology for the Benefit of the Less Developed Areas, a second United Nations Conference on the subject of science and technology for development was held in Vienna in 1979. An ambitious program of action, which was supposed to include a new "Financing System," was approved at the Vienna conference. But nothing of substance and lasting impact came out of these efforts at the United Nations level.

The World Bank established an Office for Science and Technology in the 1970s but abolished it about a decade later, while lending to build science and technology capacities has remained a marginal activity in this institution. The Inter-American Development Bank did much better, and has channeled a significant amount of financial resources to science and technology and higher education institutions in Latin America and the Caribbean. No comparable effort was made by other regional development banks. At the same time, some countries — most notably Canada and Sweden — created special agencies to support the development of research capabilities in poor countries, even though by the early 1990s Sweden had reabsorbed its specialized research support agency into its bilateral aid program and the Canadian International Development Research Centre (IDRC) was experiencing serious financial difficulties.

Academic interest in the subject of science, technology and development waned during the 1980s and early 1990s. Researchers focused on other issues, and particularly on macroeconomic stability, structural adjustment, transition economies and environmental policies. By the end of the 1980s some prominent scholars were lamenting the lack of young talent and the limited interest shown by graduate students in the science and technology policy questions of the developing regions. Moreover, the "Lost Decade" of the 1980s, during which a majority developing countries experienced economic decline, high inflation rates and rising debt burdens, were hardly conducive to focusing the attention of policy makers on the long-term problem of building and utilizing science and technology capabilities.

All of this suggests that the limited science and technology capabilities of most developing countries — which are woefully inadequate to deal in a reasonable manner with the challenges of economic advance, social progress and environmental sustainability — are likely to remain at their present low

levels for a long time. Despite the obvious importance of science and technology in the knowledge society, and of the pressing need to build bridges across the knowledge divide as we enter into the post-Baconian age, mobilizing science and technology for development objectives remains an elusive and pending issue in the international agenda.

The task of enlisting science and technology in the services development as we move into the post-Baconian age faces the same problems it faced a quarter of a century ago, when this journal was launched. We have learned much from our successes and failures, but our improved understanding of the relations among science, technology and development has not had a major and significant impact on the policies and strategies of developing countries, international institutions and rich nations. Therefore, it is not inappropriate to conclude by renewing the call for social innovation and international cooperation made nearly a decade ago by the members of the United Nations Advisory Committee on Science and Technology for Development, which is reproduced as an appendix to this editorial.[14]

NOTES

1. Jonas (1984).

2. See, in particular, Francis Bacon's reinterpretation of the myth of Prometheus in *The Essays* (Bacon, 1985, edited by John Pitcher).

3. Nisbet (1984).

4. Hobsbawm (1994) pp. 7 and p. 13).

5. Maddison (1995).

6. Carnegie Commission on Science, Technology and Government (1992).

7. See, for example, Cowen and Shenton (1996).

8. World Bank (1991)

9. UNDP (1996).

9. UNDP (1996).

10. The first modern interpretations of the knowledge society were put forward by Fritz Machlup in his pioneering book *The Production and Distribution of Knowledge in the United States* (Machlup, 1962).

11. Sagasti (1991).

12. Sagasti (1980).

13. UNESCO (1996) For a detailed analysis of interntional statistics on science and technology expenditures see Annerstedt (1995).

14. The declaration in the annex was adopted by most of the former and current (at the time) members of the now defunct United Nations Advisory Committee on Science and Technology for Development. This Committee was established as a result of the Vienna Conference in 1979 and lasted for about 12 years, gathered 27 experts from academia, business, government and nongovernment institutions, all of them acting in their independent capacities to provide advice to the United Nations system, international agencies, governments and international science and technology community. It was replaced by a rather unwieldy 54-member sub-Committee of the UN Economic and Social Council, composed larely by diplomats stationed in Geneva.

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APPENDIX A: UNITED NATIONS ADVISORY COMMITTEE ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

(a) *Science, technology and development: The imperative of social innovation*

(A declaration issued by the former chairmen and members of the Advisory Committee on Science and Technology for Development on the occasion of the tenth anniversary of the Vienna Programme of Action in October 1989)

Humanity approaches a new century confronting a fundamental paradox: we have never had so much power to influence the course of civilization, to shape the way our species will evolve, and to create an ever-expanding range of opportunities for human betterment — but we remain unwilling or unable to use this new-found power to achieve our full potential as human beings.

Throughout most of history, nations and societies have been compelled to behave as though same groups could only progress at the expense of others. Today, advances in science and technology have created new possibilities for all humanity to prosper, if we could but summon the collective will and wisdom to employ the new means available to us.

Science has been the most important factor in placing this unprecedented opportunity within our grasp. During the past four centuries, the systematic process of subjecting abstract conceptions and propositions about the world to the test of empirical observations — which is the hallmark of modern science — has superseded other forms of knowledge generation. As a result, science-based technologies are steadily replacing or improving those that development through trial and error. At the same time, our understanding of the potentials and limitations of modern science and its applications has increased considerably.

Paradoxically, progress in material well-being for a growing fraction of the world's population coexists with stagnation and even deterioration in standards of living for the majority of poor people. Deprivation of food, health, education and gainful employment besets a sizeable part of humanity, giving rise to new stresses on the environment which, in turn, undermine the basis for future development. The clash between rising aspirations and the realities of omnipresent poverty, largely triggered by growing awareness of the life styles of the affluent, has become a source of social tension, intolerance and violence.

The now enormous potential for human advancement coexists with gross inequalities, possible ominous threats to the global commons (such as the greenhouse effect and stratospheric ozone depletion), and with the diversion of significant proportion of the world's highest intellectual talent to develop technologies so awesome as to threaten human survival. This paradox puts in sharp relief the critical problem of our age: our scientific knowledge and technological mastery have outstripped our collective capacity to manage advances in science and technology so as to enhance the opportunities and reduce the threats they create. A bold and imaginative effort in social and institutional innovation at all levels — from local to international — is now essential for survival and progress.

The 1980s have been through many changes and surprises: the reversal of capital flows between North and South as a consequence as a consequence of the debt crisis, the information revolution and proliferation of personal computers, significant advances in biotechnology, the tragic emergence of AIDS pandemic, the explosive growth of megacities in the third world, and a major redistribution of economic world power, among many others. A new and as yet fluid world order has been in the making in the decade since the United Nations Conference on Science and Technology for Development was held at Vienna in 1979.

In this rapidly evolving global context, the 1990s may offer historic opportunities for broader international cooperation in science and technology. After four decades of antagonism and mistrust, the bipolar divisions of the world — East/West and North/South — are giving way to a pluralistic international environment. This creates a unique opportunity for more equitable and pragmatic distribution of the costs and benefits of scientific and technological progress, casting aside the ideological blinders that constrained the visions of statesmen for nearly half century. Our enormous and increasing stock of scientific knowledge and technological skills can become a key resource for easing international tensions.

We propose three guiding principles for a renewed mobilization of science and technology in the service of development. The international community of statesmen, scientist, policy makers, scholars, professionals, managers, workers and citizens — within which the United Nations system should play a leading role — must in our view:

(a) Evolve a broad new strategy to ensure equality of access for all people to modern scientific and technological knowledge essential to alleviating poverty, reducing population pressures, achieving minimum standards of health and nutrition, improving educational opportunities, and promoting economic growth. Without sacrificing the incentives for individual creativity and practical imagination, we must evolve a common view that scientific and technological progress should directly foster global equity, both within and between generations;

(b) Undertake a concerted effort to build the human and institutional capacities developing countries need to make independent decisions on the critical science and technology issues which will confront them. International cooperation will play a mayor role in this essential task, particularly because of the huge disparities in scientific and technological capabilities between the industrialized and the developing countries — disparities that dwarf other indicators of global inequality;

(c) Forge new international partnerships to achieve environmentally sustainable development. The times when humanity could act on the physical and biological environment with impunity — blindly trusting in the regenerative powers of ecosystems — are forever gone. New approaches in which humanity and nature jointly enhance each other's capacities are imperative. This will demand a reevaluation of the many ways in which different cultures to the natural world, using science to build constructively on this diversity, rather than seeking to universalize some

single over-arching view of the interactions between human activities and the environment.

We believe a successful collective search for social innovations during the last decade of the twentieth century will require a climate of openness and participation at all levels. Imposed solutions or visions — however well conceived — will lack authority in today's increasingly pluralistic political communities. Tolerance for cultural and religious diversity, respect for human rights, active encouragement of individual freedom and creativity, and sensitivity to the damaging effects of inequalities of knowledge and power are essential for linking science and technology to the preservation and advancement of humanity.

We reaffirm our belief in international cooperation as the most effective way to transcend the conditions which deny the power and benefits of science and technology to those most in need. International cooperation and assistance must evolve beyond charity, or narrowly conceived national interest, into expressions of collective responsibility for the well-being of all the humanity in present and future generations.

We strongly encourage the international community to develop during the next decade a multiplicity of innovative approaches to bilateral, regional and global cooperation in science and technology for development. The United Nations should monitor these initiatives, fostering the exchange of experiences, and when this century comes to an end, 20 years after the 1979 Vienna Conference, should arrange an international gathering to evaluate progress and chart the course for science and technology for development in the new century. Francisco Sagasti (Peru), Chairman 1988–1989. Essam EL-din Galal (Egypt), Chairman 1986–1987; Umberto Colombo (Italy), Chairman 1984–1985; M.S. Swaminathan (India), Chairman 1981–1983. (The signature of other 45 Committee members follows)