Folder Title:	Managing Committee Official Files: Records of the Operations Policy Subcommittee - Correspondence 05
Folder ID:	1775778
Series:	Managing Committee official files
Dates:	06/01/1982 - 07/01/1982
Subfonds:	Records of President A. W. Clausen
Fonds:	Records of the Office of the President
ISAD Reference Code:	WB IBRD/IDA EXC-09-3963S
Digitized:	03/22/2023

MC - Operations Policy Subcommittee 1982
(5)

WORLD BANK / INTERNATIONAL FINANCE CORPORATION FIS MB

OFFICE MEMORANDUM

File. Mr Qureshi accepted this

TO: Mr. Moeen A. Qureshi, SVPFI

DATE: June 18, 1982 WBt. 7/2

FROM: Ernest Stern, SVPOP

SUBJECT: FY1984 Budget

Shortly after the Annual Meetings I, with the assistance of Mr. Vergin and his staff, will have to do the country allocations for Bank and IDA lending, as a first step in the planning of the FY1984 budget. Clearly the planning assumptions for IDA for the outer years will remain uncertain. For the Bank side there is, however, a major question of policy which it would be helpful to address before we begin the allocation exercise -- i.e., whether or not we are prepared to exceed the presently indicated IBRD lending levels in real terms, and, if so, what the implications are for the $60 billion planning level. This involves, of course, the tactics of either establishing a different interpretation of the $60 billion limit and/or agreement on the timing of initiating discussions for a further capital increase. In order to have an overview of our constraints, it seems to me it would be highly desirable for the MC to have a short paper before the end of September setting out briefly the issue and the proposed conclusions. This will enable us to at least have an initial round of discussions on the general strategy as background to our planning.

cc: Mr. Vergin
Mr. Humphrey

ES:ct

M. Humphrey

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Members of the Operations Policy Subcommittee DATE: June 17, 1982

FROM: Sidney E. Chernick, SEC CPD

SUBJECT: Science, Technology and the World Bank of the 1980s

MB
I already saw an earlier version of this. We need only keep one!
WHT
6/17

The Operations Policy Subcommittee will meet on Wednesday, June 30 at 9:30 a.m. in Room E-1208 to consider the attached paper prepared by the Science and Technology Adviser, Projects Advisory Staff.

Attachment

cc: Ms. Pratt
Messrs. van der Tak
Rajagopalan (o/r)
Waide
Weiss (without attachment)

Draft
June 9, 1982
CONFIDENTIAL
Do Not Cite

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

Charles Weiss, Jr.
Room E1036, Ext. 76525/6
Science and Technology Adviser
Projects Advisory Staff
Operations Policy Staff

The World Bank
1818 H Street, N.W.
Washington, D.C. 20433

Draft
June 9, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

EXECUTIVE SUMMARY

Science and technology is universally recognized as a critical element of development.

- Economic returns on agricultural research in LDCs frequently exceed 40%.
- Improved technology for wheat and rice production has increased LDC agricultural output by $3-4 billion.
- Malaysian research has kept natural rubber competitive on world markets.
- Low-cost cookstoves for the poor can help save endangered forests and help decrease the cost of fuelwood, if their use can be effectively diffused.

Yet the level of LDC attention to science and technology is low.

- Only 3% of the world's research and development takes place in LDCs, and only 12% of its scientists and engineers live there.
- Research on malaria comes to only 2¢ per infected person, compared to $850 per cancer patient in the US.
- Existing aid efforts fall far short of the need.

Lack of attention to science and technology has contributed to diverse disasters: the destruction of the tropical forests; the decline of the jute industry; crop failure in Pakistan.

The Bank has accomplished much in science and technology, both in promoting research and in developing local scientific and technological capacity. This work includes some of the Bank's most important contributions to development.

- Projects have financed $1 billion in agricultural research and $2.6 billion in scientific and technological education.
- The Consultative Group on International Agricultural Research mobilized $140 million in 1981 to support 13 international programs, of which $14.6 million came as a grant from the Bank administrative budget.
- Bank research on appropriate technology has developed new low-cost approaches to civil works construction and to urban sanitation.
- Bank projects, totaling $118 million, encourage technological innovation in industry.

- IFC has invested $2.6 million in 3 venture capital companies.

- The Bank has helped develop capacity for project design and implementation in many countries and sectors. For example, it helped build Brazilian highway engineering to international standards.

The Bank has unique advantages for work in science and technology.

- It has money, influence, an understanding of development, and concern for social problems.

- It can scale up successful innovations.

- It can help build local technological capacity and at the same time involve it in major investment projects.

- It can plan and fund large-scale research on critical global problems.

- It can influence national policies to encourage research, innovation, and more appropriate choice of technology.

But compared to its potential, the Bank's current activities are modest. Its approach is unduly cautious and unsystematic.

The report therefore recommends a long-term expansion of its current efforts:

- The Bank should make scientific and technological development an explicit objective.

- The Regions, relevant support departments, and IFC should develop long-term plans to strengthen their work in science and technology.

  Example: Each OPS and EIS sector department should address national and global needs for research, development, pilot tests, and the building of technological capacity in the sector in which it works.

- The Bank should revise its policies and procedures so as to encourage initiatives in science and technology and make them a regular part of its work.

- The Bank should increase its lending for research, development and pilot tests.

- The Bank should provide grants to research of broad potential application, both in international programs like the CGIAR and (with appropriate administrative arrangements) to individual research projects.

- The Bank should announce its policy on science and technology in the President's annual address, and convene in, say, FY84, a high-level external advisory committee to review how the effectiveness of that policy can be further increased.

DRAFT
June 9, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980S

Table of Contents

Draft
June 9, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

Summary

i. Science and technology have changed the world beyond recognition several times in the last few centuries, and will no doubt do so again within the next decades. Science and technology have played a key role in the development of the United States, Western Europe and Japan.

ii. In the developing countries, investments to date on research, innovation and the development of technological capacity have given high rates of return through increased agricultural production, improved health and nutrition, more effective development of natural resources, and better choice and operation of imported technology. For example, improved technology for the production of wheat and rice have added $3-4 billion to the annual agricultural output of the developing countries, and have transformed most countries of South and South-East Asia into net food exporters.

iii. By contrast, neglect of the scientific and technological aspects of development has been a major factor in a number of unhappy experiences in the fields of agriculture, energy, and environment. For example, long-standing neglect of technological capacity and research has left South American governments ill-prepared to deal with the flood of immigrants now pouring into the fragile ecosystem of the Amazon valley.

iv. Despite their high potential contribution to development, investments in science and technology in developing countries have been relatively

limited. Only 12 percent of the world's scientists and engineers work in developing countries, and only 3 percent of the world's investment in research and development takes place there. For example, only 44 U.S. cents was spent on agricultural research in developing countries in 1975 for each member of the agricultural population, compared to about $175 in the United States. Research expenditure on malaria amounted to 2 cents per infected person in 1978, as contrasted with $850 per cancer patient in the United States.

v. The Bank would open up new opportunities in renewable energy, health, population, agriculture and other sectors if it increased its support to research and development needed to produce technical advances in these fields. For example, the development and widespread use of high yielding trees and other energy crops could make a major contribution to combatting deforestation, stemming balance of payments losses due to imported fuels, and opening up new avenues of rural development.

vi. By improving the capacity in developing countries for making scientific and technological decisions, the Bank would make possible sounder patterns of development--sounder because they are rooted in the countries' own perceptions of their needs, resources and capabilities, more conserving of energy and the environment, and more suited to creating productive jobs.

vii. Science and technology is a key underpinning for all stages of development, in both the modern and the traditional sector. Exclusive reliance on foreign technology--the present pattern in most developing countries--too often results in the use of expensive, inappropriate technology. Moreover, for some problems such as tropical diseases and farming systems for the small farm, adequate technology is not available and is unlikely to emerge without research and development specifically directed to these problems in developing countries.

viii. The private sector plays a critical role in the development of technology and technological capacity. But even in the most advanced countries, private investment in research, development and commercial innovation is insufficient to meet national needs, especially in fields where market incentives are lacking. For this reason, Japan, most European countries, and many advanced developing countries encourage and supplement technological innovation in the private sector by government action. In most developing countries, the private sector, including both commercial firms and voluntary organizations, is more flexible and efficient than its public counterparts, but is unaccustomed and ill-equipped to invest in research or in innovative technology, especially when commercial markets for the new product are not assured. Development assistance agencies could make a substantial contribution to technological development if they helped private firms to undertake these risky activities.

ix. More generally, the present efforts of the international community to assist the scientific and technological development of less developed countries, while substantial, fall short of the need for such assistance. The Bank is well placed to fill many of the gaps in the international effort to mobilize science and technology for the benefit of developing countries, in areas where other international institutions are unlikely to be effective and in which the interest of the private sector has up to now been limited. The limited work of the Bank in science and technology to date has been very effective and indeed includes some of its most important contributions to development. It should be substantially expanded.

x. The Bank can help to expand the general level of scientific and technological capacity and activity through its lending. It can develop

imaginative ways of collaborating with the private sector to stimulate innovation and to introduce improved technology. It can also play a leading role in efforts to link local scientific and technological capacity with production, to scale-up successful innovations, to plan and carry out large-scale research on scientific and technological problems facing the entire developing world, and to improve the awareness and understanding of the scientific and technological dimension of development among policy makers and the entire development community.

xi. Science and technology forms part of the normal project work of the Bank. Most Bank-financed projects use existing production technology, which is identified, transferred and adapted to the particular conditions of the project. Local people are trained to implement and operate the technology. Bank-financed projects occasionally improve existing technology or even develop and introduce a new technology.

xii. The Bank has made a good start towards a program of specific support to the scientific and technological development of its member countries. Its support to education and to agricultural research and extension amounted to $2.6 billion and $0.98 billion, respectively, through June 1981. The Bank supports pilot and demonstration projects, the building of local technological capability and the promotion of innovation within enterprises. The International Finance Corporation has invested $2.6 million in technologically oriented venture capital companies in three countries. The Bank Group's operations in each of these areas have in general been effective.

xiii. The Bank's scientific and technological work also includes grant contributions to the Consultative Group on International Agricultural Research (CGIAR) totaling $69.5 million from 1972 to 1981, in support of 13

international research programs on the major foodcrops and agro-ecological zones of the developing world. The improved technology for rice and wheat production referred to on page one of this summary was developed by two of these laboratories.

xiv. The Bank has also made a contribution of $2.5 million to international health research in 1981. It has supported research, amounting to $3.0 million, which has resulted in low-cost technological options that will greatly increase the productivity of investments in sanitation and in civil works construction. And it has provided technical assistance to national technology policy, especially regarding measures to promote the local consulting and engineering industry, which plays a critical role in the choice of technology suited to local conditions.

xv. The Bank has succeeded in contributing to scientific and technological development on a scale and with an approach that cannot be matched by other development assistance organizations. Nevertheless, compared to the overall size and scope of the Bank's operations, its efforts in science and technology are modest. Science and technology are not given systematic attention, nor is the Bank's work in this field widely known.

xvi. The Bank misses important opportunities because it lacks a strong policy emphasis and a systematic approach to technology. Staff tend to be cautious in approaching innovations in this area, and to assign them a low priority compared to other requirements of the lending program. Even the large-scale implementation of technology developed through the Bank's own research, as for example in low-cost road construction, is lagging for this reason.

xvii. There is a plentiful supply of ideas, both inside and outside the Bank, on the basis of which the Bank could develop a portfolio of projects and non-lending activities of high potential payoff. Discussions with potential borrowers indicate a high level of interest in the possibility of Bank assistance in this area. A Bank initiative in science and technology would have substantial impact.

xviii. Current resource constraints, however, require that the recommendations outlined below constitute a long-term policy framework within which specific activities can evolve over time. In many areas, this process is already underway. But not all the specific recommendations which follow can be implemented immediately.

Recommendations

xix. The Bank should decide to make scientific and technological development an explicit, high priority objective of its work. It should strengthen and expand the Bank's activities in science and technology.

xx. The Bank's objective in so doing should be: to build scientific and technological capacity in its borrowers and to encourage the use of that capacity to analyze practical problems and to implement the corresponding solutions; to improve the assessment and choice of technology by its borrowers and guide them towards the solution of outstanding development problems; to promote international research and diffusion of technologies on problems specific to the developing world; and to improve the understanding of the scientific and technological dimension of development.

xxi. To this end, each of the sector departments of the Operations Policy and the Energy and Industry Staff should seek out ways to increase the effectiveness of Bank work on the scientific and technological aspects of its particular sector.

xxii. The Bank should encourage lending for research, for development of scientific and technological capacity, and for pilot testing and demonstration of innovations, as elements of its projects. It should pay more attention to science and technology at all phases of the project cycle, and should encourage new approaches to promoting technological development.

xxiii. As regards research, a policy paper has already recommended increased lending for agricultural research. Lending in support of industrial innovation at the entreprise levels should also be increased. Pilot projects should be supported in such fields as renewable energy and labor-intensive civil works construction. In addition, bank technical assistance should contribute to the overall needs for development of local technological capacity, for example in pre-investment, engineering, and the formulation of national policy in the technological aspects of development.

xxiv. As an example of the search for new approaches suggested in the preceding paragraphs, there should be a systematic effort to examine key subsectors (e.g., building construction, agricultural machinery, post-harvest storage and transport, draft animal power, communication in remote areas) where improved technology and increased technological capacity could have a wide-ranging effect. Each sector should also address the problem of keeping its technical staff up-to-date with advances in science and technology. This problem is particularly acute because of the neglect of staff training in the past.

xxv. The International Finance Corporation (IFC) should continue to increase its investments in venture capital companies in developing countries, and should explicitly seek out profitable investments which use advanced or innovative technology (e.g., microcomputers) and which lead to the manufacture of new products designed to address social problems (e.g., agricultural or educational equipment). Discussions with the private sector in developed and developing countries could lengthen this list of ideas for expanded cooperation with the private sector in science and technology.

xxvi. The Bank should strengthen its own policies and procedures in ways that will facilitate and encourage its scientific and technological work. It should be more willing to accept the risks, staff costs and longer time horizons typical of such projects. The identification of priorities for research and for the testing and diffusion of new technology, and the preparation and promotion of proposals for research programs, pilot tests and demonstrations, should be a normal part of Bank work. Staff and other resources should be allocated for this purpose. In particular, resources should be provided for the identification, preparation and supervision of research and pilot projects that are included as components of investment projects.

xxvii. Programs and projects departments should give more attention to the scientific and technological elements of national development strategy, as they affect the Bank's lending program, its technical assistance and its policy dialogue with and advice to member governments. One way to begin would be to introduce a scientific and technological dimension in country economic and sector work in a few countries of each Region.

xxviii. A number of countries are beginning to develop, with technical assistance from the Bank, a national overview of the technological aspects

of development policy. This work should be expanded, guided and synthesized so as to further the general understanding in the development community of the role of science and technology in development.

xxix. The Bank should expand its support for high priority scientific and technological research, and should be prepared to devote part of its administrative budget or its profits for grants to such research. Depending on the problem, the Bank might support development and demonstration of a new approach to development in a particular sector, a global research system, individual scientific and technological research projects, or cross-disciplinary research on the scientific and technological dimension of development.

xxx. Increased Bank lending for research has been proposed in paragraphs xxii-xxiv above. The Bank should also make research grants. These might take the form of contributions to global programs, comparable to the Consultative Group on International Agricultural Research (CGIAR) and the Special Program for Research and Training on Tropical Diseases (TDR), in such fields as population and renewable energy. The Bank should also establish a separate Scientific and Technological Research Budget for the funding of specific research undertakings of broad potential application. Successful innovations resulting from such research should be systematically tested, demonstrated and promoted, including appropriate measures for design and manufacture in developing countries.

xxxi. Cross-disciplinary research on the scientific and technological dimension of development, such as the work currently underway on the acquisition of technological mastery in the modern industrial sector,

is a critical underpinning to the proposed expansion of Bank operations in this area. The Bank should allot higher priority to the preparation and funding of such research, in view of its importance and its relative neglect in the past.

xxxii. The Bank's efforts in science and technology could increase substantially within the present staffing and organizational framework, through increased focus by the operating and sector departments. A central promotional and support staff is also needed. The present Science and Technology Unit in the Projects Advisory Staff is very small for this purpose.

xxxiii. For the longer run, the Bank should consider other measures for expanded financial and staff support to research, depending on the evolution of the Bank's financial situation and of its support to research in economics and the social sciences.

xxxiv. The Bank should launch its expanded activity in science and technology with a public information effort. This should include prominent mention in the annual address by the President of the Bank to the Board of Governors and perhaps a special address to an audience of distinguished scientists and technologists. It should convene in, say, FY84, an ad hoc external scientific and technological advisory committee to review how the effectiveness of the policy recommended here can be further enhanced.

Draft

June 9, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

I. Science, Technology and Development[1]/

1.01 The introduction of new technology for industry, agriculture, power, communications, and public health has led to dramatic gains in the developing countries. The economic returns to investment in science and technology are substantial; in agricultural research, they frequently exceed 40 percent a year. In a particularly favorable case, the annual rate of return on investment in rice research by the International Rice Research Institute (IRRI), an internationally funded laboratory in the Philippines, is estimated to be about 80 percent through 1975.[2]/

1.02 The scientific and technological dimension of development is not limited to research work. It also includes developing local capacity to make

---

1/ This paper uses the definition of technology in Webster's Third New International Dictionary (Springfield, MA: G.&C. Merriam, 1966) as "a technical method of achieving a practical purpose," where "technical" signifies "having special and usually practical knowledge, especially of a mechanical or scientific subject." As used in this paper, these "technical methods" include both the tools and equipment, and the know-how, institutions and policies needed to apply them to a problem. The term "technological development" includes research, innovation, and the building of technological capacity in the sense defined in para 1.02-1.03.

Science is defined in the same source as "knowledge concerned with the physical world and its phenomena covering general truths or the operation of general laws, especially as obtained through scientific methods."

This paper is concerned only with the natural sciences and with technologies based thereon. The importance of the social sciences is readily acknowledged, but they are generally beyond the scope of this paper.

2/ G. Scobie, "Investment in International Agricultural Research: Some Economic Dimensions," World Bank Staff Working Paper #361. October 1979.

technological decisions in designing and implementing projects, assessing their social and economic impact, selecting and acquiring technologies, and adapting them to local conditions and promoting research and innovation.

1.03 These skills in a country, a sector or an institution, taken together, are for brevity called its technological capacity. Such capacity requires a supply of people trained in the natural and social sciences, engineering and management, as well as institutions which provide them with a setting where they can use their skills in helping solve problems that are important to the development of the country. The contribution of this capacity to development is harder to quantify, but it is at least as important as that of research and innovation.

1.04 Yet developing countries have given little policy attention to science and technology, and their direct investment in this area has been relatively low. The Organization for Economic Cooperation and Development (OECD) estimates that only 12 percent of the world's scientists and engineers work in developing countries, while only 3 percent of the world's investment in research and development takes place there. The total annual expenditure in the poorest developing countries in 1978 for agricultural research has been estimated at 26 cents(US) for every person dependent on agriculture for a livelihood, as opposed to $1.25 in the better off developing countries, and about $175 in the United States. Worldwide expenditures on tropical disease research are miniscule compared to the amounts spent on cancer and heart disease. Research expenditures on malaria, for example, amounted to only two cents per infected person in 1978, as contrasted with more than $850 per cancer patient in the U.S. alone. The total world research budget for all tropical diseases in 1975 amounted to only $30 million.

The Contribution of Science and Technology to Development

1.05 In favorable cases, a modest investment in science and technology can bring benefits unattainable in any other way. Conversely, inattention to or mismanagement of science and technology can lead to serious problems. Indeed, even successful applications of science and technology may give rise to secondary problems that require careful attention.

1.06 Some examples follow, first of dramatic contributions of science and technology to development.

(a) New technology has made possible self-sufficiency in food and competitiveness of an export commodity:

- High-yielding varieties of wheat and rice, first developed in international laboratories and then adapted and diffused by national researchers and extension workers, helped to transform India from a significant importer of food grains in the 1960s to a marginal exporter in the mid-1970s.

- Careful attention to agricultural and technological research has allowed natural rubber to compete effectively with synthetic rubber in world markets, despite predictions made at the end of World War II that it would follow natural indigo to extinction.

(b) Technological innovation has made possible new approaches to health, population and nutrition:

- The introduction of the bifurcated needle for quick vaccination of large groups of people, and the invention of the technique of concentrating

vaccination efforts in areas where sources of infection are known to be prevalent--instead of mass vaccination of the entire population--were turning points in the successful campaign of the World Health Organization (WHO) to eradicate smallpox.

- The development in the 1960s of renewable means of contraception--the pill, the intra-uterine device and the injectable contraceptive--made possible the establishment of national programs of population control.

- Specially formulated, nutritious, low-cost soft drinks and packaged cereals, marketed through commercial channels under the trade names Vita-Soy and Incaparina, respectively, have substantially reduced urban malnutrition in Singapore and Guatemala.

(c) Space technology has opened new possibilities in insect control and in resource planning:

- Better understanding of the meteorological patterns that influence breeding, swarming and migration of desert locusts, together with satellite monitoring of climatic features that are favorable to them, have greatly reduced the threat of the desert locust in the Middle East and East Africa.

- Use of satellite imagery, accompanied by appropriate use of aircraft and ground survey, has made land use planning much faster, cheaper and more comprehensive.

(d) Local engineering has contributed to energy self-sufficiency and to the fulfillment of basic needs:

- Brazil has been able to mount a major program to promote the economical production of fuel ethanol in large part because of its ability to adapt and manufacture competitive equipment for crushing, fermentation and distillation.

- The present high level of competence in the profession of sanitary engineering in Latin America is largely the result of a program, financed by the Rockefeller Foundation in the 1930s and by the Institute for Inter-American Affairs in the 1940s, which combined high-level training with job placement within the country.

(e) Local basic researchers can identify, address and help solve problems of critical local importance:

- Chinese scientists proved that kashen disease, a fatal heart ailment common in children and young women in certain parts of China, was due to seasonal selenium deficiency, and devised cheap preventive measures that now avert tens of thousands of deaths yearly.

- Indonesian scientists alerted the public and the government to the environmental consequences of two watershed management schemes, and successfully lobbied for major changes which in one case saved a shrimp fishery and in the other avoided premature siltation of a large irrigation scheme.

(f) Local capacity makes possible better choice of imported equipment. It also makes possible mutually beneficial relations between local companies and transnational corporations:

- An engineer in the Ministry of Industry in Burundi rejected proposals for import of an expensive brick-making machine whose capacity far exceeded local needs, and instead identified and obtained approval for the import of a much smaller machine.
- Strong engineering groups in subsidiaries of multinational corporations or in joint venture companies in Korea, Argentina and elsewhere have adapted or developed technology needed to solve local production problems, and thus enabled their companies to manufacture and export products and machinery based on this local technology.

(g) Government support to innovation can spur science-based industry:

- The Korean Technical Assistance Corporation, a venture capital and investment company spun off by the Korean Institute of Science and Technology, has established six companies to manufacture export products based on local technology.
- Subsidies provided by the Government of Israel (and financed by the Bank) to the development of products for export using local technology, have made

it possible for a small Israeli electronics company to to become, in three years, the second largest producer of tomographic scanners in the world.

1.07 Technologies now in the experimental or pilot stage promise substantial contributions to vexing development problems.

(a) Low-cost technology can help slow deforestation:

- Simple cookstoves, made of clay and sand and constructed by local artisans for $10-25, have been readily adopted by test groups of housewives in Guatemala, Upper Volta and elsewhere, and are reported to reduce the consumption of firewood by 50 percent.

(b) Low-cost technology can bring sanitation within reach of the urban poor:

- A Bank research project on low-cost technology for waste disposal found that there are many technologies between the unimproved pit privy and water-borne sewerage that can be recommended for wide-scale replication. A community can initially select a low-cost technology in the knowledge that, as its socio-economic status rises, it can upgrade by a known series of improvements--unlike conventional sewerage, for which large investments and large waterflows are needed from the outset.

(c) Basic and applied biological research using advanced techniques promises in the long run to decrease agricultural production costs:

- Research on nitrogen-fixing bacteria and other microbiological topics promises to allow plants to obtain nitrogen fertilizer from the air and to increase the availability of other nutrients from the soil, thus decreasing chemical fertilizer requirements.

1.08 On the negative side, the following examples may be given:

(a) Failure to adopt available modern technology may be costly:

- Consistent neglect of the principles of modern marketing and of the need for integrated agricultural and industrial research has been a primary factor in the rapid decline of the market for jute, a principal export of Bangladesh and India.

- Failure to incorporate existing germplasm for rust resistance into high-yielding varieties of wheat distributed to Pakistani farmers caused the crop failure of 1977-78, which led to food imports and significant problems in the balance of payments.

- Neglect of the basic principles of integrated pest management led to disastrous failures of the cotton crop in Peru and Mexico, and to a serious reduction in the quality of the cotton produced in the Bank-financed Rahad project in Sudan.

(b) Neglect of research and innovation can also be costly:

- Absence of adequate technological packages, resulting from underfunded and understaffed research programs and institutions, has been an important factor in the adoption of destructive development patterns in ecologically fragile regions, such as the humid tropical forests of the Amazon River valley.

- Worldwide failure to develop and apply technology for the efficient use of energy during the years of cheap fossil fuels has exacerbated the foreign exchange burden from imported fossil fuels after the price increases of the 1970s.

- Inadequate support to forestry research throughout the developing world has hampered efforts to find sustainable technology for production of valuable hardwoods and of fast-growing trees with which to combat deforestation.

- Failure to pursue a vigorous program of research on alternative pesticides has left the Bank-financed River Blindness Control program in West Africa without a readily available, ecologically acceptable pesticide to use if, as now seems likely, the blackfly that carries the disease develops resistance to the pesticide currently in use.

(c) Modern technology may produce inappropriate results in developing countries:

- Strategy followed by previous governments in Iran and Algeria dictated the choice of advanced technology for its own sake, in the hope that a new generation would grow up accustomed to the use of modern technology. This strategy was not accompanied by efforts to improve traditional technologies or to strengthen traditional social structures, and led to a high cost in unemployment, in over-reliance on foreign technical assistance, and in social and political disruption.

- Use of highly mechanized techniques of land clearance and log skidding, rather than cheaper and less destructive manual methods using chain saws, has transformed into useless wasteland large tracts of virgin jungle in South America, Indonesia, and West Africa, which had been planned as the sites of large-scale colonization projects.

- Bank-financed livestock projects in Kenya and elsewhere have promoted American-style, market-oriented beef-ranching. This system was not accepted by nomadic pastoralists, who needed the subsistence they obtained from traditional technology, with the result that production for commercial markets fell well short of that predicted.

The Need for National and International Action

1.09 Almost all the modern technology used in developing countries is imported from the developed countries, either as equipment, know-how or

technical services. The availability of this foreign technology has made it possible for developing countries to benefit from scientific and technological advances made in all parts of the world.

1.10 But this exclusive reliance on foreign technology has its costs. First of all, foreign technology is often not suited to local conditions. It may be too large in scale, too demanding of scarce resources (especially capital, foreign exchange, energy and skilled manpower), or inappropriate to the local culture or ecology.

1.11 Secondly, foreign technology may not be available to address problems and opportunities which are specific to developing countries and hence have not attracted the attention of researchers and suppliers of technology in the developed countries. For example, the only preventive measures and treatments available to combat parasitic diseases affecting tens of millions of people are expensive, difficult to administer, ineffective or toxic.3/

1.12 To overcome these difficulties, developing countries require local skills for mobilizing technology--that is, for assessing local needs and resources, selecting and adapting technologies suited to local conditions, acquiring these technologies at a fair price, and developing new technologies when this is necessary. If this technological capacity does not exist, as is too often the case in developing countries, a country must depend on the unchecked judgment of foreigners for the mobilization of technology, which is therefore likely to be more expensive and less efficient than it could otherwise be.

3/ A partial list of such diseases includes filiariasis (a family of diseases which includes elephantiasis and river blindness), trypanosomiasis (African sleeping sickness and Chagas' disease, its South American counterpart), and leishmaniasis (a disfiguring disease, one variety of which, kala azar, is fatal).

1.13 Why Governments Support Scientific and Technological Development. The encouragement of scientific and technological research has been a function of government since the Industrial Revolution and indeed (in the specific case of military technology) since ancient times. All developed countries support substantial programs of scientific research. In addition, the governments of Japan, France, Germany and many other European countries have developed explicit and comprehensive strategies for technological development.4/ Among developing countries, science and technology policy is particularly important in Korea, Brazil, India, Mexico, Malaysia and China.

1.14 The general economic justification of government intervention in support of scientific and technological development lies in the fact that the benefits from technological innovation accrue to many firms and also to consumers and thus exceed their value to the individual firm that produced the innovation. Even if this were not so, individual firms may be too small or too risk-averse to undertake the level of research, development and innovation which in the aggregate could be optimum for the industry or the country.

1.15 In developing countries, the preeminent justification for public support to scientific and technological development is to ensure that the capacity for scientific and technological decision making, adaptation, innovation and research is deeply rooted in the country. Even in countries with a relatively low level of technological development, technology cannot

---

4/ The U.S. lacks a well-defined technology policy. Public support to civilian technological development in the U.S. is in large part a by-product of support to scientific, military and space research, and of tax incentives to private investment in research and development and to venture capital companies.

simply be transferred. Rather it must be understood, adapted and operated by local people. There are moreover in every country important problems of policy and of research that can only be addressed by local scientific and technological capacity.

1.16 In principle, government policies intended to promote technological development should balance measures intended to increase the supply of improved technology with measures intended to increase the demand for such improved technology. Supply-oriented measures include funding universities, training programs, laboratories, technological institutes, patent offices, bureaus of standards, research granting agencies, and appropriate technology organizations. Demand-oriented measures include policies and programs intended to have a direct effect on the willingness of the productive sector to use improved technology--subsidies or tax incentives for research and development in industry, subsidies or other encouragement to specific innovations, government regulation of or intervention in private negotiations concerning commercial transfers of technology, and special taxes earmarked for training or research. Indirect measures to increase demand for improved technology include: liberal trade policies, properly valued exchange and interest rates, tariff structures that encourage local processing, price structures that encourage local production and improved product quality, and environmental or other administrative regulations which impose requirements that can be met only with improved technology. Demand-oriented measures can be effective only if a minimum level of manpower and infrastructure is already in place.

1.17 Scientific and Technological Capacity as a Critical Element in All Stages of the Development Process. In its early stages, scientific and

technological development is primarily concerned with the choice and implementation of imported technology, the development of human resources at all levels, and the establishment of basic scientific and technological infrastructure, typically beginning with higher education and with agricultural research and extension. At this stage, trained manpower is limited, and is stretched very thin in its efforts to address the many pressing development problems requiring scientific and technological expertise. Yet even these limited resources are frequently not applied effectively. The technological needs of the poor majority are particularly likely to be neglected by "mainstream" sources of technology and are frequently addressed only by non-governmental voluntary organizations.

1.18 In the more advanced developing countries, the basic scientific and technological infrastructure is typically in place: universities, basic research laboratories, technical libraries, agricultural and industrial laboratories and extension services, bureaus of standards and other basic technical services, a reasonable supply of scientists and engineers, a set of professional organizations, a consulting and engineering industry, capabilities for the processing of large quantities of information and for the use of other advanced technologies, and engineering and research units in the larger enterprises.

1.19 On the other hand, the quantity and quality of the work of these institutions is frequently spotty, as is their record of focussing on problems that are important to the country and of ensuring that successful results are brought to the attention of prospective users and implemented. The technological needs of the poor often continue to be neglected, although this situation is improving in some countries through the efforts of both governmental and non-governmental organizations.

1.20 In these most advanced developing countries, imported technology is "transferred" to the modern sector of the economy, in the sense that local people learn to operate it and usually to manage the installation. But the technology is not usually mastered to the point where local technologists could adapt it in response to a local situation or a problem encountered in operation, or could design a similar plant without extensive outside help, let alone develop an indigenous technology or develop new products suited to local markets. Moreover, the ordinary workings of the capital markets in most developing countries discourage risky ventures based on unproven technology, however promising they may be. This inhibits the process of technological innovation.

1.21 This pattern of reliance on "undigested" foreign technology has isolated local technologists from the economy that they are supposed to serve, and has made it difficult for them to make the contribution of which they are capable. Scientific researchers are still further isolated for want of a "critical mass" of local scientific competence and of a vigorous indigenous technological community which can translate practical difficulties into researchable problems and successful research results into usable technologies.

1.22 In these countries, moreover, economic policies that affect wage levels, interest rates, exchange rates, and tariff levels have frequently been responsible for a pattern of technological development that is inappropriate to local factor endowments and that fails to create a sufficient number of productive jobs. Social programs aimed at improving the life of the poor or at helping the development of the informal sector

only occasionally include encouragement to scientific and technological research and innovation. There is little demand, either from the market or from government programs, for the development of simple, low-cost technology. There are few inducements tending to overcome the natural isolation of the country's modern technological resources from the problems of the poor, and few avenues open to the poor to acquire the organizational and technological means to address their own problems.

1.23 In a few, more advanced developing countries, manufactured exports are already competitive with those of industrialized countries across a broad range of product lines. While these countries still depend for the most part on imported technology, it is likely that scientific and technological research, development and innovation will soon become important elements of their market competitiveness in some sectors. These countries are beginning to export technology in special situations and to confront many of the problems of technology policy and management typical of the more advanced industrialized countries.

1.24 Problems in Building Scientific and Technological Capacity. The efforts of the international community (other than the Bank) to promote the development of local technological capacity in the developing countries, and to support research and innovation on scientific and technological problems specific to the developing countries, are briefly summarized in Annex I of this report. While many individual projects and programs have produced important results, collectively these efforts fall far short of the needs for this type of assistance.

1.25 Recent attempts to bridge the quantitative gap by creating major new sources of funds have not been successful. An attempt to create a new

institution in the United States for this purpose failed, while the United Nations Financing System for Science, Technology and Development is struggling for survival.

1.26 Existing efforts, moreover, have difficulty in dealing with a number of special problems connected with the scientific and technological dimension of development. These are: (i) the lack of mutual understanding between scientists and technologists, on the one hand, and development planners and aid administrators, on the other; (ii) the gap between the laboratory and the productive sector; (iii) the fact that many problems of scientific and technological research are global in scope and cannot be efficiently tackled in isolation by any single country; (iv) the inadequate understanding on the part of researchers on development issues of the role of technology; and (v) the special needs of the individual inventor or researcher and of the informal and small-scale innovator.

1.27 The first of these problems is the lack of mutual understanding between scientists and technologists, on the one hand, and development planners and aid administrators, on the other. Political leaders and economic planners are generally unfamiliar with science and technology, and focus their planning on the short term, without adequate consideration of the impact of their decisions on scientific and technological development, and, conversely, of the effect of likely scientific and technological advances on their development plans.

1.28 For example, economic planners may decree a sudden shift from protectionist to liberal trade policies without taking appropriate measures to strengthen the technological competitiveness of local firms. Officials

may decide to protect a given industry or to raise the price of a commodity without taking into account technological changes that will make it obsolete. Large, long-term investments may be planned on the basis of a given currently available technology, with inadequate consideration of alternatives and no provision for research to ensure that better technology will be available in the future. Public officials may be unwilling to implement the special measures needed to ensure the effectiveness of scientific and technological institutions, and to assure the motivation of researchers and other technologists and to encourage them to pursue their careers in their home countries. Perhaps most important, policy makers may be too ready to believe in the automatic effectiveness of market forces in inducing appropriate choice and development of technology, ignoring such market imperfections as inadequate information on technological alternatives, inadequate capability to judge among them, unavailability of proven technology to meet the particular conditions of a developing country, insufficient firm and market size to support research and development, and non-availability of capital to finance innovative projects not fully backed by collateral.

1.29 On the other side of the fence, scientists and technologists in developing countries have too often chosen research problems because of their international interest or their intellectual attractiveness rather than for their local relevance. Even scientists and technologists with an interest in practical local applications of their research may find their work frustrated by their own lack of understanding of its broader context. For example, they may carry out extensive projects to improve the quality of local building materials without taking into account the constraints of market demand and capital availability that make cheap, low-quality materials more profitable to the manufacturer and the contractor.

1.30 The conceptual gap between the two groups also leads to the neglect of institutions and policies needed to ensure that science and technology is closely linked to the economy. It is common for neither group to recognize the importance of the consulting and engineering profession, not only as a source of business profits, but also as an element of local technological capacity that plays a critical role in local choice and implementation of technology.

1.31 The second special problem connected with the scientific and technological dimension of development is the gap between the laboratory and the productive sector. The productive sector in developing countries is in general unaccustomed and ill-equipped to invest in research and development or in the commercialization of innovative technology. Financial institutions in most developing countries are averse to risk and usually lack the capacity to evaluate innovative technology. The annals of developing country laboratories and development assistance agencies are filled with stories of innovative technologies found to be especially suited to developing countries, that never received full-scale tests for want of financial, policy or institutional support, or because the inventor or research institution lacked the means, the drive, or the business acumen to advance beyond the prototype or the research publication. To be successful, most of these inventions would have required specific efforts to develop a pilot plant or manufacturing prototype suited to the needs of a particular manufacturer, and to help him develop products and markets,

perhaps for an extended period. With a few exceptions,5/ development assistance institutions have avoided this kind of close association with the private sector.

1.32 Examples of existing technologies which deserve increased attention of this kind include: (i) simple, low-cost methods for constructing earthquake-proof houses from adobe; (ii) technology for making cottonseed into high-protein meal suitable for human consumption, e.g., as a milk substitute; (iii) low-cost, hand-operated looms and knitting machines capable of producing complex designs from a wide variety of fibers; (iv) low-cost equipment for teaching primary and high school science, including an 80-power microscope that can be manufactured for about US$0.50; and (v) designs for improved low-cost bullock carts and animal-drawn implements, which could extend the working life of a bullock by 20-30 percent and greatly increase its efficiency.

1.33 A third special problem is the fact that many of the most important research problems affecting developing countries are global in scope and are best approached through global initiatives on the scale (although not necessarily in the form) of the CGIAR.

1.34 To develop such proposals requires a complex blend of technology policy, institutional design, and international and interagency diplomacy.

5/ Notable efforts to assist developing country manufacturers to fabricate and commercialize equipment designed to be especially suited to local conditions are those of the International Rice Research Institute (IRRI), one of the international laboratories supported by the CGIAR, of the Appropriate Technology International (ATI), a US-based non-governmental organization, and of the Intermediate Technology Development Group (ITDG), a British-based non-governmental organization. Examples of successful design and promotion of low-cost equipment by these organizations include machines for paddy rice production (IRRI), low-cost roofing materials (ITDG) and micro-hydro generator systems (ATI).

This is expensive in staff time but offers prospects for major benefits. For example, research proposals could be prepared which could result in the development of new varieties of fast-growing trees for fuelwood and reforrestation, of new crops for the production of energy on marginal land, and (in the longer run) of methods for predicting the monsoon on which hundreds of millions of people depend for their food supply.

1.35 The fourth problem lies in the need for interdisciplinary research on the technological dimension of development. A good deal is known about the role of prices and incentives on the choice of technology and on the speed and direction of technological development; the cost and benefits of research; the factors that have led to the development of indigenous technological capacity, especially in modern industry; the contributions of universities, research laboratories, technological institutes, consulting firms, and other scientific and technological institutions to economic development; and the techniques of managing these institutions to maximize their contributions.

1.36 But many broad questions remain unanswered. What are the trade-offs and reinforcements in the long and short run between growth, innovation and the development of local technological capacity--a concept which, as we have seen, extends considerably beyond research? How should a country with few technological resources deploy them for maximum effect? What is the meaning of local technological capacity to a very poor country, and what are its costs and benefits? How can science and technology best be mobilized for the benefit of the poor? These and other questions demand a substantial long-term research effort. In the shorter run, much could be accomplished by a systematic effort to survey the links between local scientific and technological capacity and the productive system in a representative set of developing countries, and to strengthen these links

by applying ideas that have already been developed in this field. Such an effort could greatly broaden the data on which existing ideas are based and could lead to the definition of issues needing research.

1.37 A fifth problem connected with international support of science and technology is the need for special measures to recognize and support "small science and technology" -- a domain which includes the senior researcher with at most a few assistants, the backyard inventor, the inventive entrepreneur, the shop-floor innovator, or the non-governmental voluntary organization. Governments and international agencies all over the world tend to concentrate on large institutions and programs to the neglect of this domain, despite the fact that much of the most innovative research in both developed and developing countries takes place there. Special measures are needed to ensure support to these gifted individuals, both in educational institutions and in the private voluntary or commercial sector.

1.38 Examples of the accomplishments of "small science and technology" include: (i) discovery by a small group of researchers in a Brazilian university that certain free-living bacteria living in the roots of non-leguminous plants can fix atmospheric nitrogen, a discovery that opened up new horizons on a process that could, if it can be harnessed, save substantial amounts of artificial fertilizer; (ii) pioneering work by small private organizations on improved gardening techniques, woodstoves, windmills, and many devices for the use of solar energy, well in advance of official research institutions; and (iii) invention by a poor farmer in Upper Volta of a system of low-cost dikes and culverts to slow run-off and increase percolation and hence the supply of underground water--at a time when foreign experts were promoting expensive storage dams.

II. The Role of the Bank

2.01 The World Bank's comparative advantage in science and technology, as in other fields, results from its unique combination of financial resources, technical competence, policy influence and direct involvement in major investments. The Bank has made important contributions in science and technology, and the scope and effectiveness of its work in this area is increasing year by year. Still, considering its unique advantages for work in this field, these contributions fall far short of its potential.

2.02 The Bank has much more money than other UN specialized agencies or aid organizations whose main function is to support research and technical assistance in science and technology.

2.03 But more than this, the Bank's experience with the financing of large-scale development projects gives it insights into the practical problems of development, of building local scientific and technological capacity and of scaling up innovative technology, that are often not available to institutions concerned with funding and carrying out research. Its influence with political leaders and with the development community allows it to raise policy issues which, although not explicitly concerned with science and technology, have a critical influence on scientific and technological development. For the same reason, the Bank is in an excellent position to raise worldwide awareness of the importance of science, technology and development.

2.04 The Bank's links with the financial community and the private sector allow it to develop imaginative ways to collaborate with private industry to promote needed innovations. Its policy and orientation towards poverty are unusual for a technologically sophisticated institution, and allow it to draw the attention of national scientific and technological institutions, and of the world scientific and technological community, to the problems of the poor. Its global exposure to development problems, and its experience in establishing the CGIAR and in assisting in the design of the TDR program, give it expertise in the problems of formulating and promoting global research projects. Finally, the Bank is well placed to become a leader in cross-disciplinary research on the scientific and technological dimension of development by virtue of its understanding of the economics of development and its experience with the practical mobilization of science and technology for development.

2.05 The Bank's work in science and technology is an adjunct to its normal activity but not the focus of that activity. As a result, the Bank has become a technological development institution without explicitly acknowledging the fact, much like Moliere's bourgeois gentleman who discovered he had been speaking prose all his life without realizing it.

2.06 This fact is both an advantage and a limitation. It is responsible for the great strength of the efforts of the Bank in science and technology, namely their emphasis on obtaining useful results and on putting them into practice on a large scale--precisely that area where other technological institutions are frequently weakest. On the other hand, science and technology has not received strong policy emphasis as such, nor has there been a systematic approach to seeking out opportunities to contribute to scientific and technological development.

What the Bank Has Accomplished in Science and Technology

2.07 The Bank has made important contributions in science and technology through the choice and implementation of technology in the development projects which it helps finance, through its support to international research programs, through its lending for national research, innovation and technological development, through direct investments by the IFC in technological innovation in the private sector, through internal research and policy development on alternative technology and the choice of technology, and through technical assistance in the choice of project technology and in the development of technological capacity. Annex II gives a list of documents which describe different aspects of the Bank's work in science and technology.

2.08 Choice and Implementation of Technology in Investment Projects. One of the largest contributions of the Bank to the technological development of its borrowers takes place through its involvement in the selection, preparation, appraisal, and supervision of the investment projects it finances. Most Bank-financed projects use existing production technology, which is identified, transferred and adapted to the particular conditions of the project. Local people are trained to implement and operate the technology. Bank-financed projects occasionally improve existing technology or even develop and introduce a new technology. An interesting example of the latter is the support in a rural development project in Paraguay for the production, processing and marketing of a new natural herbal sweetener, ka'a he'e.

2.09 The Bank's project work is intended to ensure that the technology used in the projects it finances is suited to development goals and to

to local conditions, and that they develop local technological capacity in the sense defined in para. 1.02-1.03. The sophistication of the equipment used in Bank projects ranges from modern telecommunications and remote sensing hardware at the one extreme, to oxcarts and handpumps at the other.

2.10 Support to International Research. The Bank has helped to organize, and now presides over, provides the secretariat for, and contributes to the CGIAR, the largest and most important internationally-funded global research program on a scientific and technological problem of special interest to the developing world. The CGIAR supports 13 programs covering maize, wheat, rice, legumes, cassava, livestock and other major foodcrops of the developing world. The CGIAR mobilized $140 million for these programs in 1981, of which the Bank contributed about 10 percent. Bank contributions from 1972 to 1981 total $69.5 million.

2.11 Agricultural research by institutions currently funded by the CGIAR has made possible a greatly improved technology for rice and wheat culture which has been implemented on a massive scale world-wide. This "Green Revolution" technology has made possible $3-4 billion worth of increased agricultural output, and has transformed almost all countries of South and South-East Asia from net importers to net exporters of food. While initial benefits from increased yields went for the most part to larger farmers with assured supplies of water and fertilizer, smaller farmers began within a few years to benefit in proportion to their holdings.

2.12 More recent research funded by the CGIAR has resulted in varieties which have given promising results in large-scale field trials of tropical potatoes, pulses (pigeon peas and chick peas), sorghums, millets

and cassava. Important progress has also been made in research on farming systems, crop physiology, and animal diseases.

2.13 In May 1981, the Bank's Executive Board approved a $2.48 million contribution to the Special Program of Training and Research on Tropical Diseases (TDR), a program executed by the WHO which funds and coordinates research on six major tropical diseases: malaria, leprosy, schistosomiasis, filariasis, trypanosomiasis and leishmaniasis. The Bank previously acted as fiscal agent for the program and provided technical assistance in the design of its management system. The TDR program began only in 1977, but has already speeded the achievement of important scientific advances in the fight against four of these diseases.

2.14 Project Lending for Development of Scientific and Technological Capacity. The Bank financed 223 education projects totalling $3.9 billion in 87 countries from 1963 through June 1981. Two-thirds of this lending, or $2.6 billion, was for education in science and technology.

2.15 The Bank has assisted in strengthening 36 free-standing state or national agricultural research and extension projects in 14 countries and has supported agricultural research components in over 300 projects in 80 countries. Bank support to agricultural research and extension has amounted to $982 million through fiscal year 1981.

2.16 Bank experience to date indicates that these free-standing agricultural research and extension projects are difficult but worthwhile. The Bank has generally succeeded in persuading governments to make the institutional changes needed to encourage research institutes to cooperate more closely with each other and with the extension service, and to focus more clearly on the practical needs of the farmer. In so doing, they have

laid the foundations for the future development of new technologies for increased agricultural production. On the other hand, while it is too early to draw definite conclusions, experience with research components in regular investment projects appears to have been less favorable. Such components have typically suffered from insufficient attention during preparation and supervision, both by the borrower and the Bank staff.

2.17 In the industrial sector, the Bank has provided $118 million for projects to finance innovative government programs to encourage and help technological innovation in industrial firms in nine developing countries. The first of these projects were financed in more advanced countries in order to test their effectiveness under relatively favorable circumstances. For example, a project in Spain finances a governmental institution, run with entrepreneurial spirit, which has already begun to earn income from innovations it has catalyzed in the private sector. A project component in Israel financed the development of the non-convective solar pond, a promising new method for generating process heat and electricity from solar energy that is attracting worldwide attention.6/ A project component in Brazil supports research, development and demonstration of new technologies for the exploitation of renewable energy. Projects now in preparation in seven more countries will support a comprehensive upgrading of the mechanical and electrical engineering (machine making) industry, key subsectors with far-reaching ramifications on the technology in use elsewhere in the economy.

2.18 A number of activities are underway within the Bank that will increase its contribution to scientific and technological development in

---

6/ "And Now It's Pond Power," Time, 25 February 1980, p.39.

fields other than agriculture and industry. Bank education lending is beginning to support the development of general scientific and technological capacity (university research, multi-disciplinary technological institutes, bureaus of standards, geological and oceanographic survey and research, etc.). A few project components in support of research on health (especially health management), renewable energy, and ecology are in preparation or the early stages of implementation. Some Bank nutrition projects have included incentives to the private sector to encourage the development and commercialization of low-cost weaning foods.

2.19 The Bank has financed the wide-scale implementation of the training and visit system of agricultural extension, through which extension professionals deliver timely and specific advice to small farmers on improved technologies they can afford to use. While quantitative measurement of the specific effects of extension is difficult, Bank-financed extension projects appear to have produced significant increases in production. Bank-financed urban shelter projects support the provision of sites and services and the upgrading of slums through innovative, low-cost methods by which poor people in cities build or improve their own houses with the help of credit and technical assistance. The government provides low-cost infrastructure, such as paved footpaths, storm drains, water standpipes, sanitary facilities, and access roads for buses and municipal services.

2.20 The training and visit system of extension, and the sites-and-services approach to housing are examples of the application of low-cost technology that is specially suited to the needs of developing countries. In contrast, the Bank has also financed the innovative

application of advanced technology when this is appropriate to developing country needs, such as microcomputers for project planning, evaluation and management; advanced technology for telecommunications and distance learning; and pioneering applications of satellite remote sensing and data analysis technologies for mapping and assessment of resources.

2.21 Direct Investment in Technological Innovation in the Private Sector. The IFC has invested a total of $2.6 million in venture capital companies in Spain, Brazil and the Philippines, and is considering similar investments in Kenya and Mexico. IFC investments occasionally use innovative technology, examples being the production of fuel alcohol from cassava in Brazil, a project in Pakistan using an enzyme conversion process to produce high fructose syrup from broken rice, and the application in Egypt of a Chinese technology for producing ducks and fish from an ecologically balanced system. These projects are proceeding satisfactorily from both the commercial and the economic development points of view.

2.22 Internal Research and Policy Work. The Bank's research on labor-intensive civil works construction, highway design standards and alternatives to water-borne sewerage has established the viability of low-cost technological alternatives in these sectors. The Bank is now executing a UNDP project to test and demonstrate technologies for the recycling and re-use of materials from urban wastes. The Bank is also the executing agency for a project involving laboratory testing, field trials and technological development of manual pumps to supply water for drinking and for small-scale irrigation in rural areas, and for a project to test the use of solar pumping technology for similar purposes. It has formulated and published a global strategy for promoting technological capacity and research on the use of renewable energy in developing countries.

2.23 Some of the Bank's sector policy work, and its country economic and sector work[7/], provide excellent examples of ways in which technology can be integrated into policy and operations. For example, Bank agricultural economists, along with their colleagues in other institutions, have helped to alert officials responsible for research on agricultural production technology in the Bank and in developing countries to the importance of research intended to deal directly with the problems of small farmers. Urban sector work brought home to the sanitary engineering profession in the Bank and worldwide the need for low-cost solutions to urban sanitation problems in low-income countries.

2.24 The economic research of the Bank has contributed to the understanding within the development community of the existence of technological alternatives in agriculture and industry and of the influence of institutional and economic policies on the choice of technology in these sectors. It has shown, for example, that introducing tractors does not necessarily increase the intensity of agriculture but may instead (depending on the local situation) lead to the enlargement of landholdings and the "tractoring out" of sharecroppers.

2.25 Bank research on telecommunications and on educational radio and television has been concerned with the economic impact of modern technology on developing countries, and has emphasized the need for choice of least-cost solutions (e.g., radio rather than television) and for special facilities to meet the needs of poor people (e.g., public telephones in low-income areas). Research is also underway on how several developing

---

7/ See, for example, the Bank sector papers on Agricultural Research (June 1981), Alcohol Production from Biomass in Developing Countries (September 1980), Forestry (February 1978), and Tropical Root Crops (April 1979); the agricultural sector mission to Northeast Brazil in 1974, the economic mission of 1974 to Pakistan, and the missions on the engineering industries of Korea in 1976 and of Thailand in 1979.

countries came to master modern industrial technology to the point where they now export it, and (in collaboration with OECD and OAS) on ways in which national development banks can contribute to technological development. The Operations Evaluation Department has carried out three studies of technology in Bank operations, namely, studies of rural development projects in sub-Saharan Africa, of the diffusion of innovation from Bank-supported projects, and of the practice of the Bank in hiring local consultants.

2.26 Technical Assistance. Bank technical assistance8/ helps build technological capacity through training and "institution building" in virtually all of its investment projects. It helps its member countries in the conception, design and execution of projects, including the choice and management of technology, especially in the generation and implementation of projects, and exceptionally, in the study and implementation of innovative technology. Several courses by the Bank's Economic Development Institute (EDI) include sessions devoted to the appropriate choice of technology and the encouragement of research and innovation.

2.27 The Bank has provided assistance to eight countries in devising policy measures to assist the development of the local consulting and engineering industry, which plays a key role in the selection and design of

---

8/ Bank technical assistance embraces four main areas: (i) assistance financed by the Bank through projects, project components, and the Project Preparation Facility; (ii) assistance administered by the Bank and financed by UNDP or by the recipient country; (iii) assistance provided by the Bank through its staff during the project cycle, through country economic and sector work, and through the Economic Development Institute; (iv) assistance extended by the Bank in cooperation with UN agencies, especially through its Cooperative Programs. (See SecM 80-795, October 20, 1980).

technology in many sectors. In two of these, Indonesia and Bangladesh, specific practical advice is being provided directly to consulting firms or their trade associations. A series of technical assistance and investment projects executed or financed by the Bank over a period of 10-15 years was instrumental in the development of the consulting and engineering industry in the highway and power sectors in Brazil to international levels of competence and competitiveness.

2.28 Finally, the Bank has developed an approach to the technological elements of industrial development policy and has begun to assist three member developing countries (Israel, Korea and Portugal) to carry out studies in this area. In collaboration with the OAS, training in technology policy is being provided to government officials from seven Caribbean countries, using materials derived from Bank experience. The approach focusses on the intersection of technology and economics, and stresses policy measures intended to strengthen local capacity to improve and guide the choice and assessment of technology and to speed and direct technological research and innovation. Several additional country studies and training courses are planned for 1982-83.

The Bank's Approach to Science and Technology

2.29 The Bank has no explicit policy concerning science and technology. Over the years, senior management has lent its support to specific initiatives and the Bank's approach has gradually evolved. The focal point for science and technology in the Bank--the Science and Technology Unit in the Projects Advisory Staff of the Operations Policy Staff--is active but very small. Responsibility for science and

technology lies for the most part with organizational units to which this is only one of many competing considerations.9/

2.30 The Bank's approach to technology has evolved along with its overall approach to project lending. The "enclave" projects of the 1950s typically used proven, large-scale technology, designed and supervised by foreign consultants, executed by foreign contractors and suppliers, and managed with the help of expatriates. By contrast, the rural development loan of the 1970s provided an integrated package of goods and services to raise productivity and living standards, used local staff as much as possible, incorporated extensive training programs, and emphasized lower-cost design and appropriate technology, giving greater opportunities for local contractors and sources of supply.

2.31 This shift in project objective and design has brought about a slow and uneven change in the attitudes of Bank operational staff

---

9/ The balance between a central science and technology function and specific science and technology functions located with project staff is a familiar problem encountered in all large organizations that deal with science and technology, whether governments, departments of governments, or private corporations. The central function has these advantages: familiarity with the special problems of management and policy that are associated with science and technology, relative freedom from the pressure of day-to-day operations, so that it has time to concentrate on long-range problems, broad contacts with the scientific and technological community, respect for fundamental research, and receptivity to ideas that may not coincide with the received wisdom in a particular profession or sector.

On the other hand, a science and technology function close to the user has the advantages of intimate familiarity with the objectives and problems of the particular activity, close association with technologists who are experienced in the area, ability to test an innovation and to implement it quickly if it is successful, and a degree of immunity to desires to pursue technological elegance for its own sake, to build ivory towers dedicated to research of no practical value even in the long term, or to promote projects simply because they are technologically feasible or because they will build a bureaucratic empire for their promoter.

towards such issues as innovation, technological risk, the development of local capacity for pre-investment and research, and the use of local sources of technology and technological expertise in Bank projects and technical assistance.

2.32 The Bank's accomplishments in science and technology have resulted from individual initiatives. Some, like the CGIAR, came from proposals to the Bank and other organizations from outside foundations. But most resulted from the initiatives of individual staff members who "pushed them through the system," often overcoming on the way objections from managers at one or another level that "the Bank doesn't do this kind of thing." One of the the major tasks of the Science and Technology Unit is to develop such initiatives itself and to encourage and support good ideas that come from other parts of the staff.

2.33 One consequence of this decentralized, ad hoc approach is that the Bank's work on science and technology is not well known, nor is the Bank widely regarded as a technological institution. Neither its staff, its member countries, the development community nor the scientific and technological community knows or expects the Bank to be active in this area or believes it particularly worthwhile to develop proposals for support by the Bank of some aspect of technological development. Consequently, relatively few proposals for supporting national or international technological and scientific initiatives come to the Bank from outside, and those that do come, receive limited ad hoc treatment.

2.34 Some of the obstacles faced by these innovators result from inescapable limitations on the Bank's effectiveness as a vehicle for scientific and technological development. First, a project loan is made

through national government channels, which imposes procedures not always suited to innovative work. Second, scientific and technological innovations often require sums of money which are small compared to the typical Bank or IFC investment project. They are therefore most likely to be attached as components to Bank projects in a related area. Third, scientific and technological research may require a time horizon that is long compared to the duration of the typical Bank project. Fourth, the requirement for the government to be the borrower or guarantor of a loan effectively excludes global, and most regional (inter-country) projects. Fifth, science and technology is traditionally associated with grant financing rather than loan financing. Governments--and indeed private companies--are reluctant to borrow for such risky and speculative undertakings.10/

2.35 But more often, these difficulties are unintended results of the Bank's style of doing business. First of all, the Bank budgetary system relies on coefficients derived from historical averages. This tends to discourage new initiatives, especially in staff-intensive fields. The

---

10/ To be sure, there is no logical basis for this reluctance if the borrower can afford the debt burden and the research is important to its future. To take an analogy from private industry, a company whose share of the market was threatened by the absence of new products in its pipeline would be courting disaster if it did not borrow for research and development that it could not finance from internal resources.

Nor should lending terms for projects at the national level for scientific and technological development, education and agricultural and industrial research be more generous than those for any other type of project in the same country, as is sometimes argued. There is no reason to divert the IDA resources that would otherwise go to a poor country to support technological development in a country that is better off.

IFC, for its part, works on a small profit margin and has only a limited promotional budget. Secondly, the time allocated to staff training throughout the Bank has been limited, so that technologists on the staff have had difficulty keeping up to date with developments in their fields.11/

2.36 In general, the choice of technology in Bank projects does not receive the searching management review given to economic and financial issues, nor does the review process concern itself with promoting efforts to identify possible innovations or local sources of technology. Technologists on the Bank staff are expected to be specialists; the hiring of technologically oriented generalists, for example in the Young Professionals program, is specifically discouraged.

2.37 The overall result of the Bank's approach to science and technology has been a record of outstanding accomplishments, distributed unevenly and somewhat haphazardly across sectors and countries and falling far short of its potential contribution. Its effectiveness in this area would greatly increase were it to develop an explicit approach to science and technology, to reexamine its policies and procedures so as to increase its effectiveness in this area, and to allocate increased resources for this purpose.

11/ These training issues are discussed in depth and detail in the report "Staff Training in the World Bank: An Evaluation and Needs Assessment," by Donald P. Warwick, Inc. (January 1981) which is summarized in a memo from Mr. Kaji to all Bank staff dated September 8, 1981.

III. A Broader Role for the Bank in Science and Technology

3.01 The broad conclusions of this report and its general recommendations call for the intensification of the Bank's efforts to encourage research, innovation and the development of local technological capacity. Scientific and technological development is to be an explicit high priority objective of Bank work.

3.02 The Bank's objective in so doing is to be: to build scientific and technological capacity in its borrowers and to encourage the use of that capacity to analyze practical problems and to implement the corresponding solutions; to improve the assessment and choice of technology by its borrowers and guide them towards the solution of outstanding development problems; to promote international research and diffusion of technologies specific to the problems of the developing world; and to improve the understanding of the scientific and technological dimension of development.

3.03 Each of the relevant parts of the Bank is to address the major technological aspects of development that fall within its responsibility, and to develop a long-term plan to strengthen its activities in science and technology, using the means appropriate to its functions and objectives.

3.04 For example, each of the sector departments of the Operations Policy Staff and the Energy and Industry Staff is to consider how the Bank can increase its attention to science and technology in its respective sector. The measures appropriate to a particular sector might include any of the following: increased lending for research, for high-level training

and for scientific and technological infrastructure; greater attention in sector policy work and in the project cycle to technological capacity and the promotion of technological innovation; explicit forecasts and assessments of developments in technology which are likely to influence future policies and operations; support to the building of national capacity for technological decision making and research; support to development, pilot tests and demonstrations of promising new technologies (e.g., in renewable energy); collaboration with the private sector in promoting the design and commercialization of promising industrial products or processes that are unlikely to be developed without public support; cooperation with non-governmental organizations in their work of developing and diffusing low-cost technology; or a global public research program on the pattern of the CGIAR.

3.05 This chapter discusses the implications of these conclusions and recommendations for the different elements of Bank work. Current resource constraints require that the recommendations constitute a long-term policy framework within which specific activities can evolve over time. In many areas, this process is already underway. But not all the specific recommendations which follow can be implemented immediately.

Science and Technology in Bank Lending and IFC Investments

3.06 The Bank should: (i) lend more for research, high level training, and scientific and technological infrastructure; (ii) pay more attention to science and technology in the project cycle by which projects are conceived, planned, appraised and implemented; (iii) encourage and facilitate the inclusion of pilot tests and demonstrations of innovative technology in its projects; (iv) experiment with new mechanisms and areas

of interest through which technology can be mobilized for development; and (v) strengthen its policies and procedures so as to facilitate its scientific and technological work. The ensuing paragraphs explore each of these ideas in more detail.

3.07 Lending for Scientific and Technological Research, Training and Infrastructure. The Bank should lend more for research, high level training and scientific and technological infrastructure, including university laboratories, sectoral and cross-sectoral technological institutes, bureaus of standards, information and documentation centers, and geological and oceanographic surveys. Such lending should be based on appropriate review of sectoral or cross-sectoral needs, and may take the form of projects or project components. Support of such efforts should be a regular part of the lending program.

3.08 As regards lending for research, the policy paper on agricultural research12/ envisages an increase in Bank support of agricultural research and extension from 9 percent to 12 percent of agricultural and rural development lending, or $550 million a year by fiscal year 1984. Bank financing of programs of government support to technological innovation in industrial enterprises should also be substantially increased in number and priority and made an important part of the Bank's regular work program. The Bank should evaluate its experience and that of the Inter-American Development Bank and other development assistance agencies with such lending, and should incorporate the lessons of these experiences into the

---

12/ Agricultural Research Sector Policy Paper: World Bank, Washington, D.C., June 1981.

design of projects of this kind. Bank lending for the building of local research capability in other sectors--especially health, population, and energy--should also be increased.

3.09 Science and Technology in the Project Cycle. Scientific and technological aspects should be considered systematically in the conception, design, appraisal and supervision of Bank projects. As provided in OMS 2.12, 2.20 and 2.21, alternative project design and technology should be reviewed during project preparation. The reasons for the choice of a particular technology and for the rejection of others as a result of this review process should be noted in the Staff Appraisal Report and other operational documents. A greater effort should be made to involve local expertise in all phases of the project cycle, to build local capacity, to ensure that the technology used in the project is suited to local conditions, and to seek out and use local sources of technology. Scientific and technological project issues should be reviewed as appropriate by managers at the division, department, and higher levels, much as are economic and financial issues, with a view towards ensuring the use of the most suitable technology and strengthening the contribution of the project to the technological development of the borrower.

3.10 The Bank should also strengthen its working relationships with non-governmental organizations, which in many countries are well-established vehicles for the diffusion of technology suited to meeting the needs of the poor, such as low-cost construction methods, improved cookstoves and other technologies for exploiting renewable sources of energy. The Bank should be alert to opportunities to finance the

activities of such organizations when this is agreeable to the government and appropriate to project objectives.

3.11 Pilot and Demonstration Projects[13]/. As one of the first steps in implementing the proposed new Bank technology policy, there should be a systematic effort to identify promising technologies requiring pilot tests and demonstrations in such fields as health and population, labor-intensive civil works construction, use of renewable energy resources, and ecologically-based production systems for the small farm (no-till farming, mixed farming systems that include tree crops, integrated pest control, etc.) and to develop projects in each region using these or other innovative technologies. Such demonstrations are of particular value in highlighting the organization and management problems inherent in scaling up the application of a technology, especially when the pilot test was carried out by a non-governmental organization and the full-scale project is to be executed by the government.

3.12 Bank staff should be encouraged to propose that the Bank fund pilot projects where funding is not available from other sources. Such pilot projects and demonstrations could take the form of components of larger investments, or when necessary to avoid delays, could be programmed as separate loans. Pilot tests of technology which could have widespread application in countries other than the site of the test, might be made eligible for grant financing through the technological research budget proposed in paragraph 3.36 of this report. Specific provision in the administrative budget would be needed to cover the extra consultant and staff costs needed for the preparation of such pilot projects. The

---

13/ A pilot project is a test of a project design in a limited geographic area with intensive monitoring and evaluation. A demonstration is a more extensive test with less intensive evaluation, but still short of a full-scale application.

experience of the Urban Poverty Program shows clearly that a small amount of resources, used to promote carefully selected innovations that might otherwise have been lost due to budget limitations, can make a major difference in project quality.

3.13 The Bank should devote special efforts to ensure that successful approaches are made known to the development community. If experienced professionals are to accept radically new approaches, such as low-cost sanitation or labor-intensive construction of civil works, they may be required to re-examine the basic assumptions underlying their professional work. The spread of several technologies basic to the Bank's poverty work is at present limited by the supply of professionals who have undergone this re-examination--inside the Bank, in the developing countries, and in the consulting firms on which both must rely to provide technical assistance connected with investment projects in these sectors. The Bank is well placed to influence professions that exercise a critical influence over the design of projects, policies and research strategies in the sectors in which it lends.

3.14 New Approaches to Technological Development. The Bank should look for possibilities to support the development and commercialization of improved technology which could have far-reaching effects. The identification of such opportunities frequently require an overview of the development process which is not constrained by the limits of economic sectors as they are conventionally defined. Examples include: the building construction industry (including the building materials and contracting industries and the financial, regulatory and technological agencies that affect them), the agricultural machinery industry, the post-harvest storage

and transport system, all aspects of the economy which affect draft animal power (including breeding stock, feed, implements, vehicle, animal health and slaughtering facilities), and communications facilities for the development of remote areas. The latter might include telecommunications, mass media, or low-cost systems of vehicles and infrastructure (such as pedal-powered trucks, moped and moped paths, or airships and airship ports as possible substitutes for investment in roads).

3.15 The Bank should seek in its sector work to identify industrial products, such as low-cost baby foods, vehicles, teaching equipment and agricultural implements, which could embody improved technology that could help solve important social and economic problems. The Bank should promote their development and manufacture, either through its own projects or through investments of the IFC. For this purpose, IFC should be prepared to undertake investments smaller than its usual minimum, and to spend more than it usually does on promotion.

3.16 More generally, the Bank's links with the private sector, especially through the International Finance Corporation (IFC), could be exploited more imaginatively than at present to promote technological innovation. For example, many of the most recent revolutionary advances in technology--microelectronics, genetic engineering, somatic cell culture,[14]/ remote sensing--are or will soon be ready to be introduced into developing countries through joint ventures. IFC investments in venture capital companies should continue to increase. Discussions with the private sector in developed and developing countries could lengthen

---

14/ Somatic cell culture is a technique that allows an entire plant to be grown from a single cell taken from a part of a plant other than the seed.

this list of ideas for expanded cooperation with the private sector in science and technology and provide insights into new institutional mechanisms needed to bring them about.

3.17 Strengthened Policies and Procedures. The Bank should make a systematic effort to strengthen its policies and procedures so as to facilitate and encourage its scientific and technological work. It should be more willing to accept the risks, staff costs and longer time horizons typical of such projects. The identification of priorities for research and for the testing and diffusion of new technology, and the preparation and promotion of proposals for research programs, pilot tests and demonstrations, should be a normal part of Bank work. Staff and administrative resources should be allocated for this purpose. In particular, resources should be provided for the identification and supervision of research and pilot projects that are included as components of investment projects, and appropriate cooperative arrangements should be sought with other organizations that are experienced in this work.

Science and Technology in Bank Country Analysis and Technical Assistance

3.18 Bank country economic and sector work, if properly strengthened, could provide the analytic basis for a strategy to assist the development of local technological capability. This work provides a natural context for an assessment of national and sectoral policies for technological development. These policies influence the impact of technology and hence its suitability to local conditions. They also influence the development of indigenous technological capability, its links to the economy, and its orientation to the problems of the poor.

3.19 Bank program and projects departments should select a number of countries for pilot efforts in designing a country assistance strategy that

gives special attention in lending operations, analytical work, and the policy dialogue to the scientific and technological elements of national development. These elements include: the supply of scientific and technological infrastructure and services; the availability of people trained in science and technology and the quality of the educational system in this regard; the capacity for technological decision making, innovation and research, including basic research; the adequacy of policies and programs directed at developing this capacity; and the effects of other "implicit" technology policies which indirectly affect the development of technological capacity, the choice of technology, and the speed and direction of technological innovation, through a variety of economic and trade policies that affect the degree of internal and external competition and the prices of capital, labor, foreign exchange, energy, water, and other key inputs and products. As a first step, basic data should be collected on scientific and technological capacity through country economic and sector missions.

3.20 This work should evolve into an effort to build local capacity to carry out an overall assessment of national scientific and technological capacity, along the lines of the studies described in paragraph 2.28. Eventually, the exploration of the scientific and technological dimension of development should become a normal element of Bank country and economic work. This work should be guided and synthesized in such a way that, in addition to its value to the countries being studied, it will contribute to better understanding in the development community of the role of science and technology in development. Preliminary guidelines for the conduct of such assessments have been prepared.

3.21 The contribution to the development of local capacity through Bank technical assistance should pay more attention to technological skills in addition to its present emphasis on skills for financial and economic decisions. Technical assistance should be based on an overall country strategy leading to detailed design of the types of assignments best suited to the country, rather than responding to ad hoc requests, usually for help in preparing pre-investment studies, as is at present often the case. Such a strategy would also be of particular importance in countries to which the Bank provides reimbursible technical assistance, as this is its main contribution to their development. The Bank should continue to develop its training program in national technology policy, and should develop and publish training materials so that its approach may be incorporated into courses given under other auspices. (See paragraph 2.28).

3.22 The Bank should expand its program of assistance to national governments that are seeking to encourage the development of the local pre-investment ("consulting") and engineering industry, because of the critical importance of this industry in the selection of technology suited to local needs and conditions. Attention to technological issues in the courses of the EDI should also be increased. The Bank program to strengthen the planning capabilities of developing countries is another potential avenue--little used at present--to assist their scientific and technological development.

Support for Scientific and Technological Research

3.23 The Bank should continue and expand its present support to scientific and technological research, and should incorporate a commitment

to such increased support in its overall policy towards science and technology. The Bank should include in its work program and budget resources for the preparation, promotion, and implementation of proposals for scientific and technological research, and for the discussion, dissemination and implementation of the results of successful research. It should consider these tasks an important part of its work as a development institution. It should institutionalize procedures for facilitating the consideration and supervision of such proposals and for appropriate liaison with other funding agencies and with the scientific and technological community.

3.24 Possible Mechanisms of Bank Support to Research. There would be substantial benefits from expanded project lending for research in such sectors as agriculture,[15]/ education, industry, health and energy. Such lending could take the form of projects entirely devoted to research--in which the sums of money lent are likely to be small relative to those involved in the usual Bank project. Alternatively, it could take the form of small research components "piggybacked" onto investment projects, in which case sufficient staff resources should be provided for proper preparation and supervision. Discussions with the governments of many Bank member countries indicate widespread interest in Bank assistance in this field.

15/ The Bank Sector Policy Paper on Agricultural Research (June 1981) concludes that "underinvestment in agricultural research appears to be substantial, and considerably more money could be invested in this activity with the expectation that returns would exceed both the opportunity costs of capital and the returns from most feasible alternatives in rural areas. . . . There are probably few alternative investment opportunities to which national and international funds could be dedicated that could so consistently yield returns as high as those from investment in carefully designed and managed agricultural research programs." (pp. 19-20)

3.25 Depending on the problem, such research may take the form of development and demonstration of a new approach to Bank lending in a particular sector, a global research system, support to individual scientific and technological research projects, or cross-disciplinary research on the scientific and technological dimension of development.

3.26 While many kinds of research can be supported by loans and credits, as discussed in para. 3.07ff above, others--especially problems of interest to large numbers of LDCs--can be supported only by grants. For this reason, the Bank should be willing to provide grant support to high priority technological research in cases where the support of the Bank is justified and essential. Such grants might be provided either to global programs like the CGIAR or (through appropriate administrative mechanisms) to individual research projects.

3.27 Research on New Approaches to Sectoral Development. The Bank should develop research strategies in sectors in which research and innovation promises to open up new paths of development, including proposals for new global programs when these are appropriate.

3.28 Bank sector policy papers should include forecasts of probable developments in global technology and of the likely evolution of the design of Bank projects in the sector, should define the outstanding global and regional technological problems in the sector, and should propose approaches to the development of technological capacity and areas of scientific and technological research that can be applied by Bank developing member countries.

3.29 Depending on the circumstances, the necessary research might be carried out during the course of Bank lending, might be best suited to

being financed by an agency other than the Bank, or might require a program of Bank-financed research. Programs of very broad scope may require a global research system in which international laboratories produce general results of broad applicability for adaptation to local conditions by national laboratories in developing countries. Bank work on renewable energy on alternatives to water-borne sewerage, and for improved labor-intensive technology for construction of civil works, provide models for fruitful collaboration among economists and technologists in this direction.

3.30 Once an innovation has proven successful in the laboratory and appears to be technoeconomically feasible, the sector department should, in consultation with the Regions and, as appropriate, with outside agencies such as UNDP, develop a plan for testing and demonstrating it at full scale, for training of Bank staff, developing country officials and consultants in the new technology, and for its diffusion in the developing countries, including appropriate measures for promotion for local design and manufacture. Implementation of the new technology in projects financed by the Bank could be facilitated by the encouragement of pilot projects, and by the establishment of the technological research budget (see para 3.36).

3.31 Global Research Systems. The Bank should seek new opportunities, in addition to the CGIAR and TDR, to promote and support programs of international research on problems that face large numbers of developing countries, and should prepare and promote proposals for such programs, in cooperation with other organizations wherever possible. Their scale, scope and institutional form would vary, but should be commensurate with the problem.

3.32 There are many fields where a well-focussed international program would promise major results of practical value to developing countries:

(i) Renewable energy technology, including biomass production, biomass conversion, and direct use of sun and wind;[16]/

(ii) Forestry, including industrial forestry, watershed management, biomass energy (fuelwood and methanol feedstock), humid tropical forest management, and agroforestry (trees as an element of systems for the small farm);[17]/

(iii) Population, including basic and applied research on improved means of contraception and social sciences research on the determinants of fertility and the acceptance of contraceptive techniques;

(iv) Research on diarrheal diseases that kill millions of children annually.

(v) Inventory and screening of species of that are in danger of disappearance because of the worlwide destruction of tropical forest habitats;[18]/

16/ "Mobilizing Renewable Energy Technology in Developing Countries: Strengthening Local Capabilities and Research," "Renewable Energy in Developing Countries," and "Alcohol Production from Biomass in the Developing Countries," World Bank, July 1981, November 1980 and September 1980, respectively.

17/ World Bank and FAO, "Forestry Research Needs in Developing Countries - Time for a Reappraisal?," September 1981.

18/ US National Research Council, "Research Priorities in Tropical Biology," (Washington, D.C.: National Academy of Sciences, 1980).

(vi) Oilseed production and processing technology, especially for cottonseed, coconuts and peanuts;[19]/

3.33 The one global program to which the Bank has made grant contributions over an extended period--CGIAR--shows the major gains that can be achieved through this kind of program, both directly through results of research funded by the program and indirectly through the influence of international research on national research programs. These results would not have emerged from research programs financed by the private sector or by governments of individual developed or developing countries.

3.34 Possible criteria for grants to global research systems are discussed in a separate paper.[20]/ In brief, the paper recommends that the Bank consider grants for scientific and technological research when it is judged that such research promises a high payoff to the developing countries, and in particular to the poor; that other channels of research and technology transfer are insufficient; that Bank involvement is needed for the mobilization of finance; and that Bank staff input is needed at the technical level. These criteria are met by the two extant examples of Bank grant support to scientific and technological research, namely CGIAR and TDR.

19/ Tropical Products Institute, "Research Needs and Priorities in Relation to Certain Agricultural Commodities," (London, United Kingdom: Ministry of Overseas Development, 1975).

20/ Criteria for World Bank Financing of Scientific and Technological Research, Science and Technology Unit, May 1979.

3.35 Support to Individual Scientific and Technological Research Projects. The World Bank--specifically including the IFC--should consider how best to channel funds into scientific and technological research, including pilot projects, demonstration projects, and commercialization efforts which require grant financing and which do not form part of any global integrated program of the sort proposed in the preceding section.

3.36 As a first step, the Bank should establish out of its administrative budget a separate Scientific and Technological Research Budget. (The present Bank Research Budget is limited largely to economic and social research). This would be used for scientific and technological research and development closely linked to the work of the Bank and supervised by the Bank, perhaps with the assistance of a bilateral or non-governmental agency working as a subcontractor. Some of these funds could provide grants to supplement Bank lending for pilot projects, which if successful will have widespread application outside the borrowing country, as discussed in paragraph 3.12.

3.37 Cross-Disciplinary Research on the Scientific and Technological Dimension of Development. Bank economic researchers, augmented by suitable expertise in technology and technology policy, could make a substantial contribution to the understanding of such issues as the scientific and technological strategies best suited to least-developed countries, and the likely impact on developing countries of world-wide advances in technology in such fields as microelectronics, energy-conserving technology, and artificial substitutes for natural commodities. The Bank, moreover, is in an excellent position, by virtue of the confidence it enjoys both in governments and in the private sector, to carry out research on the contentious but critical subject of the role of the private sector in the development of industrial technology.

3.38 The Bank should therefore increase its support to cross-disciplinary research on the place of science and technology in development, such as the work currently underway in ERS on the acquisition of technological mastery in the modern industrial sector. A special effort should be made to design research shedding light on the scientific and technological problems of countries with a relatively low level of development. In order to develop a pipeline of research projects worthy of such support, the Bank should devote resources to developing proposals in this area. In view of the relatively narrow experience of the staff of the Bank in such cross-disciplinary research, it should, in setting priorities and reviewing proposals for research, be guided in part by the opinions of persons outside the Bank who are familiar with research in science and technology policy.

3.39 Finally, the ex post evaluation work of the Operations Evaluation Department provides an excellent opportunity for the analysis of the Bank's experience with using technology in its projects, both to improve future operations and to share its experience with the development community. The technological aspects of this work should be given greater attention.

Staff Implications

3.40 As its efforts in science and technology increase, the Bank should seek to maintain the great strength of its current work in this field, namely its close links to its operational work and hence to the practical needs of member developing countries. For this reason, the bulk of the scientific and technological work of the Bank should take place as an integral part of the work of its operating and sector departments. While additional staff and budgetary resources for the purpose would greatly accelerate the development of a work program in this area, much can be accomplished with existing staff.

3.41 These efforts should be supported by a central science and technology unit to provide a cross-sectoral, global overview, and to stimulate and promote the broad range of technological activities recommended in this report. The objective of the unit should be to help develop ideas to the point at which another part of the Bank will adopt them as its own. It should pass its ideas along to others as soon as it is practical to do so, in order to conserve its own resources for new initiatives.

3.42 The existing Science and Technology Unit of the Projects Advisory Staff, consisting as it does of two permanent professionals plus consultants, would have to be expanded to meet the needs of the effort proposed in this paper.

3.43 For the longer run, the Bank should consider other measures for expanded financial and staff support to scientific and technological research, depending on the evolution of the Bank's financial situation and of its support to research in economics and the social sciences.

Establishing the Image of the Bank as a Scientific and Technological Development Institution

3.44 A policy decision by the World Bank to become more active in science and technology should be accompanied by a public information effort at a high level, including prominent mention in the annual address by the President of the Bank to the Board of Governors and perhaps a special address to an audience of distinguished scientists and technologists on a suitably chosen occasion.

3.45 The Bank should stress, both internally and externally, its commitment to scientific and technological development, and should

publicize the fact that it is actively seeking ways of promoting technological innovation and development of scientific and technological capacity and is willing to consider requests for assistance of this sort. Discussions with governments and the scientific and technological community, and an increased publications program, would further publicize the Bank's expanding work in this field.

3.46 Finally, the Bank's work in science and technology as it evolves along the lines recommended in this paper, would greatly benefit from a review by an external scientific and technological advisory panel. The committee would be a source of new ideas, a link with the world scientific and technological community, and a public symbol of the Bank's commitment to science and technology. It would consist of about a dozen distinguished scientists and technologists, development thinkers and persons who have direct experience in executing technologically oriented development programs in government or the productive sector at all levels of technological sophistication.[21]/ It might be convened, say, in FY84.

21/ This recommendation is similar to but much broader than that of the Bank's General Research Advisory Panel, which noted that the Bank has in the past supported both technological research and socioeconomic research, and that while the Panel report is limited to the activities of the Bank in social science research, particularly research in economics, the Panel "nonetheless believes technological research is important, and that technological and socio-economic research can often reinforce each other in very important ways--as shown, for example, by the international agricultural research centers. We are aware of the Bank's desire to review its position as far as technological research is concerned, and we believe there may be important opportunities for additional Bank financing. Accordingly, we suggest that a further panel (or panels) focusing on technological research might be helpful."

(Sections marked by (*) have not yet been approved by the agency whose work they describe)

Draft
June 9, 1982

Annex I. Existing International Programs in Science and Technology for Development

Existing bilateral and multilateral efforts in science and technology may be briefly summarized as follows:[1]/

(i) Bilateral Programs

(a) The outstanding example of bilateral assistance to scientific and technological development in developing countries is the International Development Research Center (IDRC) of Canada, a virtually autonomous institution that is free from pressure to transfer resources. Although the IDRC is financed almost entirely by the Parliament of Canada, its policies are set by an international Board of Governors. The Center is specifically dedicated to the support of research and the development of the research capability in developing countries. It funds activities in agriculture, food and nutrition sciences, health, information, and the social sciences. More recently, it has become involved in energy research in Third World countries. The IDRC

1/ The size and effectiveness of existing bilateral and multilateral programs has never been adequately addressed, largely because of the cost and the difficulty of exactly defining the "scientific and technological" elements of a given program, in the absence of generally agreed criteria. (The effort by the Bank to describe the "scientific and technological" element of its work, eventually published as "Science and Technology in World Bank Operations," took 30 man-months.) Moreover, donor countries have been reluctant to provide statistics that might be used as the basis for setting targets in the context of the North-South dialogue.

expended a total of US$32.8 million in fiscal year 1980-81 for its various research activities and has a budget of US$38.3 million for FY 1981-82 (excluding administrative expenditures).

(b) Sweden has established an organization for the support of research and development related to developing countries, the Swedish Agency for Research Cooperation (SAREC), although on a smaller scale than IDRC and more closely related to the governmental Swedish International Development Agency. SAREC had a budget of US$22 million in Fiscal 1980 and US$25 million in Fiscal 1981.(*)

(c) In the Federal Republic of Germany, the Agency for Technical Cooperation (GTZ) plans and directs on behalf of the Federal Government all measures taken in the field of technical cooperation with developing countries. A part of GTZ called the German Appropriate Technology Exchange (GATE) serves as an information service on appropriate and innovative technology. GATE also plans, carries out and coordinates projects and programs of technical cooperation involving research and development, and initiates and supports cooperation between companies from developing and from industrialized countries.

(d) The British Government supports laboratories in Britain concerned with tropical health, the processing of tropical agricultural products, pests, agricultural engineering, tropical veterinary medicine, transportation, hydraulics, hydrology and other subjects of special concern to developing countries. In addition, there is a program of contracted research at various institutions in Britain and overseas. Special efforts are made to support indigeneous science and technology in

developing countries and in particular to strengthen national facilities for agricultural research.

(e) France supports eight networks of tropical agricultural institutes in cotton, oilseeds, livestock, food crops, agricultural machinery, tree crops, forestry and coffee. Each institute is headquartered in France, is affiliated with a series of institutions in Francophone Africa, and runs a program of global technical assistance. Through the Office for Overseas Scientific and Technological Research (ORSTOM), France also supports hydrological and meteorological surveys and other forms of applied scientific research. Various other French laboratories in public or private institutes or within universities devote part of their research to developing country problems, notably in the fields of tropical diseases, education and appropriate technology. France's research effort is almost entirely directed toward French speaking African countries.

(f) The United States supports a large program of research in its own and developing country laboratories on technology related to developing countries, in such fields as small farmer agriculture, fertilizer, tropical diseases and biomedical research related to population. It supports the building of institutional capability in developing countries for research on agricultural production research and related fields. It also supports applications of innovative technology in such fields as remote sensing and the use of mass media for education.

The United States is giving new emphasis to science and technology in its bilateral development assistance programs, particularly in the areas of food and energy. Science and Technology programs of the Agency for International Development (AID) are proposed at $425 million for FY 1983, up 48% from FY 1980. Food and nutrition accounts for about 64% of AID's activity in science and technology. Energy is the fastest growing sector, nearly doubling from FY 1981 to FY 1983. Within these totals, AID devotes a modest amount of funds ($10 million a year) to a new program which explores collaborative and more innovative approaches to the problems of development research and technology transfers.

In 1981, AID undertook a number of administrative measures designed to increase the impact of science and technology on development. Mechanisms were established to enhance the Agency's science and technology capability and to provide a means for assuring greater involvement of AID scientific and technical personnel in Agency policy and implementation processes. These new mechanisms are being utilized to involve more effectively U.S. universities and university experts in AID's research, technology transfer and institution building activities.

(g) The Dutch foundation for the support of universities in developing countries provides support for science and technology through fellowships, technical assistance, and assistance to the establishment and operation of university laboratories.

(h) The official Australian aid program, which is administered by the Australian Development Assistance Bureau (ADAB), has increased its emphasis on science and technology through its Science, Technology and Research Cooperation Program. In 1980-81, a total of US$ 63.7 million was spent on bilateral programs oriented specifically toward scientific research and technological development, especially the strengthening of the scientific and technological institutions in developing countries. Training or technical assistance components concerned with the transfer of technology form a major element of these programs. Many other ADAB projects have significant scientific and technological inputs, which in 1980-81 were estimated at US$ 60 million. In addition, a trust fund of US$ 28.7 million has been established to cover the first four years of operation of the Australian Centre for International Agricultural Research, a statutory body with the responsibility of identifying priority agricultural and related research needs in developing regions. Aside from its predominant involvement in the field of agriculture and food production, Australian science and technology aid is also giving increasing attention to the area of energy and health.

(i) Japanese aid to science and technology supports for the most part the transfer of Japanese technology to developing countries through private investment, especially in South-East Asia. Japanese aid also supports collaboration between Japanese technological researchers and those in developing countries.(*)

(j) Virtually all bilateral assistance programs support programs for developing country nationals in institutions in the donor country, as well as sister relationships between universities and laboratories in the donor country and developing countries.

(ii) Multilateral Programs

(k) The United Nations Development Programme (UNDP) and its associated funds and programs[2]/ finances technical cooperation and pre-investment for scientific and technological activities, including institution-building in developing countries. It does this chiefly through projects executed by the specialized agencies of the United Nations, although UNDP does execute some projects itself, particularly those involving high technology. Like UNDP, these agencies also support, through their regular budgets and through special funds that they administer, many regional and global programs of research and training. UNDP, and with some exceptions the specialized agencies, typically assist governments in financing those external inputs which are not normally available to a country. Participants are expected to raise operating funds from other sources.

(l) A recent institutional innovation, the global integrated research system, helps to mobilize additional financial and other resources which may not normally be available through the UN specialized agencies. It has enabled the international system to deal with such global research problems as food-crop technology, tropical diseases, and weather forecasting. Such

---

2/ Among the funds and programs administered by UNDP are the Revolving Fund for Natural Resources Exploration, the UN Sudano-Sahelian Office, the Interim Fund for Science and Technology (discussed in section o), and the Energy Account.

systems include the Consultative Group on International Agricultural Research (CGIAR), the Special Programme for Research and Training in Tropical Diseases (TDR), and the Global Atmospheric Research Program (GARP).3/ These programs are organized by multilateral organizations, but except for the GARP, the great bulk of their funds comes from bilateral aid programs. The CGIAR is described in more detail in paras 2.10-2.12 of the main report. It receives contributions from nearly all of the funding agencies mentioned in this Annex.

(m) The Inter-American Development Bank has provided loans for scientific and technological development to a few Latin American countries. These loans have involved a component of grant money for technical assistance for subsidizing interest rates. The Inter-American Development Bank has also established a special mechanism to ensure the use of "appropriate" technology in the investment projects it finances.(*)

(n) The International Foundation for Science (IFS), a Stockholm-based organization whose membership includes most of the national academies of science in the world, reviews and supports small, individual ($5,000-$15,000) projects in developing countries, on the basis of their relevance to the needs of the country as certified by local authorities and their scientific merit as judged by peer reviewers chosen from the international scientific community. An IFS award confers such prestige on an investigator in a developing country that he is often able to use it to attract additional support from other sources. The

---

3/ The GARP is a global program of the World Meteorological Organization costing several hundred million dollars a year. Although the GARP was not designed with the specific problems of developing countries in mind, much of the effort is for the study of the tropical atmosphere, and could lead to greatly improved technology for the forecasting of tropical weather, and in particular of the monsoons.

IFS has a current budget of about $2 million and supports research in the fields of aquaculture, animal production, vegetable oilseed and fruit, food fermentation and applied microbiology, mycorrhizia and afforestation, natural products, and rural technology.

(o) Upon the recommendation of the United Nations Conference on Science and Technology for Development (UNCSTED), held in Vienna in August 1979, the UN General Assembly established a new voluntary fund, the United Nations Financing System for Science and Technology for Development, to be administered by the United Nations Development Programme (UNDP) pending establishment of permanent arrangements. The first pledging sessions attracted firm commitments of about $54 million to the Interim Fund which preceded the establishment of the Financing System. Of this, about $15 million has been paid in, far short of the goal of $250 million. Another pledging conference in March 1982 raised $8 million more. Efforts are being made to increase the level of funding, particularly by attracting funds from OPEC and traditional donor countries.

(iii) Non-Governmental Programs

(p) Professional organizations of scientists and engineers, such as the various international scientific unions, national associatons for the advancement of science, and national academies of science, maintain worldwide informal links among their members. A particularly fruitful example is the program of the Board on Science and Technology for International Development (BOSTID) of the US National Academy of Sciences, which has organized

joint workshops and study groups with counterpart institutions in the developing countries, and has published a useful series of books on underexploited areas of science and technology with primary economic value to developing countries. BOSTID has recently received a $16.8 million grant from the United States Agency for International Development to support research based on its earlier work.

(q) The Rockefeller Foundation supports science and technology programs in agriculture, population, tropical diseases and energy policy. In its agricultural program, the Foundation fosters both basic research (conducted primarily at US universities) on plant genetics and animal diseases, and applied research on plant and animal food sources and appropriate agronomic practices. It also supports research on agricultural resource protection and sustainable food production on marginal land areas, and on the formation of food policies based on up-to-date scientific and technical knowledge. In its medical program, the Foundation supports research on reproductive biology and new contraceptive technology, diarrhea, parasitic diseases such as malaria, schistosomiasis, and trypanosomiasis, and on improved research methodologies in clinical epidemiology and population-based medicine.

(r) The Ford Foundation for many years has supported biomedical research aimed at developing improved methods of birth control, as well as applied research in the agricultural sciences. In its population work, assistance has gone for laboratory and clinical research in the United States and abroad on the complex biochemical and hormonal processes involved

in reproduction and on a variety of drugs and chemical agents that interrupt or inhibit various stages of the reproductive process. In its agricultural program, the Foundation supports national crop research programs in various countries, as well as research and training to improve the long-term productive capacity of land and water resources on which agriculture depends.

In a new effort, the Foundation is supporting research on the nutritional and associated health problems of infants and young children in the United States and overseas. It assists the work, for example, of the International Centre for Diarrheal Disease Research in Bangladesh, which takes an integrated approach to the treatment of diarrheal disease, malnutrition, and too frequent childbearing. Assistance has also gone for studies of the possible links between socially troublesome juvenile behavior and biological and nutritional impairments.

Annex II. Publications Describing Bank Work in Science and Technology

The Science and Technology Unit has prepared the following documents describing Bank work in science and technology. These serve as background for this paper:

(i) A 10-chapter, 208-page report entitled, "Science and Technology in World Bank Operations," which comprehensively sets forth the Bank's work in this area, sector by sector. This report was published in July 1980.

(ii) A shorter version of (i), entitled "The World Bank as an Agent of Technological Development," submitted to the United Nations Conference on Science, Technology and Development (UNCSTED) held in Vienna in August 1979.

(iii) A manuscript book, entitled "Technology, Finance and Development," consisting of 26 chapters, each of which was signed by a member of the Bank staff or consultant and describes a Bank initiative in science and technology. This manuscript was completed in September 1980 and is under consideration by MIT Press.

(iv) A paper, prepared for the President's Council in May 1979, entitled "Criteria for World Bank Grant Financing of Scientific and Technological Research."

(v) A paper, originally prepared as an annex to this report, entitled "Some Policy Issues Related to Science, Technology and Development."

(vi) A report, prepared for the U.S. Executive Director in March 1978 and updated in February 1979, entitled "Appropriate Technology and World Bank Assistance to the Poor." Follow-up reports summarize Bank work on low-cost technology in FY 79-80.

(vii) A symposium volume, "Mobilizing Technology for Development," prepared in collaboration with the Bank and published by the Overseas Development Council, the International Institute for Environment and Development, and Praeger Press, in preparation for UNCSTED.

These publications are available on request.

OPS Gen

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

MB
File with papers on the Co-financing Fund

OFFICE MEMORANDUM

TO: Mr. Frank Vibert, Co-financing Adviser, SVPOP DATE: June 15, 1982

FROM: Ernest Stern, SVP, Operations ES

SUBJECT: Co-financing Paper

WMt 6/16

The Managing Committee decided to postpone further the issuance of the co-financing paper to a date to be determined. The paper will not be considered prior to the Board recess or the Annual Meetings. Please be guided accordingly in your discussions with potential co-financiers and borrowers.

cc: Regional Co-financing Coordinators
Mr. Humphrey
Ms. Zachrich

ES:dpw

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

M. Humphrey
WH
6/14

TO: Members of the Operations Policy Subcommittee DATE: June 8, 1982

FROM: Sidney E. Chernick, Assistant Director, CPD

SUBJECT: "Review of Training in Bank-Financed Projects" - Comments on OED Report No. 3834, March 1, 1982

The Operations Policy Subcommittee will meet on Wednesday, June 16 at 9:30 a.m. in Room E-1208 to consider the attached paper on training in Bank-financed projects prepared by the Education Department.

Attachment

cc: Ms. Pratt
Mr. Habte

Summary of and Comments on the OED Report No. 3834, "Review of Training in Bank-Financed Projects," dated March 1, 1982

I. General

1.01 The Bank's involvement in training is of relatively recent origin. Prior to 1970 the Bank tended to urge Borrowers to obtain training through bilateral and other multilateral sources. However, the projects of the 1970s reflected the need for direct Bank involvement by including an increasing proportion of training investments. The Bank has maintained a close watch on training over the period. Since 1975 the Training Unit of the Education Department has annually reviewed training in Bank projects approved in each financial year and circulated its findings to Projects staff. Experience with training components was examined in detail in the review of problem projects in 1978. Also, an OPD review was undertaken in 1979-80 with a view to determining the best organizational and staffing arrangements needed to cope with training.

1.02 The recently completed OED Review is timely and represents the first major attempt to take a close look at a group of projects across regional groupings and sectors. This note comprises a summary of the scope and recommendations of the OED Review and the proposed Bank management comments on the recommendations.

II. The Scope of the Review

2.01 The sample of projects covered by the OED Review is small--during the period 1973-77 more than 400 projects included training components and the sample covered 20, or less than 5% of the total. Nevertheless, the sample has been well selected, and the findings of the Review substantially accord with the findings of the Bank in its monitoring of training components. The comments on the Review from Regions and Operations Policy Staff have generally been positive. The OED Review augments the body of analyzed Bank experience with training and gives support to many of the developments in policies and procedures which Bank management has been pursuing. The Review is frank in noting the weaknesses and strengths of that experience and the substantial improvements brought about by the Bank, particularly in recent times. These improvements have been prompted by experience with the projects reviewed as well as with other projects.

2.02 The Review looked closely at the generation, implementation and evaluation of projects, and identified weaknesses and strengths of individual training components. Its recommendations (Attachment I) are designed to build upon the more successful experiences and to avoid difficulties encountered with the less successful.

III. Review Recommendations and Management Responses

The Review:

3.01 The OED Review draws a general conclusion that a more systematic, concentrated and coordinated attention to training and human resource development is needed if Bank operations are to make their intended contribution to member countries.

Comments

3.02 As the OED Review states, the Bank has shown increasing interest in and awareness of the training function. We concur in the need for closer attention to training in Bank projects and a strengthening of our efforts in this important area. This has in fact been taking place through the gradual though modest expansion of staff resources devoted to training, centrally and in the Regions. The central Training Unit of EDC has increased its staff from 2 in FY76 to 8 in FY82. In the Regions, the Education Divisions have increasingly been brought into training.

The Review

3.03 The first set of specific OED recommendations (para. 26, attached) encourages certain emerging trends and reinforces some existing practices. Certain of these recommendations can be grouped together. They include (i) greater emphasis on general education and training strategies to overcome human resource constraints on development, (ii) building up Borrower training capacities and reviewing the scope for using local or regional training resources and institutions, (iii) using free standing training projects, (iv) ensuring an advanced state of preparation of training components before loan/credit approval, (v) strengthening the evaluation of training efforts, (vi) paying close attention to the development role of women, (vii) closer programming and monitoring of training responsibilities of experts, (viii) providing adequate support for instructional materials for training programs, and (ix) preparing of guidelines and organizing seminars to sharpen the skills of the Bank and Borrowers in diagnosing training needs and in preparing and implementing training components. In addition, the Review recommends (x) increased emphasis upon long-term approaches to training and (xi) the increased attention to the use of fellowships. The Review also proposes that (xii) the Bank make more effective use of its staff resources by increased use of Education Divisions in generating and supervising training components or projects depending upon the nature, complexity and scale of the training envisaged. This recommendation has implications for the Bank's organization of training and is dealt with separately in paras. 3.14 - 3.18.

Comments

3.04 The first group of recommendations ((i) - (viii) above) is in line with what the Bank supports; for example, free standing training projects are currently being developed in Indonesia, Nigeria and Zimbabwe. These recommendations also refer to areas in which current practice needs

to be strengthened or improved. We accept these recommendations. The effort invested in good project design pays high dividends later in the project cycle and this is as true of training as it is of other activities.

3.05 One recommendation concerns developing Bank and Borrower skills in training (para. 3.03(ix)). The OED Review (paras. 24, 1.09-1.21) traces the development of Bank policy on training and outlines the progress made to date in preparing guidelines for staff and policy statements on training. This progress is continuing. Sector guidelines are being prepared or updated and in this process the needs of the Borrowers are being attended to. Seminars for Bank staff have been held and continue to be held by the Training Unit of EDC on sector-specific training. Furtheremore, some of the EDI programs designed to assist Borrowers' staff to prepare and implement projects include training in the analysis of institutional organization and of training needs; more recently, training courses for trainers have been organized. Thus, the pattern is one of increasing momentum in building the capacity of Bank and Borrower staff in training and we agree that this effort should be intensified.

3.06 However, we need to qualify our acceptance of some of the other recommendations in this set. The Review found that some training components were limited in their horizon: too much restricted to the immediate needs of the projects and too little concerned with the wider sector implications and needs (para. 3.03 (x)). We support the basic idea that training requirements and investments should, as far as possible, be set within the wider sector or agency context and generally this is reflected in recent practice. However, the scale of involvement in wider sector issues should be assessed individually for each project and will vary from project to project according to the other objectives being pursued.

3.07 A second qualification concerns the means of training (para. 3.03 (xi)). On the basis of the experience with fellowships in the sample of projects covered, the Review recommends increased use of fellowships. The success noted in the sample does not appear to be reflected in the general Bank experience which has been mixed and has not given rise to any clear standards. Each case should be judged on its merits and training methods selected and their outcome evaluated carefully. This does not mean that fellowships will not be used increasingly, but that a decision to recommend them for financing will depend upon the circumstances of each case.

The Review:

3.08 The second set of specific recommendations (para. 27) concerns the appraisal and supervision reports and is designed to bring about greater specificity in regard to training. In the case of appraisal, it is proposed that (i) all appraisal reports (and President's reports for Technical Assistance Projects) touch on manpower deficiencies in the sector or agency concerned and report on how these are being addressed; (ii) technical assistance provisions in a project be accompanied by indications of institutional measures to reduce or eliminate future dependence upon these services, and (iii) a separate annex on training be presented in the appraisal report. In addition, it is recommended that supervision activities and reports specifically cover training components, that a modification be made in the supervision summary form (No. 590) to

accommodate training, and that after the training component has been implemented, the supervision mission monitor and report on the Borrower's use of the training investment and assess its outcomes.

Comments:

3.09 Some of the OED recommendations on the reporting system amount to reinforcement of current procedures and practices while others would sharpen the Bank's focus on training. We support the recommendations provided that they are interpreted and applied in a practical manner.

3.10 Under the guidelines for the appraisal of projects, manpower deficiencies affecting the proposed investment must be addressed and appraisal reports generally mention such deficiencies. No change is required in these respects. The OED Review recommends that where manpower deficiencies exist in the relevant sector or agency, the appraisal reports include a statement showing what attention is being given to these deficiencies, whether under the proposed project or outside it. We agree that the appraisal report (or President's report in the case of Technical Assistance Projects) should treat human resource and training issues adequately and appropriately. Selectivity would be exercised as to the extent of treatment in each case, depending upon their relevance to the proposed investment.

3.11 In the same spirit, we support the OED recommendation that the inclusion of foreign technical assistance in a project should be accompanied by a statement as to the steps being taken to eliminate or reduce future dependence upon such imported services. This recommendation would also need to be applied selectively. The OED recommendation anticipates correctly that there might be circumstances in which it is not appropriate to build up local capacity to perform those services. Nevertheless, such a statement would be important where substantial technical assistance components are being included and would need to be candid about the prospects of reduction or elimination of the demand for the particular type of imported expertise.

3.12 The inclusion of a separate annex on training in the appraisal report would be helpful in those cases where the training investment is complex or substantial. At the present time, it is up to the discretion of individual managers to prepare such an annex, and it should continue to be so.

3.13 In regard to supervision reports, the Review recommends that they cover specifically the training component of the project being supervised and that space be provided in the supervision summary form to record the status of its progress. Existing guidelines on supervision require a review of all components. However, as training components have tended to be overlooked, we support the proposal of adding to the present form No. 590 a specific category--training--for performance rating. This should be included during the presently ongoing revision of the performance rating system. We endorse the recommendation that supervision monitor the use made of training investments which may have been completed early during project implementation.

The Review:

3.14 There are two OED recommendations on the organization, resources and staff use for training:

The first is a relatively minor one--the greater utilization of existing Cooperative Programs with international agencies (para. 28).

The second has broader implications for internal organization of the Bank; namely, bringing the regional Education Divisions more into operations which involve training, while maintaining a central operational support unit with sector training specialists (paras. 19, 26(d)).

Comments:

3.15 We support a wider use in training of Cooperative Programs and of the resources of other international agencies with whom we have working relationships, with the clear understanding that (i) this involvement would not present any increase in staff years to the existing Cooperative Programs but rather a change in staff utilization, and (ii) any review of these Cooperative Programs would in no way be constrained by such use.

3.16 The matter of how much and what kind of staff would be needed to cope with the increasing training workload and where the responsibility for training should be located has been under consideration for several years. Three major alternatives have been discussed: the possibilities of (i) using Education Divisions to deal with training, (ii) placing training specialists in each Projects Division, and (iii) strengthening the central Training Unit in the Education Department of Operations Policy Staff to assist Projects Divisions in training. A study by OPD in 1979-80 concluded that emphasis should continue to be placed, in the near term, upon expanding the Training Unit, but that the goal should be regionalization starting in FY84. This OPD recommendation has been followed so far but the planned expansion has been slowed down for budgetary reasons. The OED Review recognizes the past and potential value of a central Training Unit and recommends its retention for quality control, selected operational support and as an information clearing house. The OED Review also urges a larger role for Education Divisions in training so that they might provide continuous overview of the education and training system and needs of each country and support other regional operation divisions when required.

3.17 This OED recommendation raises two distinct organizational issues. The first is whether a reinforcement to help the Regional Offices discharge their responsibilities in training should be focussed on the central unit or whether it should be concentrated in the Regions. Given that the Bank's involvement in training is expected to increase, we support the idea of regionalization of training and strengthening of the capacity at the Regional Offices as soon as possible. An overall improvement in Bank performance in training will require an increase in staff resources. The magnitude of this increase is not yet known, but it is clear that the skill and experience needed to improve and expand training components in non-education projects are not readily available, and some lead time would be required to develop in the Regional Offices the necessary professional

capability in training. The central Training Unit must therefore be prepared to provide substantial operational support to the Regions for at least the near future, while increasingly focusing on training Bank Education and other staff in dealing with training components, preparing of guidelines and policy statements, and monitoring the effectiveness of the Bank's training work.

3.18 The second issue raised by the OED recommendation is the organization within the Regional Offices of the training responsibilities. Such internal reorganization is a matter for each Region to decide, but it would be useful to have an exchange of regional views on the perceived advantages and disadvantages of the various possible approaches. Regional Offices are currently handling training responsibilities in a variety of ways and the arrangements involve the Education Divisions to varying degrees. OPS supports the OED recommendation that greater use be made of the resources in the Education Divisions rather than adding training staff to the various Projects Divisions. The Education Divisions are generally in a better position to deal with training and manpower issues than the other operational divisions in the Regions. However, only few of Education Division staff are training specialists. Because of manpower constraints and the priority given to education projects proper in the past, the Education Divisions have been able to service only a minor part of training activities in the regional lending programs. A more systematic involvement in sector-related training will require some adjustments of the staffing profiles of the Education Divisions and a mandate from their management to be responsible for education and training operations in their respective Regions.

General Conclusion

3.19 Both the Bank and its Borrowers are coming increasingly to accept that training is not a development option but a development imperative and that it is not marginal but central to the kinds of change and growth which the Bank supports. This Review has taken a timely, thorough and balanced look at how the Bank has handled training--a relatively new dimension of its lending activities. While endorsing the initiatives taken by the Bank in recent years to improve its work in training, the Review urges that we intensify our efforts and make our approaches to training more systematic. We welcome the overall thrust of this Review and, with the few caveats which we have indicated, we accept its recommendations. Of course, we cannot do everything in every project; our achievements will be influenced in each case by the objectives and priorities of the project and by the available resources. Nevertheless, we believe that further improvements will take place as a result of the increased resources becoming available, more attention to how training work is organized and carried out, and continuing assessment of the effectiveness of the training effort.

Education Department
April 27, 1982

C. Recommendations

26. Recommendation (1): In recognition of the crucial role of trained manpower in development the Bank needs to raise the visibility of human resource development in its operational work. In particular the Bank should:

(a) conduct more thorough reviews of human resource development needs in its country economic and sector work, developing for each country an agreed strategy of investment which takes account of the human resource constraints and the role of training in meeting the needs (para. 6.06). Such an intention is implicit in the July 1980 policy statement on training.

(b) place increased emphasis upon long-term approaches to training, including (i) greater efforts to build up the borrowers' training capacities--a most urgent task--whether within individual agencies or through establishing and strengthening existing borrower or regional education and training institutions, and (ii) where advantageous, greater use of separate training projects (paras. 3.01-3.05, 3.26, 4.15-4.16, and 6.28).

(c) utilize more widely management review of the sectors and agencies concerned in the cause of assessing the diagnosis of training needs (paras. 2.23, 3.01-3.04) and devote considerably more effort to ensuring that the diagnosis of training needs is more systematically and thoroughly done (paras. 2.23-2.28), including analysis of achievements or deficiencies of prior investments or efforts in training in the particular sector or agency (paras. 3.11 and 3.12) and more specific attention to what the prospective trainees lack and need to learn (paras. 2.10-2.19).

(d) make more effective use of its staff resources in training, particularly by (i) the increased use of the resources of education divisions in the generation and supervision of training components or training projects, the extent of use depending in large measure upon the nature, complexity and scale of the training component; (ii) the provision of detailed guidelines to borrowers and Bank staff on the diagnosis of training needs and the preparation and implementation of training components and training projects and (iii) the organization of seminars for project staff on the application of these guidelines (paras. 3.01-3.04, 6.01, 6.05, 6.19 and 6.28).

(e) require training components and training projects to be as advanced in their preparation as possible before loan/credit approval--in effect applying the spirit of Operational Manual statement 2.28 of October 1978 to training (paras. 3.05-3.10, 3.32 and 3.37).

(f) ensure that local and regional training resources and institutions are examined with a view to their possible utilization in training efforts (paras. 3.15-3.19, 3.33-3.36).

(g) ensure that training investments are supported by evaluation arrangements to assess both internal and external efficiency of the programs (paras. 5.02, 5.07 and 3.03); in particular that, where

experts are being used as trainers, stronger and more specific references to the training role are included in their terms of reference and arrangements are built in for periodic review of the training performance of the experts (paras. 3.21 and 4.09).

(h) ensure that, in the cases of expert-counterpart relationships in which the expert occupies a line position as distinct from an advisory role, the progressive transfer of responsibilities to the counterparts is built into the project design (para 3.22).

(i) pay increased attention to the use of fellowships as a means of training and to separate provision of loan/credit funds for financing fellowships, instead of leaving such funding to contracts with consulting firms (even if such firms actually administer the fellowship program) (paras. 3.17, 4.13-4.15).1/

(j) provide adequate support for instructional materials for training programs as needed (para 4.18).

(k) pay due attention to the potential and role of women within the scope of training investments which are being considered or implemented (para. 4.19).

27. Recommendation (2): Given the need to ensure that due attention be paid to training in all lending activities, certain Bank reports need to be more specific on training:

(a) the Appraisal Report in each case (and President's Reports in the case of Technical Assistance projects) should be required to include

(i) where manpower deficiencies exist in the sector or agency concerned, a statement showing what these deficiencies are at all levels and how they are being addressed, whether within the appraised project or outside it. Encouragement should also be given to appraisal missions to adopt the practice observed in some appraisal reports of stating, where applicable, that deficiencies do not exist or are already being taken care of;

(ii) in cases where foreign technical assistance experts are being proposed for project financing, a statement as to what steps are being included or taken to eliminate or reduce the future demand for the importation of such services; and where such technical assistance is being provided for the conduct of studies under a project, whether the local institutions of higher education and training are being involved in the conduct of studies and, if not, what the barriers are to such involvement; where the foreign technical services are being included to provide services for which it would not be appropriate (for reasons of economy or any other reason) to build up local capacity, an explanatory statement to that effect; and

---

1/ For Bank staff reservations on the general question of the effectiveness of fellowships, please see p. 28, footnote to para. 3.24.

(iii) where training is being financed in a project, a separate Annex on training detailing the objectives and scope of the intended training, its state of preparation, the agencies or units responsible for carrying it out and other basic data essential to a full understanding of the component as agreed between Bank and country.[1/]

(b) the Supervision Report should include specific reference to training in all cases where training is included in the project. If the training component was not reviewed in the course of the particular supervision visit this should be stated. In Section 2 of the Supervision Summary Form (No.590) the Performance Rating categories should be expanded to include Training Components, as none of the existing categories--"Institution Building", "Performance of Consultants" and "Expected Benefits"--is adequate to cover training. If the training component has been completed the project supervision missions should monitor and report on the Borrower's utilization of the training and assessments of its outcomes (para. 5.07).

28. In commenting upon a draft version of this report the Bank staff, while on the whole expressing broad agreement with the conclusions and recommendations of the report, frequently raised the question of the staff resources needed to bring about the improvements which are needed in the Bank's work in training. It is clear that any changes in organization and staffing require detailed study which is beyond the purview of this review of performance in training and that improvement in performance will probably require more and appropriately trained and oriented staff resources. However, it is important to summarize here some of the broader conclusions and their resource implications. The report

(i) recommends greater focus upon the human factor in national development--a concern which should persist through economic and sector work and lending operations and bring the education and training systems more into play in addressing manpower constraints. This is essentially a change in emphasis, not an increase in lending; to the extent that human resource or people-oriented activities may be more time-consuming, some increase in staff resources will be inevitable; however, no vast net increases are needed to bring about this change in emphasis; and

(ii) advises that the attention given to training be more systematic and that the staff be oriented where necessary towards the application of relevant guidelines.

In this connection, it is important to note that greater participation by borrowers in the conceptual, preparatory and implementation stages of training components is recommended; hence not all of the additional work pertaining to improvement in training would necessarily require additional Bank resources. Greater use of the Bank's cooperative programs with international agencies to assist borrowers in these tasks is also recommended.

1/ The provision of such Annexes appears in practice to be optional at present.

OFFICE MEMORANDUM

M. Humphrey

TO: Members of the OPSC

DATE: June 4, 1982

FROM: E. Bevan Waide, Director, CPD

WB

File with the memo to which this relates with 6/8

SUBJECT: Bank Group Financing of Tea, Coffee and Cocoa: Suggested Agenda of Issues for June 9 OPSC Meeting - 9:00 a.m.

A brief memo on this subject, circulated on May 27, describes an interim procedure for lending decisions on these crops while a new approach is developed. In this new approach, a comprehensive assessment of project prospects would be made early in the project cycle by a panel of projects staff, EPD and AGR: one important element would be a quantitative evaluation of the impact of beverage crop projects on the real income of producers and consumers in other developing countries, using an extension of existing economic rate of return analysis.

I suggest that the agenda for the June 9 meeting include the following subjects.

1. Will the Interim Lending Guidelines work? (Annex A)

   a) Is the panel approach suggested in Annex A, para. 1 acceptable?

   b) Does the proposed procedure give adequate guidance on projects in the pipeline?

   c) Why should cocoa projects be treated differently from tea (as suggested by Annex A, para. 9); what is the basis for the 50 percent discount factor used?

2. Are there reservations about the wisdom of working on the proposed new approach?

   a) What is the likelihood that the methodology can be developed, tested and refined for use within the next 6-12 months?

   b) If reaching agreement on application of a new methodology takes longer than expected, will the interim procedure be adequate or is work on other alternatives needed?

   c) Should the Bank be more concerned with consumer

..../

interests, even if most consumers of these commodities are in developed countries? Does the proposed policy violate Bank-supported free trade principles?

d) Is any special work on diversification required to help identify alternative projects to absorb labor in poor countries likely to be denied Bank lending for beverage crop projects?

e) What are the implications of the proposed methodology for Bank projects for commodities other than tea, coffee and cocoa?

cc: Ms. Pratt
Mr. van der Tak
Mrs. Hughes
Messrs. Yudelman
Grilli
Scandizzo
Chernick

AShakow:ww

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

Mr. Humphrey

OFFICE MEMORANDUM

File wtt 6/4

TO: Operational Vice Presidents

DATE: June 3, 1982

FROM: Ernest Stern, SVPOP

SUBJECT: Energy Policy Paper

1. The last comprehensive statement by the World Bank on energy issues was "Energy in the Developing Countries", August 1980. On many issues, this paper still represents the state of the art. Since the preparation of this paper, however, the World Bank (among other institutions) has gained considerable additional experience in operating in the energy sector in developing countries and has an improved understanding of some important issues. Further, there is a need to update the World Bank's estimates of investment requirements which have gained wide publicity. We have therefore started work on a new policy paper with the following objectives:

(i) To update the Bank's analysis and perception of energy issues in LDCs, relying particularly on the experience gained in lending operations and country assessments in the last couple of years;

(ii) To update the estimates of investment requirements in developing countries, based on revised estimates of energy demand and production;

(iii) To review estimates of capital flows from official and commercial lenders, examine approaches and mechanisms used by other financing institutions (including oil companies) and identify ways in which the World Bank could complement and supplement their activity in financing of energy investments in developing countries; and

(iv) To review progress on the financing of an expanded World Bank lending program and provide guidance on the programming of the World Bank's energy lending within projected availability of finance.

2. The responsibility for preparing this policy paper lies with the Energy Department. However, they will consult other departments as required for relevant areas and will get in touch in the next few weeks to discuss the inputs they need.

3. The draft paper is expected to be ready for review at the end of January 1983. A preliminary outline of the paper is attached.

Attachment

cc: Messrs. Rovani, EGYDR, Fuchs, INDDR, Yudelman, AGRDR,
Waide, CPDDR, Wood, FPADR, (Mrs.) Hughes, EPDDR

Managing Committee

Energy Policy Paper

Preliminary Outline

A. Energy Sector Management and Development in Developing Countries

This chapter will focus on issues on which there is something to say beyond what was said in the 1980 paper.

- Overview of global/developing country trends in consumption and production.

- Assessment of progress in development of indigenous energy sources in Oil Importing Developing Countries (oil, gas, geothermal, coal, fuelwood, alcohol, etc.).

- Petroleum exploration activity: global and developing countries; roles of governments, national oil companies, multi-national oil companies, World Bank and other agencies; modalities of cooperation among different actors; review of World Bank petroleum exploration promotion activities.

- Use of gas: update on gas prospects in developing countries; costs; optimizing use of gas in export and domestic markets; role of international gas industry, governments, World Bank.

- Power: Increased complexity of system planning; importance of pre-investment, loss reduction, demand management; role of coal conversion, cogeneration, combined cycle; preparing hydro and nuclear power programs; financial viability of power utilities; role of World Bank, UNDP, governments.

- Refineries: growing imbalance between demand pattern and normal refinery output; technology and economics of refinery conversions to upgrade bottoms; criteria for refinery investments in developing countries; role of World Bank.

- Renewables: priorities in developing renewables (other than fuelwood), local institutional capacity and constraints in research and commercialization, importance of pre-investment, role of World Bank and other external assistance;

- Conservation: scope and content of energy conservation measures in industry, transport, household uses of different energy sources (including fuelwood).

- Regional development issues: scope for optimizing use of energy resources by preparing regional projects; operational difficulties.

- Pricing: analysis of pricing policies in power, petroleum and fuelwood; suggest principles.

- Institutional development: identify inadequacies in overall sector management and planning, operation of enterprises, execution of investments, modalities for external assistance.

- Oil price: outlook in medium and long term; implications for economics of energy investments in developing countries.

B. Estimation of Investment Requirements in Developing Countries

Demand: update on trends in energy (and power) demand; sectoral patterns and determinants; interfuel substitution; conservation; projected demand for 1985, 1990, 1995.

Supply: projected production of primary fuels and electricity.

Investment estimates: costs of production, transmission and distribution of energy; pre-investments and investment requirements for exploration and development of primary fuels, electricity, refineries.

C. Financing

- Estimates of financial flows from various sources (official and commercial); terms; objectives of different financing sources; procedural and other constraints.

- Role of banks and oil companies in financing petroleum exploration and development; their objectives, technique of analysis, use of project finance.

- Scope for increased collaboration between World Bank and others.

D. Conclusions and Role of World Bank

Role of World Bank in energy development, collaboration with other institutions, desirable scale and composition of World Bank lending.

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

M. Humphrey
5/2

TO: Mr. Moeen A. Qureshi, SVPFI

DATE: June 2, 1982

FROM: Ernest Stern, SVPOP

SUBJECT: Variable Maturity Option

I do not favor the proposed option discussed in Mr. Wood's memo of June 1. I think the device offered provides very minor protection against uncertainties and on the other hand could impose reduced maturity levels in countries where our terms already are inadequate from the viewpoint of project implementation. I recognize, of course, that this danger is as minimal as the protection offered against uncertainty. The scheme will complicate the system further, and while this clearly is a cost we should be able to bear if it serves a substantive purpose, this option is almost entirely symbolic.

I believe we have seriously overstated the problem of borrowers with a lack of familiarity with variable rate borrowings. There is virtually no country (I would say no country, but I have not had time to check them all) which is a Bank borrower and is not at the same time in the commercial market. Even the IDA-blend countries, such as India and Kenya, have outstandings on the Euro-market.

If we decide to go ahead with the option, I agree it should be offered to everyone.

However, I would suggest that we leave the proposal as originally submitted, indicate more clearly the limits of a variable maturity option which is affordable in terms of the impact on commitment limits, and indicate that the matter will be studied further and should additional degrees of freedom become available we will consider adding a meaningful variable maturity option.

cc: Members of the Managing Committee

ES:dpw

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

MB
File with OPSC papers
wht
6/3

TO: Members of the OPSC

DATE: June 1, 1982

FROM: Sidney E. Chernick, Assistant Director, CPD

SUBJECT: OPSC Meeting on Electric Power Sector Support Strategy Paper - Agenda of Issues

As you know, the OPSC will meet on Wednesday morning, June 2 at 9:30 a.m. in Room E-1208 to discuss the Energy Department's Sector Support Strategy Paper: Electric Power. Mr. Stern has asked that the attached agenda of issues for discussion be distributed to you.

cc: Ms. J. Pratt
Messrs. W. Humphrey
Y. Rovani
J. Fish

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Ernest Stern

DATE: May 28, 1982

FROM: E. Bevan Waide, Director, CPD

SUBJECT: OPSC Review of Electric Power Sector Support Strategy Paper - Possible Issues for Discussion

The OPSC meets on Wednesday, June 2 to discuss the Electric Power Sector Support Strategy paper. The Executive Summary (pp. v-xvi) and the Summary of Recommendations (pp. 49-51) provide a synopsis of the paper's main points. I suggest that the following issues be used as a basis for discussion.

A. Electric Power in the Broader Sectoral and Macro-Economic Context

The paper recommends that more emphasis be placed on longer-term planning of country programs, increased sector work, and an improved policy framework with appropriate conditionality.

1) Does regional experience support the paper's general assessment that a "wide gamut of changes in the Bank's approach to power operations" is necessary? (para. 3) Are the problems as serious as described? Is the limited attention paid to planning above the project level the most significant problem? Are there, in any case, energy strategies in many countries into which to integrate power programs? How widespread is the reluctance of governments to seek increased efficiencies, expand self-financing and otherwise mobilize domestic resources? (para. 1.10)

B. Size and Scope of the Lending Program

1) Country focus. As the Bank's financial and staff resources are limited, and the demand for power financing is so great, should the Bank concentrate on fewer countries? For example, at the moment, the portfolio is "heavily sprinkled with countries at both ends of the income spectrum" (para. 1.13), including those at the upper end that are returning to the program; should the Bank concentrate on the poorer countries, where the Bank's resources, policy influence, and technical assistance might be most needed and effective?

2) Size and nature of the program. Should the Bank's primary objective in this sector be "to mobilize project financing" (including making co-financing a principal objective) (para. 10 and page 49) or to heighten our sector policy work (as most of the paper suggests)? If the latter, how large a Bank financial participation in a government's total program is needed to achieve sectoral policy objectives?

a) A "three-year crash program" of important sector work is proposed. If staff resources are not increased, does this not imply that the number of lending operations would have to be reduced?

b) How can we determine the right level for CESW? Is there agreement that the staff problems are especially difficult in this sector - more so than in others? The paper proposes a variety of techniques for making the best of a difficult situation. Are the steps suggested (e.g. to add engineering loans and credits, draw on resources outside power divisions, increase use of UNDP, work more closely with ADB et al, enhance training and professional development activities) adequate to correct them?

3) Other energy investments

a) Is there need for a revision of the 1975 Bank policy on nuclear energy as suggested by the paper (para. 2.52)?

b) Do the actions described in the paper (paras. 2.54-56, 2.57-60), including coordination with UNDP, add up to adequate Bank attention to the opportunities for mini-hydro and other new and renewable energy sources? Conservation may offer many opportunities for efficiencies and cost savings (see para. 2.38-.43); are the suggested steps in para. 2.43 adequate?

c) The paper (para. 2.46) suggests rural electrification projects are not effective "vehicles for Bank lending". While available evaluation data supports the view that the links between rural electrification and increased agricultural and industrial productivity are often neglected or difficult to construct, could not properly designed projects be worthwhile investments? Should clearer Bank policy be enunciated in this area?

C. Program Conditions

1) Is it agreed that the emphasis in Bank project analysis should shift - that efficiency pricing should take precedence over financial viability? (paras. 18, 2.12)

2) What are the implications of attempting to gain ex ante agreement on major policy issues (e.g. efficiency improvements, resource mobilization and pricing) rather than continuing to place the Bank in an ex post regulatory role? (para. 2.05) Is this likely to result in a reduction in operations. Are there examples of particularly successful Bank experience in policy reforms?

3) Is it agreed that Bank covenants should be changed as proposed in para. 2.21?

4) Is the stress on autonomy (para. 2.04) likely to raise difficulties which cut across the paper's major point that the integration of power decisions more directly within the total economy is crucial? Is increased autonomy a realistic objective in most countries?

D. Where Do We Go from Here?

Understandably, given the original purpose of this sector support strategy paper, it could not provide extensive coverage of broad sectoral policy issues. In view, however, of the useful and stimulating way in which it touches on many of these policy issues, is there a case for a full scale energy sector review?

cc: Ms. J. Pratt