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## WORLD BANK FINANCING OF SCIENCE AND TECHNOLOGY; HIGHLIGHTING FUNDING IN AFRICA

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In discussions of "science and technology" there is sometimes an implicit ivory tower bias - emphasizing research and development done by learned professionals in university and government research laboratories. Certainly such research is important to the World Bank. However, in terms of the World Bank's mission of sustainable development benefiting the poor, "technology" often has more the connotation of shop floors or farming systems. If "technology" is the organized body of knowledge relating to production of goods and services, then the Bank is interested in the technology used on farms, in shops and businesses, and especially the technology used by and for the benefit of the poor. Such knowledge may be embodied in people (e.g. farmers, entrepreneurs, shop foremen), machines, software, or indeed in organizational or social capital. Programs which promote rapid technological innovation in developing country economies are perhaps prototypical of the relevant Bank interests. Such programs may focus on training, finance, policy changes, or investment in institutional capital, as well as traditional R&D and university education of scientists and technological professionals.

Scientific knowledge is applied more rapidly than in the past as technology. Topics in molecular biology that were recently the realm of the basic sciences are now fueling the biotechnology revolution. However, the relationship between science and technology is far more complex than just science informing technology. As technology shows us how to efficiently utilize mineral and other resources, geological and other sciences show us where those resources are to be found and how they can be managed. As technology allows us to more efficiently confront diseases, Epidemiology informs us as to who suffers from the diseases, and how public health campaigns can most effectively deal with them. As we seek to develop new technology based firms, Organization Science informs us how those firms can best be managed, and Economics informs us how their markets may be developed. As technological knowledge helps us design goods and services and their production, so does scientific knowledge inform us as to the needs our technology must fill, the resources our technologies may utilize, and the institutions and policies that we must put in place. Surely pure science and the search for and dissemination of knowledge for its own sake are important, but the Bank's primary interest is strongly in applied science.<sup>1</sup>

### GENERAL DESCRIPTION

The World Bank family includes several institutions. This paper discusses primarily two World Bank agencies: the International Bank for Reconstruction and Development (the IDRB) and the International Development Association (IDA). However, the Bank family also includes the International Finance Corporation, the Multilateral Investment Guarantee Agency and the International Center for the Settlement of Investment Disputes; each of these latter agencies also has a role in financing science and technology in developing nations.

IBRD provides loans and development assistance to middle-income countries and creditworthy poorer countries. IDA plays a key role in supporting the Bank's poverty

reduction mission. IDA assistance is focused on the poorest countries, to which it provides interest-free loans and other services.

This year, the President of the World Bank, James Wolfensohn, announced a Bank initiative termed "The Comprehensive Development Framework"<sup>2</sup> now being piloted in 13 countries. Its aim is:

to bring the social and the structural aspects of development together with the macroeconomic and the financial so as to establish a much more balanced and effective approach. To bring the players together so as to leverage all our activities. To work with the broad development community - the United Nations, the European Union, bilaterals, regional development banks, civil society and the private sector to build a new generation of genuine partnerships.<sup>3</sup>

Science and technology efforts of the Bank, with all other efforts, will increasingly be managed within this Framework.

Joseph Stiglitz, the Chief Economist of the World Bank, has noted:

Development represents a transformation of society, a movement from traditional relations, traditional ways of thinking, traditional ways of dealing with health and education, traditional methods of production, to more "modern" ways. For instance, a characteristic of traditional societies is the acceptance of the world as it is; the modern perspective recognizes change, it recognizes that we, as individuals and societies, can take actions that, for instance, reduce infant mortality, extend life spans, and increase productivity. Key to these changes is the movement to "scientific" ways of thinking, identifying critical variables that affect outcomes, attempting to make inferences based on available data, recognizing what we know and what we do not know.<sup>4</sup>

The Framework and its theoretical basis both emphasize knowledge. Indeed, Mr. Wolfensohn has emphasized the World Bank is seeking to become a "Knowledge Bank". He has recognized the need

- \* to capture best global thinking and expertise on issues and making it easily accessible to clients and partners, and

- \* to pioneer new partnerships that connect Bank clients with global centers of knowledge.

This year the Bank's Economic Development Institute was transformed into a "World Bank Institute" combining client and staff learning activities. The Bank also launched the World Bank Learning Network, a distance learning program that offers interactive video- and web-based courses, linking participants across the globe. In Africa, WBI worked with the African Development Bank and IMF to establish the Joint Africa Institute which developed pilot on-line Internet courses with the African Economic Research Consortium and 13 partner universities.

The new thinking in the Bank has led to an increased emphasis on capacity building, and specifically in Africa to the Partnership for Capacity Building. This initiative is African-led and will be implemented by Africans. It involves the direct support and collaboration of the Bank, the IMF, UNDP and the African Development Bank and it is rooted in partnership with the private sector and civil society. We have pledged \$150 million

to a supporting fund. We will all join with our African colleagues to support them in a coordinated and urgent effort to achieve their objectives.<sup>5</sup>

Carl Dahlman has put the Bank's interests in technology well. He stated:

Technology development is central to the three primary objectives of the Bank economic growth, poverty alleviation, and environmental sustainability. The main advantage of the Bank over other institutions is that it can provide comprehensive packages to countries packages of policy action, technical assistance, and finance for institutional and human resource development.<sup>6</sup>

Three thousand of the Bank's staff of 10,000 are reported to hold doctorates!

The IBRD and IDA are primarily lending institutions. Thus their main role in science and technology in developing countries is to finance loans to governments which the governments then use to support programs. The Bank also plays an important part in the donor community through programs in which it grants moneys to selected S&T institutions, and through its convening power to work with other donors to develop and manage such S&T programs.

### TRUST FUNDS AND GRANT PROGRAMS

The World Bank holds funds for specialized programs in trust, and these trust funds are important for technical assistance, grant making, and co-financing in specialized programs. Total trust fund disbursements in fiscal year 1999 were \$1.3 billion.<sup>7</sup> The administrative budget of the Bank was \$1.5 billion in fiscal year 1999.<sup>8</sup> The administrative budget included \$101 million for "development economics and the World Bank Institute", and \$129 million for the Development Grants Facility. It is not clear to the author what portion of these funds supports science and technology, but the following examples suggest the importance of the Bank's Trust Fund supported programs.

In agriculture the Bank plays an important role in the Consultative Group on International Agricultural Research, which supports 16 international agricultural research centers (IARCs). A Bank representative chairs the CGIAR, and another its finance committee. The World Bank provides the largest portion of CGIAR funding - \$45 million of the total of \$339.9 million in 1998.<sup>9</sup> The IARC centers play a key role in the international agricultural research system.

The Bank is also a leader in the Special Program for African Agricultural Research.<sup>10</sup> The Chair of the SPAAR Executive Committee is the World Bank Vice President for the African Region. The Bank houses the SPAAR secretariat and provides part of its staff. SPAAR's "Sustainable Financing Initiative"<sup>11</sup> was created to help meet the crisis in financing African national agricultural research systems. SFI has also recognized that there is a need for sustainable financing for regional systems of agricultural research since poor countries in Africa can not meet all their agricultural research needs domestically, nor can they domestically realize available economies of scale in agricultural research.<sup>12</sup>

The infoDev<sup>13</sup> program was initiated by the World Bank, to promote the development and application of information and communications technology in developing countries. The Bank funds the program (about \$3 million per year of the total of about \$15 million per year) and provides staff to the secretariat. Among its many grants, infoDev counts early support to the African Virtual University.<sup>14</sup> (Indeed the World Bank is a principal member of the donor

partnership supporting the AVU, having provided some \$6.5 million over the period 1995-99.)

In health, the World Bank is one of three co-sponsors of the Tropical Disease Research Program,<sup>15</sup> and has provided more than ten percent of TDR's funding since its initiation. TDR is a major source of financing for research on Leishmaniasis, Onchocerciasis, Filariasis, Malaria and Schistosomiasis (as well as other diseases) in developing countries. The Bank has participated in the Multilateral Initiative on Malaria, which supports research and training in Africa; thus it has supported the MIM/TDR Task Force on Malaria Research Capability Strengthening in Africa.<sup>16</sup> It is a co-sponsor of the HRP, a program which sponsors research on fertility regulation, methods of family planning and their safety and on methods of controlling sexually transmitted disease.<sup>17</sup> The Bank has also convened a group of partners to support the African Onchocerciasis Control Program<sup>18</sup> and its predecessor the OCP. These programs emphasized the application of existing technology to the elimination of River Blindness, but have required extensive R&D and technological innovation.<sup>19</sup> The Bank is also one of three funders of the International Health Policy Program, which funds policy research in developing countries.

In environment, the World Bank is one of three implementing agencies of the Global Environmental Facility, and it is the trustee of GEF funds. From 1991 to 1998, the GEF funded more than 500 projects, with a total of some \$2 billion (and co-financing from other sources exceeding \$5 billion).<sup>20</sup> While overall the GEF is heavily science based, it has significant technological components such as its programs to promote sustainable energy technologies.<sup>21</sup> The GEF Program for Measuring Incremental Costs for the Environment (PRINCE) funds methodology development and case studies on this topic, as well as dissemination of their findings.<sup>22</sup>

## LOAN PROGRAMS

Total worldwide IBRD and IDA lending reached \$28.6 billion in Fiscal Year 1999. \$21.1 billion was loaned by the IBRD, and \$7.5 billion by IDA. Nearly all lending to the Africa region (\$2.1 billion) was via IDA. Adjustment lending (\$15.3 billion) for the first time exceeded investment lending. Lending for human development (education, health, nutrition, and social protection) was \$7.3 billion; lending for rural and urban services was about 30 percent of the total.<sup>23</sup>

In fiscal year 1999, co-financing amounted to \$11.3 billion,<sup>24</sup> and co-financing added 39.1 percent to the value of lending provided by the Bank. Partners in co-financing are primarily bilateral and multilateral official donors.

At present, the World Bank has committed \$17 billion for 455 loans to Sub-Saharan African governments. Nearly all of these loans are made through the International Development Association (IDA). The agricultural sector accounts for almost one fifth of the projects in the sub-Saharan African portfolio, followed by Transportation, Education, and Population, Health and Nutrition. Other areas where the World Bank makes loans to African countries are energy, the environment, mining,<sup>25</sup> public sector management, telecommunications, and urban development. In terms of the size of commitments, the Transportation sector accounts for the highest portfolio ( US \$3.1 billion), followed by Agriculture ( US \$1.8 billion) and Multisector (US \$1.8 billion).<sup>26</sup>

Ghana, Madagascar and Uganda have the highest number of loans, accounting for about 19%. But Ghana, Ethiopia and Tanzania account for the biggest loan amounts, with total credits of \$4.2 billion.<sup>27</sup>

Few of the Bank's loan projects are explicitly classified as "science and technology", and there is no explicit accounting category in the Bank to provide summary data on the scientific and technological components in its very large number of loan projects. As a result the following remarks draw on a number of special studies of scientific and technological loan funding in selected portions of the program.

Worldwide, from 1981 through 1996 the World Bank lent \$3.9 billion for funding agricultural research through 458 projects in 91 countries.<sup>28</sup> Of these 458 projects, fifty were free standing agricultural research projects, while the others included agricultural research with other agricultural and rural development objectives. This intermixture of research support with support for other functions appears typical of all sectors.

In the period 1981-84, only six percent of the average of some \$225 million in annual World Bank agricultural research funding went to sub-Saharan Africa; by the period 1993-95 funding for sub-Saharan African agricultural research had risen to 50 percent of the world total of some \$250 million per year. Thus the Bank has been funding about \$125 million for agricultural research per year in Africa. Funding of agricultural extension somewhat exceeds that of agricultural research, and the two together now account for more than a quarter of World Bank agricultural lending.

A now somewhat dated study<sup>29</sup> notes that:

World Bank lending for higher education and science and technology development has increased significantly. Between 1970 and 1991, lending for higher education amounted to US\$5.0 billion, of which 50% was lent between 1985 and 1991. The science and technology component of higher education lending amounted to US\$2.16 billion, of which 63% was invested between 1985 and 1991.

World Bank funding of higher education began in 1963. From 1963 to 1991, the Bank funded 140 higher education projects in Africa, which amounted to 32 percent of its worldwide higher education portfolio. However, Africa's share of higher education lending was only eleven percent in 1991.

A review of the Bank's experience developing industrial technology was published in 1995.<sup>30</sup> It noted that, while the World Bank provided funding for industrial development for many years, until the 1970s, technological capability building remained incidental to the Bank's major lending activities. After the establishment of the office of Science and Technology Advisor, in the 1970's, a number of studies were conducted for the promotion of industrial scientific and technological capabilities in the developing countries. The Bank's first lending for industrial technology development was approved in 1975, and the first project devoted solely to industrial technology development was launched in 1977 in Spain. During the 1980s a series of technology development projects, mostly for Newly Industrializing Economies, was designed and approved. But the Office of the Science Advisor was abolished, and thereafter such efforts remained sparse.

More recently, the World Bank has focused on lending programs to support micro, small and medium enterprises. The majority of this funding supports financial services to such enterprises. A key means of technology innovation in small and medium enterprises is the acquisition of new equipment embodying technological advances, and Bank programs have supported development of leasing and of loan services to enable such equipment acquisition. The Bank has also supported efforts to develop non-financial (Business Development) services for SMEs, including training and technology development and diffusion services;<sup>31</sup> again, such efforts may play an important technological role in the sector.

It has been estimated<sup>32</sup> that in 1992 the World Bank spent one to two percent - some \$20 million to \$30 million - of its total health sector commitments on R&D. These expenditures were divided among:

- \* research with results having generalizability across countries (16 percent);
- \* specific policy analysis (22 percent); and
- \* country specific sector work (64 percent).

Unfortunately it has not been possible to estimate for this presentation the clearly much larger portion of Bank loans that might appropriately be considered "science and technology" involving such activities as the professional training of health service providers or innovations in health service technology.

Other scientific and technological activities are scattered throughout the Bank's portfolio. Some examples include:

- \* The mining sector's technical assistance portfolio includes a) strengthening institutions through re-organizing government agencies responsible for supervision of the sector and training of public and private sector officials; b) creating of earth and environmental science database management systems; c) putting into place mining title registries and land management systems; d) improving the technical, environmental and social conditions of small scale miners; and e) providing funding for geological cartography, geochemistry and geophysical surveys, and remote sensing imagery.<sup>33</sup>
- \* The Asia Alternative Energy Program (ASTAE) focuses on renewable energy and energy efficiency in the World Bank's power sector lending operations in Asia. The cumulative pipeline of ongoing and prospective alternative energy projects is about US\$1.2 billion in 31 Bank/GEF loans and grants in 10 countries. Renewable energy projects involve the installation of over 0.7 GW of environmentally-sustainable electricity generation capacity, and energy efficiency projects will avoid need for over 0.9 GW of capacity.<sup>34</sup>
- \* The Bank has produced a manual for mini-electrical grids, used in villages which have local generators but are not tied to regional nor national grids.<sup>35</sup>
- \* The telecommunications and informatics programs of the Bank are focused on opportunities offered by technological advances, and how these opportunities can be realized for developmental purposes, especially those benefiting the poor.
- \* The transportation sector of the Bank deals with many modes of transportation: roads, railroads, and ports as well as urban and rural transportation systems. Technological choice in these systems relates fundamentally to efficiency. Bank client nations are frequently restructuring their transportation systems, increasing the role of the private sector; as they do



so, the need for increased public planning and regulation raises new needs for scientific and technological knowledge. The Bank's transportation "thematic knowledge bases respond in part to these needs.<sup>36</sup>

\* Technological choice is also critical to sustainable and affordable water and sanitation systems, and the Bank has reviewed some 4,000 websites worldwide to provide links to the most valuable for developing countries.<sup>37</sup>

\* The Bank has a strong program in educational technology.<sup>38</sup>

The applications of science and technology are perhaps less recognized by the Bank in the area of financial services financial services. Clearly the applications of information and communications technology have transformed the sector, and the sector is dependent on knowledge from economics and organizational sciences, but there seems to be little explicit recognition of such dependencies in Bank literature.

Environmental programs of the bank emphasize topics such as biological diversity, forestry, water resources management, pollution management, drylands management and global climate change. Programs dealing with such topics must be based strongly on scientific knowledge, and must often emphasize technological innovation. Indeed, it seems clear that development of scientific and technological capacity in developing countries to deal with environmental problems must be a key part of successful donor programs. Unfortunately, it has not been possible in this paper to identify the science and technology components of the Bank's portfolio of environmental projects.

A recent study<sup>39</sup> has focused on the portfolio of World Bank "science and technology projects" funded from 1992-98. The study included projects such as:

\* the Knowledge Innovation Project in Mexico (FY98), which supports a competitive research grants programs, efforts to improve Mexico's network of governmental SEP-CONACYT research centers, and efforts to improve the linkages between governmental and university research institutes and the private sector;

\* the Private Sector Development Project in Ghana (FY95) which seeks to improve the incentive structure for competition and technological efforts;

\* and the Mauritius: Technical Assistance to Enhance Competitiveness Project (FY94) which created a national quality system, and supported upgrading of services related to metrology, testing and standards.

The study was complementary to the review of agricultural research described above, and did not seek to identify the science and technology components of other programs.<sup>40</sup>

The 23 projects included in the study had an aggregate loan value of \$2.15 billion (approximately \$300 million per year). Most were to large, relatively technologically-advanced developing countries, and only four percent of the total went to African nations.

The World Bank has recently announced its Millennium Science Initiative. The Initiative seeks to encourage developing countries to develop centers of excellence in which high quality research can be performed and researchers can be trained. Such centers must have a critical mass of highly competent researchers. Peer review is considered the sine qua non for the selection of the centers to be funded. Eventually it is expected that the centers will be linked in an international network serving the scientific and technological needs of the developing world. The first loan<sup>41</sup> in support to this program was made to Chile in 1999 with

a value of \$5 million. Proposed loans to other countries to enable them to participate in the Millennium Science Initiative are under discussion.

## CONCLUSIONS

The World Bank is the world's largest donor of development assistance. Its program is large and complex. Its program is heavily and increasingly knowledge based. As even the brief discussion of the program above has indicated, the scientific and technological aspects of the Bank's program are complex and of such a magnitude as to stretch one's understanding.

The Bank has used its loan portfolio to develop scientific and technological capacity in developing countries. Efforts have been especially important in agriculture. As is perhaps natural, countries more able to utilize funding for science and technology have received most such loan funding in the past. On the other hand, the Bank's recognition of the need for help in building agricultural research capacity in Africa has lead it to devote half of its total agricultural research funding to Africa in the latter part of the 1990's.

The World Bank has a much smaller grant budget than loan budget, but it has entered into partnerships to leverage these funds and has taken a leadership position in supporting research and development, especially in key institutions such as the CGIAR, TDR and infoDev.

As the World Bank transforms itself into a "Knowledge Bank" it will continue and in all probability increase its efforts to build scientific and technological capacity in developing countries, as part of a comprehensive approach to sustainable development and poverty alleviation.

## ENDNOTES

1. The World Bank has funded the "Science and Technology Infrastructure Project" in Mexico, which primarily funded the renovation and extension of the University R&D infrastructure, and indeed lending for infrastructure in other contexts is a regular Bank function.

2. <http://www.worldbank.org/cdf/>

3. Wolfensohn, James D., "Coalitions for Change," World Bank Annual Meeting Speech, September 1999.

<http://www.imf.org/external/am/1999/speeches/PR02E.pdf>

4. Stiglitz, Joseph, "Towards a New Paradigm for Development: Strategies, Policies and Processes," 1998 Prebisch Lecture at UNCTAD, October, 1998.

<http://www.worldbank.org/html/extdr/extme/jssp101998.htm#F24>

5. Wolfensohn, James D., "Coalitions for Change," World Bank Annual Meeting Speech, September 1999.

<http://www.imf.org/external/am/1999/speeches/PR02E.pdf>

6. Dahlman, Carl, "Technology, Development, And The Role Of The World Bank", Human Capital Development and Operations Working Paper, The World Bank, Washington, DC, no date specified. [http://www.worldbank.org/html/extdr/hnp/hddflash/workp/wp\\_00053.html](http://www.worldbank.org/html/extdr/hnp/hddflash/workp/wp_00053.html)

7. World Bank Annual Report, 1999, page 144.

8. World Bank Annual Report, 1999, page 148.

9. Consultative Group on International Agricultural Research Annual Report: 1998.

10. <http://www.worldbank.org/afr/aftsr/index.htm>

11. <http://www.worldbank.org/afr/aftsr/sfi1.htm>



12. A model for such programs might be the Inter-American Development Bank initiated "Regional Fund for Agricultural Technology" which provides competitive grants for agricultural research, based on an endowment funded by the countries of the Latin America.  
<http://fontagro.org/aindex.htm>
13. <http://www.worldbank.org/infodev>
14. <http://www.avu.org/>
15. <http://www.who.int/tdr/index.html>
16. <http://www.who.int/tdr/diseases/malaria/mimprojects.htm>
17. <http://www.who.int/hrp/about/index.html>
18. <http://www.worldbank.org/gper/>
19. The program was based on the discovery of an insecticide which would kill the vector carrying the disease, but early research confirmed that areas cleared of the disease were being re-infected and required development of a regional strategy. Later, as resistance to the pesticide developed, new pesticides had to be developed and tested for the program. Eventually a program involving rotational use of seven larvacides was instituted on the basis of understanding of the potential of development of resistance in the black fly vectors. A major advance was made when the program demonstrated that ivermectin could eliminate 95 percent of the microscopic parasites that cause the disease from infected people, leading to a strategy which combined vector control and mass distribution of ivermectin to the villagers in the regions affected.
20. <http://www.gefweb.org/intro/gefintro.pdf>
21. Indeed it can be involved in major R&D projects, such as its efforts with the Rockefeller Foundation, General Electric, Shell and others to develop and demonstrate a biomass gas turbine technology that uses eucalyptus chips to produce electricity.
22. <http://www.gefweb.org/prince/primer.htm>
23. World Bank Annual Report.  
<http://www.worldbank.org/html/extpb/annrep/index.htm>
24. World Bank Annual Report, 1999, page 141.
25. In conjunction with its mining program, the Bank is assisting 14 African countries in the development of their Geological Surveys, including provision of institutional innovation and best practice, assisting in the creation and dissemination of information and knowledge, and assisting the Geological Surveys to identify good practices in information technology implementation.  
<http://www.worldbank.org/html/fpd/mining/harare.pdf>
26. <http://www.worldbank.org/afr/portfolio.htm>
27. [idem.](#)
28. "The World Bank's Role in Strengthening National Research Systems," chapter four of Byerlee, Derek and Gary Alex, Strengthening National Agricultural Systems, World Bank, 1998.
29. Eisemon, Thomas Owen, and Lauritz Holm-Nielsen, "Developing Capacity for Research and Advanced Scientific Training: Lessons From World Bank Experience," Education and Social Policy Department, World Bank, March 1995.  
<http://www.worldbank.org/html/extdr/educ/backgrnd/paris1.html>
30. Najmabadi, Farrokh and Sanjaya Lall, Developing Industrial Technology: Lessons for Policy and Practice, World Bank, 1995.
31. Cf. Hallberg, Kristin, "Small and Medium Scale Enterprise: A Framework for Intervention," World Bank, May 1999.  
<http://www.worldbank.org/html/fpd/mining/harahttp://wbln0018.worldbank.org/networks/fpsi/rmfsme.nsf/a22044d0c4877a3e852567de0052e0fa/c96929051aa63773852567fa006b8112?OpenDocument>

32. Investing in Health Research and Development: Report of the ad hoc Committee on Health Research Relating to Future Intervention Options, World Health Organization, Geneva, 1996, page 223.
33. "The World Bank Group Mining Sector Reform,"  
[http://www.worldbank.org/html/fpd/mining/submining/sector\\_reform.htm](http://www.worldbank.org/html/fpd/mining/submining/sector_reform.htm)
34. "ASTAE: Asia Alternative Energy Program", <http://www.worldbank.org/astae/>
35. "Mini-Grid Design Manual: Draft Report,"  
[http://www.worldbank.org/html/fpd/energy/off\\_grid/mini-grid.htm](http://www.worldbank.org/html/fpd/energy/off_grid/mini-grid.htm)
36. <http://www.worldbank.org/html/fpd/transport/entry.htm>
37.  
<http://www.worldbank.org/html/fpd/transport/entry.htm><http://www.worldbank.org/html/fpd/water/topics/technology.html>
38.  
<http://wbIn0018.worldbank.org/HDNet/HDdocs.nsf/a4a4350ee87460838525670c004e2f09/e9e53f4433e1c1828525670d0001c20a?OpenDocument>
39. Crawford, Michael F., "Review of World Bank Lending for Science and Technology: 1992-98", Technet Working Paper, Draft Version, September, 1999.
40. For example, infrastructure projects dealing with telecommunications, energy, transportation, and water are likely to be highly technical, and strongly involved in technological transfer and innovation, but could not be reviewed for science and technology content within the Crawford report. Similarly, mining and other projects seem likely to have significant scientific and technological content, but were not reviewed for Crawford's study.
41. The Learning and Innovation Loan, 1999.