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Report No: 20411

# IMPLEMENTATION COMPLETION REPORT
(36930)

ON A

LOAN

IN THE AMOUNT OF US$190 MILLION

TO THE

REPUBLIC OF KOREA

FOR A SCIENCE AND TECHNICAL EDUCATION PROJECT

June 7, 2000

**Human Development Unit**
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective June 2000)

Currency Unit = Korean Won (W)
W 1 = US$ 0.0009
US$ 1.00 = W 1060

FISCAL YEAR
January 1 December 31

ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| BK21 | Brain Korea 21 |
| EOP | End of Project |
| GOK | Government of Korea |
| ICB | International Competitive Bidding |
| ICR | Implementation Completion Report |
| JTC | Junior Technical College |
| KBSI | Korea Basic Science Institute |
| L/C | Loan/Credit |
| MOE | Ministry of Education |
| MTR | Mid-Term Review |
| NCB | National Competitive Bidding |
| OU | Open University |
| O&M | Operations and Maintenance |
| PAP | Policies and Actions Program |
| PCD | Project Concept Document |
| PSR | Project Status Report |
| QAG | Quality Assurance Group |
| R&D | Research & Development |
| SAROK | Supply Administration, Republic of Korea |
| S/F | Student/Faculty |
| S&T | Science and Technical |
| TL | Team Leader |
| VHS | Vocational High School |

| | |
|---|---|
| Vice President: | Jemal-ud-din Kassum |
| Country Director: | M. G. Sri-Ram Aiyer |
| Sector Director: | Alan Ruby |
| Task Team Leader: | Carol Hau-Lai Ball |
| Primary Author: | Yoko Nagashima |

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| *Project ID:* P004168 | *Project Name:* KR-SCIENCE & TECH EDUC SECT |
| *Team Leader:* Carol Hau-Lai Ball | *TL Unit:* EASHD |
| *ICR Type: Core ICR* | *Report Date: June 7, 2000* |

## 1. Project Data

*Name:* KR-SCIENCE & TECH EDUC SECT
*L/C/TF Number:* 36930
*Country/Department:* KOREA, REPUBLIC OF
*Region:* East Asia and Pacific Region
*Sector/subsector:* ET - Higher Education

KEY DATES

| | | | Original | Revised/Actual |
|---|---|---|---|---|
| *PCD:* | 10/02/92 | *Effective:* | 05/11/94 | 05/11/94 |
| *Appraisal:* | 06/22/93 | *MTR:* | 03/01/97 | 10/27/97 |
| *Approval:* | 01/06/94 | *Closing:* | 12/31/99 | 12/31/99 |

*Borrower/Implementing Agency:* GOK/MOE/KBSI
*Other Partners:*

| STAFF | Current | At Appraisal |
|---|---|---|
| *Vice President:* | Jemal-ud-din Kassum | Gautam Kaji |
| *Country Manager:* | M. G. Sri-Ram Aiyer | Callisto E. Madavo |
| *Sector Manager:* | Alan Ruby | J. Shivakumar |
| *Team Leader at ICR:* | Carol Hau-Lai Ball | |
| *ICR Primary Author:* | Yoko Nagashima | |

## 2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

*Outcome:* HS
*Sustainability:* HL
*Institutional Development Impact:* H
*Bank Performance:* HS
*Borrower Performance:* S

| | QAG (if available) | ICR |
|---|---|---|
| *Quality at Entry:* | | |
| *Project at Risk at Any Time:* | No | |

## 3. Assessment of Development Objective and Design, and of Quality at Entry

*3.1 Original Objective:*

The overall objective of the project was to assist in improving the quality of science and technical (S&T) education and research in Korea through implementation of an agreed Policies and Actions Program (PAP) by the Ministry of Education (MOE) and the provision of specialized equipment. Specifically, the project was to:

(a) support quality improvement in undergraduate science and engineering departments in selected universities;
(b) assist in strengthening the teaching and research capacity of marine science institutions to address environmental problems;
(c) assist in improving the quality of practical science and engineering programs in the open universities (OUs) and in selected junior technical colleges (JTCs);
(d) improve opportunities for junior research activities in basic sciences through strengthening common research facilities at the Korea Basic Science Institute (KBSI), formerly the Korea Basic Science Center (KBSC); and
(e) enhance the quality of training in selected vocational high schools (VHSs).

*3.2 Revised Objective:*

The project objectives were not revised.

*3.3 Original Components:*

The loan was to finance equipment with a total baseline cost of US$190 million. This equipment was to be allocated to: (1) MOE - US$170 million; and (2) KBSI - US$20 million. The MOE's share was allocated as follows: (1) engineering departments - US$60 million; (2) natural science departments - US$45 million; (3) marine science departments - US$20 million; (4) OUs - US$15 million; (5) JTCs - US$10 million; and (6) VHSs - US$20 million.

The Government of Korea (GOK) was to supply complementary inputs of US$134.8 million including contingencies to ensure all the equipment would be utilized effectively. Of this, US$63.9 million was to finance local transportation and installation, operations and maintenance (O&M) and consumable materials for the equipment. The GOK was also to finance physical facilities for KBSI's equipment (US$8.8 million) and all contingencies (US$62.0 million).

*3.4 Revised Components:*

Components were not revised. However, there were some changes in the loan allocations within the components (from private to public institutions) due to some cancellation during the financial crisis of 1998 - 1999 by the private institutions of the subsidiary loans for equipment made to them by the GOK.

*3.5 Quality at Entry:*

Not available.

## 4. Achievement of Objective and Outputs

*4.1 Outcome/achievement of objective:*

The project met overall project objectives.

Approximately 16,800 pieces of equipment were provided to a total of 123 MOE institutions and the KBSI by the project. Under the MOE, the project facilitated and enhanced research capabilities and teaching programs, especially in science and technology, at 36 university engineering departments, 41 university natural science departments, 10 marine science institutions, 9 OUs, 8 JTCs, and 19 VHSs. All equipment items are actively used for research and teaching at the project institutions (see Tables 1 and 2 of Borrower's Evaluation Report, MOE). The research outputs have been impressive. Under the MOE, the number of research projects has more than doubled from 4,105 in 1995 to over 10,000 in 1999. A total of 40,929 research activities were conducted during the implementation period, about 50% over appraisal estimates. The results of 87% of these activities were published either domestically or internationally, 12% have been used by related industries, and 2% have been awarded patents. Similarly, KBSI conducted over 40,000 joint research projects with universities, research institutes and industrial companies during the implementation period, and a total of approximately 600 of them have been published domestically and internationally.

The project benefited not only the project institutions but also other institutions including several in the private sectors by making the procured equipment available to them. For example, 9 major national universities in Korea have allocated 29.4% of their loan allocations to their research and teaching support institutes which provide common facilities and equipment to users from not only inside but also outside the project universities. Similarly, equipment provided to the Korea Marine University was utilized by private organizations and industries for training.

*4.2 Outputs by components:*

**Component 1: MOE**

Agreed PAP was monitored and updated regularly. The outputs of the project by component are measured against the agreed PAP.

**Engineering Departments**: A total of 4,055 pieces of equipment were provided to 19 public and 17 private universities. The following PAP targets were also achieved: (a) the number of professors was increased from 6,500 in 1992 to 11,615 in 1999, more than the target of 10,840 which was expected to result from an annual increase of 620; (b) a reduction in student/faculty ratios from 37 in 1992 to 25 in 1999; and (c) a reduction in teaching load from 12 classes per week in 1992 to 9 classes per week in 1999.

**Natural Science Departments**: A total of 4,688 pieces of equipment were provided to 20 public and 21 private universities to help upgrade their laboratories. The supply of equipment was complemented by an increase in the number of professors from 7,900 in 1992 to 11,563 in 1999. This increase in staff also led the natural science departments to achieve other PAP targets: (a) a reduction in student/faculty ratios from 26 in 1992 to 19 in 1999; and (b) a reduction in teaching loads from 12 classes per week in 1992 to 9 classes per week in 1999. The following joint targets for both engineering and natural science departments were also met: (c) expansion of library capacity; (d) an increase in the number of visiting professors which reached 806 in 1998 and exceeded the target of 120 for that year; and (e) an increase in academic research

subsidies from W20 billion in 1992 to W100 billion in 1999.

**Marine Science Departments**: The project provided a total of 1,091 pieces of equipment to 10 public marine science departments. The project-funded equipment has helped these institutions to enhance their research capacity. Under GOK's concept of centralizing expensive equipment to make it efficient to maintain and operate and to allow its utilization without institutional discrimination, the Marine Simulation Training and Research Center was built at the Korea Marine University to host the most expensive project-financed equipment item, a Full Mission Shiphandling Simulator System. This item has been well utilized not only by the university's staff and students, but also by the private sector for training.

**Open Universities**: Although the project did not meet the original PAP target for provision of equipment in 1998, it made significant contributions to quality improvement of the OU's technical programs. The project provided a total of 1,232 pieces of equipment to 9 OUs and raised the equipment provision rate from 26% of standard lists for each category of laboratory in 1992 to 73% in 1999.

**Junior Technical Colleges**: A total of 1,177 pieces of equipment were provided to the 4 public and 4 private JTCs. The project raised the equipment provision rate from 54% of the standard lists in 1992 to 90% in 1998, which was well above the PAP target of 76%. The JTCs also achieved the following PAP targets: (a) an increase in student enrollments from 159,000 in 1992 to 294,250 in 1999; (b) an increase in a number of JTC/industry cooperation committees to 60 by 1999; and (c) a reduction in student/faculty ratios from 29 in 1992 to 18 in 1999.

**Vocational High Schools**: The project provided a total of 4,240 pieces equipment to 19 VHSs and met the equipment provision target of 70% in 1999. The number of Joint Practice Centers in the VHS system increased to 38 in 1999 and well exceeded the PAP target of 30.

**Component 2: KBSI**

A total of 322 pieces of equipment were provided to the KBSI main campus and 4 regional centers by the project and were utilized for joint research projects with universities, research institutes and industrial companies during the project period. There were a total of 44,692 research projects undertaken by 4,191 participating organizations. Three hundred sixty eight of them were published domestically, and 242 were published internationally.

*4.3 Net Present Value/Economic rate of return:*

Not applicable.

*4.4 Financial rate of return:*

Not applicable.

*4.5 Institutional development impact:*

The project had a significant impact on institutional development of the selected institutions which directly received equipment from the project as well as other universities, research institutions, and industrial companies with which joint research projects were conducted. The project-funded equipment enabled these institutions to enhance their research capabilities and teaching programs. These impacts are evidenced in

the increased number of research projects, publications, and patent awards during the project implementation mentioned in Section 4.1.

## 5. Major Factors Affecting Implementation and Outcome

*5.1 Factors outside the control of government or implementing agency:*

The financial crisis in Korea that began in September 1997 did not cause a shortfall of counterpart funds due to the GOK's strong commitment to the project. However, there were some changes in the loan allocations within the components (from private to public institutions) due to the cancellation during the crisis by the private institutions of the subsidiary loans for equipment made to them by the GOK.

*5.2 Factors generally subject to government control:*

The GOK was highly committed to improving the quality of S&T education and to producing skilled manpower to support the country's technical advancement in the coming decades. Therefore, the project received strong support and close collaboration from the government throughout its implementation period. There were no factors subject to GOK control that negatively affected implementation or the outcome of the project.

*5.3 Factors generally subject to implementing agency control:*

The performance of the project implementation agencies was satisfactory throughout the implementation period (Sections 7.5 and 7.6) and there was no negative impact on implementation or the outcome of the project that were subject to the implementation agencies' control.

*5.4 Costs and financing:*

The total project cost estimated at appraisal was US$324.8 million including contingencies of US$62 million. There was no problem with counterpart funds throughout the project. At project closing, the total project cost was US$322.39 million, and cumulative disbursements were US$189.23 million. Financing under IBRD was 59% of total and 41% under the GOK. Detailed project costs and financing are shown in Annex 2.

## 6. Sustainability

*6.1 Rationale for sustainability rating:*

The sustainability of project objectives is **highly likely** due mainly to: (1) the GOK's continuing strong commitment to the S&T education sector; (2) already-secured funding for future operation of the project institutions; (3) the high technical and professional knowledge of the staff working in the sector; and (4) the continuous revision of policy to meet new demands in the sector.

The GOK remains strongly committed to the expansion and improvement of S&T education and research to ensure an adequate supply of trained manpower for the rapidly changing information age.

**Universities**: The GOK launched Brain Korea 21 (BK 21) in 1999 to develop internationally known Korean research universities mainly in the fields of natural science and engineering. The government is committed to investing a total of US$1.2 billion over the next seven years for BK 21. In addition, US$70

million will be provided annually to procure highly-technical experimental equipment to advance the research capacity of the universities.

GOK funds have been provided to build new facilities such as the Marine Simulation Training and Research Center to house some of the more sophisticated project-financed simulation and research equipment. The contracts for these pieces of equipment include training by the manufacturers as well as maintenance contracts. In addition, these items generate income to the Center by providing access and training to the private sector. Therefore, O&M funds for future operation of the equipment are expected to be adequate.

**Open Universities and Junior Technical Colleges**: The GOK will continue to finance experimental equipment for the OUs and selected JTCs to improve the quality of their practical science and engineering programs and research (a total of US$7 million will be provided to JTCs for procurement of experimental equipment in 2000).

**Vocational High Schools**: The GOK will further support expansion of region-based joint practice centers for the VHSs and has committed an additional US$5 million to build 2 new centers in 2000. Moreover, investment for the multimedia laboratories will be provided to a total of 774 VHSs by 2001.

**Korea Basic Science Institution**: The GOK opened another KBSI regional branch center in Chonju, the fifth one, in December 1999 and is committed to further support expansion of research and development (R&D) at the KBSI and interaction with universities and industrial institutions through collaborative projects in basic science.

*6.2 Transition arrangement to regular operations:*

Not applicable.

## 7. Bank and Borrower Performance

***Bank***

*7.1 Lending:*

The Bank performance in identification, preparation, and appraisal was highly satisfactory. The project was carefully prepared to respond to the government's request for assistance in the S&T education and research sector. The project was designed within a policy and institutional framework which had been strengthened under previous Bank projects. During preparation, a number of issues in the sector were discussed with the Borrower and appropriate actions were identified in the PAP. The project appraisal document was well prepared and provided clear guidance to the Borrower during implementation. Efficiency was gained during the preparation stage by combining the preparation of this project with preparation of both the Environmental Research and Education Project (Loan 3612-KO) and the Environmental Technology Development Project (Loan 3694-KO).

*7.2 Supervision:*

Supervision performance was highly satisfactory. The Bank conducted supervision missions every six months with adequately skilled staff. Continuity of Bank staff throughout project implementation, combining supervision with the other two projects (Section 7.1), and efficiently coordinated missions both by the Bank and the Borrower minimized the total staff weeks spent on supervision to below 30. Mission supervision reports were complete with updated performance indicator, covenant compliance, and project

status reports (PSRs) which included detailed information on disbursements and procurement.

*7.3 Overall Bank performance:*

The overall Bank performance is rated **highly satisfactory**.

***Borrower***

*7.4 Preparation:*

The Borrower's performance in identification, preparation, and appraisal was highly satisfactory. The borrower identified the project for potential external financing before requesting Bank assistance. Most of the preparation work was completed by the Borrower and was compliant with requests for information formulated by the Bank.

*7.5 Government implementation performance:*

The GOK's implementation performance was highly satisfactory throughout project implementation. The government had a strong commitment to the project and provided close collaboration with the Bank during the supervision missions. The borrower was in compliance with Bank requirements for the timely submission of audit reports, semi-annual progress reports, and status reports. The government's efficient monitoring and reporting on project implementation facilitated supervision by the Bank missions and should be given special recognition.

*7.6 Implementing Agency:*

Staff of the implementation agencies (MOE and KBSI) were highly dedicated and knowledgeable in project management and implementation. The major component of the project, procurement of specialized equipment, was handled in a highly satisfactory manner by the Supply Administration, Republic of Korea (SAROK), the government's central procurement agency which has had a long and successful experience in equipment procurement under past Bank projects. The implementing agencies were excellent in record keeping and reporting and provided sufficient information to the Bank's supervision missions. However, there was a change in responsible project staff toward the end of the project, causing some delays in the preparation of the ICR questionnaires and evaluation summaries due to their unfamiliarity with the project.

*7.7 Overall Borrower performance:*

The overall Borrower performance is rated **satisfactory**.

## 8. Lessons Learned

Korea originally graduated from borrower status in June 1995. However, due to the financial crisis in 1997, Korea is now under "re-graduation" status. This will probably be the final education loan to the GOK. Therefore, the key lessons to be learned from this project shall apply to other projects in general.

(1) **Project design and capacity of implementation agencies**: The project design was simple. The project had only two major components and these were implemented by two implementation agencies (MOE and KBSI) which had considerable experience in implementing earlier Bank projects. The simple project design and the careful assessment of implementation agencies during project design facilitated a smooth and successful project implementation.

(2) **Capacity of procurement agency**: The borrower's procurement agency had sufficient knowledge of the Bank's procurement procedures and capacity to prepare technical specification which greatly enhanced the project's implementation.

(3) **Diffusion of project equipment**: The project made the procured equipment available to outside project institutions including some universities, private organizations and industries. This resulted in high equipment utilization rates and generated impressive numbers of researches and publications (Section 4.1), and supplemental income for future O&M funds of equipment (Section 6.1).

## 9. Partner Comments

*(a) Borrower/implementing agency:*
See Annex 7 for the Borrower's comments.

*(b) Cofinanciers:*
Not applicable.

*(c) Other partners (NGOs/private sector):*
Not applicable.

## 10. Additional Information

## Annex 1. Key Performance Indicators/Log Frame Matrix

**Outcome / Impact Indicators:**

| Indicator/Matrix | Projected in last PSR[1] | Actual/Latest Estimate |
|---|---|---|
| 1.0 Support quality improvement in undergraduate science and engineering departments in selected universities. | Achieved by end of project (EOP) | Achieved |
| 2.0 Assist in strengthening the teaching and research capacity of marine science institutions to address environmental problems. | Achieved by EOP | Achieved |
| 3.0 Assist in improving the quality of practical science and engineering programs in the open universities and in selected junior technical colleges. | Achieved by EOP | Achieved |
| 4.0 Improve opportunities for joint research in basic sciences through strengthening common research facilities at the Korea Basic Science Center (now termed Korea Basic Science Institute (KBSI). | Achieved by EOP | Achieved |
| 5.0 Enhance the quality of training in selected VHSs. | Achieved by EOP | Achieved |

**Output Indicators:**

| Indicator/Matrix | Projected in last PSR[1] | Actual/Latest Estimate |
|---|---|---|
| Science and Engineering | | |
| 1.1 Gradually change undergraduate enrollment ratios in the fields of science and engineering relative to humanities; improve the capacity and graduation rates of students to better meet industrial manpower requirements. | Ratio of 57:43 in 1998 | Ratio of 54:46 in 1999 |
| 1.2 Student enrollment to reach 231,000 by 1998, an increase from 192,000 in 1992. These increases would be subject to a review of manpower requirements in 1996. | Reached 231,000 in 1998 | Reached 280,857 in 1999 |
| 1.3 Student/staff ratios to be reduced | Ratio of 20:1 for science and 25:1 for engineering | Reached 19:1 in science and 25:1 in engineering |
| 1.4 Visiting Professors program to be expanded. | 120 in 1998 | 841 in 1999 |
| 1.5 Academic subsidies for research to be increased. | 100 billion Won in 1998 | 150 billion Won in 1998 and 100 billion Won in 1999 |
| 1.6 Library capacity will be increased (library seats/student enrollment). | 20% in 1998 | 20% in 1999 |
| 1.7 Implement relevant policies and actions (see Annex 2, SAR). | Implemented by ICR year | Fully implemented |

| | | |
|---|---|---|
| 1.8 Equip all science and engineering programs to 100% of standard equipment lists for each program. | 70% in 1996 | Standard list abolished in 1997<br>301.8 billion Won for 1999 |
| Marine Science | | |
| 2.1 Equip all marine science teaching and research programs to 100% of standard equipment lists for each program by ICR year. | 100% by ICR year | Standard list abolished in 1997 |
| Junior Technical Colleges | | |
| 3.1 Admission quotas in JTCs to be increased. | 118,000 by ICR year | 148,040 in 1999 exceeded target |
| 3.2 JTC student/staff ratios to be improved. | 25:1 by ICR year | 18:1 in 1999 |
| 3.3 JTC/Industrial cooperation committees to be established. | 53 by 1998 | 60 by 1999 exceeded target |
| 3.4 Enrollment percentages of population at age 18 will be increased in JTC technical programs. | 30% by 1998 | 37% in 1999 exceeded target |
| 3.5 Equip all selected programs as a % of standard equipment lists for each program. | 76% by ICR year | 90% in 1998 exceeded target |
| Korea Basic Science Institute<br>4.1 KBSI will upgrade equipment to provide improved capacity to conduct basic science research. | 100% by ICR year | Program completed |
| Vocational High Schools<br>5.1 The project will assist VHSs to upgrade provision rate of equipment. | 70% by ICR year | Standard list abolished in 1997<br>70% of the original list in 1999 |
| Open Universities<br>6.1 Equip all open universities to 100% of standard equipment lists for each program. | 100% by ICR year | Standard list abolished in 1997<br>73% of the original list in 1999 |

[1] End of project

## Annex 2. Project Costs and Financing

Project Cost by Component (in US$ million equivalent) Appraisal Estimate

| Project Cost by Component and category | Equipment | Transportation and Installation | O&M | Consumable Materials | Civil Works | Total costs |
|---|---|---|---|---|---|---|
| Engineering Departments | 60.00 | 3.61 | 7.86 | 7.86 | | 79.33 |
| Natural Science Departments | 45.00 | 2.72 | 6.17 | 6.17 | | 60.06 |
| Marine Science Departments | 20.00 | 1.20 | 2.88 | 2.88 | | 26.96 |
| Open Universities | 15.00 | 0.90 | 1.92 | 1.92 | | 19.74 |
| Junior Technical Colleges | 10.00 | 1.02 | 1.4 | 1.4 | | 13.82 |
| Vocational High Schools | 20.00 | 1.15 | 2.88 | 2.88 | | 26.91 |
| Korea Basic Science Institute | 20.00 | 1.20 | 2.88 | 2.88 | 8.81 | 35.77 |
| Baseline Cost | 190.00 | 11.80 | 25.99 | 25.99 | 8.81 | 262.59 |
| Contingencies | | | | | | |
| Physical | 19 | 1.18 | 2.61 | 2.61 | 0.87 | 26.27 |
| Price Contingencies | 21 | 2.12 | 6.3 | 6.3 | 0.22 | 35.94 |
| Subtotal Contingencies | 40 | 3.3 | 8.91 | 8.91 | 1.09 | 62.21 |
| **Total Project Cost** | 230.00 | 15.10 | 34.9 | 34.9 | 9.9 | 324.80 |

Project Cost by Component (in US$ million equivalent) Actual/Latest Estimate

| Project Cost by Component and category | Equipment | Transportation and Installation | O&M | Consumable Materials | Civil Works | Total costs |
|---|---|---|---|---|---|---|
| Engineering Departments | 76.87 | 2.20 | 1.92 | 1.18 | 10.82 | 92.99 |
| Natural Science Departments | 66.84 | 1.68 | 1.54 | 0.95 | 10.83 | 81.84 |
| Marine Science Departments | 22.85 | 0.73 | 0.71 | 0.43 | 18.15 | 42.87 |
| Open Universities | 15.54 | 0.59 | 0.45 | 0.28 | | 16.86 |
| Junior Technical Colleges | 16.87 | 0.67 | 0.38 | 0.23 | | 18.15 |
| Vocational High Schools | 32.05 | 0.73 | 0.70 | 0.43 | | 33.91 |
| Korea Basic Science Institute | 20.00 | 1.20 | 2.88 | 2.88 | 8.81 | 35.77 |
| **Total Project Cost** | 251.02 | 7.80 | 8.58 | 6.38 | 48.61 | 322.39 |

* Submissions from KBSI and MOE dated February and April 2000 respectively, provided actual loan costs and partial project costs; where there were no project costs provided, original appraisal estimates have been used.

**Project Costs by Procurement Arrangements (Appraisal Estimate)** (US$ million equivalent)

| Expenditure Category | Procurement Method[1] ICB | NCB | Other[2] | N.B.F. | Total Cost |
|---|---|---|---|---|---|
| 1. Works | 0.00 | 0.00 | 0.00 | 9.90 | 9.90 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2. Goods | 195.60 | 23.00 | 11.40 | 0.00 | 230.00 |
| | (161.50) | (19.00) | (9.50) | (0.00) | (190.00) |
| 3. Services Operations & maintenance | 0.00 | 0.00 | 0.00 | 34.90 | 34.90 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 4. Transportation & Installation | 0.00 | 0.00 | 0.00 | 15.10 | 15.10 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 5. Consumable materials | 0.00 | 0.00 | 0.00 | 34.90 | 34.90 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Total | 195.60 | 23.00 | 11.40 | 94.80 | 324.80 |
| | (161.50) | (19.00) | (9.50) | (0.00) | (190.00) |

**Project Costs by Procurement Arrangements (Actual/Latest Estimate)** (US$ million equivalent)

| Expenditure Category | Procurement Method[1] ICB | NCB | Other[2] | N.B.F. | Total Cost |
|---|---|---|---|---|---|
| 1. Works | 0.00 | 0.00 | 0.00 | 48.61 | 48.61 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2. Goods | 249.22 | 1.10 | 0.70 | 0.00 | 251.02 |
| | (187.43) | (1.10) | (0.70) | (0.00) | (189.23) |
| 3. Services Operations & maintenance | 0.00 | 0.00 | 0.00 | 8.58 | 8.58 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 4. Transportation & Installation | 0.00 | 0.00 | 0.00 | 7.80 | 7.80 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 5. Consumable materials | 0.00 | 0.00 | 0.00 | 6.38 | 6.38 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Total | 249.22 | 1.10 | 0.70 | 71.37 | 322.39 |
| | (187.43) | (1.10) | (0.70) | (0.00) | (189.23) |

* Submissions from KBSI and MOE dated February and April 2000 respectively, provided actual loan costs and partial project costs; where there were no project costs provided, original appraisal estimates have been used.

1/ Figures in parenthesis are the amounts to be financed by the Bank Loan. All costs include contingencies.

2/ Includes civil works and goods to be procured through national shopping, consulting services, services of contracted staff of the project management office, training, technical assistance services, and incremental operating costs related to (i) managing the project, and (ii) re-lending project funds to local government units.

## Annex 3: Economic Costs and Benefits

Not applicable.

## Annex 4. Bank Inputs

*(a) Missions:*

| Stage of Project Cycle | No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.) | | Performance Rating | |
|---|---|---|---|---|
| Month/Year | Count | Specialty | Implementation Progress | Development Objective |
| **Identification/Preparation** | | | | |
| 03/92 | *2* | Economist/Technical Educator | | |
| 07/92 | *6* | Economist/Technical Educator/Environmental Technology/Environmental Science Specialist/Science Educator/Environmental Policy and Institution | | |
| 12/92 | *6* | Economist/Technical Educator/Environmental Technology/Environmental Science Specialist/Science Educator/Environmental Policy and Institution | | |
| 03/93 | *3* | Economist/Technical Educator/Environmental Science Specialist | | |
| **Appraisal/Negotiation** | | | | |
| 07/93 | *3* | Economist/Technical Educator/Environmental Science Specialist | | |
| 11/93 | *1* | Economist | | |
| **Supervision** | | | | |
| 09/94 | *1* | Technical Educator | HS | HS |
| 12/94 | *3* | Environmental Specialist/Vocational Training Specialist/Technical Educator | S | HS |
| 07/95 | *3* | Environmental Specialist/Vocational Training Specialist/Technical Educator | S | HS |
| 12/95 | *2* | Vocational Training Specialist/Technical Educator | S | HS |
| 06/96 | *2* | Senior Technical Educator/Technical Educator | S | HS |
| 11/96 | *3* | Environmental Specialist//Technical Educator/Senior Technical Educator | HS | HS |
| 06/97 | *2* | Procurement/Senior Technical Educator | HS | HS |
| 05/98 | *2* | Senior Technical Educator/Implementation Specialist | HS | HS |
| 11/98 | *1* | Senior Technical Educator | HS | HS |

| | | | | |
|---|---|---|---|---|
| 05/99 | *2* | Operations Analyst/Task Assistant | HS | HS |
| **ICR**<br>11/99 | *1* | Operations Officer | HS | HS |

*(b) Staff:*

| Stage of Project Cycle | Actual/Latest Estimate | |
|---|---|---|
| | No. Staff weeks | US$ (,000) |
| Identification/Preparation | 30.4 | 69.8 |
| Appraisal/Negotiation | 7.1 | 18.8 |
| Supervision | 29.6 | 71.5 |
| ICR | 7.1 | 14.8 |
| Total | 74.2 | 174.9 |

## Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

| | *Rating* |
|---|---|
| ☒ *Macro policies* | ○ *H* ○ *SU* ○ *M* ○ *N* ● *NA* |
| ☒ *Sector Policies* | ○ *H* ● *SU* ○ *M* ○ *N* ○ *NA* |
| ☒ *Physical* | ● *H* ○ *SU* ○ *M* ○ *N* ○ *NA* |
| ☒ *Financial* | ● *H* ○ *SU* ○ *M* ○ *N* ○ *NA* |
| ☒ *Institutional Development* | ● *H* ○ *SU* ○ *M* ○ *N* ○ *NA* |
| ☒ *Environmental* | ○ *H* ○ *SU* ○ *M* ○ *N* ● *NA* |
| *Social* | |
| ☒ *Poverty Reduction* | ○ *H* ○ *SU* ○ *M* ○ *N* ● *NA* |
| ☒ *Gender* | ○ *H* ○ *SU* ○ *M* ○ *N* ● *NA* |
| ☒ *Other (Please specify)* | ○ *H* ● *SU* ○ *M* ○ *N* ○ *NA* |
| *Human Development* | |
| ☒ *Private sector development* | ○ *H* ○ *SU* ● *M* ○ *N* ○ *NA* |
| ☒ *Public sector management* | ○ *H* ● *SU* ○ *M* ○ *N* ○ *NA* |
| ☐ *Other (Please specify)* | |

## Annex 6. Ratings of Bank and Borrower Performance

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

| *6.1 Bank performance* | *Rating* |
|---|---|
| ☐ *Lending* | ● *HS* ○ *S* ○ *U* ○ *HU* |
| ☐ *Supervision* | ● *HS* ○ *S* ○ *U* ○ *HU* |
| ☐ *Overall* | ● *HS* ○ *S* ○ *U* ○ *HU* |

| *6.2 Borrower performance* | *Rating* |
|---|---|
| ☐ *Preparation* | ● *HS* ○ *S* ○ *U* ○ *HU* |
| ☐ *Government implementation performance* | ● *HS* ○ *S* ○ *U* ○ *HU* |
| ☐ *Implementation agency performance* | ○ *HS* ● *S* ○ *U* ○ *HU* |
| ☐ *Overall* | ○ *HS* ● *S* ○ *U* ○ *HU* |

## Annex 7. List of Supporting Documents

1. Implementation Completion Mission Aide-memoire, The World Bank
2. Borrower's Project Evaluation Report, KBSI
3. Borrower's Project Evaluation Report, MOE

REPUBLIC OF KOREA

IBRD Progress Review Mission for
The Science and Technical Education Project – Loan 3693-KO

Aide Memoire [1]

1. The IBRD Mission[2] visited Korea from November 17 to 27, 1999, to review the implementation progress of the Science and Technical Education Project (Loan 3693-KO), and to prepare the project for closing on December 31, 1999.

2. During the course of its review for the project, the mission visited the Ministry of Finance and Economy (MOFE), Ministry of Education (MOE), the Supply Administration, Republic of Korea (SAROK), Korea Basic Science Institute (KBSI), Taejon City Office of Education, Chungnam Mechanical and Technical High School, Pusan National University (College of Natural Science and College of Pharmacy), Korea Maritime University, Pukyong National University, Pusan Metropolitan City Office of Education, and Kyong Nan Technical High School. The mission would like to take this opportunity to express its appreciation for the kind hospitality and assistance extended to the mission during these visits.

3. The mission received two status reports, one from Ministry of Education (MOE) and one from Korea Basic Science Institute (KBSI)[3]. The mission also received the FY98 Audit Report from KBSI. The overall progress was generally satisfactory.

4. **Summary of Procurement and Disbursement.** The Loan will be closed on schedule on December 31, 1999. Procurement and disbursement for KBSI have been completed with their Loan allocation fully disbursed (US$20.0 million approximately). The overall progress of procurement and disbursement under the MOE components has been satisfactory, and expected to reach almost full disbursement. MOE has informed the mission that there may be about $250,000 unused funds to be cancelled at closing. Annex 1 provides a summary of the procurement and disbursement data given to the mission by MOE and KBSI.

5. **Procurement.** Total amount of procurement requests sent to SAROK has reached US$196.6 (103% of the loan amount), of which US$175.4 million was from MOE (103% of its allocation) and US$21.2 million from KBSI (106% of its allocation). The total amount of signed contracts was US$186.3 million (98% of the loan amount), of which US$165.7 million was from MOE (97% of its allocation) and US$20.6 million from KBSI (103% of its allocation). Some of the requests are in the process of being contracted, and for an approximate amount of US$630,000, MOE would like to request the Bank's approval for procuring four research equipment packages using international shopping procedures. The mission endorsed such procurement procedures for meeting

[1] This Aide Memoire is subject to the review and modification by Bank Management.
[2] The mission comprised Ms. Carol Hau-Lai Ball, Task Leader, EASHD.
[3] KBSI component of this Loan is not under MOE, but is under the Ministry of Science and Technology.

the relatively short procurement lead time in order for the project to be closed on time, and would recommend to the Bank that approval be given on an exceptional basis, if such request would forward to the Bank officially.

6. **Disbursement.** Total disbursements have improved from US$168.0 million (88% of total loan amount), of which US$156.3 million was from MOE (93% of its allocation) and US$20.0 million from KBSI (100% of its allocation). The mission urged MOE to speed up its disbursement activities in order to fully utilize the Loan proceeds before its Closing Date. Both KBSI and MOE expressed their desire to request the four-month grace period in order to process disbursement documents. The mission expressed such request will be supported by the Bank if needed.

7. **Covenant Compliance.** All loan covenants are in full compliance. There is no outstanding audit report. The final Policies and Actions Program will be submitted to the Bank by December 31, 1999.

8. **KBSI.** The mission visited KBSI in Taejon and found their procurement and disbursement activities have been nearly completed with the last Application for Withdrawal #17, totaling about US$653,346.03, to be submitted to the Bank shortly. The mission discussed with KBSI staff the preparation activities for the Implementation Completion Report (ICR) and its purpose, and agreed on the ICR schedule including the submission of project financial data and project achievements as well as the ICR questionnaires (a simpler version of Annex 4).

9. **Field Visit Findings**. As stated in paragraph 2 above, the mission visited three universities and two technical high schools in Taejon and Pusan cities. Equipment financed by the Bank represents only about 2% to 3% of the total equipment in Chungnam Mechanical and Technical High School and Kyong Nan Technical High School (US$462,262 and US$213,422 respectively). Mechanical equipment and computers are well kept and highly utilized. Graduation rate for both schools is almost 100% and employment rates are about 60% to 70% with the rest of the students entering universities and technical institutions. Both high schools are very well managed with no shortage of staff and classrooms. About 10% of the 25,000 students in Chungnam Mechanical and Technical High School stay in school dormitory, which was built in 1978. Computer and English courses are essential part of the school curricula. Girl enrollment represents about 30% of the total student enrollment in the Kyong Nan Technical High Schools, where as Chungnam Mechanical and Technical High School is a boys' technical high school.

10. The actual Loan allocations for Pusan National University, Korea Maritime University, and Pukyong National University are US$2,925,890, US$5,418,000 and US$11,931,602 respectively. Pusan National University has a yearly budget of US$97.8 million, Korea Maritime University US$35.0 million, and Pukyong National University US$83.0 million. All three universities were participants of previous Bank-financed education projects, such as 7$^{th}$ and 9$^{th}$ education projects. All universities expressed their gratitude toward the Bank for helping them to accomplish the science and technical academic achievements including enhancing their research capability to remain competitive in the globalization environment.

11. New facilities were built to house the additional expensive simulation and research equipment financed by the Loan such as the Marine Simulation Training and Research Center of Korea Maritime University, and the Cooperative Laboratory Center of Pukyong National University. Bank-financed equipment represents about 60% to 70% in these two centers. These two research centers are very modern buildings, and they are well maintained and managed. Korean universities usually do not charge user fees for use of their equipment by the public, however, the Cooperative Laboratory Center has been charging small amounts of user fees since 7 months ago. So far, they have collected about 10.0 million Won. They are aiming at 30.0 million Won per year, and no charge for university students and faculties. Different pieces of equipment are being kept in three Colleges in Pusan National University – Colleges of Natural Science, Engineering, and Pharmacy, and their utilization rates are fairly high compared to the new research centers in Korea Maritime University and Pukyong National University.

12. Equipment for three universities is well kept, and utilization activities are logged for each piece of equipment. There is no shortage of funds for staff and consumables. Several full time staff are on the job to assist research activities as well as for maintenance and inventory controls. Some highly sophisticated pieces of equipment have included training contracts by manufacturers as well as maintenance contracts. The most expensive equipment financed by this project and inspected by the Bank is the Full Mission Shiphandling Simulator System in the Marine Simulation Training and Research Center of the Korea Maritime University. It costs about US$2.0 million, which has a 270 degree bridge view. The center also offers training courses to private sector as well.

13. **MOFE.** The mission paid a courtesy visit to MOFE, and thanked them for their support and cooperation during the implementation of all 11 education projects. The mission also discussed the mutual understanding of loan allocation distributions among project components.

14. **SAROK.** Review of Bid Evaluation Reports and Contract Awards. The mission visited SAROK in Taejon City, and reviewed a random sample of 68 procurement items out of 262 items (26% of total contract awards under this review period). The mission reminded SAROK that no price negotiations are allowed under the ICR procedures, and the requirement of revising the technical specifications for rebidding as well as its reasons have to be clearly documented. The Bank's guidelines need to be strictly followed for the rest of the implementation period.

15. **SOE Review.** There were 6 applications for withdrawals (AFWs) under MOE and 1 AFW under KBSI. The mission reviewed about 12% of the items of MOE's AFWs, totaling about 25 items; and 100% of the 11 items of KBSI's AFW#16. No discrepancies were found.

16. **ICR Preparation.** ICR preparation and its activity schedule were agreed upon with both KBSI (see paragraph 8) and MOE (see Annex 5). A set of questionnaires was given to each of the implementation agencies to complete and submit to the Bank separately (see Annex 4). The purpose of ICR was also discussed (see Annex 2).

17. **Settlement of the Special Account.** Either AFWs or the refund of the balance of the Special Account should be done in order to settle the Special Account with the Bank's Disbursement Division. Refund should be sent to the following World Bank account:

Federal Reserve Bank of New York
33 Liberty Street, NY, NY 10045, USA
Account IBRD A-General ABA no. 210-8138-3
Attention: Foreign Department
Reference: IBRD Loan 3693-KO, SA Refund

18. **Other Educational Documents**. The mission expressed its appreciation for receiving several education documents from MOE in the subject areas of: (i) introducing computers and internet access to classrooms, (ii) teacher's training on new technology, and (iii) higher education reform.

19. There will be no future progress review mission for this project. The project is expected to close on December 31, 1999. The ICR is scheduled to be finalized in June 30, 2000.

November 26, 1999

# Project Evaluation Summary

# Korea

# The Science and Technical Education Project

# (Loan 3693-KO)

February 15, 2000

Korea Basic Science Institute

# < Project Review from the Borrower's perspective >

## 1. Objectives of the project

The project was the second phase of a large master plan aimed at improving opportunities for joint research activities in the basic research through strengthening common research facilities and equipment at KBSI.

## 2. Benefits from the projects

2.1 KBSI could be committed by the project to support our government's science and technology polices in serving the needs of university faculty members and professionals from public and private R & D institutes by helping to build and operate the unique and state-of-the-art equipment as well. (Table 1, 2)

2.2 The project would lead to improved research cooperation between institute, university and industry through more efficient research equipment and facilities for basic research. (Table 3)

2.3 KBSI helps to prepare the scientific and technical work force of the future by offering a variety of learning and R & D experiences to graduate students and faculty members. (Table 4)

2.4 Close relationship between Bank staff and the executing department has yielded several institutional benefits to KBSI.

## 3. Bank's performance

3.1 Bank personnel were recognized as professional in all respects. Not only mission members were always highly qualified in their respective fields but also staff appraisal report was appropriate to address the kinds of implementation problems occurring.

3.2 The constructive dialogue and Bank's supervision effort was quite beneficial.

## 4. Lessons learned

4.1 The overall communications between the Bank and the Borrower, including accounting of commitments and draw-down of loan proceeds, should be sufficiently well documented and thoroughly understood so that when the changes in government or mission personnel occur, such changes will deeply affect project implementation.

4.2 The performance of the participating institutions in overall project planning should be reviewed to compare with the results.

4.3 A specialist and manual should be made available to make a thorough review of equipment specifications before going out to tender. Moreover, clearly stated responsibilities about warranty should be pointed out in equipment specifications.

4.4 Bidding and reimbursing procedures should be fully recognized not to take much time in preparing and getting documents.

## 5. Project sustainability

5.1 The sustainability of economic benefit is to provide reliable utility support and the additional necessary infrastructure required to produce the appropriate environment for conducting outstanding research.

5.2 In terms of technology progress, new scientific research fields came into being as a result of newly acquired equipment and we were able to commit education programs on state-of-the-art equipment.

5.3 The users are strongly recommended to carry out research in the basic sciences to ensure a national competence and knowledge in research and development field.

## 6. Conclusion

6.1 During the past year, significant effort was expended on a working administrative framework for each of the equipment, and KBSI has continued its outreach programs, ranging from the dissemination of information about facilities to the development of extensive contacts

through the headquarters and nation-wide branches. Therefore, remarkable progress was made in relatively short periods.

6.2 Plans for the future involve the expansion of such efforts and the assumption of additional responsibility in facilitating scientific education programs.

6.3 This year will see completion of many of the activities developed during the project period.

6.4 R & D interactions between university and industry should be greatly increased by more exchange of knowledge, personnel and collaborative projects.

6.5 We shall continue to develop our basic understanding of the structure of our activities so that we can define meaningful measures of progress.

6.6 We believe that our enriched research equipment, when fully set up, will make constructive changes to revitalize the university and industry research so that our wealth of talent and facilities will contribute more effectively to our research capacities and economic growth.

Table 1.

## NUMBER OF RESEARCH SERVICES AT KBSI

| Year / Sector | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Total |
|---|---|---|---|---|---|---|---|
| Cases | 3,671 | 5,386 | 5,968 | 7,870 | 9,647 | 12,150 | 44,692 |
| Samples | 22,611 | 28,589 | 31,211 | 43,455 | 54,160 | 72,094 | 252,120 |
| Users | 1,872 | 2,527 | 3,062 | 3,523 | 3,085 | 3,509 | 17,578 |
| Organizations | 482 | 591 | 653 | 573 | 1,041 | 851 | 4,191 |

Table 2.

## NUMBER OF EQUIPMENT AND FACILITY

## (BY REGION)

Dec. 1999

| Region | Number |
|---|---|
| Taedok Headquarters | 164 |
| Seoul Branch | 71 |
| Pusan Branch | 30 |
| Taegu Branck | 30 |
| Kwangju Branch | 27 |
| Total | 322 |

Table 3.

# RESEARCH WORK AFTER THE PROJECT

(Unit : Thousand Won / One year)

| Project Name | Budget | Source |
|---|---|---|
| 1. Studies on the Structures and Functions of Nucleic Acids and Proteins Which are Related to the Protein Synthesis | 28,000 | Government |
| 2. Material Science under Multi-extreme Conditions | 320,000 | Government |
| 3. KSTAR System Design and Integration | 730,000 | Government |
| 4. Development of Tokamak Structure and Vacuum Systems | 4,203,000 | Government |
| 5. Development of Plasma Diagnostic and Control Systems | 540,000 | Government |
| 6. Development of Superconducting Magnet Systems | 125,000 | Government |
| 7. Studies on Three-dimensional Structures of Biomolecules Using NMR | 69,000 | Government |
| 8. Development and Application of High Resolution Microimaging System | 170,000 | Government |
| 9. Installation of Ultra High Voltage Transmission Electron Microscope | 1,000,000 | Government |
| Total | 7,185,000 | |

Table 4.

# EDUCATION PROGRAMS('94-'99)

1) Outlines

| Sector / Year | Number of Education | Number of Participants |
|---|---|---|
| 1994 | 7 | 165 |
| 1995 | 16 | 345 |
| 1996 | 18 | 338 |
| 1997 | 21 | 382 |
| 1998 | 21 | 313 |
| 1999 | 18 | 408 |
| Total | 101 | 1,951 |

2) Participating Organizations

| Sector / Year | Universities | Industries | Institutes | Total |
|---|---|---|---|---|
| 1994 | 124(75%) | 20(12%) | 21(13%) | 165 |
| 1995 | 235(68%) | 68(20%) | 42(12%) | 345 |
| 1996 | 270(80%) | 31(9%) | 37(11%) | 338 |
| 1997 | 229(60%) | 73(19%) | 80(21%) | 382 |
| 1998 | 245(78%) | 41(13%) | 27(9%) | 313 |
| 1999 | 302(74%) | 73(18%) | 33(8%) | 408 |
| Total | 1,405 | 306 | 240 | 1,951 |

# About KOREA BASIC SCIENCE INSTITUTE

In order for Korea to recover from the current economic crisis and to become an advanced nation, it is essential that we transform from the technology import mode to the creative R&D mode. The real economic development takes place only when it is strongly based on science and technology. Basic science is the basis of creative and innovative technological advances and also the source that breathes vitality into applied or exploratory research.

Korea Basic Science Institute(KBSI) was launched in August, 1988 as the first National Users' Facility to help carry out effective basic science research in Korea. By maintaining the most advanced, state-of-the-art equipment and research facilities that are typically too expensive for individual institutes to acquire, joint use of facilities and cooperative research are being conducted at Taedok headquarters and at four regional branches. KBSI is also leading the national fusion R&D program, which is to design and construct a superconducting tokamak device, called KSTAR(Korea Superconducting Tokamak Advanced Research). It eventually will become a world-class national users' facility.

Following the original charter mission of KBSI, we will do our best to keep it as the central institute to promote basic science, to expand its specialized areas of scientific support, and to secure the user-oriented support capabilities.

We like to make sure that the users have an easy access to the equipment and facilities by establishing an user-friendly open-door operation. Through such effort, we believe KBSI can become a world-class basic science joint research institute.

Facing upon the era of science and technology of the 21st century, we promise to do our best to provide high-level research support, based on our ten-year experience and accumulated knowledge. And we sincerely hope that all members of the science & technology communities and related organizations around the world continue to support our mission.

# Brief History

| | |
|---|---|
| 1987. May | A public hearing was held to establish the Korea Basic Science Center(KBSC). |
| 1988. Aug. | KBSC was established as an affiliate of the Korea Science and Engineering Foundation. |
| 1988. Aug. | Dr. Hyun-Nam Kim was appointed the first president. |
| 1991. Aug. | Dr. Bak-Kwang Kang was appointed the second president. |
| 1991. Oct. | KBSC was reorganized under the auspices of the Korea Research Institute of Standards and Science. |
| 1992. Mar-Apr. | Four regional branches(Seoul, Pusan, Taegu and Kwangju) were established. |
| 1992. Dec. | Taeduck headquarters construction was completed. |
| 1993. Apr. | Dr. Byong-Kwon Park was appointed the third president. |
| 1993. May | KBSC became an affiliate of the Korea Research Institute of Standards and Science |
| 1995. Jan. | Dr. Duk-In Choi was appointed the fourth president. |
| 1995. Apr. | KBSC has been renamed to the Korea Basic Science Institute(KBSI). |
| 1996. Jan. | National Fusion R&D Center was established at KBSI. |
| 1998. Jul. | Dr. Jung-Soon Lee was appointed the fifth president. |
| 1999. May | KBSI was formally registered as a non-profit organization. |
| 1999. Dec. | Chonju regional branch was established. |

# Function

## Headquarters

Promote and activate high quality research in the basic science through joint use of equipment in selected fields of national importance by

1. Install and operate the National User's Facility and Measurement Center
2. Construct joint research system using advanced equipment
3. Study interpretation and analysis of measurement results and develop educational training program

Establish Korean National Fusion R&D Program

1. Construct a steady-state capable KSTAR Device that is Next Generation Advanced Superconducting Tokamak Device
2. Step up the strong international collaboration joining with leading countries of fusion research

Play a pivotal role in basic science research and information dissemination by

1. Exchange information with Scientific Research Center and Engineering Research Center(SRC, ERC), and reinforce cooperation in basic science research field
2. Establish science information center for basic research with scientific journals
3. Promote joint use of research equipment through the DB

## Branches

Conduct joint research with regional scientific studies and exchange information by

1. Support joint use of equipment appropriate to the research activities and university characteristics of each region
2. Provide measurement and analysis service for the regional university research community and industry
3. Offer educational programs and practical training opportunities related to super accurate equipment

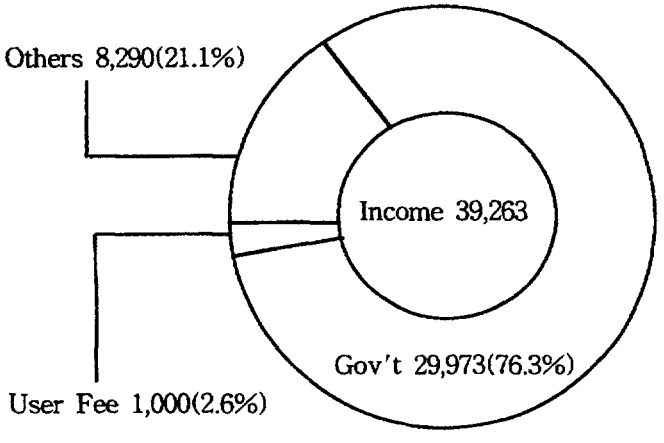
# Finance & Personnel

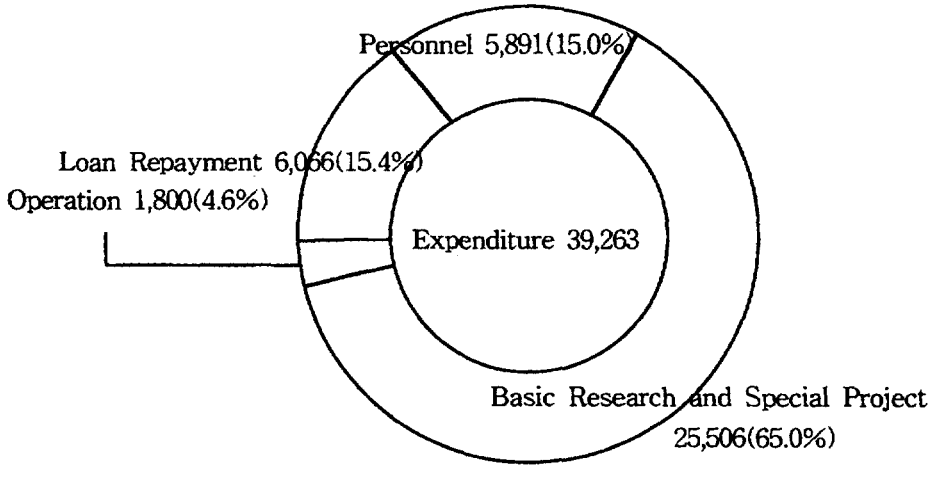
## Personnel(December 1999)

| | |
|---|---|
| Executive | 1 |
| Researchers | 66 |
| Engineering Staff | 65 |
| Administration Staff | 38 |
| Total | 170 |

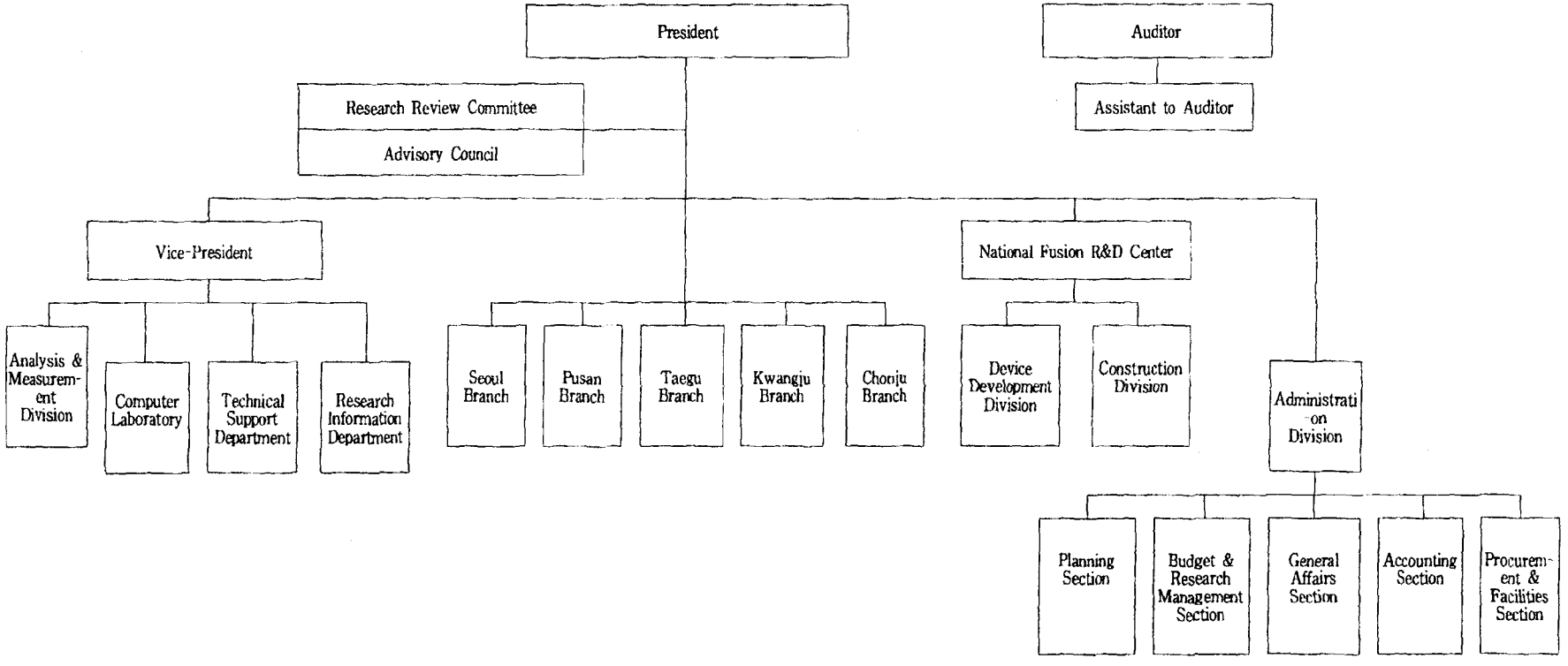
## Finance(December 1999)

Unit : Million Won



# Organization(Dec. 1999)



**Borrower's Evaluation Report**
**for**
**the IBRD Science and Technical Education Project (LN 3693-KO)**

## 1. Project Rationale and Objectives

1.1 For more than two decades, the World Bank has supported the development of S&T education and research in Korea. Emphasis has been placed on expanding the supply of technical manpower at all levels and also on qualitative improvements. In the 1980s, attention was given to the policy framework within which S&T education and research operated and policy improvements were introduced under two sector loans (Ln. 1800-KO, and Ln. 2427-KO). This has permitted recent science and technical (S&T) education and research projects to be designed within a policy framework that was generally sound. The next decade will be a period of accelerating technological change and Korea's S&T education system will be challenged to respond by ensuring that it continues to produce, in quantity and quality, the necessary skilled manpower to support the country's technological advancement. The project represents the final opportunity for the Bank to assist Korea in identifying policy improvements and specifying the targets which will improve S&T education in future years. As Korea's graduation project in education, it brings to a close the long and successful association between Korea and the Bank in the education sector..

1.2 The overall objective of the project was to assist in improving the quality of S&T education and research through implementation of the Policies and Actions Program and the provision of specialized equipment. Specifically, the project would: (a) support quality improvement in undergraduate science and engineering departments in selected universities; (b) assist in strengthening the teaching and research capacity of marine science institutions to address environmental problems; (c) assist in improving the quality of practical science and engineering programs in open universities and in selected junior technical colleges; (d) improve opportunities for joint research activities in basic science through strengthening common research facilities at the Korea Basic Science Institute; and (e) enhance the quality of training in selected VHSs. Quality improvement is being supported through the provision of up-to-date laboratory and workshop equipment. Provision of such equipment under the project is expected to enhance the performance of faculty in a wide range of institutions.

## 2. Origin and Description of the Project

2.1 The Government of Korea (GOK) included the project in its FY93 list of projects suitable for external financing and formally asked the Bank for assistance in November 1992. Most of the preparation work was completed by GOK in accordance with requests for information formulated by the Bank. The project was preappraised in March 1993 and appraised in July 1993. Appropriateness of the loan proposal was recognized and the loan agreement was signed on February 16, 1995 for the loan of US$190,000,000 or less after negotiation on the agreement

conditions in Washington, D.C. GOK sent to the Bank all documents required for the loan such as legal comments on the agreement, etc. The loan agreement was notified by the Bank to be effective as of May 11, 1994.

2.2 The project was designed to finance for equipment procurement and to be completed by December 31, 1999. The categories of items to be financed out of the proceeds of the loan and the allocation of the amounts of the loan to each category were as follows:

| | |
|---|---|
| (a) University Engineering Departments | US$ 60,000,000 |
| (b) University Natural Science Departments | US$ 45,000,000 |
| (c) Marine Science Departments | US$ 20,000,000 |
| (d) Open Universities | US$ 15,000,000 |
| (e) Junior Technical Colleges | US$ 10,000,000 |
| (f) Vocational High Schools | US$ 20,000,000 |
| (g) Korean Basic Science Institute | USS 20,000,000 |

## 3. Implementation of the Project

A. Selection of Participating Institutions

3.1 According to the criteria specified in the Loan Agreement, MOE has selected 23 public universities, 26 private universities, 9 open universities, 4 public technical colleges, 4 private technical colleges, and 19 vocational high schools. The Korean Basic Science Institute (KBSI) that is under the Ministry of Science and Technology (MOST) was included in the project from the designing stage of the project. KBSI was to achieve value added in the form of fostering efficient mechanism for centralizing common research activities, which would be of particular benefit to smaller institutions.

B. Equipment Procurement

3.2 General Procedures of Equipment Procurement. Most of equipment procurement was undertaken by the Supply Administration, Republic of Korea (SAROK), which is highly experienced in procuring equipment under the Bank's international competitive bidding procedures. On the basis of equipment lists and specifications submitted by project institutions, SAROK has prepared international competitive bidding documents, invited bids, evaluated them in collaboration with the institutions, and made contract awards with selected suppliers. In the case of equipment procurement for vocational high schools, 16 district offices of education prepared equipment lists based on the requests from vocational high schools within their districts and submitted them to SAROK. Toward the closing date of the project, equipment of US$627,000 equivalent was procured through the international shopping procedure under the permission by the Bank. The supplier was responsible for installation, initial testing and operation of the equipment as specified in the contract. It has usually taken 3-8 months between the procurement request to SAROK and the equipment installation. Most of equipment was under 1 or 2 year warranty.

3.3 Equipment Procurement. Although the final allocations of loan to categories of the project were not changed from the original one, there were some changes within categories. Because the currency exchange rate for Korean Won to US$ became almost doubled after the unexpected crisis of national economy in 1998-1999, private institutions cancelled some of their loan allocations which had not been disbursed yet. MOE has transferred the loan cancelled by private institutions to public institutions in 1999 under the permission by the Bank and relevant authorities of GOK (Table 1).

3.4 A total of 16,483 pieces of equipment were procured under the project and US$169,373,072.86 As of April 20, 2000, the disbursement rate of the project was 99.63%. The cancellation occurred mainly from university engineering departments and junior technical colleges (Table 2). Procurement activities were slow in the first year of the project. However, disbursement rate increased rapidly in the following years and exceeded the appraisal estimated (Table 3).

## 4. Evaluation of the Project Implementation

4.1 Overall implementation was satisfactory although US$626,927.14, 0.37 % of the loan, is to be cancelled. Disbursements conformed to all Bank procedures. The allocation of the loan among disbursement categories was similar to the original estimates. Some changes in the loan allocation among disbursement categories were mainly due to the cancellation by private institutions during the unexpected crisis of national economy in 1998-1999. The objectives of the project were satisfactorily accomplished. One hundred and twenty three institutions were significantly benefited by the project. The project helped to increase sustainability of the previous assistance in Korea's S&T education by the Bank.

4.2 The project has facilitated and enhanced research capabilities and teaching programs, especially in science and technology at 36 engineering colleges, 41 natural science colleges, 10 marine science colleges, 9 open universities, 8 junior technical colleges, and 19 vocational high schools. Approximately 16,483 pieces of equipment were provided under the project. All equipment are actively used for research and teaching at the project institutions (Table 5). The research outputs have been impressive. The number of research projects has been more than doubled from 3,197 in 1995 to 6,471 in 1999. A total of 40,929 research activities were conducted during this period, about 50% over appraisal estimates. The results of 87% of these activities were published either domestically or internationally, 12% have been used by related industries, and 2% have been awarded patents (Table 6).

4.3 The project has benefited not only the selected institutions but also other institutions by making the procured equipment available to staff and students in other institutions. For example, 9 major national universities in Korea have allocated 29.3% of their loan allocations to the research and teaching support institutes which provide common facilities and equipment to users from not only inside but also outside of the universities (Table 7). These institutes were established in late 1980s or early 1990s under the concept of centralizing expensive equipment to efficiently maintain

and operate for any users without institutional discrimination. Most of their equipment were relatively expensive, often over US$100,000 per piece, and procured by external finances such as the previous IBRD loan projects (Ln. 3203-KO and Ln. 3612-KO). Sustainability of these institutes has been improved greatly by the project.

## 5. Sustainability of the Educational Equipment Provision

The Government will invest $650 million in the national universities for the next five years (2000 – 2004) including open universities. The fund will help the universities increase the effectiveness of the educational equipment that have been supplied through the external loan projects and national funding. It is also necessary to sustain additional provision of the fund to well maintain the machines. The Government has already provided $500 million for the national universities, junior technical colleges, open universities. Table 8 indicates planned annual investment of the Government from 2000 to 2004(Table 8).

## 6. Conclusion

6.1 Although 0.37% of the loan is to be cancelled, overall implementation of the project was successful. Performance of the project institutions, MOE, and SAROK was satisfactory during the project years. The project will make substantial contribution to S&T education and research in vocational high schools, technical colleges, and universities in Korea in future years.

6.2 Efficient and effective guidance by the Bank during the project years, especially approving the international shopping procedures at the last stage of implementation was greatly appreciated by MOE and the National Instrumentation Center for Environmental Management (NICEM), the beneficiary of the approval.

## 7. Statistical Information

Table 1. Allocations of Loan by Categories

| Category | Public/ Private | No. of Institutions | Original Allocation | Final Allocation |
|---|---|---|---|---|
| University Engineering Departments | Public | 19 | 43,329,000 | 47,214,076 |
| | Private | 17 | 16,671,000 | 12,785,924 |
| | Sub-total | 36 | 60,000,000 | 60,000,000 |
| University Natural Science Departments | Public | 20 | 33,816,000 | 35,151,778 |
| | Private | 21 | 11,184,000 | 9,848,222 |
| | Sub-total | 41 | 45,000,000 | 45,000,000 |
| Marine Science Departments | Public | 10 | 20,000,000 | 20,000,000 |
| | Private | 0 | - | - |
| | Sub-total | 10 | 20,000,000 | 20,000,000 |
| Open Universities | Public | 9 | 15,000,000 | 15,000,000 |
| | Private | 0 | - | - |
| | Sub-total | 9 | 15,000,000 | 15,000,000 |
| Junior Technical Colleges | Public | 4 | 7,829,000 | 7,989,365 |
| | Private | 4 | 2,171,000 | 2,010,635 |
| | Sub-total | 8 | 10,000,000 | 10,000,000 |
| Vocational High Schools | Public | 19 | 20,000,000 | 20,000,000 |
| | Private | 0 | - | - |
| | Sub-total | 19 | 20,000,000 | 20,000,000 |
| Total | | 123 | 170,000,000 | 170,000,000 |

Table 2. Equipment procurement and the disbursement rate of the project

| Category | Public/ Private | Loan allocation (US$) | Disbursed amount (US$) | Disbursement rate (% ) | Number of equipment procured (pc) |
|---|---|---|---|---|---|
| University Engineering Departments | Public | 47,214,076 | 45,689,320 | 96.8 | 3,094 |
| | Private | 12,785,924 | 12,090,230 | 94.6 | 961 |
| | **Sub-total** | **60,000,000** | **57,779,550** | **96.3** | **4,055** |
| University Natural Science Departments | Public | 35,151,778 | 40,665,590 | 115.7 | 3,632 |
| | Private | 9,848,222 | 8,584,070 | 87.2 | 1,056 |
| | **Sub-total** | **45,000,000** | **49,249,660** | **109.4** | **4,688** |
| Marine Science Departments | Public | 20,000,000 | 19,957,180 | 99.8 | 1,091 |
| | Private | - | - | - | - |
| | **Sub-total** | **20,000,000** | **19,957,180** | **99.8** | **1,091** |
| Open Universities | Public | 15,000,000 | 13,551,200 | 90.3 | 1,232 |
| | Private | - | - | - | - |
| | **Sub-total** | **15,000,000** | **13,551,200** | **90.3** | **1,232** |
| Junior Technical Colleges | Public | 7,989,365 | 7,488,000 | 93.7 | 863 |
| | Private | 2,010,635 | 1,991,882 | 99.1 | 314 |
| | **Sub-total** | **10,000,000** | **9,479,882** | **94.8** | **1,177** |
| Vocational High Schools | Public | 20,000,000 | 19,355,600 | 96.8 | 4,240 |
| | Private | - | - | - | - |
| | **Sub-total** | **20,000,000** | **19,355,600** | **96.8** | **4,240** |
| Total | | 170,000,000 | 169,373,072 | 99.63 | 16,483 |

Table 3. Loan Disbursements: Cumulative, Estimated and Actual (*US$ million*)

| Year | Appraisal Estimate (US$ million) * | | | Actual (US$ million)** | | |
|---|---|---|---|---|---|---|
| | Disbursed | Cumulative | % of Total | Disbursed | Cumulative | % of Total |
| 1995 | 20 | 20 | 10.5 | 3 | 3 | 1.8 |
| 1996 | 35 | 55 | 28.9 | 59 | 62 | 36.5 |
| 1997 | 60 | 115 | 60.5 | 36 | 98 | 57.6 |
| 1998 | 40 | 155 | 81.6 | 50 | 148 | 87.1 |
| 1999 | 30 | 185 | 97.4 | 13 | 165.39 | 97.3 |
| 2000 | 5 | 190 | 100.0 | 3.98 | 169.37 | 99.63 |

* Loan allocated to KBSI was included in appraisal estimate.

* Percentage of the actual disbursement was calculated based on the total of US$170,000,000 which was allocated to institutions under MOE.

Table 4. Summary of Project Costs by Category of Expenditure

| Component | Appraisal estimate (US$M) | | | Actual costs (US$M) | | |
|---|---|---|---|---|---|---|
| | Local costs | Foreign costs | Total | Local costs | Foreign costs | Total |
| Equipment | - | 170 | 170 | 61.7 | 169.37 | 222.8 |
| Equipment transportation and installation | 11.9 | - | 11.9 | 6.6 | | 6.6 |
| Operations and Maintenance | 26.0 | - | 26.0 | 5.7 | | 5.7 |
| Consumable materials | 26.0 | - | 26.0 | 3.5 | | 3.5 |
| Civil works | 8.8 | - | 8.8 | 39.8 | | 39.8 |
| Contingencies | 62.0 | - | 62.0 | 0 | | 0 |
| Total | 134.8 | 170 | 304.8 | 117.3 | 169.37 | 278.4 |

Table 5. Hours of Equipment Utilization

| Category | Yearly Use-Hour (x 1,000 hr) | | | | | | Number of Equipment Items | Average Use-Hour (hr) |
|---|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 | Total | | |
| University Engineering Dept. | 9 | 739 | 975 | 1,317 | 1,425 | 4,466 | 7,732 | 578 |
| University Natural Science Dept. | 75 | 1,958 | 1,661 | 2,078 | 1,955 | 7,727 | 10,118 | 764 |
| Marine Science University | 4 | 73 | 118 | 264 | 290 | 749 | 2,251 | 332 |
| Open University | 7 | 136 | 352 | 490 | 537 | 1,522 | 3,027 | 503 |
| Technical College | 0.2 | 105 | 107 | 129 | 227 | 568 | 2,564 | 221 |
| Vocational High School | 114 | 592 | 970 | 1,246 | 1,607 | 4,529 | 13,565 | 334 |
| Total | 211 | 3,603 | 4,183 | 5,524 | 6,041 | 19,560 | 39,257 | 498 |

Table 6. Research Activities, Publications, and Patent Awards Resulting from the Project

| Project Year | Research Activity | | Published Internationally and Domestically | Used by Related Industries | Patent Awards |
|---|---|---|---|---|---|
| | Estimated | Actual | | | |
| 1995 | 3,197 | 4,105 | 3,603 | 475 | 80 |
| 1996 | 4,952 | 7,283 | 6,327 | 757 | 119 |
| 1997 | 5,928 | 8,921 | 7,854 | 1,018 | 162 |
| 1998 | 6,682 | 10,560 | 9,158 | 1,191 | 236 |
| 1999 | 6,471 | 10,060 | 8,638 | 1,447 | 232 |
| Total | 27,230 | 40,929 | 35,607 | 4,888 | 829 |

Table 7. Loan Allocations to Research and Teaching Support Institutes of 9 Major National Universities in Korea

| National University | Institute | Loan allocation to institute (US$) | Number of equipment (pc) | Total loan disbursed by university (US$) |
|---|---|---|---|---|
| Kangwon | Central Laboratory | 943,000 | 15 | 5,559,000 |
| Kyungbuk | Center for Scientific Instruments | 754,000 | 9 | 1,858,158 |
| Gyungsang | Central Laboratory | 1,355,000 | 6 | 6,634,000 |
| Pusan | Central Laboratory | 0 | 0 | 2,925,890 |
| Seoul | National Instrumentation Center for Environmental Management | 630,000 | 5 | 16,432,469 |
| | Inter-University Center of Natural Science Research Facilities | 6,167,000 | 24 | |
| Chunbuk | Center for University-Wide Research Facilities | 1,397,000 | 6 | 2,478,545 |
| Cheju | Research Instrument Center | 1,052,000 | 19 | 6,596,108 |
| Choognam | Center for Research Facilities | 1,047,000 | 12 | 3,394,570 |
| Choongbuk | Center for Research Instruments and Experimental Facilities | 1,269,000 | 6 | 3,890,420 |
| Total | | 14,614,000 | 102 | 49,769,160 |

Table 8. Sustainability of the Educational Equipment Provision

(Unit : Million)

| Detailed Provision | Gross Fund Need | Annual Investment Plan | | | | | |
|---|---|---|---|---|---|---|---|
| | | To '99 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Equipment Purchase | 1,244,741 | 574,706 | 78,350 | 140,705 | 144,253 | 154,936 | 151,791 |
| Equipment Maintenance | 68,708 | 24,764 | 6,650 | 7,516 | 8,375 | 9,883 | 11,520 |
| Total | 1,313,449 | 599,470 | 85,000 | 148,221 | 152,628 | 164,819 | 163,311 |