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IMPLEMENTATION COMPLETION REPORT

KOREA

ENVIRONMENTAL TECHNOLOGY DEVELOPMENT PROJECT

(Loan No. 3694-KO)

March 23, 1999

**Human Development Unit
East Asia and Pacific Regional Office**

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CURRENCY EQUIVALENTS

Currency Unit	=	Korean Won (W)
At appraisal	=	US\$1 = W 785
At completion	=	US\$1 = W 1240

WEIGHTS AND MEASURES

Metric System

FISCAL YEAR

January 1 - December 31

ACADEMIC YEAR

March - February

ABBREVIATIONS AND ACRONYMS

EA	Environmental Agency
ETRI	Electronics and Telecommunications Research Institute
GERI	Genetic Engineering Research Institute
GOK	Government of Korea
ICB	International Competitive Bidding
ICR	Implementation Completion Report
KAIST	Korea Advanced Institute of Science and Technology
KAITECH	Korea Academy of Industrial Technology
KEI	Korea Environment Institute
KIMM	Korea Institute of Machinery and Metals
KITECH	Korea Institute of Industrial Technology
K-JIST	Kwangju Institute of Science and Technology
KORDI	Korea Ocean Research and Development Institute
KRIBB	Korea Research Institute of Bioscience and Biotechnology
KRISS	Korea Research Institute of Standards and Science
KWAIST	Kwangju Advanced Institute of Science and Technology
MAS	Minimum Application Size
MOF	Ministry of Finance
MOFE	Ministry of Finance and Economy
MOEN	Ministry of Environment
MOST	Ministry of Science and Technology
O&M	Operations and Maintenance
QAG	Quality Assurance Group
R&D	Research and Development
RRS	Regional Research Site
SA	Special Account
SAROK	Supply Administration, Republic of Korea (name at completion)
SERI	Systems Engineering Research Institute

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TABLE OF CONTENTS

Preface..... iv
Evaluation Summary.....v

PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. Project Objectives 1
B. Achievement of Project Objectives.....2
C. Implementation Record and Major Factors Affecting the Project.....3
D. Project Sustainability4
E. Bank Group Performance.....5
F. Borrower Performance5
G. Assessment of Outcome.....6
H. Future Operation6
I. Key Lessons Learned6

PART II: STATISTICAL INFORMATION

Table 1: Summary of Assessments7
Table 2: Related Bank Loans/Credits9
Table 3: Project Timetable11
Table 4: Loan/Credit Disbursements: Cumulative, Estimated and Actual12
Table 5: Key Indicators for Project Implementation.....13
Table 6: Key Indicators for Project Operation14
Table 7: Overseas Training and Visiting Scholars Included in Project16
Table 8A: Project Costs`17
Table 8B: Project Financing18
Table 9: Economic Costs and Benefits19
Table 10: Status of Legal Covenants20
Table 11: Compliance with Operational Manual Statements21
Table 12: Bank Resources: Staff Inputs.....22
Table 13: Bank Resources: Missions23
Table 14: Name of the Nine Project Participating Institutions24

ANNEXES

Annex A: Completion Mission Aide Memoire25
Annex B: Borrower's Evaluation Report submitted as a contribution to the
Implementation Completion Report (ICR)36

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IMPLEMENTATION COMPLETION REPORT

KOREA

ENVIRONMENTAL TECHNOLOGY DEVELOPMENT PROJECT

(Loan 3694-KO)

PREFACE

This is the Implementation Completion Report (ICR) for the Environmental Technology Development Project in Korea, for which Loan 3694-KO in the amount of US\$90 million equivalent was approved on January 6, 1994, signed on February 16, 1994 and made effective on May 11, 1994.

The loan was closed on schedule on September 30, 1998. Final disbursement took place on March 11, 1999. There were two cancellations during the project period: (i) the final balance of US\$499,746.95 which was canceled on March 11, 1999, and (ii) on September 15, 1998, the Government of Korea (GOK) requested a cancellation of US\$931,629.81.

The ICR was prepared by Ms. Carol Hau-Lai Ball, assisted by Mr. William Rees and Ms. Ruth Montague. The ICR was reviewed by Mr. Alan Ruby, Manager, EASHD, and Mr. Sri-Ram Aiyer, Country Director, EACKF. A summary of the submissions to the ICR by the nine project participating institutions is included as Annex B.

Preparation of this ICR was begun during the Bank's final supervision/completion mission in May 3-19, 1998, which visited the Ministry of Finance and Economy (MOFE), and the Supply Administration, Republic of Korea (SAROK). The mission also held a meeting at the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon City with representatives of all nine project institutions. The information in this report is based on materials in the Project Implementation Index File, Divisional Black Books, and submissions from the nine project institutions as well as information received during the completion mission. The nine project institutions contributed to the preparation of the ICR by: (a) providing specific data upon request; and (b) contributing their own evaluation of the project's preparation and execution. The Bank summarized the individual evaluation summaries submitted by the nine project institutions and their submissions are included as Annex B. No comment was provided by the Government on the draft ICR prepared by the Bank.

IMPLEMENTATION COMPLETION REPORT
KOREA
ENVIRONMENTAL TECHNOLOGY DEVELOPMENT PROJECT
(Loan 3694-KO)

EVALUATION SUMMARY

Objectives

i. The objective of the project was to strengthen: (a) selected national research institutes in Korea to assist them to identify and adequately address environmental issues and to undertake environmental research and development (R&D) activities, and (b) the Ministry of Environment's (MOEN's) policy and planning role.

Implementation Experience

ii. Overall implementation was satisfactory. The project was closed on schedule and had no cost overruns. Equipment procurement for all project institutions was completed as planned and in accordance with the Loan Agreement while the library materials procured actually exceeded the original allocation by about 70%. The overseas training and visiting experts components were on target or exceeded for nearly all project institutions (Table 7). The final disbursements for these two components were, however, only 67% and 38%, respectively, compared to the original Loan allocations. Reallocation of Loan proceeds from the two components in favor of equipment and library materials was agreed to by the Bank, after a review indicated that there would be no significant deviation from the original project objectives.

iii. The actual disbursements were US\$88,568,623.24 or about 98.4% of the loan amount. Disbursements conformed to all Bank procedures and included the use of Special Accounts (SAs). Counterpart funds for equipment transportation and installation, operations and maintenance, consumable materials and civil works for housing the equipment were adequately provided throughout the life of the project.

iv. There were nine institutions under this project under five different ministries (Table 14). Only four out of the nine institutions had had experience in implementing Bank-financed projects, but overall there were no serious implementation problems. The most significant problem came through the establishment of a single SA at the Ministry of Finance (MOF) for all nine project institutions which delayed SA processing at the initial implementation stage. When this was rectified by a Loan Amendment and nine SAs were established, the Minimum Application Size (MAS) for Applications for Withdrawal became too large, which required a second disbursement letter. These early disbursement difficulties plus the inexperienced new project institutions resulted in the sending out of several inactive SA messages from the Bank. Several also went out toward the end of the

project when some of the institutions had completed their procurement ahead of schedule or were nearing completion which meant that SA activities were less frequent than the normal three-month minimum allowance for SA replenishment requests.

v. In addition, audit reports from a few of the nine institutions were submitted somewhat later than scheduled but none was ever seriously overdue. These delays, however, did not adversely affect the completion schedule or the output of the project. There were no overdue audit reports at Loan Closing, and all other covenants were in full compliance.

vi. The effectiveness during the later implementation years of the nine project institutions plus the help of the experienced procurement agency of the Government of Korea's (GOK) SAROK made project implementation satisfactory.

Results

vii. All of the project objectives were successfully met. The project has enhanced R&D capacities at all nine project institutions, especially in the areas of environment-related research activities and technology development, by providing up-to-date and highly specialized equipment, library materials, staff training and international expert services. The project also has strengthened the role of MOEN by helping them to develop sound and up-to-date environment-related policies.

viii. Research activities and publications of research findings as well as receipts of patent awards have increased steadily over the project years for all nine project institutions. Of the total research activities conducted by the nine project institutions, 12% were environment-related, the results of 22% were published either domestically or internationally, more than 12% were used by related industries, and 10% were awarded patents.

ix. New environmental research centers and divisions have been established in some project institutions and they are serving important roles in the areas of environmental technology development. Small and medium size enterprises have also benefited from the project-financed equipment, library materials and research results. These companies usually lack the necessary financial resources, knowledge and equipment to develop related industrial technologies and to focus on environmental issues, and the project institutions have helped them to do both.

Sustainability

x. The GOK's commitment in the two Bank-financed environment-related projects (this project and the Environmental Research and Education Project¹) indicates its awareness of the serious environment-related problems that have been caused by the rapid

¹ This project complements the Environmental Research and Education Project (Loan 3612-KO), which assists in strengthening the capacity of selected agricultural and veterinary colleges to address rural environmental problems.

industrialization of Korea. Adequate counterpart funds have been provided for both projects throughout the project years.

xi. In order to develop more efficient methods of production to conserve natural resources and reduce pressures on the environment, the GOK has responded to the emerging environmental problems by strengthening its institutional and legal frameworks. The Environmental Agency (EA) was upgraded to the Ministry of Environment (MOEN) in 1990, and new basic legislation was introduced. With the help of the Korea Environment Institution (KEI) and its newly established Regional Research Site (RRS) {Table 6, Section 2 (a)}, the MOEN now leads in formulating environmental policies and coordinates and monitors environmental planning activities.

xii. Another indication of sustainability is GOK's support for the Cleaner Production Technology Program organized by the Korea Institute of Industrial Technology (KITECH). This program aims at minimizing the generation of waste and pollution, and the GOK has doubled the program budget for 1999 compared with 1998.

xiii. Given GOK's continuous support for several environmental research programs after the completion of this project (paras. 8 and 18) as well as the long-term commitment in MOEN, there is reason to assume that these environment-related policies and R&D activities will continue and that the possibility of sustaining the enhanced role of the project institutions is very strong.

Bank Group Performance

xiv. Overall Bank performance was highly satisfactory. Efficiency and economies of scale were gained through combining the preparation of two environment-related projects (para. x) with an education project, and by fielding a single mission to supervise all the on-going education projects in Korea at the same time. Staff continuity throughout the implementation period also improved supervision efficiency and problem-solving.

xv. Bank supervision for this project totals about 33 staff weeks (Table 2). This commitment of time is average by Bank standards, but extremely efficient for a project with nine implementation agencies. The project's supervision was rated "excellent" by the Bank's Quality Assurance Group (QAG) during FY 1997.

Borrower Performance

xvi. Overall Borrower performance was satisfactory. Among the nine project institutions, some performed better than others, but good working relationships among the nine project institutions and the Bank helped to overcome small implementation problems. Covenants were in full compliance.

xvii. Counterpart funds were adequate. Satisfactory facilities for housing the equipment in each of the nine project institutions were provided. The highly specialized equipment

provided by the project was well-maintained, managed, and utilized. There was no shortage of spare parts and consumable materials.

xviii. Staff were appropriately identified and trained and visiting scholars assisted with the research activities. Some funds for overseas training and visiting experts, due to savings and under-programming were reallocated in favor of needed equipment and library materials (para. ii) consistent with project objectives.

Summary of Findings, Future Operations and Key Lessons Learned

xix. Project performance indicators were added three years after project startup. Impact and output indicators were set and fully met (Table 6). Research projects have been increased and results published. Equipment is well-managed and maintained, and its utilization rate is high. KEI has established information systems to help them do systematic analysis and management of environmental information, leading to the formulation of better environmental policies and governance.

xx. Korea graduated from borrower status in June 1995; however, due to the recent financial crisis in the region, the GOK has asked for some structural adjustment and technical assistance loans.

xxi. The design of this project was straight-forward and supervision work was well-coordinated, detailed and cost-effective. Therefore, there are no major lessons to be learned from the project.

IMPLEMENTATION COMPLETION REPORT
KOREA
ENVIRONMENTAL TECHNOLOGY DEVELOPMENT PROJECT
(Loan 3694-KO)

PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. PROJECT OBJECTIVES

1. The objective of this project was to strengthen: (a) selected national research institutes in Korea to assist them to identify and adequately address environmental issues and to undertake environmental R&D activities, and (b) the Ministry of Environment's (MOEN) policy and planning role. This would result in a better understanding of the technological aspects of environmental problems, improved methods of measuring and monitoring key environmental indicators and more environmentally-sound production processes, and would lead to improved environmental policy formulation and implementation. The Loan financed specialized equipment, overseas training, visiting experts and library materials.

Sectoral Development Objectives

2. There was an urgent need in Korea to develop more efficient methods of production to conserve natural resources and to reduce pressures on the environment. Among the consequences of Korea's rapid industrialization has been the increasing degradation of the environment. Air, water and noise pollution have become major problems. Waste disposal, in densely populated Korea, has been another critical concern. This project was developed in response to these urgent needs.

Policy Issues

3. The increasing complexity of environmental issues and the growing sensitivity to them led the GOK to broaden its existing legislation and to strengthen its implementation. The GOK also wanted to strengthen the policy and planning functions of the responsible agency/ministry. In 1990, the Environmental Agency (EA) was upgraded to the MOEN and the Basic Environmental Policy Law was introduced. This was supported by separate laws dealing with specific problems such as air preservation, water preservation, noise control, hazardous substance control, solid waste management, and marine pollution. Environmental offenders were prosecuted and penalized for their damage to the environment. The principle of "polluter pays" was enforced and strengthened through advanced deposits and raising the pollution excise tax on users of environmentally harmful substances.

4. Strengthening the legal framework was an important part of the strategy to address environmental problems, but improving the understanding of the scientific and technical nature of these problems was equally important, such as the basic scientific relationships bearing on

environmental problems, improved methods of measuring environmental degradation and more effective monitoring arrangements. In these areas, the universities were playing an important role. Complementing the work of the universities were the national research institutes, most of which were under the authority of the Ministry of Science and Technology (MOST) (Table 14). Initially they were established in the 1960s and 1970s to provide private sector leadership in key areas of industrial R&D. After large-scale private firms had taken over about 70% of the industrial R&D projects, these national research institutes focused mostly on non-commercially oriented applied research and in research support and technical assistance to small and medium size enterprises, which lacked the resources to undertake R&D activities. Their environment-related research projects included the development of technology to improve measurement and monitoring, compatible products, and sound production processes as well as training of industry personnel in these areas.

Evaluation of Objectives

5. The GOK's objectives for this project were highly relevant to the environmental problems caused by Korea's rapid industrialization. The results of the project research activities and technology development are being used by related industries as well as receiving patent awards (para.7). MOEN has assumed a more important role in the areas of policy making and planning for environment-related matters in Korea, and they are now much more advanced and up-to-date on global environmental issues and concerns (para. 6).

B. ACHIEVEMENT OF PROJECT OBJECTIVES

6. All of the project objectives were fully met or exceeded. The project has facilitated and enhanced the research capabilities of all nine project institutions, especially in the areas of environment-related research activities and technology development. The project has also upgraded MOEN's environment-related information systems by providing mainframe computers and related staff training. This has greatly increased MOEN's access to the latest global environmental information and sound solutions, and enhanced its participation in the planning and formulation of policies for environmental concerns and in conducting its own research activities. Sixty-eight research activities were carried out by MOEN under the project, the results of all of them were published and most of the results were utilized as environmental policy guideline materials.

7. Research activities, publication of their findings, and patent awards have steadily increased over the project years for all nine project institutions. Project institutions conducted a total of 7,152 research projects during this time. Of these, 871 (12%) were environment-related, the results of 1,602 (22%) were published either internationally or domestically, 860 (12%) were used by related industries, and 692 (10%) were awarded patents.

8. In some of the project institutions, new centers, divisions and plans were established for the sole purpose of promoting a cleaner environment -- for example, KITECH's Textile and Cleaner Production Technology R&D Center and its Cleaner Production Technology R&D

Division, and the Korea Research Institute of Bioscience and Biotechnology's (KRIBB's) Biotechnology Development Plan.

9. Small and medium size enterprises also benefited from this project. Some of the project institutions have provided advice, services and the use of equipment to these companies, which often lack the financial resources, knowledge and equipment needed to conduct their own environmental research projects.

C. IMPLEMENTATION RECORD AND MAJOR FACTORS AFFECTING THE PROJECT

Implementation Record

10. Overall implementation was satisfactory. There were nine institutions in this project under five different ministries (Table 14), which in reality was like implementing nine sub-projects. Five of them were new project institutions with no prior experience in implementing Bank-financed projects -- therefore minor implementation hiccups were to be expected. There were no serious implementation problems. There were two initial disbursement difficulties (para. 11), several inactive SAs and some overdue audit reports requiring reminders from the Bank (para. 12). None of the problems adversely affected the outcome of the project. The project was closed on schedule with no cost or time overruns. Final disbursement reached about 98.4% of the total loan amount.

11. The first disbursement difficulty resulted from the agreement made by the Economic Cooperation Bureau without the clearance of the Treasury Bureau of the MOFE that one SA was to be opened and put under the control of the MOF (later renamed MOFE). In effect, this made the Treasury Bureau the bookkeeper for all nine institutions. This was not convenient for any of the parties concerned. MOFE did not have the office space or the manpower to handle the extra work needed to track the nine project institutions' disbursement activities and to keep the project accounts. It was not convenient for the project institutions to process their disbursements in a timely manner while situated at different locations. This problem was solved by the First Loan Amendment which allowed the nine institutions to have their own SAs. The second disbursement difficulty was that the size of the MAS for Applications for Withdrawal should have been adjusted at the same time as the Loan Amendment in proportion to the smaller SA amounts needed by the nine individual institutions. The initial MAS of US\$300,000 was appropriate for the original single SA, but was too high for the smaller individual SAs in processing disbursements. This difficulty was quickly resolved by a second disbursement letter.

12. There were several inactive SA messages from the Bank during the beginning and at the end of the project years. The initial disbursement difficulties as mentioned in para. 11, plus the inexperienced new project institutions resulted in the sending out of several inactive SA messages. Other inactive SA messages near project completion were due to the fact that several project institutions had completed their procurement ahead of schedule or were nearing completion. Therefore SA activities were less frequent than the three-month minimum

allowance for SA replenishment requests. There were also some minor delays in submitting the annual audit reports at the beginning of the implementation period, probably due to unfamiliarity with the conditions of the covenant. Other covenants were in full compliance (Table 10).

13. Equipment procurement was handled by the GOK's experienced central procurement agency, SAROK. As international competitive bidding (ICB) procedures were used for all equipment procurement even when not required by the Loan Agreement, substantial savings resulted, and project institutions were able to purchase more items than originally planned. All procurement procedures were in compliance with Bank procurement guidelines. No irregularities have been found.

Major Factors Affecting the Project

14. There were no major problems affecting the project, other than constant changes of institution names (Table 14) and persons in-charge which made project monitoring difficult and time-consuming.

Consulting Services

15. The actual number of visiting experts was higher than originally planned (Table 7), frequently because international experts were unable to commit to long periods in Korea. Instead, project institutions hired more short-term experts for shorter durations. Their inputs were valuable and highly relevant and improved the quality of the research activities (para.7).

D. PROJECT SUSTAINABILITY

16. The GOK has a very clear understanding of the environment-related problems that have resulted from Korea's rapid industrialization and densely populated cities. Its continuous support for this project and for the Environmental Research and Education Project (Loan 3612-KO) are obvious indications of GOK's awareness in these areas. There has been no shortage of counterpart funds for both projects even during the country's financial crisis period, which started in September 1997.

17. The GOK's strengthening of the planning and policy-making functions of MOEN by upgrading the EA to a line ministry, is another indication of its long-term commitment to solving its environmental problems. MOEN now leads in formulating environmental policies and coordinates and monitors environmental planning activities.

18. The GOK will continue its support to several research institutions' environment-related programs and centers (para. 8), and KEI's RRS, even after the completion of this project, and in some areas program budgets will be doubled in line with the national plan, such as for KITECH's Cleaner Production Technology Program.

19. All the research institutions' equipment is well-maintained and managed, and highly utilized. O&M funds for the future operation of the equipment are expected to be adequate. The national research institutions' R&D activities are also on an upward trend (para. 7).

20. All of the above indications strongly suggest that the development objectives of the project will continue to be met for years to come.

E. BANK GROUP PERFORMANCE

21. Overall Bank performance was highly satisfactory. Efficiency was gained during the preparation stage by combining the preparation of this project with preparation of both the Environmental Research and Education Project (Ln. 3612-KO), and the Science and Technical Education Project (Ln. 3693-KO). Economies of scale were also achieved during implementation by fielding a single mission to supervise all the on-going education projects in Korea at the same time. In addition, the continued involvement throughout the implementation period of original team members, most notably the task manager and his technical consultant for advice and supervision activities as well as for training new task managers prevented the lost of project information and resulted in timely and effective problem-solving.

22. Supervision work was well-coordinated, detailed and cost-effective. An early project launch workshop for all project institutions aimed at preventing implementation mishaps and delays was considered money well-spent. Small implementation hiccups during the beginning years (paras. 11 and 12) were quickly dealt with and corrected in a timely manner. As a result, the project supervision team received an "excellent" award from the Bank's QAG during FY1997.

23. Although it was time-consuming and difficult to monitor nine sub-project institutions with constant changes of names and persons in-charge (para. 14), Bank staff continuity and efficiency in supervision have helped keep the time spent on this project to a minimum 33 staff weeks (para. 21).

F. BORROWER PERFORMANCE

24. Overall Borrower performance was satisfactory. Each of the nine project institutions carried out its own project activities on individual time schedules. Among them, some performed better than others. Minor implementation hiccups, such as inactive SAs and slight delays in submitting audit reports and/or ICR data and evaluation summaries were all overcome by good working relationships with the Bank teams, effective communications, and the taking of timely corrective actions (paras. 11 and 12).

25. Equipment procurement was handled by SAROK which is well-experienced and efficient (para. 13). Technical specifications were revised according to the latest technology and were tailored to meet the individual project institution's particular needs. Other procurement procedures were also in compliance with the Bank's guidelines including the

direct contracting procedures for procurement of the library materials and the hiring of international experts.

26. There were no shortages in counterpart funds for the installation and transportation of project-financed equipment, consumable materials and O&M costs. Satisfactory facilities for housing the equipment in each of the nine project institutions were provided. Equipment was well managed and maintained and the utilization rate was high.

27. There were minor Loan reallocations for some project institutions due to savings in procurement and under-programming of staff training and visiting experts in favor of additional equipment and library materials. Nevertheless, overall staff training needs and technical assistance from international experts were met and not sacrificed.

G. ASSESSMENT OF OUTCOME

28. Overall project objectives were successfully achieved. Research capabilities of the nine project institutions have been enhanced, and the role of MOEN in policy-making and planning has been strengthened (para. 6). Project institutions have steadily over the years increased their R&D activities and the results have been published either internationally or domestically. Most of their findings have been used by related industries and some have been awarded patents (para. 7). All project performance indicators were fully met and/or exceeded (Table 6), and the GOK remains committed to supporting the national research institutions (para. 18). Equipment is well-managed and maintained, and highly utilized by the research staff and the related communities. These are strong indications that research activities tackling Korea's environment-related problems will be continued.

H. FUTURE OPERATION

29. Korea graduated from borrower status in June 1995; however, due to the recent financial crisis in the East Asia region, GOK has asked for some structural adjustment and technical assistance loans.

I. KEY LESSONS LEARNED

30. The design of this project was straight-forward and supervision work was well-coordinated, detailed and cost effective. Therefore, there are no major lessons to be learned from the project.

PART II : STATISTICAL INFORMATION

Table 1: Summary of Assessments

A. <u>Achievement of Objectives</u>	<u>Substantial</u>	<u>Partial</u>	<u>Negligible</u>	<u>Not applicable</u>
	(✓)	(✓)	(✓)	(✓)
Macro Policies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sector Policies	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Financial Objectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Institutional Development	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Objectives	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Poverty Reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gender Issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other Social Objectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Environmental Objectives	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Public Sector Management	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other - Private Sector Development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
B. <u>Project Sustainability</u>	<u>Likely</u>		<u>Unlikely</u>	<u>Uncertain</u>
	(✓)		(✓)	(✓)
	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

(Continued)

<u>C. Bank Performance</u>	<u>Highly satisfactory</u> (✓)	<u>Satisfactory</u> (✓)	<u>Deficient</u> (✓)
Identification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Preparation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Appraisal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supervision	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>D. Borrower Performance</u>	<u>Highly satisfactory</u> (✓)	<u>Satisfactory</u> (✓)	<u>Deficient</u> (✓)
Preparation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Implementation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Covenant Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Operation (if applicable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>E. Assessment of Outcome</u>	<u>Highly satisfactory</u> (✓)	<u>Satisfactory</u> (✓)	<u>Unsatisfactory</u> (✓)	<u>Highly unsatisfactory</u> (✓)
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TABLE 2: Related Bank Loans/Credits

Loan/credit title	Purpose	Year of approval	Status
<i>Preceding operations</i>			
1. First Education (Cr. 151-KO)	Expansion of vocational high schools (VHSs), junior technical colleges and teacher training	1969	Completed 09/76
2. Second Education (Ln. 906/Cr. 394-KO)	Improvements in VHSs, junior technical colleges and science, engineering and education colleges	1973	Completed 12/79
3. Third Education (Ln. 1096-KO)	Expansion and quality improvement in vocational high schools, junior colleges and vocational training institutes (VTIs)	1975	Completed 11/81
4. Vocational Training (Ln. 1474-KO)	Further expansion of VTIs and expansion and improvement of instructor training	1978	Completed 06/83
5. Sector Program on Higher Technical Education (Ln. 1800-KO)	Improving technical colleges and colleges of engineering and management through supply of equipment, staff development, manpower planning, equipment maintenance and academic accreditation	1980	Completed 02/86
6. Program for Science and Technology Education (Ln. 2427-KO)	Raising quality of science and technology education to standards required by a more skill- and knowledge-intensive industrial system through planned policy and institutional changes	1984	Completed 06/89
7. Technology Advancement (Ln. 3037-KO)	Strengthening the development of SMIs in technology-intensive sectors, improving the quality of education in a center of excellence in science and engineering education and enhancing the capacity of selected R&D institutions to provide technical support for SMIs	1989	Completed 12/31/93
8. Second Technology Advancement (Ln. 3202-KO)	Improving the research capacity of one leading graduate school in science and engineering and enhancing R&D capacities in the areas of biotechnology, basic and industrial standards, and energy and resource utilization	1990	Completed 06/30/94

Loan/credit title	Purpose	Year of approval	Status
9. Science and Technology Research (Ln. 3203-KO)	Enhancing basic research programs in selected universities in priority fields in science and technology and improving science teacher training	1990	Completed 12/31/95
10. Vocational Education (Ln. 3314-KO)	Upgrading the skill training provided in selected vocational high schools meeting the increasing complex skill requirements of industry, commerce, agriculture and fisheries	1991	Completed 06/30/96
11. Third Technology Advancement (Ln. 3315-KO)	Improving the quality of research programs for developing advanced technologies, increasing opportunity for joint basic science research activities through common research facilities; and enhancing the development and application of industrial standards	1991	Completed 06/30/94
12. Science Education and Libraries Computerization (Ln. 3468-KO)	Raising the quality of science programs in secondary schools and universities and establishing an interlibrary network system to enhance the access of information to students, faculty and researchers	1992	Completed 12/31/97
13. Vocational Schools Development (Ln. 3469-KO)	Continuing with the objectives of Ln. 3314-KO to upgrade skill training in selected VHSs and strengthening VHS systems through five studies in five agreed areas	1992	Completed 12/31/97
14. Environmental Research and Education (Ln. 3612-KO)	Upgrading the capacity of selected agricultural and veterinary colleges to undertake research into key environmental problems, reinforcing the environmental aspects of basic science programs in the colleges and establishing appropriate arrangements for improving environmental research and training programs	1993	Completed 12/31/98
<i>Following operations</i>			
15. Science and Technical Education (Ln. 3693-KO)	Improving science and technical education and research through implementation of an agreed policies and actions program and the provision of specialized equipment	1994	To be completed 12/31/99

Table 3: Project Timetable

Steps in Project Cycle	Date Planned	Date Actual/ Latest Estimate
Identification		07/26-08/13/92
Preparation		03/08-03/26/93
Appraisal	07/01/93	07/17-07/24/93
Negotiations	12/93	11/01/93
Board Presentation	02/15/94	01/06/94
Signing		02/16/94
Effectiveness		05/11/94
Project Completion		03/31/98
Loan Closing		09/30/98
Last Disbursement	09/30/98	03/11/99
Cancellation of Remaining Funds		03/11/99

Table 4: Loan/Credit Disbursements: Cumulative, Estimated and Actual*(US\$ million)*

Cumulative Disbursements	FY94	FY95	FY96	FY97	FY98	FY99
Appraisal Estimate	9.0	26.0	60.0	82.0	90.0	90.0
Actual	0.0	08.9	32.1	57.6	79.6	88.6
Actual as % of Estimate	0%	34%	54%	70%	88%	98%
Date of Final Disbursement -	March 11, 1999					

Table 5: Key Indicators for Project Implementation

Key Implementation Indicators in the SAR/President's Report

	In 1994 estimated	By 1999 actual
(a) Loan proceeds by components (in million)		
Ministry of Environment	\$2.0	\$1.4
Korea Advanced Institute of Science and Technology		\$22.3 \$22.5
Korea Academy of Industrial Technology		\$19.5 \$19.4
Korea Research Institute of Standards and Science		\$9.8 \$9.8
Korea Ocean Research and Development Institute		\$9.8 \$9.7
Systems Engineering Research Institute		\$9.8 \$9.1
Kwangju Korea Advanced Institute of Science and Technology		\$7.0 \$6.9
Korea Institute of Machinery and Metals		\$4.9 \$4.9
Genetic Engineering Research Institute		\$4.9 \$4.9
Total	\$90.0	\$88.6

Category	Appraisal	Actual
Person/Staffmonth	Person/Staffmonth	

(b) Overseas Training	317/1017	542/1107
(c) Visiting Scholars	148/175	290/138

Table 6: Key Indicators for Project Operation

1. The project would strengthen selected national research institutes to identify and adequately address environmental issues and to undertake environmental R&D activities.

Impact Indicators:

- (a) Participating institutions will implement at least 10 R&D activities with environmental concerns by the end of the project. The results exceeded expectations -- a total of 871 environment-related R&D projects were conducted.
- (b) Participating institutions will increase the publication of journal articles and scientific papers relating to environmental concerns by 40% by the end of the project. The results of about 1600 R&D activities were published, although final evaluation submissions from the participating institutions did not indicate how many were environment-related. However, it can be assumed that the target was achieved.

Output Indicators:

- (a) Where planned in the respective participating institutions, staff training will be implemented according to the implementation plan. This was largely achieved, although not to 100% in every participating institution; however, staff training needs have been generally met.
 - (b) In each of the nine participating institutions, equipment procurement will be implemented according to the implementation plan. Implementation was completed on schedule for all institutions.
 - (c) Computer systems will be enhanced according to an established plan in all participating institutions. All needed computer systems have been procured, and their utilization rate is high.
2. The Project would assist MOEN to lead in formulating environmental policies and enhance its role in coordinating and monitoring environmental planning activities.

Impact Indicator:

- (a) MOEN (or KEI) will demonstrate its increased participation in the planning and formulation of policies for environmental concerns by increasing its interaction with participating institutions and by increasing its publication rate by at least 20% by the end of the project. The achievement exceeded the plan -- all environmental information systems (KEINS, KLIS, GIS, INS

linked with IGBP/DIS²) have been completed and are in use. The RRS has also been established in KEI. The results of the 68 environment-related R&D activities were published and are being used mostly by industries and as materials for environmental policy guidelines.

Output Indicators:

- (a) 50% of the staff training will be provided to MOEN personnel by 1996; by the ICR year training will be complete. Although the number of people trained fell short of the Appraisal estimate, staff training for the needs of MOEN has been generally met for this project.
- (b) Equipment and facilities will be upgraded to support the planning and policy formulation role by MOEN. Equipment procurement has been completed at a cost of about 70% of original estimates, largely due to lower mainframe prices obtained through the international competitive bidding process.

² KEINS – the Korea Environmental Information Network System; KLIS – the Korea Library Information System; GIS – Geographical Information System; INS – the International Environmental System; IGBP – the International Geographic-Biosphere Program; and DIS – Data Information System.

Table 7: Overseas Training and Visiting Scholars Included in Project

Old Name/ New Name of Institution	Overseas Training Numbers/Staff-Months		Visiting Experts Numbers/Staff-Months	
	SAR Planned	Actual	SAR Planned	Actual
MOEN/KEI	21/60	11/67	-/-	-/-
KAIST	60/360	130/779	17/30	29/23
KORDI	71/100	150/120	32/50	100/37
SERI/ETRI	30/160	84/45	15/20	15/5
KWAIST/K-JIST	15/45	31/20	9/21	41/14
GERI/KRIBB	72/140	25/25	43/30	68/33
KAITECH/KITECH	48/152	111/51	32/24	37/26
Total	317/1017	542/1107	148/175	290/138

Source: Submissions from the nine project institutions dated January/February 1999, and the latest status reports provided during the completion mission in May 1998.

Note: There were no Bank-financed overseas training and visiting experts for KIMM and KRISS under this project.

Table 8A: Project Costs

Item	Appraisal Estimate (US\$M)			Actual/Latest Estimate(US\$M) ¹		
	Local Costs	Foreign Costs	Total	Local Costs	Foreign Costs	Total
1. Equipment	-	80.8	80.8	-	80.5	80.5
2. Equipment transportation and installation	4.3	0.5	4.8	4.3	0.5	4.8
3. Operations and maintenance	8.8	1.0	9.8	8.8	1.0	9.8
4. Consumable materials	8.8	1.0	9.8	8.8	1.0	9.8
5. Overseas training	0.5	5.1	5.6	0.3	3.4	3.7
6. Library materials	-	2.4	2.4	-	4.0	4.0
7. Visiting experts	0.3	1.7	2.0	-	0.7	0.7
8. Civil works	11.5	2.8	14.3	11.5	2.8	14.3
9. Contingencies	8.9	17.6	26.5			
TOTAL	43.1	112.9	156.0	33.7	93.9	127.6

1: Submissions from the nine project institutions dated January/February 1999, provided actual costs only on Bank-financed categories; where there were no costs provided, original appraisal estimates have been used.

Table 8B: Project Financing

Source	Appraisal Estimate (US\$M)			Actual/Latest Estimate(US\$M) ¹		
	Local Costs	Foreign Costs	Total	Local Costs	Foreign Costs	Total
IBRD	-	90.0	90.0	-	88.6	88.6
Domestic Contribution	43.1	22.9	66.0	33.7	5.3	39.0
TOTAL	43.1	112.9	156.0	33.7	93.9	127.6

¹: Submissions from the nine project institutions dated January/February 1999, provided actual costs only on Bank-financed categories; where there were no costs provided, original appraisal estimates have been used.

Table 9: Economic Costs and Benefits

Not Applicable

Table 10: Status of Legal Covenants

Agreement	Section	Covenant type	Present status	Original fulfillment date	Revised fulfillment date	Description of Covenant	Comments
Ln 3694-KO	3.03	5	C	Undated	NA	KAIST, KAITECH, KORDI, SERI, K-JIST, and KRIBB shall carry out overseas training programs for themselves and also for selected research staff of MOEN.	Fulfilled
	4.01	1	CD	6/30 of each year		Furnish to the Bank audit reports including separate opinions on SOEs, not later than June 30 of each year	Fulfilled

Notes: (a) Covenant type (only for those used in this table)

- 5 Management aspects
- 1 Accounts/audit

(b) Status (only for those used in this table)

- C Complied with
- CD Complied after delay

Table 11: Compliance with Operational Manual Statements

No evidence of non-compliance with applicable Bank manual statements observed.

Table 12: Bank Resources: Staff Inputs

Stage of Project Cycle	Planned		Revised		Actual	
	Weeks	US\$(000)	Weeks	US\$(000)	Weeks	US\$(000)
Through Appraisal	-	-	-	-	24.5	76.7
Appraisal	-	-	-	-	4.9	17.7
Negotiations through Board approval	-	-	-	-	2.9	10.1
Supervision	22.0	-	23.3	80.0	27.6	104.5
Completion	8.0	-	8.0	14.7	5.6	10.2
TOTAL	-	-	-	-	65.5	219.2

Note: No or incomplete MIS or COS data for the planned or revised in staffweeks and in dollars.

Table 13: Bank Resources: Missions

Stage of Project Cycle	Month/Year	Number of Persons	Days in Field	Specialized Staff Skills Represented	Performance Rating		Types of Problems
					Implementation Status	Development Objectives	
Through Appraisal	07/26-08/13/92	3	31	Econ./Impl. Spec./Sci. Educator			
	11/16-12/05/92	5	51	Econ./Tech. Spec./Sci. Educ./Environ. Scientist/Impl. Specialist			
	03/08-03/26/93	4	46	Econ./Impl. Spec./Sci. Educ./Environ. Scientist			
Appraisal through Board Approval	07/17-07/24/93	4	20	Econ./Impl. Spec./Sci. Educ./Environ. Scientist			
Project Launch	04/30-05/26/94	1	13	Impl. Specialist	NR	NR	
Supervision	11/13-12/03/94	3	13	Impl. Spec./Voc. Trg. Spec./ Environ. Spec.	HS	HS	
	06/18-07/08/95	3	13	Impl. Spec./Voc. Trg. Spec./ Environ. Spec.	HS	HS	
	11/05-12/03/95	3	18	Impl. Spec./Voc. Trg. Spec./ Environ. Spec.	S	HS	
	05/13-06/01/96	2	8	Tech. Educ./ Impl. Spec.	S	HS	
	10/28-11/16/96	3	13	Tech. Educ./ Impl. Spec./ Environ. Spec.	S	HS	
	05/18-06/05/97	2	12	Tech. Educ./ Impl. Spec.	S	HS	
	09/29-10/18/97	3	12	Tech. Educ./ Impl. Spec./ Ops. Analyst	S	HS	
Completion	05/03-05/19/98	2	13	Impl. Spec./ Ops. Analyst	HS	HS	

Ratings: S - satisfactory, HS - highly satisfactory, NR - not rated

Table 14: Name of the Nine Project Participating Institutions

Full Name at Appraisal	Acronym at Appraisal	Full Name at Completion	Acronym at Completion	Responsible Ministry
Ministry of Environment	MOEN	Korea Environment Institution	KEI	Ministry of Environment
Korea Advanced Institute of Science and Technology	KAIST	No change	No change	Ministry of Science and Technology
Korea Academy of Industrial Technology	KAITECH	Korea Institute of Industrial Technology	KITECH	Ministry of Commerce, Industry and Energy
Korea Research Institute of Standards and Science	KRISS	No change	No change	Ministry of Science and Technology
Korea Ocean Research and Development Institute	KORDI	No change	No change	Ministry of Maritime Affairs and Fisheries
Systems Engineering Research Institute	SERI	Electronics and Telecommunications Research Institute	ETRI	Ministry of Information and Communication
Kwangju Korea Advanced Institute of Science and Technology	KWAIST	Kwangju Institute of Science and Technology	K-JIST	Ministry of Science and Technology
Korea Institute of Machinery and Metals	KIMM	No change	No change	Ministry of Science and Technology
Genetic Engineering Research Institute	GERI	Korea Research Institute of Bioscience and Biotechnology	KRIBB	Ministry of Science and Technology

REPUBLIC OF KOREA**IBRD Progress Review Mission - May, 1998****Environmental Technology Development Project
Loan 3694-KO****Aide Memoire ^{1/}**

1. The IBRD Mission ^{2/} visited Korea between May 3 and 19, 1998, to review the implementation progress of three World Bank financed projects and perform the tasks of a project completion mission for one of the three projects. This Aide Memoire will address only one, Loan 3694-KO. During the course of its review, the mission received nine status reports and had a meeting at KAIST, Daejeon, with representatives of all nine participating institutions ^{3/} of the project. The mission would like to take this opportunity to express its appreciation for the kind assistance offered to the mission members and special thanks to KAIST for allowing IBRD to hold the meeting at KAIST and providing assistance and hospitality. The mission also visited the Treasury Division of the Ministry of Finance and Economy (MOFE) and the Supply Administration, Republic of Korea (SAROK).

2. The overall progress of the project is generally satisfactory. The status of procurement and disbursements planned and achieved for the nine participating institutions in this project are summarized in Annex 1, and is considered as satisfactory. Six out of nine institutions have completed or nearly completed implementation. Annex 2 provides a summary of the implementation of Overseas Training and Visiting Experts in the seven institutions concerned. Implementation of these two components can only be considered as fair.

Unused Loan Proceeds by Closing Date

3. Seven of the nine institutions stated that there would not be any significant amount of unused loan proceeds by the time of the Closing Date, September 30, 1998. However, SERI and KEI stated respectively that about US\$0.6 million and US\$0.8 million might not be used by the Closing Date. The mission pointed out that: (a) for this

^{1/} This Aide Memoire is subject to review and modification by Bank management.

^{2/} The mission comprised Ms. Carol H.L. Ball (Task Team Leader, EASED), and Sing Zak Sung (Consultant).

^{3/} See Annex 3 for their full names and their responsible ministries.

loan, there will not be any extension of the Closing Date; and (b) the unused fund would be cancelled from the total loan amount.

4. KAIST would like to use an additional US\$0.5 million of the unused fund as mentioned in para. 3 above for buying more library materials. MOFE indicated to the mission that the request, if forthcoming, would be duly reviewed and a quick decision on its approval would be made taking into consideration of the proximity of the Closing Date and the lead time for procurement and disbursement.

5. The Bank would normally have no objection to any transfer of small percentage of loan funds between categories of expenditures at a time near a loan's closing date, as long as the project's development objectives are not adversely affected. There is also no need for an amendment of the Loan Agreement of minor transfer of funds between institutions within the same project. The Bank would respect the Government's decision while still achieving the original development objectives.

6. In this particular case, the request for transfer is probably under 1% of this loan's total amount (US\$90.0 million), the mission's view is that the Bank would not have any objection, if so requested to MOFE, and MOFE approves it. This would not adversely affect the project's development objectives.

Matters Related to Implementation Activities At The Time Near the Closing Date

7. At a late stage of project implementation, ICB and NCB procurement procedures are not suitable, because the lead time is too long. More suitable procurement procedures are prudent shopping procedures for equipment, and direct negotiations with suppliers for library materials. The lead time for each is short. There should be enough time for completing the transactions, particularly for delivering the goods to the Purchaser before the Closing Date. This is crucial because expenditures for goods and services delivered after the closing date are not eligible for disbursement.

8. A suitable disbursement procedure to be used at a late stage of project implementation is "Direct Payment to Suppliers" for which Form 1903 should be used. This would obviate two difficulties: (i) the use of Special Commitment would involve the issuance of a Letter of Credit (L/C), for which the expiry date may be after the Closing Date, and the Bank would not honor such L/Cs; and (ii) the Special Account (SA) used may not have a large enough balance to cover the transaction during the SA recovery period near the Closing Date.

9. Sometimes payments on eligible expenditures could not be all made before the Closing Date. The Bank, however, could grant a grace period of four months after the Closing Date to facilitate such payments. The Bank would usually agree to this request, if asked for, and the mission recommends to Bank management granting such grace period for the nine institutions.

Review of Bid Evaluation Reports and Contract Awards

10. During the visit to SAROK, the mission reviewed recent bid evaluation reports and contract awards made for the nine institutions during this review period. From a sample coverage of about 25%, no irregularities were found. All awards were made to the lowest evaluated bidders. Single bids, if responsive and of reasonable price, were awarded contracts without retendering. There was no negotiations of prices after bid opening. SAROK's performance is satisfactory.

Review of Statement of Expenditures and the Supporting Vouchers

11. The mission's review covered all institutions except KEI, which had no expenditure during this review period. Sample coverage ranged between 22% and 100% of their entries in the applications of withdrawal. All the supporting vouchers (contracts and receipts) matched with the entries on the SOEs. The review, therefore, indicated the eight institutions' satisfactory operation of both the Special Account and the SOEs.

Covenant Compliance and Audit Reports

12. All covenants in the Loan Agreement were in full compliance. The audit reports for expenditures made in the Korea's Fiscal Year of 1997 (January 1 to December 31) should reach the Bank on or before June 30, 1998. One such report was received during this mission. It contained the Independent Auditor's opinion in general but did not include a separate opinion on the Statements of Expenditures (SOEs). As this is a requirement in the Loan Agreement, the mission reminded this institution to make good on this shortcoming before June 30, 1998. This message was conveyed to the other eight institutions during the meeting at KAIST.

Inactive Special Accounts

13. Five of the nine institutions have inactive Special Accounts according to the record of our Disbursement Division. These five institutions were asked to communicate with our Disbursement Division and provide either application for withdrawal or to refund the balance of the Special Account 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 3694-KO, SA Refund for (Name of Institution, e.g. KRISS)

Research Activities

14. In all the institutions in this project, research activities continued to increase annually together with the number of environment-related research topics. The mission is

satisfied with their reports. More detailed information will be provided to the Bank as required in the Questionnaire (see Annex 4) for the preparation of the Implementation Completion Report (ICR).

Preparation of ICR

15. It is the Bank's policy to prepare an ICR for each project after its Closing Date. The purpose is to evaluate the success or failure of the project. Whether the development objectives had been achieved as anticipated. Is there a cost- or time- overrun? Whether the performance of the Borrower and of the Bank during the implementation of the project had been satisfactory? Is the project sustainable after its completion? What are the measures taken by the Borrower to make it sustainable? What are the lessons learned for the Borrower and the Bank? For example, is it worth being replicated in other developing countries?

16. For achieving the above tasks, both the Bank's and the Borrower's effort is needed. Accordingly the mission prepared a Questionnaire (Annex 4) and presented it to the representatives of the nine institutions at the meeting at KAIST for comments and improvements. The draft was approved during the meeting.

17. There is a due date for the ICR in its final form to reach the Bank's Executive Directors for their review and comments. This due date is March 31, 1999, six months after this Loan's Closing Date. Therefore a time schedule is needed for the preparation of the ICR. The mission's draft time schedule was also presented at the KAIST meeting, discussed and approved by the nine institutions' representatives. It is included in this Aide Memoire as Annex 5. Any comments, if provided, will be included in the ICR. The mission also stressed the importance of adherence to the time schedule, so that the ICR in its final form could be delivered by the due date.

Next Mission

18. There will be no more progress review missions from the Bank for this project, as the Closing Date is September 30, 1998.

May 14, 1998

CC List of Recipients of Aide Memoire (Loan 3694-KO)

May 1998

Name of Institution	Name of Contact Person	Position	Tel. No.	Fax No.
MOFE	Kang, Jung Young	Director, Treasury Division, Treasury Bureau	02-503-9280	02-503-9282
SAROK	Lee, Sung Lun	Director, Foreign Procurement Division II	02-533-0790	02-533-0711
KEI/MOEN	Jung, Eun-Hwa	Chief, Environmental Technology Information Division, KEI	02-3488-7731 02-3488-7777	02-3488-7799
KAIST	Ko, Kyung-Ho	Chief, International Cooperation Section	042-869-2441-4	042-869-4930
K-JIST	Won, Suk Chong	Chief, International Cooperation Section	062-970-2021 062-970-2114	062-970-2029
KRISS	Shin, Ok-Kyoon	Chief, Planning Section	042-868-5081	042-868-5088
KITECH	Kim, Bum-Yong Chun, Jong-Woo	Research and Planning Department Chief, Planning Dept. KTLIT (Korea Testing Laboratory for Industrial Technology)	417-560-8022-4 02-860-1222	417-560-8030 02-860-1225
KIMM	Yi, Kil Joon	Manager, Publicity and Intercooperation Division	042-868-7861	042-868-7863
KRIBB	Ha, Hun-Pyo	Chief, International Cooperation and PR Section	042-860-4730-3	042-860-4739
KORDI	Jin, Dong Min	Chief, International Cooperation Section	0345-400-6070-2	0345-406-6925
SERI	Kim, Hong-Ki Park, Noh-Hoon	Chief, Public Relations and International Cooperation Div. Staff	042-869-1141-2	042-869-1149

REPUBLIC OF KOREA

Revised Procurement and Disbursement Plan for Loan 3694-KO (May, 1998)
(US\$ million)

Procurement Goods and Services	CY 1995		CY 1996		CY 1997		CY 1998		Total Loan Allocation		% A/P	Remarks
	Planned	Achieved	Planned	Achieved	Planned	Achieved	Planned	Achieved	Planned	Achieved		
1. KAIST	5.5	0.6	9.5	7.0	6.1	10.0	1.2	1.3	22.3	18.9	85%	Loan allocation expected to be used
2. KITECH	1.0	1.6	8.0	7.2	10.5	9.5	0.0	1.1	19.5	19.4	99%	Implementation completed
3. KRISS	7.4	6.1	2.4	2.8	0.0	0.9	0.0	0.1	9.8	9.9	101%	Implementation completed
4. KORDI	1.2	0.3	4.4	4.6	4.2	0.5	0.0	2.3	9.8	7.7	79%	Loan allocation expected to be used
5. SERI	0.0	0.0	3.7	2.8	4.0	6.1	2.1	0.8	9.8	9.7	99%	Implementation completed
6. K-JIST	6.6	3.4	0.4	3.0	0.0	0.1	0.0	0.3	7.0	6.8	97%	Implementation nearly completed
7. KIMM	3.0	4.4	1.7	0.3	0.2	0.3	0.0	0.0	4.9	5.0	102%	Implementation completed
8. KRIBB	0.0	0.0	2.8	1.7	1.6	1.6	0.5	1.6	4.9	4.9	100%	Implementation completed
9. KEI/MOEN	0.4	0.0	1.1	0.4	0.5	0.4	0.0	0.4	2.0	1.2	60%	No plan for using remaining US\$0.8 million
Total Planned	25.1		34.0		27.1		3.8		90.0			
Total Achieved	16.4		29.8		29.4		7.9		83.5		93% (of total loan amount)	

Disbursements	CY 1995		CY 1996		CY 1997		CY 1998		Total	Total	% A/P	Remarks
	Planned	Achieved	Planned	Achieved	Planned	Achieved	Planned	Achieved	Planned	Achieved		
1. KAIST	2.7	2.2	8.0	4.6	10.6	5.4	1.0	5.5	22.3	17.7	79%	Behind schedule, but full disbursement is still expected
2. KITECH	2.5	1.9	8.0	4.7	7.0	8.4	2.0	1.8	19.5	16.8	86%	Full disbursement expected
3. KRISS	4.9	3.5	4.9	4.6	0.0	1.7	0.0	0.0	9.8	9.8	100%	Implementation completed
4. KORDI	1.0	0.3	4.6	4.6	4.2	0.5	0.0	3.0	9.8	8.4	86%	Full disbursement expected
5. SERI	1.9	0.0	2.8	2.6	3.8	5.1	1.3	1.4	9.8	9.1	93%	About \$0.6 million may be cancelled
6. K-JIST	3.9	4.6	3.1	1.8	0.0	0.2	0.0	0.1	7.0	6.7	96%	Full disbursement expected
7. KIMM	3.0	2.3	1.7	2.2	0.2	0.1	0.0	0.0	4.9	4.6	94%	Full disbursement expected
8. KRIBB	0.0	0.5	2.7	1.7	1.6	1.1	0.6	1.5	4.9	4.8	98%	Full disbursement expected
9. KEI/MOEN	0.2	0.2	1.3	0.4	0.5	0.2	0.0	0.4	2.0	1.2	60%	About \$0.8 million may be cancelled
Total Planned	20.1		37.1		27.9		4.9		90.0			
Total Achieved	15.5		27.2		22.7		13.7		79.1		88% (of total loan amount)	

Source: Latest status reports and discussions during progress review meetings.

REPUBLIC OF KOREA

Loan 3694-KO

Implementation of Overseas Training and Visiting Experts
(May 1998)

Name of Institution	Overseas Training Numbers/Staff-Months			Visiting Experts Numbers/Staff-Months		
	SAR Planned	Revised	Achieved	SAR Planned	Revised	Achieved
KEI	21/60	11/67	11/67	-/-	-/-	-/-
KAIST	60/360	135/1000	130/823	17/30	20/10	28/86
KORDI	71/100	-/-	147/120	32/50	-/-	99/37
SERI	30/160	107/58	86/77	15/20	15/5	15/5
K-JIST	15/45	-/-	22/32	9/21	-/-	29/21
KRIBB	70/140	-/-	25/25	43/30	30/30	68/33
KITECH	48/152	144/76.3	44/87	32/24	60/444	12/24

Note: There are no Bank-financed training and/or experts for KIMM and KRISS under this Project.

Source: Latest status reports and discussions during progress review meetings.

Republic of Korea**Environmental Technology Development Project
(Loan 3694-KO)****Project Institutions and Related Ministries**

Abbreviation of Institution	Full Name of Institution	Under Which Ministry
KAIST	Korea Advanced Institute of Science and Technology	Ministry of Science and Technology
KITECH	Korea Institute of Industrial Technology	Ministry of Commerce, Industry and Energy
KRISS	Korea Research Institute of Standards and Science	Ministry of Science and Technology
KORDI	Korea Ocean Research and Development Institute	Ministry of Maritime Affairs and Fisheries
SERI	System Engineering Research Institute	Ministry of Information and Communication
K-JIST	Kwangju Institute of Science and Technology	Ministry of Science and Technology
KIMM	Korea Institute of Machinery and Materials	Ministry of Science and Technology
KRIBB	Korea Research Institute of Bioscience and Biotechnology	Ministry of Science and Technology
KEI	Korea Environment Institution	Ministry of Environment

Republic of Korea
Environmental Technology Development Project
(Loan 3694-KO)

Questionnaire for the Preparation of Implementation Completion Report (ICR)
(to be filled out by each project institution)

Questions unrelated to the institution need not to be answered. For example, this project did not provide civil works financing in the project cost for several institutions. If included in the project cost, the relevant question then should be answered, even not financed by the Loan.

Implementation Result

1. What is the result of equipment procurement?
 - (a) total amount of loan used
 - (b) number of items of equipment purchased
 - (c) comparison with original estimate for each of the above
 - (d) any major changes with the original plan (quantity, major specification changes, unit cost estimate, reasons for the change)
 - (e) any cost overrun
 - (f) completion date of equipment procurement, and any time overrun
 - (g) any major problem encountered
 - (h) comments on quantity (adequacy in terms of need), quality (meeting users' requirements), and management

2. What is the result of civil works implementation?
 - (a) total area built: actual and original plan (specify the part for project equipment, and the part for other purposes, if possible)
 - (b) total cost: actual and original plan
 - (c) comment on adequacy for equipment housing
 - (d) completion date and any time overrun

3. What is the result of fellowships and visiting experts implementation?
 - (a) number of fellowships and man-months: actual and original plan
 - (b) number of visiting experts and man-days: actual and original plan
 - (c) comments on usefulness of the fellowships and visiting experts
 - (d) any major problem encountered
 - (e) any major contributions of the visiting experts

4. What are your comments on project implementation? Your institution? Your ministry?, SAROK? and the Bank?
5. What are your overall comments on the project, any major contribution to your institution?

Quantitative and Qualitative Achievements

1. How many research topics were newly undertaken by year (1995, 1996, 1997 and 1998, actual/estimate)?
2. Within which (refer to above figure), how many are environmentally related? (Answers for questions 1 and 2 could be presented in one table.)
3. Within the same time period (see question 1 above), how many environmental research results were published domestically and/or internationally?
4. How many research results were used by industry?
5. If any, how many patents have been received?

Management Indicators

1. What is the average utilization rate of equipment purchased by this project?
2. Is there any delivery delay, delivery shortage, delivery mistake (e.g. wrong specifications), non-responded claims, forfeiture of bid bonds/performance bonds and any needed legal action?
3. Is there any domestic budgetary problem?
4. Is there any Bank's poor performance?

REPUBLIC OF KOREA

LOAN 3694-KO

Closing Date: September 30, 1998

ICR Preparation Schedule

Bank Side Step Name	Date
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(a) Time Schedule - Steps and Dates

1. Project Completion Mission	Held in May 1998
2. ICR Drafting	11/01/98 - 12/01/98
3. Draft ICR to reach Institutions	12/15/98
4. Gray Cover ICR Preparation	01/16/99 - 02/15/99
5. ICR to Bank Board	3/31/99
6. Final ICR to Institutions & GOK	5/31/99

Institution Side Step Name	Date
-------------------------------	------

(a) Time Schedule - Steps and Dates

1. ICR Data Collection	06/01/98 - 09/30/98
2. Replies to the Questionnaire, Documents & Tables to reach Bank	by 10/31/98
3. Preparation of Evaluation Summary	06/01/98 - 10/15/98
4. Evaluation Summary to reach Bank	by 10/31/98
5. Comments on Draft ICR to reach Bank	by 01/15/99

(b) List of Documents and Tables to be sent to the Bank from Institutions

1. The Evaluation Summary to be annexed to the ICR (see 3 & 4 above)
2. Questionnaire, Documents and Tables (see 2 above)
 - (i) Replies to the questionnaire, or any other consolidated information on the project
 - (ii) Project cost table
 - (iii) Project finance table
 - (iv) Project components starting and completion dates
 - (v) Plan for future operation, as evidence of sustainability
3. Comments on draft ICR (see 5 above)

**SUMMARY OF SUBMISSIONS BY THE GOVERNMENT OF KOREA'S
NINE PROJECT INSTITUTIONS**

The loan amount of US\$90 million, allocated to nine project institutions, was 98.4% disbursed. The components of the loan were: equipment (US\$80.8 million); overseas training (US\$5.1 million); library materials (US\$2.4 million); and visiting experts (US\$1.7 million). Implementation of these components was generally satisfactory but in a small number of cases, procurement fell short of targets. Implementation experience is summarized as follows:

Equipment

The procurement of equipment was successfully completed in eight institutions. KEI fell short with only about 70% of the loan amount allocated to equipment being disbursed. Equipment procurement was managed successfully by SAROK in association with the institutions. There was a tendency for procurement to lag behind planned levels in the early years of the project but shortfalls were overcome in the later years.

Overseas Training

Seven institutions financed overseas training. This was successfully completed in five institutions but ETRI and KRIBB fell well short of training targets. Disbursements were only 33.4% for ETRI and 23.7% for KRIBB, respectively. The shortfall in KRIBB was the result, in part, of a reallocation of loan funds in favor of equipment and library materials at the expense of overseas training and visiting experts (see below).

Library Materials

Five institutions procured library materials. KAIST secured an additional allocation of US\$300,000 to procure research and teaching materials. KRIBB also exceeded its allocation for library materials by about 20%.

Visiting Experts

Six institutions financed visiting experts. This was successfully completed in four institutions. ETRI and KRIBB again fell short of targets with disbursements of 56.6% and 33.0% respectively. KRIBB's reallocation of loan funds, noted above, resulted in the reduction of visiting experts.

Other Project Outcomes

Although data coverage was limited, institutions indicated substantial increases in key indicators during the first three years of the project (1995-97).

- ◆ Nine institutions showed increases in research projects averaging 7% per year.
- ◆ Five institutions showed increases in research publications averaging 45% per year.
- ◆ Four institutions showed increases in patent awards averaging 67% per year.
- ◆ Regarding the utilization rate of equipment, five institutions provided estimates in the range of 75%-100%. Three institutions, which did not provide a numerical estimate, indicated that utilization rates were high to very high.
- ◆ All institutions indicated that the overall objective of the project i.e. to strengthen the R&D capabilities and, where relevant, teaching capacities, had been successfully achieved.

Individual evaluation summaries from the nine project participating institutions are included here as attachments.

Individual Institution Evaluation Summary	Acronym at Appraisal	Acronym at Completion
Attachment 1	MOEN	KEI
Attachment 2	KAIST	No change
Attachment 3	KAITECH	KITECH
Attachment 4	KRISS	No change
Attachment 5	KORDI	No change
Attachment 6	SERI	ETRI
Attachment 7	KWAIST	K-JIST
Attachment 8	KIMM	No change
Attachment 9	GERI	KRIBB

IBRD Loan No. 3694-KO
KEI project

Environmental Technology Development Project
Evaluation Summary
(Project review from the borrower's viewpoint)

February 1999

Korea Environment Institute

Environmental Technology Development Project Evaluation Summary(Loan 3694-KO)

1. Objectives

Our project objectives are gain & enhance ;

- 1) the systematic analysis and management of environmental information;
- 2) the development and operation of the KEINS(Korea Environmental Information Network System)

2. Implementation.

2-1. Allocation and disbursement of the loan

	Equipment	Library	Overseas Training	Total	Percentage (%)
Amount of the Loan Allocated	\$ 1,600,000	\$100,000	\$300,000	\$2,000,000	100.00
Amount of the Loan Disbursed	\$1,116,271.92	\$84,542.08	\$231,857.83	\$1,432,671.83	71.6

2-2. Comparison of the actual completion date of the project with the initial-planned completion date based on the Loan Agreement

	Planned Completion Date	Actual Completion Date	Remarks
Procurement of Equipments	September 1998	September 1998	Completed as Planned
Installation of Equipments	September 1998	September 1998	Completed as Planned

2-3. Major Equipments Purchased

Items	Amount(USD)	Equipment Installation
- GIS Equipments	\$284,943.62	Info. & Computer Center
- Library Information Management System	\$91,134.32	Info. & Computer Center
- KEINS Equipments	KRW 714,000,000	Info. & Computer Center
- EIA Application and DB	KRW 309,600,000	Info. & Computer Center

2-4. Managerial difficulties and some suggestions

None

3. Benefits from the Project

- GIS H/W and S/W have been introduced to be applied to environment- related GIS activities.
- Library information management system used for information division activities has been upgraded with advanced computer and telecommunication technologies.
- KEINS(Korea Environmental Information Network System) has been operated access to environmental information resources on the Internet.
- The World Wide Web is being used for environmental information services.
- Environmental Impact Assessment Application and DataBase is being used for domestic EIA-related searches and queries.

4. Conclusion

The research capabilities for KEI researchers has been enhanced through the equipments, library materials and overseas training supported by IBRD. Loan Project 3694-KO has been satisfactorily and successfully completed by KEI.

Summary of Evaluations

1. Korea Advanced Institute of Science and Technology (KAIST) was established with the aim of nurturing highly qualified scientists and engineers proficient in the in-depth learning of fundamental knowledge and practical application, and the aim of promoting basic and applied research to raise Korea's strength in science and technology. Today, KAIST has successfully consolidated itself as the nation's best research-oriented science and engineering educational institution, playing the leading role in the development and advancement of science and technology.

2. In the pursuit of systematic and effective education for the scientifically gifted, KAIST was founded by and remains under the auspices of the Ministry of Science and Technology rather than the Ministry of Education, as is the case with all the other universities. This ensures KAIST a full financial support from the government and a greater operational flexibility. Furthermore, KAIST enjoys a special geographical advantage of being situated within the Taeduk Science Town along with other universities, public and private research institutes as well as venture businesses. This creates an ideal environment for our faculty and students, to obtain maximum results from their endeavors in academic and research fields through mutual cooperation and exchange.

3. Over the past 28 years, KAIST has produced about 18,700 graduates, including 3,400 Ph.D. degree holders, all of whom are now carrying out a central role in the development of science and technology in many spheres but not limited to universities and research institutes at home and abroad, government and industries. Annual research projects of over 1,000, totaling approximately US\$58 million, and a continuous stream of major, quality research papers show that KAIST is truly a research-oriented university.

4. Our potential to grow as a world class science and engineering university has already been proven, amply, by receiving some of the highest recognition from both local and international communities. As a testament to our superior qualities, KAIST was ranked the overall first in 1995, 1998 *Joong Ang Daily Newspaper* Nationwide University Evaluations, and the first in 1996 Nationwide Evaluation of Information-oriented Universities by *Dong-A Daily Newspaper*. Furthermore, KAIST graduate programs were rated as being in the top 10% in relation to US colleges and universities in the 1992 ABET (Accreditation Board for Engineering & Technology) Evaluation.

Attachment 2

5. KAIST believes that these achievements have been realized with the support from the Korean government and from the World Bank, provided over a number of occasions. In particular, it is regarded that the recent Environmental Technology Development Project (Loan No.3694-KO) has contributed enormously to facilitate and promote environmentally related academic and research activities at our university.

6. The following categorically summarizes the results and evaluations of the activities undertaken in relation to the Environmental Technology Development Project by our university.

1) Equipment Purchase

- A total of 415 items purchased; in some cases more upgraded and improved equipment than the ones originally planned for purchase were procured.
- Environmentally related equipment with educational purposes were purchased for sharing among departments such as civil engineering, chemical engineering, biology and chemistry, whose works are closely related to the environment. In particular, a substantial amount of equipment provided to the Energy and Environment Research Center meant that truly in-depth researches could be performed.
- Also, with a proportion of the total purchase devoted to the equipment required for the computerization of campus, they will significantly assist in establishing an intelligent campus.
- In conclusion, all these equipment purchases have greatly contributed to enhancing the level of quality of teaching and research at KAIST.

2) Library Materials Purchase

- As originally planned, 12,520 academic serials in 1,1880 titles, 4,957 book volumes and 8 titles of CD-ROM databases have been purchased.
- In addition, the supplementary loan of US\$300,000.00 provided at the conclusion of the Project permitted an additional procurement of publications needed for teaching and research.
- The expansion of data in the form of books, serials, etc. has not only supported academic and research activities of our faculty and students, but provided essential science and technology information to research institutes in Taeduk Science Town and to other institutes at home and abroad. Furthermore, it has given our library an opportunity to develop into a specialist library in national science and technology.

3) Fellowships

- The duration of fellowships varied, ranging from 2 months to 6 months and 12 months; it, however, was adjusted with respect to the nature of training.

Attachment 2

- In order to widen the scale of fellowship training, the amount of financial support per head was reduced and, hence, an increased number of faculty from the number originally planned was provided with the opportunity to participate in attaining advanced technologies from overseas.
 - Original plan : 60 persons, 360 man-months
 - Actual implementation : 130 persons, 779.3 man-months

4) Visiting Experts

- The actual implementation of securing visiting environmental experts consisted mainly of short-term visits rather than the long-term visits as stated in the original plan.
 - Original plan : 17 persons, 360 man-days
 - Actual implementation : 29 persons, 279 man-days
- The reason for the actual implementation result was because, in many cases, it was difficult for the visiting experts to stay a longer term to meet other commitments.
- Also, the need for visiting experts was partly decreased with the implementation of overseas training by our own faculty.

7. In conclusion, the IBRD Environmental Technology Development Project (Loan No.3694-KO) has been a successful one, which has contributed immensely to KAIST with the identification of environmental issues, the strengthening of capacity to address those issues adequately and to undertake environmental research and development activities.

8. We thank the World Bank, again, for supporting the Environmental Technology Development Project (Loan No.3694-KO). Especially, we would like to express our most sincere thanks to Sing-Zak Sung, Carol Ball, Gaye Lindsey, Robert McGough and Alan Ruby for their assistance to allow the Project to be carried out without a hiccup right from the start to the end.

Environmental Technology Development Project Evaluation Report

December 1998

Korea Institute of Industrial Technology

Environmental Technology Development Project Evaluation Report (Loan 3694-KO)

1. Objective

There is an increased awareness for the need to preserve our environment for future generations. This calls for the development of environmentally sound technologies.

In terms of industrial technology, there is a need for the development of technologies that will minimize damage to our natural surroundings and keep the generation of pollutants to a minimum.

Also the Environmental Technology Development Project by IBRD has helped enhance KITECH's capability to conduct research into developing technologies that are environment-friendly.

2. Implementation

2.1 Loan Expenditure

The total amount of the loan for KITECH was \$19,500,000.00 with the proceeds allocated to three categories : Equipment purchase, overseas training, and technical assistance.

KITECH have used a total of US\$19,417,971.84.

The breakdown of the expenditure by category are as follows.

Description (Category)	Budget (Allocation)	Completion	Variance	Remark
Equipment purchase	\$18,880,000	\$18,883,090.44	△\$3,090.44	
Overseas Training	\$490,000	\$443,822.79	\$46,177.21	
Technical Assistance (Expert)	\$130,000	\$91,058.61	\$38,941.39	
Total amount	\$19,500,000	\$19,417,971.84	\$82,028.16	

Attachment 3

All the equipments were delivered on schedule before the closing date(Sep 30,1998.). Towards the end of the Loan Project, KITECH re-directed a portion of funds allocated for visiting experts and overseas training for the purchase of equipment with the Bank's approval. Through the technical assistance and overseas training, KITECH was able to gain useful information on trend and development in other countries. Two areas gave KITECH researchers an opportunity to become familiar with global trends in environment-related technology.

2. 2 Major equipment purchased(more than US\$270,000)

These equipments has help build substantial framework of KITECH R&D capabilities.

Items	Amount (US\$)	Equipment Installation
TEM/EDS	\$393,456.87	Technology Development& Assistance Center
Rolling mill	\$342,841.63	Same as above
Laminated Object Manufacturing System	\$301,000	Same as above
Jig Grinding Machine	\$395,900	Same as above
Mass Spectrometer	\$493,305.84	Technical Supervision Division(KTL))
ICP Mass Spectrometer	\$344,500	Same as above
Hot Wire Anemometry System	\$295,418.89	Industrial Equipment Technology R&D Center
CNC Universal Cylindrical M/C	\$289,000	Same as above
Small & Wide Angle X-Ray Scattering Diffractometer	\$277,717.07	Material & Textile R&D Center
Psychometric Calorimeter	\$277,185.53	Industrial Equipment Technology R&D Center

2. 3 Problems with Implementation

KITECH encountered no major difficulties in regard to the implementation of the Loan 3694-KO Project and there were no noteworthy delays. KITECH wishes to express its thanks to the IBRD and other related agencies for their support and cooperation.

3. Impact on the Loan Project

The Loan Project enhanced KITECH's ability to conduct research into developing environment-related technology. The Loan has helped the institute acquire necessary equipment to carry out its works in this field.

In addition, the overseas training and technical assistance obtained from the Loan Project has helped facilitate KITECH's research into the development of environment-related technologies.

Over the course of the implementation, KITECH carried out 55 research projects related to environment technology. Many of the results obtained have been transferred to the industrial sector. In addition, 27 patents were received between 1995 and 1998.

KITECH has start to put a greater emphasis on the development of environmentally sound technologies. To facilitate the implementation of the Loan Project(3694-KO), KITECH organized the Textile & Cleaner Prouction Technology R&D Center in 1995. The proceeds of the Loan helped secure the necessary equipment to carry out environmental research.

In September of 1998, the completion month of the Loan Project, KITECH set up the Cleaner Production Technology R&D Division, which is solely devoted to research in environmental technology. The Division assist the local manufacturing industry cope with increasingly stringent environmental regulation both in and out of Korea. The Division works to develop technologies that minimize the generation of waste and pollution, rather than focusing on ways to deal with pollution after it has been created.

KITECH's efforts are in line with the position of the Korean government.

The institute is the supervising body for the Cleaner Production Technology Program, which brings together interested parties from the industry, academia and the research sector. As an indication of the growing importance of the environmental issue, the government has nearly doubled the program budget for 1999 compared to this year.

KITECH's tasks include the planning and coordination of the program as well as follow-up supervision after the completion of research.

In addition to a wide range of environment-related research projects, seminar and conferences are organized to keep up to date on the latest advances in the field of cleaner production technology.

Along the line of KITECH's objectives, the institute works to support and medium sized manufacturers. These companies often lack the necessary financial resources and equipment to concentrate on environmental issues.

The institute provides assistance to smaller firms that are involved with development of cleaner production techniques.

4. Conclusion

The Loan Project enabled KITECH to accumulate experience and know-how in the field of environment-related technology. KITECH is taking a proactive stance in regard to the development of this field. The procurement of equipment has facilitated research at the institute while information gained from overseas training and visiting experts helped broaden our researcher's perspectives and knowledge base.

The IBRD Loan project also laid the foundation for close Multinational and bilateral cooperation, especially in the area of environment-related technology. KITECH hopes to build on this foundation to pursue cooperative projects with other countries. An example of such a project is the "South-South Cooperation" which we have discussed with the Bank on previous occasions.

With international boundaries becoming less defined, KITECH hopes to make use of the know-how and experience accumulated through the Loan Project by taking part in similar projects in the future.

Attachment 4
IBRD Loan No. 3694-KO
KRISS Project

Environmental Technology Development Project
Evaluation Summary

(Project review from the borrower's viewpoint)

October 1998

Korea Research Institute of Standards and Science

Environmental Technology Development Project Evaluation Summary(Loan 3694-KO)

1. Objective

Development of advanced measurement technology is one of the key technologies to protecting the earth from environmental pollution. Accurate measurement technology of the pollutants should be established in order to minimize the damage due to the environmental pollution. Particularly, reliable analysis and standardized testing method of the pollutants, based on the measurement technology, are crucial for the development of environmental technology.

The objectives of this loan project are to improve R & D capabilities of Korea relating to environmental technology, to help KRISS to develop standardized analysis methods of the pollutants, and to disseminate them into industries.

2. Implementation

2-1. Allocation and disbursement of the loan

(Unit : US\$1,000)

Year	'94	'95	'96	'97	'98	Total	Percentage (%)
Amount of the Loan Allocated	-	5,300	3,700	800	-	9,800	100%
Amount of the Loan Disbursed	-	3,072	4,647	1,303	770	9,792	99.9%

2-2. Comparison of the actual completion date of the project with the initially-planned completion date based on the Loan Agreement

	Planned Completion Date	Actual Completion Date	Remarks
Procurement of Equipment	September 30, 1998	January 1998	
Installation of Equipment	September 30, 1998	July 1998	

2-3. Major equipment purchased (more than US\$300,000)

Items	Amount (US\$1,000)	Equipment Installation
High resolution ICP mass spectrometer	360	Inorganic analysis Research Group
High resolution organic mass spectrometer	410	Organic analysis Research Group
Mass spectrometer for precision gas analysis	455	Organic analysis Research Group
High power X-ray generator	678	Crystal Evaluation Research Group
Ion microscope	530	Surface analysis Research Group
Midrange computer system	614	Computer center

2-4. Managerial difficulties and some suggestions

None

3. Benefits from the Project

Through the loan project, KRISSE was able to enlarge its technical base in measurement technologies as well as to improve its R&D capabilities relating to the environmental analysis technology. The following tables shows the increased number of patent and research paper presented in journals, compared with the year before the loan project.

3-1. Comparison of the number of research paper published in domestic or international journals

	1994 (Before the Project)	1997 (After the Project)
Domestic Journals	360	352
International Journals	213	237

3-2. Comparison of the number of patent

	1977 ~ 1994 (Before the Project)	1995 ~ 1998 (After the Project)
National Patents	33	40
International Patents	3	6

4. Conclusion

For the improvement of the national measurement standards which plays a key role in the development of environmental technology, advanced research facilities are needed.

In this respect, the IBRD Loan Project contributed considerably to the improvement of the R&D capabilities of the KRISS for the development of environmental technology.

**IBRD Loan No. 3694-KO
KORDI Project**

**Environmental Technology Development Project
Evaluation Summary**

(Project review from the borrower's viewpoint)

December 1998

Korea Ocean Research and Development Institute

Environmental Technology Development Project

Evaluation Summary (Loan 3694-KO)

1. Objective

Due to the limited land resources, Korean Government encourages the coastal developments through reclamation of low tidal flats in western and southern coasts. Recent increase in the activities of maritime transportation in Korean coastal waters is noticeable. Consequently, environmental problems threaten the water in terms of high casualty in marine pollution, marine disaster and unbalanced ecosystem. It was necessary to start working on the environmental problem to minimize the environmental impacts through improving the research potential with the aids of international cooperative program like IBRD.

2. Implementation

2-1. Allocation and disbursement of the loan

(Unit : US\$1,000)

	Equipment	Library	Technical Assistance	Overseas Training	Total	Percentage(%)
Amount of the Loan Allocated	8,870	130	300	500	9,800	100.00
Amount of the Loan Disbursed	8,843	128	277	462	9,710	99.08

Attachment 5

2-2. Comparison of the actual completion date of the project with the initially-planned completion date based on the Loan Agreement

	Planned Completion Date	Actual Completion Date	Remarks
Procurement of Equipment	September 1998	September 1998	Completed as Planned
Installation of Equipment	September 1998	September 1998	Completed as Planned

2-3. Major Equipment purchased (more than \$250,000)

Items	Amount (USD)	Equipment Installation
NOAA/HRPT & Seaster/Seawifs Data Reception System	311,900	Physical Oceanography Div.
Deep Tow Side Scan Sonar & Sub-Bottom Profiler System	876,789	Geological Oceanography Div.
Sediment Trap System	242,500	Instrumentation Center

2-4. Managerial difficulties and some suggestions
None**3. Benefits from the Project**

- Exploration of innovative approaches to environmental improvement
 - Sharing the increasing efforts to watch the international water quality problem
 - Reducing the natural disaster arising from coastal development

- Increasing the productivity of fishery industry and the welfare for fisherman
- *Optimum regulation and management of marine resources*
- *Fast treatment of the spilled oil and toxic contaminants*
- *Preservation of clean water and marine ecosystems*

4. Conclusion

The capability related to environmental technology of KORDI researchers has been enhanced through purchase of equipments and libraries, technical assistances and overseas training with the aid of IBRD. KORDI has completed the Loan Project 3694-KO very satisfactorily and successfully.

IBRD Loan (3694-KO) Evaluation Summary

Electronics and Telecommunications Research Institute

1. Objective

- The objective of this loan project are to enlarge the R&D capabilities of ETRI(Electronics and Telecommunications Research Institute) to protect the earth from environmental pollution.

In order that, enhancement of the quality of R&D is required, through procuring of equipment, overseas training, expert invitation, and participate in building of international environmental R&D network.

2. Implementation

- Since the launch of project, ETRI has been disbursed U\$9,135,956.15 among U\$10 million through 1995 to 1998.6.
- As of April, 1998, the project has been terminated early of the schedule.
- The classified disbursement categories

(UNIT:U\$)

Categories	Original Amount	Cancellation	Disbursed Amount	Remarks
Procurement Of equipment	8,800,000.00	186,461.11	8,616,538.89	includes S.A. x/rate factor
Expert Invitation	800,000.00	347,252.89	452,747.11	
Overseas Training	200,000.00	133,329.85	66,670.15	
Total	9,800,000.00	667,043.85	9,135,956.15	

- SERI (Systems Engineering Research Institute), which had the allocated loan, was established as an affiliation institute of KIST(Korea Institute of Science & Technology), and transferred to ETRI(Electronics Technology Research Institute) as an affiliation institute on Jan. 1, 1996 and finally was merged in ETRI as of May 26, 1998.

3. Organization & Management

- Special unit to manage IBRD Loan Project was not organized, but Public Relations & International Cooperation Group was responsible for overall management. And Personnel Group was responsible for expert invitation, and overseas training.

After SERI was merged in ETRI, Technology Cooperation Team has been responsible for overall management.

- Independent accounting system was taken to control this project following the Generally Accepted Accounting Principles.

Accounting work has been managed in SERI Accounting Group.

After SERI was merged in ETRI, ETRI Accounting Team has been responsible for.

Both SERI and ETRI have taken internal audit system, in which a qualified Auditor and an Assistant to Auditor have audited to prevent any possible problems.

4. Evaluation

- ETRI has secured large equipment which the institute needed, and great result in enhancement of R&D through overseas training and expert invitation.

K-JIST's Evaluation Summary

Abstract

- KOREA-Environmental Technology Development Project(Lo.3694-KO) is determined to have the loan of US\$700,000 with the consent of the National Assembly in December, 1991.
- The terms of IBRD Loan
 - loan unredeemable for five years('94~98)
 - repayment dividedly in ten years('99~'2008)
- During the term unredeemed we paid only interest on the loan, from 1999 we will begin to repay the principal sum of loan.
- The loan of US\$700,00 was used in equipments(US\$5,995,404.79), library materials(US\$714,006.04), fellowships(US\$112,429.86) and visiting experts (US\$85,549.18).

Factor of the evaluation

- The degree of learning on the recent information and method of research in an advanced nation
- The degree of upgrading the quality of faculty
- The degree of establishing the foundation of exchange of personnel with an advanced nation

Result of the evaluation

▶ **General evaluation**

- KOREA-Environmental Technology Development Project(Lo.3694-KO) greatly contributed to our institution development in that ;
 - Building up the infrastructure of education and research through use of the recently purchased equipments
 - Resulting in upgrading the quality of faculty
 - Learning on the recent information and library materials
 - Building up the foundation of exchange of education and research with an advanced nation
- We evaluate that we founded the base of development in education and research, and we made the educational circumstances for the 21st.

▶ **Partial evaluation**

- Equipments : We purchased 132 items by US\$5,995,404.79. The newest equipments contributed to upgrade the quality of faculty and students.
- Library Materials : We used US\$714,006.04 in purchasing library materials. The library materials contributed to give the newest information to faculty and students.
- Fellowships : We used US\$112,429.86 in visiting the excellent laboratories and universities. 31 persons used the loan, they learned the newest research methods.
- Visiting Experts : We used US\$85,549.18 in visiting experts. 41 persons used the loan, they had seminars, discussed about the international joint researches.

Contents of loan used('96 ~ 98)

Year, Month, Number	Withdrawal	Equipments	Library Materials	Fellowships	Visiting Experts	Balance
95. 4. KJ1	700,000.00	7,040.00				
5.		145,907.00				
6.		391,857.43				
7. KJ2	356,516.61	667,409.06				
7. KJ3	188,288.18					
8. KJ4	667,409.06	675,332.85				
9. KJ7	352,312.03	13,124.48				
9. KJ8	336,145.30	194,598.24	196,542.98			308,858.78
10. KJ9	194,598.24	386,153.68				117,303.34
10. KJ5	441,427.64	441,427.64				
10. KJ6	168,502.97	168,502.97				
11. KJ10,11	567,109.66	279,131.83	344,495.42			60,785.75
12. KJ12	131,822.03	183,441.53				
12. KJ13	507,392.22					516,558.47
96. 1.		48,809.81				467,748.66
2.		131,311.00	20,601.88			315,835.75
3. KJ14	232,251.34	854,917.34				67,335.11
3. KJ15	356,995.64			14,167.19		35,998.23
4. KJ16	275,669.25	3,859.50		4,253.67		
4. KJ17	388,332.52					691,886.83
5.		198,846.18			1,693.00	491,347.65
6. KJ18	208,652.35	320,590.97				379,409.03
7. KJ19	220,590.97	185,297.25			8,971.29	405,731.46
8.		83,257.73			5,146.24	317,327.49
9. KJ20	135,987.98	35,767.50			1,858.00	415,689.97
10.					7,022	408,667.97
11.		56,086.59			3,200	349,381.38
12.		154,566.00			2,930.00	191,885.38
97. 1.2.S KJ21	73,031.47	48,597.25		4,166.00		212,173.60
4. KJ22	133,319.84					345,493.44
5.		2,000.00		4,166.00	4,054.00	335,273.44
6.		4,584.00		3,100		327,589.44
7.		35,878.95		49,883.00	4,709.00	237,118.49
8.		13,250.00		8,112.00	4,495.00	211,261.49
9.		59,313.00			6,835.43	145,113.06
10.	100,380.38			4,114.00	882.22	240,497.22
11.		14,895.00			2,216.00	223,386.22
12.					2,652.00	220,734.22
98. 1		30,301.95				190,432.27
98. 2						
98. 3					8,359.00	182,073.27
98. 4					1,770.00	180,303.27
98. 5		61,305.00				118,998.27
98. 6		26,991.50		2,500.00	1,546.00	87,960.77
98. 7. KJ-24	112,039.23	45,881.18		17,968.00		136,150.82
98. 8.		12,957.90				123,192.92
98. 9. KJ-25	58,594.93	12,212.09	93,770.83		17,210.00	58,597.93
98. 9.			58,594.93			0
Total	6,907,389.87	5,995,404.79	714,006.04	112,429.86	85,549.18	0

IBRD Loan No. 3694-KO

KIMM Project

Environmental Technology Development Project

Evaluation Summary

(Project review from the borrower's viewpoint)

November 1998

Korea Institute of Machinery & Materials

Environmental Technology Development Project
Evaluation Summary(Loan 3694-KO)

1. Objective

The pollution problems such as air pollution, noise and vibration caused by the industrialization are becoming the major issue for people's health. The research capability in the area of the environmental protection and pollution prevention should be enhanced to minimize the damage of pollution.

The objectives of this loan project are improving R & D capabilities of Korea relating to environmental technology and helping KIMM to enhance the research capability of preventing pollution.

2. Implementation

2-1. Allocation and disbursement of the loan

(Unit : US \$ 1,000)

Year	'94	'95	'96	'97	'98	Total	Percentage (%)
Amount of the Loan Allocated		4,400	300	200		4,900	100
Amount of the Loan Disbursed		2,274	2,212	82	334	4,902	100.04

2-2. Comparison of the actual completion date of the project with the initially-planned completion date based on the Loan Agreement

	Planned Completion Date	Actual Completion Date	Remarks
Procurement of Equipment	September 1998	September 1998	
Installation of Equipment	September 1998	September 1998	

2-3. Major equipment purchased (more than US \$ 250,000)

Items	Amount (US \$ 1,000)	Equipment Installation
SEM/EDAX System for airborne	261	Combustion and Environment Engineering Group
Particle Image Velocimeter System	276	Thermal and Fluid System Department
Reaction Radical Image System	381	Fluid Machinery Group
Scanning Election Microscope	263	Material Engineering Department
High Temperature Microscope	260	Material Engineering Department

2-4. Managerial difficulties and some suggestions

None

3. Benefits from the Project

Thanks to the loan project, KIMM was able to enhance its R&D capability relating to the environmental technology.

The following tables show the increased number of patent and research paper presented in journals, compared with the year before the loan project.

3-1. Comparison of the number of research paper published in domestic or international journals

	1994 (Before the Project)	1997 (After the Project)
Domestic journals	460	750
International journals	107	188

3-2. Comparison of the number of patent

	1981-1994 (Before the Project)	1995-1998 (After the Project)
National Patents	45	110
International Patents	4	6

4. Conclusion

For the research on the prevention of air pollution, noise and vibration, advanced research equipments are needed.

The IBRD loan project provided KIMM 32 equipments which were technically advanced and related to environmental technology.

Our evaluation is that the project has been completed satisfactorily.

**IBRD Loan No. 3694-KO
GERI Project**

**Environmental Technology Development Project
Evaluation Summary
(project Review from the Borrower's Viewpoint)**

December 1998

Korea Research Institute of Bioscience and Biotechnology

Environmental Technology Development Project
Evaluation Summary (Loan 3694-Ko)

1. Objective

Mankind has achieved modern civilization through the advancement of science and technology since the Industrial Revolution. However, the crisis of fossil energy, the major driving force of the mechanical civilization, and the increased pollution caused by industrial development has begun to threaten the eco-systems in which we live. It has begun to show the limits of growth of the modern industrial society. It has been recognized that continued socio-economic development requires a tangible solution for the current environmental problems to ensure a better life and to improve the quality of life.

There is no choice, but that mankind must seek alternative ways of life and the advancement of science and technology to solve such urgent problems as energy resources, and conservation of environment for the future sustainable living and continued prosperity of mankind.

The objective of this loan project is to find clues to solution for the global problems of environment and resources by using biotechnology, including genetic engineering, which has become an important tool for the solution of the current environmental problems.

2. Implementation

2-1. Allocation and disbursement of the loan

(Unit : US\$1,000)

Description	'95	'96	'97	'98	Total	Percentage(%)
Amount of the Loan Allocated	-	2,800	1,600	500	4,900	100%
Amount of the Loan Disbursed	-	1,398	1,975	1,501	4,875	99.5%

2-2. Comparison of the actual completion date of the project with the initially-planned completion date based on the Loan Agreement

	Planned Completion Date	Actual Completion Date	Remarks
Equipment	December 1997	December 1998	• 4-Month
Library Materials	December 1997	December 1998	Grace Period
Overseas Training	September 1998	August 1997	• Two Times of
Expert Employment	September 1998	August 1997	Reallocation

2-3 Major items purchased (more than US\$100,000)

(Unit : US \$1,000)

Description	Item	Amount
Research Equipment	Laser Scanning Confocal Microscope	193
	Spray Dryer	120
	Technical Retrieval Name Server	130
	Construction & Firewall System	276
	DNA Sequencer System	132
	Multimedia Image Processing System	189
	LC/MS Spectrometer	130
Library materials	CD-ROM (Sinwon Datanet)	114
	Shinwon Data Net	119

2-4. Managerial difficulties and some suggestions

None

3. Benefits from the Project

The initiation of this loan project fell on the launch of the biotechnology development plan, Biotech 2000, which has been propelled by the Korean government. Korea research institute of Bioscience and Biotechnology (KRIBB) plays a crucial role in the practical implementation of the national policy for the development of biotechnology. One of the main areas of the plan is environment. In this sense, the loan project hit the spot. Thanks to the IBRD loan project, KRIBB was able to achieved its goal of the first phase of the national plan which runs from 1994 to 1997. And the second phase is in progress.

4. Conclusion

Biotechnology is regarded as an 'Environmentally Sound and Sustainable Technology (ESST)' because of the unique nature of the bio-processes.

This loan project was to develop environmental technology to make Korea environmentally sound and sustainable which is also one of the main concern of the Korean government's national plan for the development of biotechnology. The loan project laid a concrete foundation for achieving goals of the Biotech 2000 program. Our evaluation is that the loan project has been completed satisfactorily.