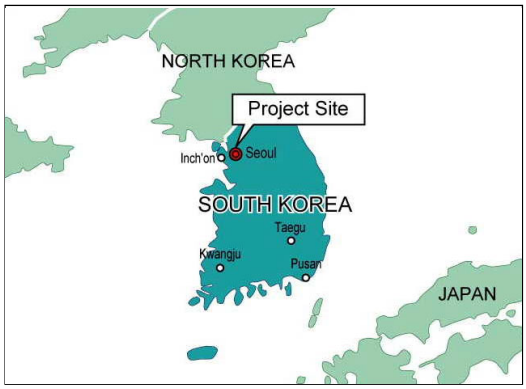
Korea

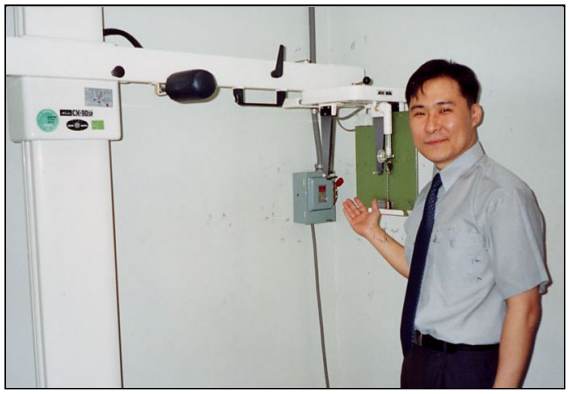
Medical Facilities Expansion Project (Seoul National University Hospital)

Report Date: March 2002
Field Survey: July 2001

1. Project Profile and Japan's ODA Loan



Site Map: Seoul


Site Photo: Dental equipment

1.1 Background

During the planning stage of the project, the people of the Republic of Korea (ROK) were increasingly concerned with health issues as improving living conditions as a result of economic development. In response to the people's concerns, the Government took up health and medical issues as a basic strategy for economic and social development, and put various policies into practice for the improvement of the medical environment and for the enhancement of people's welfare. In 1989, the Government accomplished universal health insurance coverage for all citizens and as a result, a future increase in the demand for medical services was expected. Therefore, a further strengthening of the medical insurance service system was necessary. In addition to the quantitative improvement, it was deemed necessary to provide good medical services through the improvement of medical service quality.

As a center of medical education, research, diagnosis and treatment, Seoul National University Hospital (SNUH) had always played a leading role, and gradually improved and expanded its equipment and facilities. At the time of the appraisal, the service capacity for outpatients was about 3,000 persons per day but the actual daily average number of outpatients had already reached 3,049 persons in the fiscal year of 1988, exceeding the allowable capacity. The fact that more than 30 % of outpatients were those from outside Seoul-si showed the strong reliance on SNUH by the people. Furthermore, the inpatient bed availability rate reached 89.7% at that time.

As described above, the medical diagnosis and treatment at SNUH were active for both out-patients and in-patients. However, some of the medical equipment introduced earlier when the main hospital buildings was constructed in 1979, had already became obsolete and this increasingly necessitated replacement of the equipment so as to ensure reliable diagnosis and treatment. In addition, being an advanced general hospital, SNUH was expected to lead research activities to level up the country's standard of medical service, which also necessitated to modernize equipment and facilities.

1.2 Objectives

To replace obsolete and out-dated medical equipment and introduce new equipment in order to increase the reliability of diagnosis and treatment of various types of diseases and to improve medical standards . as well as to strengthen research activities for the prevention and treatment of intractable diseases.

1.3 Project Scope

①Renewal of equipment for medical use (429 units) ②New equipment for medical use (375 units) ③ New equipment for dental use (367 units) ④New equipment for medical research use (103 units) ⑤New equipment for controlling computer system (1 unit). The ODA loan was to be utilized to fund the entire foreign currency portion of the project cost.

1.4 Borrower／Executing Agency

The Government of the Republic of Korea /Seoul National University Hospital (SNUH)

1.5 Outline of Loan Agreement

Loan Amount/ Loan Disbursed Amount	4,320 million Yen / 4,169million Yen
Exchange of Notes/ Loan Agreement	September 1990 / October 1990
Teams and Conditions Interest Rate Repayment Period (Grace Period) Procurement	 4.0 % p.a. 25 years (7 years) General untied
Final Disbursement Date	January 1996

2. Results and Evaluation

2.1 Relevance

During the planning stage of the project, the Republic of Korea (ROK) faced an urgent necessity to improve the medical services system as people became increasingly concerned with the health issue and the potential demand on the medical services was being actualized with the expansion of medical insurance systems. Hence, the Government of ROK placed great importance on the health sector improvement; under its fifth and sixth economic and social five year development plans, establishment of the national medical security system and medical institutions based on the public welfare, and the development of a national insurance system were prioritized. Seoul National University Hospital (SNUH), being a center of medical education, research, diagnosis and treatment, always took the lead in the country's medical sector. Therefore, improvement of the medical facilities at SNUH meant improvement not only at a single hospital but also in the country as a whole. Under these circumstances, the project objective, “to provide equipment to improve the medical standards and to strengthen research activities at SNUH,” is evaluated relevant to the development plan of ROK during the planning stage.

At the time of the project evaluation, SNUH was playing a leading role in the medical education, research, diagnosis and treatment as a central hospital of the nation, and in accordance with the public health and medical policy of the Government. The significance of SNUH remained unchanged in the country's medical and health sector. The project is still relevant to the development plan of the country at present.

2.2 Efficiency

2.2.1 Project Scope

The following table compares the actual number of units procured with the planned number for each category. In accordance with the plan at the appraisal time, equipment for the medical use, dental use, medical research use was introduced, together with a controlling computer system. For the purpose of selecting the types of equipment to be procured, the Biomedical Engineering Department of SNUH examined technical aspects of the equipment and an appraisal committee for the equipment was organized to study the justification of the selection of equipment and prioritize the equipment based on that justification.

As for the medical equipment, it was planned to replace obsolete equipment as well as to introduce new medical equipment but new medical equipment was not introduced. Because the estimated replacement costs of obsolete medical equipment from each department exceeded the amount of the ODA loan, priority was placed on the renewal of obsolete equipment. However, as the advancement of medical equipment is very fast with increased performance efficiency, SNUH assumed that renewal of the obsolete medical equipment would have a comparable effect to the introduction of the new equipment.

Table 1：Comparison of Plan and Actual

Unit: No. of Units

	Plan	Actual	Differences
1. Renewal of equipment for medical use	429	762	+ 333
2. New equipment for medical use	375	—	- 375
3. New equipment for dental use	367	402	+ 35
4. New equipment for medical research use	103	204	+ 101
5. New equipment for controlling computer system	1	1	—
Total	1,275	1,372	- 97

Source：SNUH

2.2.2 Project Cost

The foreign currency portion of the project cost was expended nearly as originally planned. The local currency portion of the project cost was not available because the data was not recorded so as to determine local expenses only for this project.

2.2.3 Implementation Schedule

According to the original implementation schedule, the project was planned to start from May 1990 with the preparation of tender documents and to complete in December 1993. In reality, the project was completed in December 1995, a delay of two years. SNUH pointed out several reasons for this delay. Firstly, one reason is that the medical staff of the departments requested to modify the specifications of some of the medical equipment based on their needs: specifications for the medical equipment were altered along with the advancement of the medical equipment and with the acquirement of new technology and capacity by the medical staff. Secondly, while the procurement was done under international competitive bidding, the procurement agency (Office of Supply, the Republic of Korea) requested changes in the specifications of some equipment in order that the competitive bidding conditions be secured. Fourthly, the procurement of equipment was adjusted in order to meet the completion schedule of the construction work for the facilities at respective departments. However, it was not reported that the delay in the project completion triggered any cost overrun nor disturbance on the diagnosis and treatment and on research activities. A delay of two years in the project completion was seen as a result of SNUH's taking appropriate measures in consideration of a more effective utilization of equipment at each of the departments. No specific problem was observed in terms of the implementation schedule.

2.3 Effectiveness

①Utilization of Equipment Procured

It was not feasible to examine current status of all the equipment procured under the project. Therefore, study was made of the existing conditions of the five most important items from the respective categories of medical, dental and research equipment. The results of the survey are shown in Table 2 below. Equipment listed in the table is only equipment available at SNUH. Although utilization ratios of the equipment were not recorded, it was learned that they had been operated without trouble. It is assumed that most of the equipment procured under the project had been in use under relatively good conditions.

However, as more than five years had passed since the procurement, some of the equipment had reached their expected life span, and certain equipment was under consideration for disposal at the time of the site survey[1]. There would be more equipment to be disposed of in the coming years.

Table 2：Current Conditions of Equipment Procured

（Medical Equipment）

No.	Name of Equipment	Quantity	Proportion of project equipment in the whole equipment at SNUH
1	Cyclotron	1	100
2	P.E.T	1	100
3	CT	1	100
4	Digital X-ray System	1	100
5	Bi-Plane Angio	2	100

（Dental Equipment）

No.	Name of Equipment	Quantity	Proportion of project equipment in the whole equipment at SNUH
1	CT	1	100
2	Steam Formaldehyde Sterilize	1	100
3	Cephalometric Preview System	1	100
4	Operating Microscope	1	100
5	Automatic Chemistry Analyzer	1	100

（Research Equipment）

No.	Name of Equipment	Quantity	Proportion of project equipment in the whole equipment at SNUH
1	Automatic Coagulation Analyzer	1	100
2	Blood Gas Analyzer	1	100
3	Centrifuge	1	100
4	High speed centrifuge	1	100
5	Operating microscope	1	100

Source：SNUH

②Inpatient bed Availability Ratio

The following Figure 1 shows Inpatient bed availability ratios since 1989. Except for the year 2000 when the ratio decreased due to a strike protesting against the separation of the prescribing and dispensing of drugs, the ratios have been stable at as high as 90 %. The constant high level of the ratios implies a high confidence in SNUH among the people.

The average length of stay (days) per inpatient is shown in Figure 2. After recording 14.2 days in 1991, it constantly shows a decreasing trend except for the year 2000. According to SNUH, this is largely due to the advancement of medical science and the development of new medical technology.

[1] For example, one of the medical equipment, Angio DSA and General Angiographic System was procured in 1992. Due to an unclear screen image, they stopped using the equipment and planned to replace it with the new equipment. An Automatic Coagulation Analyzer, equipment for the research, was already packed for the disposal at the time of the site visit.

Figure 1：Sickbed Availability Ratio [Note1]

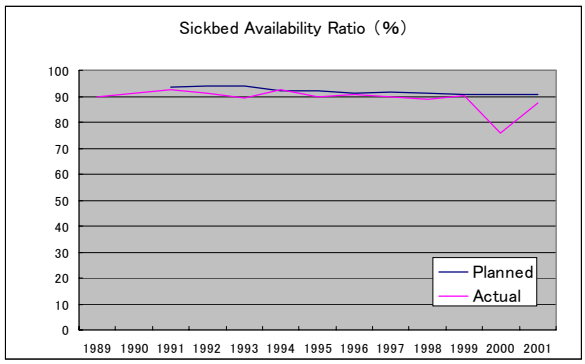
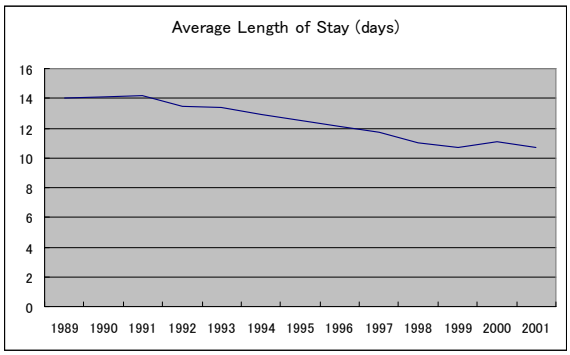


Figure 2：Average Length of Stay (Days) [Note2]



Source：SNUH

Note：

1)Sickbed Availability Ratio＝ $\frac{\text{Daily average number of inpatients}}{\text{Daily average number of available beds}} \times 100$（%）

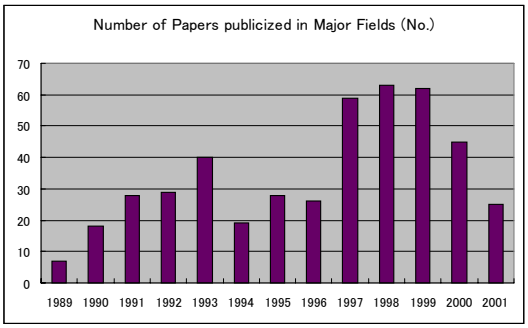
2)Average Length of Stay (Days) ＝ $\frac{\text{Annual number of inpatient-days}}{(\text{Annual number of newly admitted inpatients} + \text{discharged inpatients}) / 2}$

3) In the case of 2001, the figures for Tables 3 and 4 are averages as of the time of the site survey

③Research Activities at SNUH

The following Figure 3 shows the number of research papers published in the main research fields at SNUH since 1989. Under the project, 204 units of new equipment for medical research use (about twice as many as the planned number) were introduced from the middle of 1992. It is assumed that the new equipment for research use contributed to the increase in the number of research papers during the second half of 1990s, resulting in an improvement of research activities.

Figure 3：Number of Papers Published in Major Fields [Note]



Source：SNUH

Note：The figure in 2001 was as of the time when the field survey was conducted. The major journals where research papers were publicized were: Brain Research, AM. J. Trop. Med, The Journal of Urology, World Journal of Surgery, American Journal of Obstetrics, American Journal of Hematology, AM J Obstet Gynecol, Neuro Pharmacology, Muscle & Nerve, European Journal of Nuclear Medicine, Journal of Neurochemistry, Archives of Gerontology and Geriatricsemd, etc.

2.4 Impact

①Comparison of Capacity and Actual Numbers of Medical Diagnosis and Treatment for Inpatients and Outpatients

As already described, SNUH's capacity for medical diagnosis and treatment at the time of the appraisal was around 3,000 patients per day while the actual average daily outpatients numbered 3,049 in 1988, exceeding the capacity. The inpatient bed availability ratio reached 89.7% as seen in Figure 1. Under the project, medical equipment was introduced in order to ensure the reliability of diagnosis and treatment. The capacity for medical diagnosis and treatment for in- and out-patients has been steadily enhanced as shown in the following tables and accordingly, the actual numbers for diagnosis and treatment have increased. For example, medical diagnosis and treatment was given to 5,043 outpatients per day on average as of the time of the site survey during 2001 as against the capacity of 5,151.

SNUH increased the number of physicians from 1989 to 1990 and from 1992 to 1993 by a large margin. The renewal of obsolete equipment under the project, coupled with the increase in the number of physicians, contributed to improvement of the capacity for medical diagnosis and treatment. It is considered that this was done in response to the medical service needs of patients.

Figure 4 :Average Daily Number of Inpatients

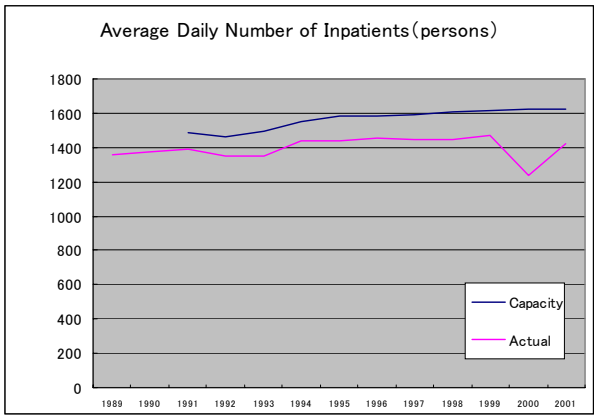
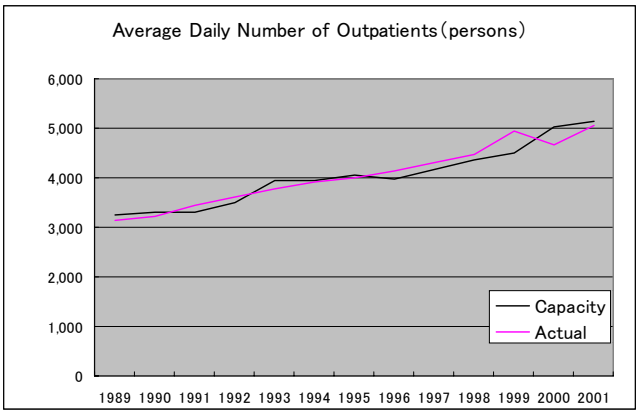


Figure 5 : Average Daily Number of Outpatients



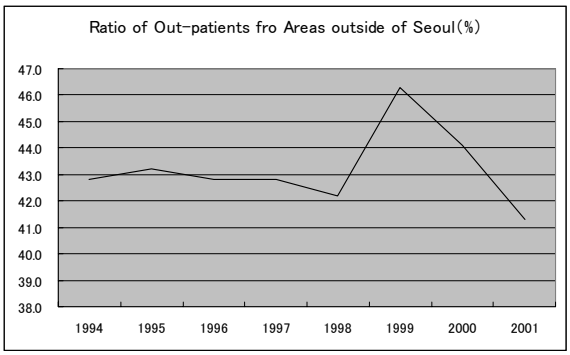
Source : SNUH

②Ratio of Outpatients outside Seoul

During the planning period, the ratio of outpatients outside Seoul-si was more than 30% and, as shown in Figure 6, the ratios have exceeded 40% since 1994 when the oldest data was available during the survey, although the ratios fluctuated over the years. This implies that SNUH has been highly appreciated among the people as a tertiary hospital under the referral system[2].

[2] In March 2001, the Korea Management Association conducted a survey on the brand power of the hospitals for residents in seven urban cities. According to the results, SNUH was ranked first among the general hospitals. This indicates that SNUH is widely known in the country.

Figure 6：Ratio of Outpatients from Areas outside Seoul [Note]



Source：SNUH

Note：Ratio of Outpatients from Areas Outside Seoul

$$= \frac{\text{Number of Outpatients from Areas Outside Seoul}}{\text{Annual Total Number of Outpatients}} \times 100 \quad (\%)$$

③Improvement in Health and Medical Conditions in ROK

As shown in the statistics of Figure 7 and 8, the health and medical environment of the ROK has rapidly improved in recent years. As the medical equipment was provided to a single university hospital under the project, it is considered that the direct impact on the improvement and enhancement of the medical standard in the country as a whole was limited in terms of its scale. However, SNUH is regarded as a central hospital in the nation and it played a leading role in improving the quality of the conditions of the medical standards.

Figure 7： Life Expectancy at Birth [Note1]

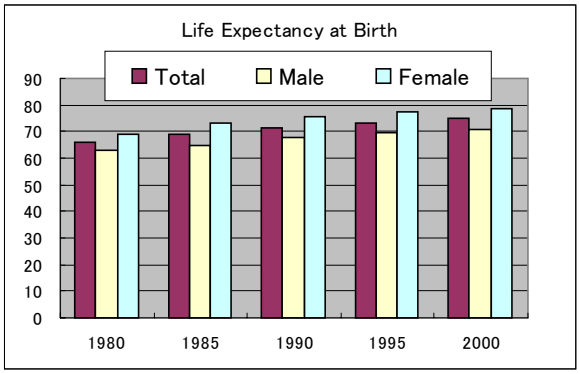
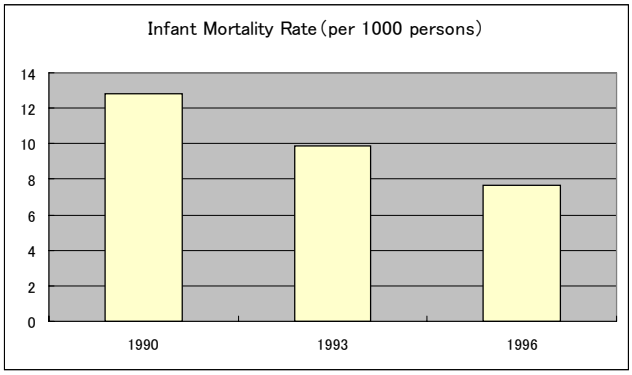


Figure 8：Infant Mortality Rate [Note2]



Note：

1)Life Expectancy at Birth=The number of years a newborn infant would live if prevailing patterns of mortality at the time of birth were to stay the same throughout the child's life.

2) Infant Mortality Rate=The probability of dying between birth and exactly one year of age times 1000.

④Environmental Impact

During the project appraisal, the environmental impact from incinerators inside SNUH was discussed. SNUH removed the incinerators at the end of 2000 and private agents were commissioned to handle medical wastes. No specific environmental problem was reported.

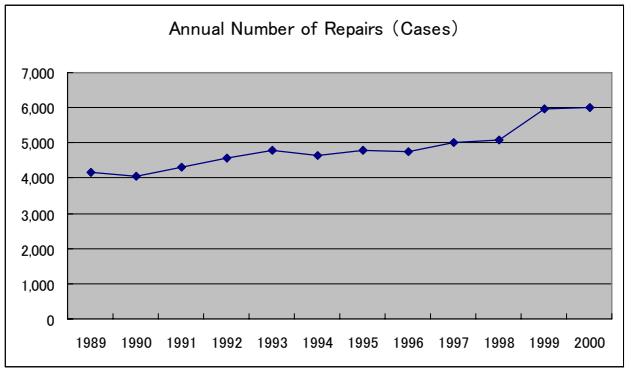
2.5 Sustainability

①Operation and Maintenance

In accordance with the plan at the time of the appraisal, the operation and maintenance of the equipment has been carried out by the Biomedical Engineering Department of SNUH after the completion of the project. The number of staff at the department was 39 at the time

of the site survey, out of which 23 are engineers. As for maintenance and repair, for example, each staff member of the department examines the number and types of equipment, and makes a presentation regarding the operation of the equipment through the study of operating manuals. He or she also receives technical training when new equipment is introduced. This practice and training has contributed to the improvement of the technical standard and the acquirement of new technology among staff members. The number of repairs conducted at the department reaches 6,000 in a year, excluding those done by external agents. The following Figure 9 shows the annual number of repairs, excluding those subcontracted to external agents. The annual number of repairs is on an increasing trend. This can be explained by the increased technology level of the staff as well as by obsolescence of the equipment.

Figure 9：Annual Number of Repairs



Source：SNUH

Note：Number of repairs internally conducted, excluding those outsourced

②Financial Conditions

As the financial conditions over the last five years at SNUH shows, operating revenues were not able to cover operating expenses except in 1999. SNUH is a national hospital that was established with purpose to contribute to the improvement of the people's health in the ROK and, being an educational and research institute, it receives government subsidy. If non-operating revenues are taken into account, the income has been more or less positive over the last five years. Due to the strikes over the separation of prescribing and dispensing of drugs, SNUH recorded a substantial loss in 2000.

Table 3：Income Statement of SNUH

Unit：Million Won

	1996	1997	1998	1999	2000
Operating Revenue	205,527	229,914	259,484	281,647	253,218
Out of which, Revenues from Medical Service	205,191	229,508	259,202	280,780	251,628
Operating Expense	213,024	239,853	260,009	280,122	290,802
Operating Income	-7,497	-9,939	-525	1,525	-37,584
Other Operating Revenue [Note]	16,970	17,423	17,584	12,738	11,649
Other Operating Expense	7,111	8,174	14,160	13,160	9,101
Net Profit before Extraordinary Profits and Losses	2,362	-690	2,899	1,103	-35,036

Source：SNUH

Note: Other operating revenues include interest received, foreign exchange profits, subsidies, etc.

The medical sector of the ROK has been experiencing reform, including the introduction of a refund

system for drug transactions[3], the separation of prescribing and dispensing of drugs, issues relating to the stable management of insurance finance, etc. These institutional and policy changes were directly and indirectly influencing hospital management, and not necessarily contributing to financially sound hospital management. Under these circumstances, SNUH, as a central hospital with the four main goals; patient-oriented, human-respecting, creative knowledge, social services, was undertaking to institute a revolutionary managerial environment, by eliminating organizational inefficiency, through the enhancement of mutual understanding among different departments and occupational categories, in order to achieve a sustainable growth and the prosperity of the hospital management. At the time of the post-evaluation, there was no significant problem being observed in the fields of the operation, maintenance, and finance. SNUH is expected to realize a self-sustainable development of the project effects on through its own efforts in hospital management.

[3] Under the official price-based refunding system in the past, medical service expenses relating to drug prices were reimbursed based on pre-determined official prices which did not reflect the actual purchasing prices. At the time of the post-evaluation, the market price-based refunding system was already being adopted. However, under the new system, the basis of calculation for the reimbursement was the total of purchasing prices and administrative costs, etc. This new basis however was not considered to sufficiently cover the required costs. Therefore, the system worked negatively on the financial conditions of hospitals.

Comparison of Original Plan and Actual

Item	Plan	Actual
①Scope	(Number)	(Number)
・ Renewal of Equipment for Medical Use	429	762
・ New Equipment for Medical Use	375	－
・ New Equipment for Dental Use	367	405
・ New Equipment for Medical Research Use	103	204
・ New Equipment for Controlling Computer System	1	1
・ Total	1,275	1,372
②Implementation Schedule	May 1990～December 1993	May 1990～December 1995
③Total		
Foreign currency	4,320 Million Yen	4,168Million Yen
Local currency	6,048Million Won	N/A
（Local currency in Won）		
Total	5,614Million Yen	4,168Million Yen
ODA loan	4,320Million Yen	100Won＝15.64Yen
Exchange Rate	100Won＝21.42Yen	（Average of 1990～1995）
	（1990）	

Source：JBIC Appraisal Documents and SNUH Documents