

Comprehensive Tideland Reclamation in Korea and Transferability of Its Development Strategies and Techniques to Developing Countries *

Choi, Soo Myung**

*Presented at the Seminar on International Cooperation of Agricultural Technology Among Developing Countries, Kyungpook National University, Taegu, 18-20 October 1989.

**Dept. of Agricultural Engineering, Chonnam National University

Abstract□In 1980 the Ministry of Agriculture, Forestry and Fisheries(MAFF) established the Long-term Tideland Development Scheme in the South-west Seashore Region. Since that time Korea has been developing comprehensive and innovative development frameworks in reclamation works and levelling up the potentialities of the donating country of international cooperation in that field.

And also, Korea has the well-organized governmental institutions for international cooperation in the development of tideland reclamation technologies such as RDC(Rural Development Corporation) for the field of agricultural engineering and RDA(Rural Development Administration) for the field of agricultural development.

In Conclusion, it is ascertained that Korea has a good potentiality of aiding developing countries in the development of tideland reclamation, especially in agricultural development.

Keywords□Comprehensive Plan, Reclamation, Technical Cooperation, Saemankeum Project, Developing Countries

I. Introduction

Korea is very mountainous and one of the most densely populated countries in the world. Its total land area is about ten million hectares of which a quarter is used for agricultural purpose.

Therefore, despite well-developed irrigation system and highly intensive cultivation, the level of food self-sufficiency in Korea has been remaining between 50 and 60%. The main reasons for

this are the shortage of cultivable land and rapid population growth. During the 1960s, the government tried to develop hilly area reclamation projects. However, these projects were eventually failed because of heavy construction costs, shallow soil depth and difficult erosion control during the rainy season.

This experience made the priority of government policy turned from upland to tideland reclamation during the 1970's. Since then, the govern-

ment agency, the Agricultural Development Corporation(ADC, renamed as Rural Development Corporation in 1990) had carried out two important studies ; a survey on the conditions of existing dikes under state control,¹⁾ and a reconnaissance survey on tideland reclamation in the south west seashore region in 1980.²⁾ From the survey results, far reaching proposals for tideland reclamation had been put forward by the government which, if fully implemented, would increase the total land area of the country by more than 6 per cent and the total cultivable area by 15.4 per cent.

In this paper, firstly, history of tideland reclamation in Korea would be briefly reviewed and then a case plan of comprehensive development methodology introduced. Finally, through checking up the institutional abilities for project implementation, technical training and research activities, the potentialities for technical cooperation to developing countries would be evaluated.

II. Historical Review of Tideland Reclamation Works in Korea : Past Experience as A Recipient Country of International Cooperation

Untill late 1960's most tideland reclamation projects were carried out by the non-governmental sector, for example, rich landlords, brave pioneers, land companies, irrigation associations, charitable organizations and other related groups. As shown in Table 1, most of existing reclaimed areas under state control had been built up during two periods ; the first from 1921 to 1940 and the second from 1951 to 1970. During the first period, the Japanese colonial government pushed ahead with

a programme for increasing rice production whose main aims were to export Korean rice to Japan and to secure supplies of rice for the military forces. Under this programme many reclamation schemes were initiated by Japanese land companies and Korean large landholders. This marked the beginning of modern reclamation works.

After the Korean war, the government tried to restore agricultural production following the war havoc and subsidised the developers of reclamation projects through supply of US-aided food grains. As a result of this inducement policy, many projects were initiated by the private sector.

In terms of engineering standards, earth structures are usually designed to last for 50 to 100 years, provided that moderate level of maintenance be on there. On this basis, being considered the level of construction technology at that time, there can be little doubt that most sea dikes constructed before liberation from Japanese occupation be repaired. Furthermore, although the sea dikes constructed after the Korean War had not yet reached half of their life span, most of them needed repair works for the following reasons ; poor site development conditions, unsuitable design and construction works by inexperienced developers, shortage of finance, imperfect site investigation and government control and poor maintenance by the occupants.^{1,4)}

The Ministry of Agriculture, Forestry and Fisheries(MAFF) received many petitions from farmers requesting goverment level action to cope with this problem and was continuously put under pressure by the Members of Parliament from the troubled areas.^{1,3)} From 1967 the government took over the responsibilities for the maintenance of the troubled dikes and started repair works. Since then, at some places, overall level of maintenance

Table 1. Sea dike construction by completion year

Completion year	Irrigation area (ha)	Sea dike construction		
		No.	Length(km)	%
Prior to 1910	434.5	1	0.434	0.3
1911~1920	869.3	7	4.734	3.0
1921~1930	5,760.8	15	37.156	23.6
1931~1940	8,033.8	25	52.810	33.5
1941~1950	315.8	1	2.696	1.7
1951~1960	2,847.9	10	25.859	16.4
1961~1970	4,561.2	21	33.742	21.5
Total	22,823.9	80	157.431	100.0

had been reasonably improved, but the safety level of most sea dikes was not substantially improved because of the shortage of finance.

Under these circumstances MAFF undertook a survey of maintenance state of sea dikes under state control to obtain the basic information for dealing with this troublesome problem and planning long-term repair works. Until 1989, as in the base of reclaimed farming area, of total 7,284 ha, 4,485 ha had been developed, while 1,614 ha under repairing and 1,185 ha planned to be developed after 1991.³⁾

III. Comprehensive and Innovative Development Framework in Reclamation Works : A New Horizon as A Donating Country of International Cooperation

1. Establishment of Long-term Tideland Reclamation Plan

A. Background

Government level efforts to assess the nationwide development potential for the tideland reclamation began in the early 1960's. In 1960 MAFF thought the development of tideland reclamation feasible for the first time at the official level and

asked for financial assistance on this project from FAO to evaluate its economic and technical feasibility. In 1962 a Dutch consulting company, NEDECO, made on-the spot survey with financial support from FAO. From 1965 to 1972, the Ministry of Construction(MOC) also surveyed tideland resources to get the basic materials for comprehensive coastal region development scheme. From 1975 to 1976 MAFF carried out investigation works on 59 possible sites, of which 15 sites were surveyed in detail in 1976 and others from 1977 to 1980. The final report was published in December 1980.^{3,4)}

B. Planning Objectives

The report estimated that, if the present level of investment in the agricultural sector maintain in the future, the overall level of self sufficiency in food grains would drop to about 40% in 2001. And it was assumed that the average net loss of agricultural land into other uses would be 14,000 hectares per year to that year. By these points, the report concluded that action should be devised for promotion of reclamation projects. The basic objectives of this plan can be explained as follows ; the rational use of potential land resources by comprehensive development efforts, increase in agricultural production to supply food for gro-

wing population, maintenance of flexibility of agricultural land use to cope with possible changes in food consumption patterns, expansion of national land resources and shortening of the length of coastlines with a view to national security.

C. Proposals

The plan proposed that the major civil engineering works required at total 59 sites would involve 774.3 kms long of sea dikes and 113 sets of sluice gates, 278 pumping stations for irrigation and further 117 pumping stations for drainage purpose. The total length of inner dikes would be 1,236.1 kms, the drainage and irrigation networks 272.9 kms and 4,253.0 kms in length respectively. In addition the project would involve the construction of 521.6 kms of roads.

Details of reclaimed land resources created by this project are given in Table 2. Totally 608,905 ha would be newly reclaimed and further 103,070 ha of hinterland developed. Of the total reclaimed area, 55.8% would be developed for agricultural purpose, 32.1% as freshwater lakes and 12.4% for other purposes.

According to the Table 3, the main difference between the 1976~1980 survey findings and earlier studies is in terms of the extent of reclama-

tion. In all the previous cases, reclamation works was limited to the development of tidelands, of which ground level are higher than the average sea water level to be dried out by natural drainage system. But, in this plan, the reclamation work is extended to the development of deep sea lands of which ground level is lower than the average sea water level and in which mechanical pumping systems should be introduced for drying such as in Dutch polders.

This methodological change in reclamation works has not only brought about enlargement of the enclosed area but it has also made possible to secure large-sized freshwater lakes. Considering that the most difficult problem in previous schemes was to obtain the required volume of water resources for project purposes near the sites, the technical improvement of this type has very important implications for the promotion of the reclamation projects.

D. Implementation

The plan would be progressively implemented according to the order of national priorities controlled by Comprehensive National Land Development Plan. And the project would be financed basically by the public sector. However, wherever

Table 2. Distribution of Reclaimed Land by Province

Province	No. of sites	Reclaimed Area (ha)				Hinterland (ha)	Developing area (i. e. Agric. Land and Hinterland) (ha)
		Confined area	Agr. land	Freshwater lake	other		
Kyunggi	8	103,420	56,980	33,085	14,455	15,590	72,570
Chungnam	12	86,619	39,895	35,898	10,826	20,509	60,404
Chonbuk	4	51,324	26,900	19,794	4,630	9,320	36,220
Chonnam	33	362,807	213,040	105,411	44,682	57,181	269,895
Kyungnam	2	3,635	1,770	1,245	620	470	2,240
Total	59	608,905 (100.00)	338,259 (55.55)	195,433 (32.09)	75,213 (12.36)	103,070	441,329

Note : () : %

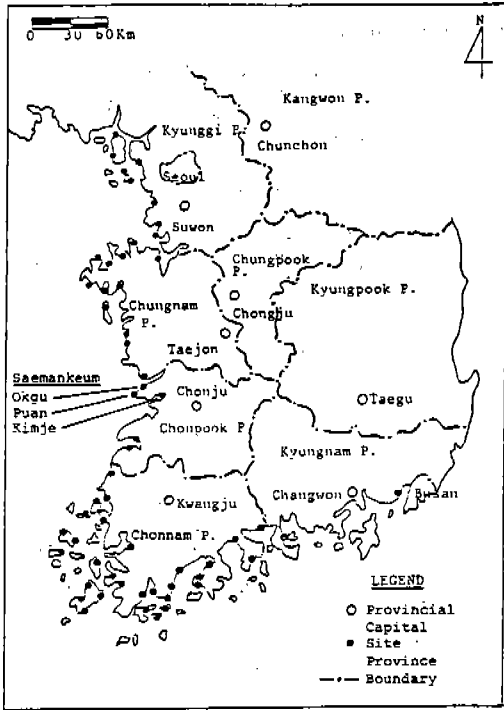


Fig. 1. Location map of 59 possible sites for land reclamation

possible, private capitals would be induced to the maximum and the foreign loan considered.

The project would be implemented by two stages ; investigation and design stage and actual implementation stage.

E. Expected Effects of the Project

After completion of the proposed reclamation projects, it is expected that additional 2,994 thousand tons of agricultural products would be produced, which could be valued as 1,470 billion Won at 1980 constant price and which is equivalent to 14.4% of the total project cost. Other measurable effects of the project are as follows ; enlargement of national land area by 608,905 ha, enlargement of agricultural land area by 338,259 ha, creation of 195,433 ha of freshwater lakes, employment of total 310 million man-days during the project construction period, resettlement of 700 thousand people in the new area

Table 3. Comparison of survey results

Area unit : $\times 1000$ ha

Items	I	II	III	IV
Investigation year	1962	1968~72	1975~76	1980
Concerned authority	FAO	MOC	MAF	MAF
Working agency	NEDECO	consultant	ADC	ADC
Survey results				
No. of sites	71	144	59	59
Confined area(A)	225	276	635	609
Reclaimed area(B)	189	230	476	413
Agricultural area(C)	165	160	402	338
B/A	84.0%	83.3%	75.0%	67.8%
C/B	87.3%	69.6%	84.4%	81.8%
Naturally drained area(D)	189	230	261	219
Mechanically drained area	—	—	141	118
D/B	100%	100%	64.4%	65.0%
Average size	2.3	1.1	6.8	6.7

Table 4. Land reclamation project stages

1st stage : Investigation and design

Responsibility Phase Works	State or State agency		State or Private	
	Reconnaissance	Basic survey	Detailed survey	Design
Major Works	Determination of sites	Basic planning	Detailed planning	Detailed design
Engineering Works	Framing of basic ideas, Field check, Analysis of water balance	Skeleton survey for cost-estimation	Basic design works	Detailed design works for structures
Farming & Soil survey	Farming survey, Field & soil survey	Survey of agr. economics & farm management, Farming facilities in & around site, Detailed soil survey	Check of agr. ext. service, Planning of cropping system, Land use planning Regional dev. planning	

2nd stage : Implementation

Resp. Phase Works	State or Private			State or Private
	Eng. works	Development of hinterland	Drainage	Distribution of land
Major Works	Construction works	Agr. land development	Improvement of land	Arrangement of land properties
Supervision	Licensee of the project or ADC →			ADC
Completion Check-up				
Preliminary	ADC →			
Final	Licensing authorities →			
Maintenance	Licensee			ADC

2. Comprehensive Development Strategy and Technology in Tideland Reclamation-A Case Plan of Saemankeum Project⁵⁾

A. Project History

In 1971, ADC studied "Ogseo Comprehensive Agricultural Development Project" which included tideland reclamation works in Kimje-Gun of Cho-

nbuk Province and between 1981 and 1985 had taken feasibility study of Kimje Reclaimed Land Development Project.

In 1986, The Saemankeum Comprehensive Tideland Reclamation Project was established in the enlarged scale comprising three sites proposed by the plan explained in Chapter III ; Ogku, Kimje and Buan Sites of Chonbuk Province. Through

the feasibility study by ADC in 1987, the government accepted its promotion by listing of officially-promised projects in presidential campaign that year.

On February 1988, ADC established the Saemankeum Project Department as the official authority and started the basic survey on the project.

B. Site Investigation

The site investigation works had been carried out by two phases. The phase 1 had been done for 4 years from 1981 to 1984 as Kimje Project, of which major survey items comprised as follows ; marine and hydrology, hydraulics, working conditions for construction, water quality, geology, topography and agricultural economics around the site. The phase 2 had been done for 3 years from 1986 to 1988 as Saemankeum Project ; sea dike lane, location of sluice gate, soil, vested rights in and around site, environment, access roads and marine topography.

C. Development Strategy

1) Development based on national and regional balance

The reclamation project should be executed to efficiently use the very limited national land resources and to cope with increasing demand of land required by rapid industrialization. Therefore, the land resources gained by the project should be used by far-sighted national policy which weighs much more on long-term national prosperity, balanced regional development and optimal use of national land resources than economic consideration.

2) Multipurpose development

Expected land shortage problem in future due to the continued industrialization should be solved by land expansion policy and by increasing efficiency of existing land use. From this point

of view, the single purposed tideland development for agriculture as in the past time must end and the land resources created from the project should be developed as living and working space on multi-purposed base.

3) Large scale development under comprehensive plan

Because the reclaimed area should be developed as newly idealized living and working space, the plan should cover all ranges of systems and facilities necessary for human and natural activities, and pay close attention to harmonize between development components and cost of infrastructures. The development cost of infrastructures should be reduced by enlarging the scale of the project.

D. Development Plan

1) Major construction facilities

Major facilities to be constructed by civil engineering works were proposed as follows ;

Sea dikes : 12 sets of enclosed dams totally 34 km long

Sluice gates : 2 sets totally 520m long consisted of 18 drainage gates, 2 navigation locks and 2 fishways

Freshwater lake : 64,832 ha-m of total storage and 13,449 ha of reservoir area

Pumping stations : 6 for irrigation and 8 for drainage

Canals : 11 sets, 127.5km long for irrigation, 11 sets, 134.4km long for drainage and 1 set, 15.2km long for connecting between the lake and Keum River Estuary Dam

Byunsan dam : 5,810 ha-m of total storage capacity

2) Land use plan

The project area to be enclosed by sea dikes amounts to 42,000 ha of which 29,000 ha is planned as dried land and 13,000 ha as freshwater lake.

Table 5. The proposed land use plan in Saemanku project

Classification	Area(ha)	%
Total(Enclosed area)	42,000	100.0
Reclaimed land	29,000	69.1
Arable farming	12,500	29.8
Horticulture	3,500	8.3
Livestock breeding	1,000	2.4
Aquaculture	2,000	4.3
Industrial site & land for urban purpose	9,000	21.4
Farming Village	1,000	2.4
Freshwater lake	13,000	30.9

3) Planning system

The project has 3-tier planning system ; basic strategy, sectoral and implementation plans. The scope of each planning system would be summarized as follows ;

Strategy plan : population, economic and comprehensive land use plans

Sectoral plan : detailed land use plan, water resources, aquaculture, industrial harbour, recreation and tourism, settlement and urban development, industrial site construction, environmental conservation and protection against natural disasters, and hinterland development

Implementation plan : financial and investment programme

4) Project cost and period

The total project cost was estimated as 1,307,546 million Won(mW) in 1988 price, of which 754,466 mW for civil engineering works and 553,080 mW for reclaimed land development. The project period was scheduled as 13 years from 1990 to 2002 ; 8 years(1990~1997) for construction works and 6 years(1997~2002) for land development

E. Major Research Works for the Project since the Feasibility Studies Stage

The Saemanku project is the largest reclamation project which has ever been developed or planned in Korea. By the reason it is anticipated that the development works may influence on the environment in and around the site greatly and vitally and so, much more research efforts should be necessary for minimizing the uncertainties of the development before the project come into being executed. Major studies on the project completed to 1988 were listed as follows ; proposals for optimal land use, development of deep sea land reclamation techniques, sea dike construction method in deep sea bed, structural analysis of drainage sluice, marine environmental analysis and changeability of tide current after enclosure of the site.

IV. Appraisal on Potential Resources on Technical Cooperation to Developing Countries in the Field of Tideland Reclamation

In Korea, RDC(former ADC) is the only governmental agency responsible for almost all fields of physical development in rural areas. The major fields being executed by RDC are shown as follows ; ⁶⁾

Integrated rural development project : county structure plan, road construction in rural areas, agricultural-cum-industrial region development, comprehensive upland development

Tideland reclamation project

Maintenance and repairing project for irrigation and drainage facilities

Comprehensive agricultural development project : 9 projects completed and 10 under construc-

tion, their total area being 232,280 ha

Medium-scale irrigation development project : 427 projects, 144,819 ha completed and 81 projects, 42,637 ha under construction

Farmland consolidation project : 1,208 sites, 155,788 ha completed

Upland reclamation project : 738 sites, 91,403 ha completed

Drainage Improvement Project : 295 sites, 57,968 ha completed

Groundwater development project : 11,258 irrigation wells and 3 groundwater reservoirs completed, the hydrogeological maps for 144,000 ha prepared

Farming development project : basic farming survey, farming improvement scheme and rural extension service

Environmental impact assessment project : designated as an authorized environmental assessment organization in 1988 by the Office of Environment.

And also, it has an independent research and experiment institute. The institute is carrying out test and research activities to support planning, design and implementation works in the execution of the related projects to RDC.

As for research activities, the institute has been carrying out fundamental and practical research works for irrigation, drainage, tideland and upland reclamation, farmland consolidation, construction techniques, project implementation techniques in its own capability or in some cases in collaboration with other related institutions or specialists.

Coping with the necessities of bringing up qualified engineers and specialists in various fields, RDC established the Training Institute as an independent organization in 1977. Total 14,389 trainees has been educated since then from related

institutions to rural development and from foreign countries as well as from RDC itself.

Based on the well-organized system for and cumulative experiences in various project implementation, RDC has been rendering overseas consulting services since 1967. For the past 20 years, RDC had carried out technical assistance and consulting services to developing countries for ; pre-feasibility and feasibility studies, detailed design, construction supervision and appraisal for agricultural development projects in such countries as Indonesia, Bangladesh, Nepal, Pakistan, Brunei, South Vietnam, Argentina, Ethiopia, Ghana and Guinea-Bissau(22 projects completed and 8 on going).

In the field of technical cooperation with developing countries, RDC has been continuously recommended by related countries governments and international organizations like as IBRD and UN to offer on-the-job training on the related technical sectors. Accordingly, international technical training programmes have been being presented in the field of agricultural engineering and water management. Up to now, 641 personnels have been participated in the programme from 58 countries.

Korea has a well-organized system agricultural research and extension on the public sector base. Rural Development Administration(RDA) in the integrated unique body for agricultural research and extension, which consists of 6 bureaus in the head quarter, 14 key research organization and 9 provincial RDA's. And it has 1,248 research staffs among whom 268 have Ph. D. degree in related fields.^{7,8)} This shows that Korea has a good potentiality for research and technical development in all the fields of agricultural sector.

Especially, RDA has an independent experiment station for better farming in reclaimed land as

a form of sub-station under Honam Crops Experiment station, one of key research stations.⁹⁾ It is located in Gyehwado reclaimed land which is one of largely-scaled reclaimed areas in Korea and has been doing research activities on the related topics to farming in reclaimed area like as rice breeding for highly yielding with saline tolerance, cultural practices in tideland and selection of saline tolerant crops during winter season.

However, because Korea has developed during the recent period and so remained in the very early stage of international cooperation, there needs some basic institutional arrangements typically required for successful levelling up of it into higher stage. Generally speaking, institutional arrangements fundamentally required for international cooperation would be summarized as follows :

- a. establishing cooperation funds
- b. reorganizing the responsible organizations
- c. training personnel who will be in charge of international cooperation
- d. enacting necessary regulations and adoption of other measures
- e. coordination and cooperation between responsible organizations
- f. staff's good commanding of one or more of the officially spoken languages

V. Conclusion

Through the discussion in this paper, it is ascertained that Korea has a good potentiality in carrying out rural or agricultural development works and in progressing their related strategies and technologies to highly advanced stage, especially in the engineering or physical development sector.

Especially, rapid industrialization and continuous favourable balance of international payments of Korea in future will provide her a good potentiality in aiding developing countries.

References

1. Ministry of Agriculture, Forestry and Fisheries (MAFF) and Agricultural Development Corporation(ADC), 1974, A Survey Report on the Conditions of Existing Sea Dikes under State Control.
2. MAFF and ADC, 1980, A Reconnaissance Report on Land Reclamation in South West Seashore Region.
3. ADC, 1984, Comprehensive Report on Development of Troubled Reclaimed Areas under State Control.
4. ADC, 1990, Handbook on Tideland Reclamation in Korea.
5. MAFF and ADC, 1988, Saemankeum Comprehensive Tideland Reclamation Project (Feasibility Study).
6. MAFF and ADC, 1988, Guidebook on Agricultural Water Resources and Land Development in Korea.
7. Rural Development Administration, 1989, Annual Report on Agricultural Experiment and Research Projects of RDA.
8. Chung, Moo-Nam, 1989, International Spread of Agricultural Technologies of Korea, Proceedings of International Seminar on International Cooperation of Agricultural Technology Among Developing Countries, Kyungpook National University, Taegu, Korea, pp.77-91.