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EVALUATION STUDY ON IBRD LOAN PROJECT

FARMING IN RECLAIMED LAND

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I. INTRODUCTION

1. Necessity and Goals of the Study

The major goal of the agricultural policy was to achieve self-sufficiency in staple food grains of rice and barley. The self-sufficiency in rice was achieved by 1975 mainly due to the expansion of irrigation facilities, development and diffusion of high-yielding new rice variety, price support program and improvement in cultivation practices, and good weather condition.

However it is not certain that Korean agriculture will produce enough rice to meet domestic demand in the future. The high-yielding new rice variety is not well proved yet to resistible to disease and insects. Therefore yield and production level depend significantly on weather condition and occurrence of disease and insects.

On the other hand, the demand for food is increasing rapidly due to the increases of population and per capita income. As a result the degree of self-sufficiency in all food grains has been decreasing in the past. It has decreased from 95 percent in 1966 to 76 percent in 1975 and to 73 percent in 1978.

It indicates increasing dependence of nation's food supply on foreign food resources. However world food production is uncertain. Therefore it is desirable to increase the degree of self-sufficiency of food grains by full utilization of domestic resources and improvement of resource productivity in order to guarantee stable domestic food supply at reasonable prices.

An increased production of food grains can be achieved either by increased land productivity or increased crop area or by both. Gains in land productivity is limited by the law of diminishing returns and technological innovations do not occur continuously. Therefore the expansion of the land base is imperative in order to achieve a higher degree of self-sufficiency in food grains.

However the area of cultivated land has been declining in recent year. If this trend continue in the future the dependency of nation's food supply on import will be accelerated. To cope with this situation the expansion of land is necessary. Fortunately there are approximately 600 thousand hectares of land in seashore that could be reclaimed. It is estimated that about 400 thousand hectars of paddy will be newly formulated

when the potentially reclaimable seashore is developed. This paddy area is equivalent to 18 percent of total cultivated land of 2,231 thousand hectares and 31 percent of existing paddy area of 1,303 thousand hectares in 1977 respectively.

The reclamation of seashore should be considered with respect to nation's land utilization planning and farm income.

In fact the land is a very scarce factor in Korea leading to small farm size and low farm income. The small farm size has been the critical restrictive factor for the increase of farm income and agricultural mechanization.

Therefore land reclamation is imperative to improve the degree of self-sufficiency in food grains, farm income and for the agricultural mechanization. However, for the implementation of land reclamation project it is necessary to study technical possibility and economic feasibility. And also economic analysis of farms in the reclaimed zone is needed for the successful settlement.

This study attempts to review the situation of farming land in Korea and analyze farm managerial aspects of settlers in reclaimed farming zones. Specifically, this study intends (1) to review the changes and trend of area of cultivated land

in Korea, and potentiality of reclaimable land, (2) to analyze farm size, land utilization, agricultural production structure, farm income, economic feasibility of rice production and cropping system in reclaimed zones, and (3) to seek optimum farm size in reclaimed regions.

There are some economic studies on farms in reclaimed regions. However this studies have analyzed based on hypothetical cropping system and crop yields. Therefore the main emphasis in this study was placed upon the analysis of farm management based on the data collected from sample farms in reclaimed zones. By doing this it is hoped that we can identify the farming problems in reclaimed region and thereby providing methods of possible solutions.

2. Scope and Methodology of Research

a. Main data base of this study is information collected from sample farms in 4 reclaimed agricultural zones. Existing research results are supplemented as needed.

b. Distribution of samples. Four reclaimed farming areas are selected for the sample survey. The locations are as follows:

- (1) Nam-Yang: Kyunggi-Do, Hwasung-Gun, Changan-Myon,
Changan-1 Ree and Rajin-Ree.
- (2) Aa-Saan: Chung-Nam, Aasaan-Gun, Daichun-Eup, Naihang-
Ree and Kwongsei-Ree.
- (3) Dai-Chun: Chung-Nam, Boryung-Gun, Daichun-Eup,
Naihang-Ree and Shinhung-Ree.
- (4) Dong-Chin: Chung-Buk, Buan-Gun, Dongchin-Myon,
Changbok-Ree and Shinchangbok-Ree.

The distribution of sample farms in four regions are presented in Table 1. The samples are allocated with consideration of number and size of farms in each region. More samples,, especially large-size-farm samples, are allocated in Mam-Yang area because there are more farms and more of large sized farms in this area compared to other areas. A few samples of large sized farm are allocated in Dai-Chun and Dong-Chin areas because there are not many large size farms. Although we have collected information from 4 large size farms in Dai-Chun, only two samples are used in this analysis because the reliability of information on two other farms are seemed very low.

Samples are selected randomly based on the list of farms. However samples in Dai-Chun was subjectively due to the difficulty in obtaining samples.

Table 1. Distribution of Sample Farms

Location	Size			Total
	Less than 1.5 ha.	1.5 to 2.5 ha.	2.5 ha. and more	
Nam Yang	7	10	17	34
Aa Saan	10	8	6	24
Dai Chun	12	7	2	21
Dong Chin	10	8	4	22
Total	39	33	29	101

c. Methodology: General aspect on reclamation was analyzed based on the already available information. Farm management analysis in reclaimed regions was based on the information collected for agricultural production for 1978 in four sample regions.

II. CULTIVATED LAND AND POTENTIALITY OF RECLAMATION

The acreage of land for agricultural use has been declining due to the transfer of cultivated land for non agricultural use. This has occurred by the urban-industrialization and high way construction. Farming land had been declining 46,000 hectares per year, on the average, during the period of 1966 through 1969. It had declined 72,000 hectares annually during period from 1971 to 1973 when the Restrictive Law of Transferring of Farming Land for Other Use was registered.

In spite of the large scale land development projects carried out by the government, the acreage of cultivated land had declined from 2,312 thousand hectares in 1967 to 2,231 thousand hectares in 1977.

Therefore it is quite clear that farming land will decline further in the future if this trend continues. The decrease of cultivated land will be accelerated if the reclamation projects are not implemented.

According to an estimation annual decrease of land will be 7,200 hectares for paddy, 9,200 hectares for upland totaling to 16,400 hectares if land reclamation projects are not

undertaken^{1/} (see Table 2). Based on this figures it is estimated that areas of total cultivated land will be 2,001 thousand hectares in 1991 or 89.7 percent of cultivated land in 1977, and 1,837 thousand hectars in year of 2001. This in equivalent to 82.4 percent of the cultivated land in 1977.

Table 2. Acreage of Cultivated Land Converted into Other Use
Per Year - Estimation

	Unit: hectares		
	Paddy	Upland	Total
Burying and Washed away	640	656	1,296
Building site	1,535	2,399	3,935
Public use	3,359	3,152	6,511
Others	1,670	3,001	4,671
Total	7,204	9,208	16,423

Note : It is assumed that one-half of acreage that buried and washed away to the flood would be restored.

Source: Agriculural Development Corporation, The Direction of the Formation of Agricultural Land Base for the Improvement of Agricultural Production Structure. 1978, p. 35

^{1/} Agricultural Development Corporation, Direction of Land-Base-Formation for the Improvement of Agricultural Production Structure, 1978, p. 35

Table 3. Estimation of Cultivated Land in Thousand Hectares

Year	Agricultural Development Corporation			Korea Development Institute		
	Paddy	Upland	Total	Paddy	Upland	Total
1977	1,303	928	2,231	1,303	928	2,231
1981	1,274	891	2,165	1,294	909	2,203
1986	1,238	845	2,083	1,307	867	2,174
1991	1,202	799	2,001	1,319	828	2,147
1996	1,166	753	1,919			
2001	1,130	707	1,837			

Source: Agricultural Development Corporation, *ibid.*, p. 38
Korea Development Institute, *Long-Run Perspective of Economic and Social Development, 1977-91*, 1977, p. 135

Table 4. Comparison of Survey Results on Acreage of Reclaimable Foreshore by

Various Institutes,

	First survey	Second survey	Third Survey	Fourth Survey	Fifth Survey
Year of Survey	1962	1965	1966	1968-72	1975-76
Supervisory institute	UNTID	Ministry of Construction	Ministry of Construc- tion	Ministry of Construction	Ministry of Agriculture
Survey in charge	NEDECO	1st Technical Team	1st Techni- cal Team	1st Techni- cal Team	ADC
No. of Location Surveyed	71	116	182	144	132
Area of Development	225	259	262	276	605
Area of Reclaimable Foreshore	189	233	213	230	405
Area of Paddy Development	165	161	163	160	405
Rate of Reclamation(%)	84.0	90.0	81.3	83.3	66.9
Paddy Ratio (%)	87.3	69.1	76.5	69.6	100.0
Natural Drainage	189	233	213	230	261
Mechanical Drainage	-	-	-	-	144
Rate of Natural Drainage(%)	100.0	100.0	100.0	100.0	64.4
Average Area Per Location	2.3	1.4	0.9	1.1	3.1

- Source (1) NEDECO: Final Report on First Survey, 1962 Table of Location.
- (2) Agricultural Development Corporation, Report on the Long-Run Development Plan for the Agricultural Land Formation, 1972, Table of Location.
- (3) _____, 30 Year of Land Improvement Project, 1976, pp. 212-215

However these figures certainly lead to underestimation in a sense that land development is not accounted for in the estimation. When we take account of both transfer of existing farming land for other use and the land development programs continue at a rate of the recent past, the area of total cultivated land was estimated to be 2,147 hectares in 1991. ^{2/}This is equivalent to 96.2 percent of area in 1977. In any case it is clear that the total cultivated land will decline unless an ambitious land reclamation projects are implemented (see Table 3). Therefore it is imperative to expand farming land through reclamation if agricultural policy goal is to maintain a higher degree of

^{2/} Korea Development Institute, Long-Run Perspective of Economic and Social Development, 1977-91, 1977, P. 135.

self-sufficiency for food grains.

Fortunately enough there are approximately 605,000 hectares of potential land in seashore in the west coast that could be reclaimed (see Table 4). It is estimated that about 405,000 hectares of paddy will be newly formulated if the potentially reclaimable seashore is developed. Whenever this land is developed and put into use for agricultural production, man-land ratio will not be worse off even some of existing farming land is transferred for other use. This will also help to increase domestic supply of food grains to meet increasing demand for them.

III. FARM ASSETS, LABOR AND LAND UTILIZATION ON SAMPLE FARMS.

Some study results on farming in regions are available. However, many of them deal with technical aspects of reclamation, and relationship between crop yields and salinity of land based on the data collected from experimental fields. Also economic analyses were carried out either based on the information obtained from neighboring farms or hypothetical data. Sometimes economic analysis was made based on the data provided by farming by public institutions. All these studies are not sufficient enough to understand the reality of farming by farmers. In this respect, this study attempts to analyze farming situation based on the information obtained from sample farms.

1. Labor

The labor and land are the two primary factors of agricultural production. In recent past population in rural area has been declining at an annual compound rate of 2.2 percent. This has resulted in shortage of labor supply during the peak season of the year and thereby increased wage rate in rural sector. This phenomena was also true in reclaimed farming zone. However

farmers in reclaimed region has advantage to cope with the shortage of labor supply due to concentration of farm land and large size of a plot. Furthermore, it is easier to mechanize agriculture in these regions by the completion of land rearrangement.

As we can see in Table 5 average family size of all sample farms are 5.40 persons which is more or less same as average

Table 5. Family Size and Labor Force of Sample Farms by
Location and Farm Size. Average Per household

	Location				
	Nam Yang	Aa Saan	Dai Chun	Dong Chin	Total
	Family Size				
Less than 1.5 ha	5.7	5.9	4.7	5.8	
1.5 to 2.5 ha	4.7	5.3	5.6	5.3	
2.5 and more	5.6	6.2	5.0	6.0	
Average	4.1	5.8	4.8	5.6	5.40
National average	.				5.38

In Efficiency Unit

Less than 1.5 ha	3.14	3.55	3.33	2.73
1.5 to 2.5 ha	2.43	2.80	3.40	2.25
2.5 and more	3.04	3.33	4.20	3.00
Average	3.14	3.24	3.40	2.60

family size in total rural area in Korea. The family size is the largest in Dong-Chin and smallest in Nam-Yang among four regions surveyed. The one probable reason for the difference of family size among 4 sample villages might be the years of cultivation after settlement. Most farmers in Nam-Yang are new settlers coming from various professions and various regions. The average labor force in man-equivalent efficiency unit is 3.42 persons per farm. It is interesting to compare the compositions of family between Nam-Yang and Dong-Chin. On the average, total number of family per farm in Dong-Chin exceeds that in Nam-Yang by 1.5 persons. However, average labor force in man-equivalent efficiency unit in former region is less than latter region by 0.54 persons.

This indicates that a large part of family members in Dong-Chin are consisted of elders, women and children compared to family composition in Nam-Yang.

The family composition seems to have related with farm sizes. The farm size in Nam-Yang is greater than that in Dong-Chin on the average. However this is not true when we look at labor composition in other two regions.

2. Livestock

Production of livestock and its products is important source of income to the farm family. Farm management specialist often advocates introduction of livestock into farm organization in the ground of advantages accruing from complementary or supplementary relationship between production of crops and livestock.

On the other hand consumption of livestock and its products has been increasing very rapidly due to the changing pattern of food consumption. As income level rises people become to eat more of meat, eggs and milk compared to rice and barley. This trend will continue further in the

Table 6. Inventory of Livestock by Region and Farm Size Per Farm.

Livestock Region & Farm Size	* in thousand won.							
	Native Cattle		Pigs		Chicken		Others	
	Ratio*	Value	Ratio*	Value	Ratio*	Value	Value	Total Value
<u>Nam Yang</u>								
Less than 1.5ha	-	-	-	-	4.00	4	2	5
1.5ha to 2.5ha	0.40	143	0.60	73	4.70	5	-	221
2.5ha and more	0.35	123	0.47	19	3.94	4	-	146
Average	0.29	48	0.41	31	4.18	4	-	84
<u>Aa Saan.</u>								
Less than 1.5ha	0.40	140	1.00	35	1.50	2	-	177
1.5ha to 2.5ha	-	-	1.00	36	2.13	2	-	38
3.5ha and more	0.50	242	5.67	152	-	-	-	39
Average	0.29	119	2.17	69	1.33	1	-	189
<u>Dai Chan</u>								
Less than 1.5ha	0.42	271	-	-	2.5	4	-	274
1.5ha to 2.5ha	0.57	543	0.14	7	3.57	4	-	554
2.5ha and more	1.00	700	-	-	-	-	-	700
Average	0.52	402	0.05	2	2.62	3	-	408

Livestock Region & Farm Size	Native Cattle		Pigs		Chicken		Others		Total
	Ratio*	Value	Ratio*	Value	Ratio*	Value	Value	Value	
Dong Chin									
Less than 1.5ha	-	-	0.50	22	3.00	6	2		30
1.5ha to 2.5ha	-	-	1.10	43	3.75	7	2		53
2.5ha and more	-	-	0.75	59	5.00	10	-		69
Average	-	-	0.77	36	3.64	7	2		45
Total average A.	0.27	128	0.83	35	3.06	3	0.4		168
National Average	-	-	-	-	-	-	-		390
B.									
National 2ha and more, C.	-	-	-	-	-	-	-		662
Ratio A/B x 100, %	-	-	-	-	-	-	-		43
Ratio A/C x 100, %	-	-	-	-	-	-	-		25

Note 1. * Ratio in each livestock class implies the Ratio of farms which raise the
the livestock to total farms.

2. Figures are rounded up.

future. Increased production of livestock and its products are badly needed to meet increasing domestic demand for them and to raise farm income.

The inventory of livestock on sample farms is shown in Table 6. As a whole, per farm inventory value of livestock as of 1978 is 168,000 won or equivalent to 43 percent of national average. When compared to national average of livestock holdings of large size farms with 2 hectares and more cultivated land, average of sample farms account only for 25 percent of large farm size. Therefore it can be concluded that livestock enterprise in reclaimed farming area is very poor.

There are some differences in holdings of livestock among sample regions. Regions in which new settlers are dominant (i.e. Nam-Yang and Dong-Chin), farmers raise less livestock when compared to farmers in regions in which established farms before reclamation had received some reclaimed land (i.e. Dai-Chun and Aa-Saan). Average value of livestock holding per farm in Nam-Yang and Dong-Chin accounted for only 21% and 12% respectively to national average and 13% and 7% of national average holding of livestock by farm size with 2 hectares and more of cultivated land.

No sample farm in 4 regions surveyed had raised neither beef cattle nor dairy cow. The most important livestock in value terms was Korean native cattle. However no farmer was found who raises Korean native cattle in Dong-Chin. It was also found that farmers in regions in which established farms are dominant raises more Korean native cattle compared to the region in which new settlers are dominant. It can be concluded that low farm income with a larger size of cultivated land in reclaimed farming region compared to national average, as we see later, is partly due to stagnation in livestock production. One reason of stagnation in livestock production might be the lack of natural pasture in reclaimed areas.

3. Farm Machinery and Implement

In recent years farm population had been declining at an annual compound rate of 2.2%. This caused the shortage of labor supply during the peak farming seasons and thereby raised wage rate in rural area. To cope with the changing circumstance of factor supply for agricultural production farmers as well as policy makers are strongly arguing agricultural mechanization.

Table 7. Value of Farming Implements by Region and Farm Size

in thousand won				
Size Region	Less than 1.5 ha	1.5 ha to 2.5 ha	2.5 ha and more	Average
Nam Yang	151	281	927	577
Aa Saan	248	482	525	395
Dai Chun	193	775	1,168	480
Dong Chin	188	176	1,077	345
All A.				449
National Average of 2 ha and more B				307
Ratio A/B x 100, %				146

Holdings of farm machineries and implements are shown in Table 7 and Appendix Table 1. Per farm average holding of farm machinery and implements was valued at 449,000 won which is equivalent to 146% of national average of large farm size with 2 hectares and more of cultivated land.

Farms in Nam-Yang area owns more farm machinery and implements among four regions. Farmers in Nam-Yang area may own more farm machinery because the size of cultivated land is larger than other regions.

Some distinctive features are noticeable with respect to holding of farm machineries. Firstly farms in reclaimed regions own more of machineries compared to other areas. This is mainly due to: (1) larger farm size, (2) better land arrangement and larger plot size, (3) better irrigation facilities, and (4) stagnant production of draft cattle caused by lack of natural grass resources. Secondly farmers are increasingly using powered dynamic farm machinery instead of static traditional farm implements. The 42 percent of all sample farms surveyed in 4 regions operate their own power tiller. The estimated value of power tiller accounts for 64 percent of farm machinery and implement asset value. Farmers are using more of powered machines in threshing and insects and disease control. Thirdly, however, the diffusion rate of rice transplanter and harvester is very low. We found only 4 rice transplanters and 2 rice cutter among 101 sample farms.

Therefore it is necessary to promote the diffusion of rice transplanter and harvesters to solve the labor shortage problems during the busy seasons.

4. Operating Land

Operating farmland can be classified into paddy, upland, orchard and others according to use of the land or owner operated land and rented land according to the ownership of land.

a. Farm Size and Composition of the Operating Land

Acreage of operating farming land per farm by regions and by farm sizes was shown in Table 8. By observing this table we can find some distinctive features of land composition in reclaimed farming zones.

(1) Farm sizes measured in terms of acreage of cultivated land is larger compared to national average. Average farm size of all samples is 2.23 hectares which is 2.23 times larger than national average size of 1 hectare in 1978. There are some difference in farm sizes among regions. Compared to national average farm size, average farm size in Nam-Yang is 2.7 times larger, Aa-Saan, 1.95 times, Dai-Chun, 1.92 times and Dong-Chin, 2.11 times larger respectively.

Larger farm sizes in reclaimed region two major economic implications. Firstly farms in these region will make higher income from agricultural production if the land productivity,

the rate of land utilization and cropping systems are similar to national average. However, as we see later, this was not true due to the low land productivity and lower rate of land utilization. Secondly we can assume that farm mechanization might have advanced than other regions. This is quite true as we have discussed in previous section.

(2) Cultivated land is dominantly consisted of paddy leading to monotonous rice culture. As we can see in Table 8 acreage of paddy accounts for 92 percent of total operating land compared to national average of 62 percent. So that the average area of paddy on sample farms is 3.3 times larger compared to national average. However the average area of upland and other land is only 46% of national average. Especially the ratio of paddy to total cultivated land is high in newly settled regions of Nan-Yang and Dong-Chin.

This implies that farm income is more uncertain subjecting rice yield. They do not have much of risk spread alternatives. Therefore their decision making with respect to choice of cropping pattern is very simple.

Table 8. Area of Cultivated Land in Sample Farms by Location and Farm Size in Pyong

Farm Size	Item & Location	Nam Yang			Aa Saan		
		Paddy	Upland and other ¹⁾	Total	Paddy	Upland and other ¹⁾	Total
Less than 1.5 ha		3,932	166	3,766	2,515	521	3,036
1.5 to 2.5 ha		6,466	126	6,592	4,879	451	5,330
2.5 ha and more		10,206	541	10,747	9,583	1,627	11,210
Average		7,848	264	8,112	5,070	774	5,844
		Dai Chun		Dong Chin			
Less than 1.5 ha		3,625	732	4,357	3,750	100	3,850
1.5 to 2.5 ha		5,400	1,202	6,602	6,479	100	6,579
2.5 ha and more		9,350	1,815	11,165	12,000	100	12,100
Average		4,762	992	5,754	6,242	100	6,342
Sample total A.		6,162	527	6,689			
National Average ²⁾	B.	1,860	1,141	3,000			
Ratio, A/B x 100, %		331	46	223			
Composition Ratio, % Sample Farms		92.1	7.9	100.0			
National Average		62.0	38.0	100.0			

Note: 1) Upland and Others on Sample farms includes building site.

2) Ministry of Agriculture and Fishery; Report on the Results of Farm Household Economy Survey, 1969.

3) 300 pyong \div 10 are.

b. Ownership of Operating Land

Operating land is consisted of originally owned or purchased land, reclaimed land received and rented land. When a farmer receive reclaimed land, he pays back the land value in pre-contracted time period.

When we classify the operating land by ownership, reclaimed land received accounts for 57.5%, originally owned or purchased land, 28.8% and rented land, 13.7% respectively. The percentage of reclaimed land received to total cultivated land is greater in newly settled zones of Nam-Yang and Dong-Chin (see Table 9).

Some new settlers have moved out from the region by selling or renting out of reclaimed land received. Main reason was that there farmers could not maintain their living on incomes derived from the agricultural production. Neither they had enough land to work efficiently with their labor force and farm machineries. This suggests that more land per farm should be allotted at the time of allotment of reclaimed land.

Table 9. Composition of Cultivated Land by Ownership

Pyong per household				
<div>Ownership</div> <div>Farm Size</div>	Reclaimed Land Received	Originally Owned or Purchased	Rented in	Total
Nam Yang				
Less than 1.5 ha	2,740	-	1,054	3,766
1.5 to 2.5 ha	4,928	1,214	450	6,592
2.5 ha and more	7,523	1,000	2,224	10,747
Average	5,675	941	1,496	8,112
Ratio (%)	70	11.6	18.4	100.0
Aa Saan				
Less than 1.5 ha	1,445	1,439	150	3,036
1.5 to 2.5 ha	753	2,002	2,574	5,330
2.5 ha and more	3,745	6,382	1,083	11,210
Average	1,789	2,863	1,192	5,844
Ratio (%)	30.6	49	20.4	100.0
Dai Chun				
Less than 1.5 ha	2,184	2,173	-	4,357
1.5 to 2.5 ha	3,329	3,273	-	6,602
2.5 ha and more	2,250	8,925	-	11,165
Average	2,572	3,182	-	5,754
Ratio (%)	44.7	55.3		100.0
Dong Chin				
Less than 1.5 ha	3,550	150	150	3,850
1.5 to 2.5 ha	5,350	201	1,028	6,579
2.5 ha and more	4,975	6,000	1,125	12,000
Average	4,464	1,231	647	6,342
Ratio (%)	70.4	19.4	10.2	100.2
Average of All	3,843	1,930	916	6,689
Ratio (%)	57.5	28.8	13.7	100.0

c. Utilization of Reclaimed Land.

Increased utilization of existing farm land is important to earn more income from given area of land. However as we can see in Table 10 multiple cropping index on reclaimed land is only 103 percent. Only 3% of paddy was planted to barley after rice cultivation. No barley was planted to in Nam-Yang area. The rate of double cropping is higher in Dai-Chun and Dong-Chin. These two regions are located southern part of west coast relative to other two regions. Therefore the rate of double cropping partly depends on climatic conditions.

Anyhow it can be concluded that agriculture in reclaimed regions are monotonous rice culture.

d. Allotment of Reclaimed Land

When semi-governmental organization like Agricultural Development Corporation (ADC) completes reclamation, the land is distributed to new settlers or neighboring farms. In Nam-Yang and Dong-Chin, ADC allotted most of the reclaimed land to new settlers. In case of Nam-Yang the land was allotted to farmers who lost their farm land due to the construction of water reservoir in the region and dam construction in other regions as well as to people living on welfare payment.

Table 10. Utilization of Reclaimed Land

Region	Area of Reclaimed Land	in Tanbo*	
		Area of Double Cropping	Multiple Cropping Index(%)
Nam Yang	836.4	-	-
Aa Saan	242.4	11.7	4.8
Dai Chun	176.4	15.1	8.5
Dong Chin	400.4	25.0	6.2
Total	1,655.6	51.8	3.1

The allotment in Nam-Yang ranged 1 ha, 2 ha, and 3 hectares in addition to 50 to 145 pyong^{1/} for house site (see Table 11). The average allotment per farm was slightly over 2 hectares.

The allotment per farm in Dong-Chin region ranged 0.5, 1.0, 1.5 and 2 hectares in addition to 100 pyong for house site. The average allotment per farm was slightly over 1.5 hectares.

^{1/} 3,000 pyong is approximately equal to one hectare.

The other two regions received less land compared above two regions. This is because farmers in Aa-Saan and Dai-Chun owned their own land before the reclamation projects were undertaken. They added reclaimed land received to existing land.

The reclaimed land in Nam-Yang accounted for 73.5% of total operating land, 34.1% in Aa-Saan, 46.8% in Dai-Chun, and 72.5% in Dong-Chin respectively (see Table 12).

Concerning to the allotment of reclaimed land some problems should be pointed out. Firstly paddy accounts for most of operating land. Therefore the expansion of double crop area is badly need to raise farm income in these areas. Secondly, the size of allotment to a farm should be enlarged. Even though average farm size in reclaimed regions are much larger compassed to national farm size the farm income in these regions, as we see later, is lower than national average. In order to achieve the goals of farm mechanization and income level that is comparable to income levels in other sector, the size of allotment should be enlarged.

Table 11. Area of Reclaimed Land Per Farm.

Region	Allotment Standard			No. of Farms Received the Land	Average Allotment Per Farm*			in Pyong
	Paddy	Building Site			Paddy	Building Site		
		Upland				Upland		
Nam Yang	3,000-	50-		34	5,838	67	138	6,043
	6,000-	70-						
	9,000	80						
Aa Saan	1,500-	-	-	17	1,995	-	-	1,995
	3,000							
Dai Chun	1,500-	-	-	21	2,695	-	-	2,695
	4,500							
Dong Chin	1,500-			22	4,500	-	-	4,600
	3,000-		100					
	4,500-	-						
	6,000							

* Acreage at the time of allotment received. It is different from the presently operating land.

Table 12. Ratio of Reclaimed Land Received to Operating Land

Land Class Region	Operating Land	Reclaimed Land	Ratio
	A	Received B	B/A x 100%
Nam Yang	8,219	6,043	73.5
Aa Saan	5,844	1,995	34.1
Dai Chun	5,754	2,695	46.8
Dong Chin	6,342	4,600	72.5

Note: Both classes of land include building site.

IV. FARM INCOME ANALYSIS

Farm income is consisted of net income from farming and off-farm income. Net farm income is obtained by subtracting agricultural expenses from gross agricultural receipts. Gross agricultural receipts is made up of gross crop receipts, gross receipts from livestock, livestock products, poultry, sericulture, agricultural processing and handicrafts and others. In the estimation of gross agricultural receipts an adjustment is made for the inventory changes of farm products and value of major livestock and perennial trees. Agricultural expenses are consisted of payment made for the purchase of fertilizer, pesticides, etc, rental payment, wages paid for hired labor and depreciation charges for farm building and farm machineries.

Off-farm income is made up of net income from subsidiary business other than farming, wages earned and receipts from interest, donation and subsidy.

Table 13 shows gross agricultural revenue (i.e. gross agricultural receipts), agricultural expenses, agricultural income, off-farm income and farm income by farm sizes and

regions.

Average farm income of all sample farms in 1978 was 1,534 thousand won or equivalent to 81.4% of national average farm income of 1,884 thousand won. Average farm in reclaimed regions is equivalent to only 42.2% of national average farm income of large farm with 2 hectares and more of cultivated land.

There are significant differences in average farm income by sizes and among regions. As can be expected, the farm income increases as farm size becomes larger. Average farm income is the highest in Aa-Saan region and the lowest in Dong-Chin region (see Table 13).

In spite of the large farm size in reclaimed region average farm income is substantially low. A few reasons explain the low farm income in these regions. (1) Off-farm income is very low compared to national average. Average off-farm income was only 47% of national average and 53% of large farm size's average off-farm income respectively. (2) Farming income is heavily dependent on the rice production. Hence farmers in these regions are lacking to obtain income from other profitable crops. This implies that the low rate of

Table 13. Gross Revenue, Expenditure and Farm Income on Sample Farms, 1978

Gross Agricultural Revenue								in thousand won
Crop Production	Livestock and Livest Products	Total	Agricultural Expense	Agricultural Income	Off-Farm Income	Farm Income		
<u>Nam Yang</u>								
Less than 1.5 ha	1,067	49	1,116	879	237	539	776	
1.5 ha to 2.5 ha	2,271	82	2,353	1,256	1,097	71	1,168	
2.5 ha and more	5,400	9	5,408	2,430	2,978	274	3,252	
Average	2,789	39	2,828	1,766	1,063	269	1,331	
<u>Aa Saan</u>								
Less than 1.5 ha	2,016	53	2,069	379	1,690	385	2,075	
1.5 ha to 2.5 ha	2,724	132	2,856	1,233	1,623	6	1,629	
2.5 ha and more	8,259	532	8,791	1,499	7,291	419	7,710	
Average	3,601	199	3,800	944	2,856	267	3,123	
<u>Dai Chun</u>								
Less than 1.5 ha	1,533	26	1,559	1,177	382	353	735	
1.5 ha to 2.5 ha	2,913	35	2,948	1,538	1,410	277	1,687	

Gross Agricultural Revenue		Agricultural Expense		Agricultural Income		Off-Farm Income	
Crop Production	Livestock and Livest Products	Total					
2.5 ha and more	5,300	39	5,339	1,373	3,966	-	3,966
Average	2,440	30	2,471	1,316	1,155	294	1,449
Dong Chin							
Less than 1.5 ha	967	5	973	794	179	72	251
1.5 ha to 2.5 ha	1,787	4	1,791	1,617	174	49	222
2.5 ha and more	2,505	8	2,513	2,218	295	457	752
Average	1,534	5	1,539	1,352	187	152	344
Total average, A	2,605	68	2,673	1,387	1,286	248	1,534
National Average, B							
National Average of 2 ha & more, C			1,769	413	1,356	529	1,884
Ratio A/B, %			4,301	1,143	3,158	470	3,628
Ratio A/C, %			151.1	335.4	94.9	47.0	81.4
			62.1	121.3	40.7	52.8	42.2

land utilization. (3) Livestock production is stagnant. (4) Another important factor is that the agricultural expense per farm is very high relative to gross agricultural revenue.

Average gross agricultural receipts was 2,673 thousand won which exceeds national average of gross agricultural receipts by 51%. However agricultural expense per farm was 1,387 thousand won exceeding national average of 418 thousand won by 235 percent. This means the receipts per unit of expense incurred is very low or management including production activities is very inefficient. When we compare the receipts and expenses on sample farms with national average of large size farms, we will notice further inefficiency in farm management in reclaimed zones.

The relatively low gross agricultural receipts and the exceedingly high agricultural expenses resulted in relatively low net agricultural income. Average agricultural income was 1,286 thousand won in 1978, or equivalent to 95% of national average of farm income or 41% of large size farm. (5) Low agricultural income, low off-farm income consequently resulted in low level of farm income relative to farm income in other regions.

By the above analysis it is clear that increased land utilization rate, introduction of livestock and cash crops other than rice into the farm organization, increasing of management efficiency and more opportunities for off-farm income source are necessary conditions for the improvement of farm income in reclaimed zones.

V. Analysis of Rice Production

1. Economic Analysis of Rice Production

As we have discussed previously the most distinctive character of farm management in reclaimed regions is the monotonous rice cultivation. Therefore rice production predominantly affects on farm income. This chapter analyzes the reality of rice production.

a. Per Farm Gross Receipts and Expenses in Rice Production

As we can see in Table 14 the area planted to rice per farm was 16.4 Tanbo* in 1978. It exceeds the national average per farm crop area of 12.5 tanbo by 31.2%. Gross receipts from rice production including by-products was 1,816 thousand won exceeding national average of gross receipts from all crop production, 1,484 thousand won by 22.4% in 1978 crop year. However expenses incurred for the production of rice amounted to 874 thousand won per farm exceeding national per farm agricultural

* one tanbo \doteq 10a

expense (excluding expenses for other than crop production) of 363 thousand won by 140%. This resulted in net income from rice production to only 942 thousand won per farm or 84% of national average of 1,120 thousand won derived from crop production.

In spite of the larger area planted to rice in reclaimed area compared to national average of per farm crop area, the per farm net income from rice production was lower than national average of per farm income from crop production. This is mainly due to three factors. Firstly, the land productivity in reclaimed region is relatively low. Secondly agricultural expense per farm or per unit of rice planted is high. Thirdly the land utilization rate is low.

Farmers in reclaimed areas usually expend more for given area of rice planted because they have to irrigate more often for the desalinization. For this matter they have to pay more irrigation fees, have to apply more of fertilizer and pesticides and use more labor force.

Management of farming seems less effective. On the average, new settlers lack production techniques and management capability compared to indigenous farmers. It was often

found, during the interview, that incentives to make a success by farming in the part of new settlers are lacking.

b. Gross Receipts Expenses and Net Income per Unit of Land from Rice Production

The efficiency of rice production can be compared by looking at land productivity. Table 15 shows revenue, expenses and income per tanbo in rice production in the reclaimed regions by farm size and regions.

Average yield per 10a was 275 Kg which is equivalent to 70.7% of National average in 1978. However the expense per 10a exceeded that of national average by 22.4% leading to income to only 50.9% of national average. The expense incurred in the cultivation of rice on reclaimed land is higher due to the more application of fertilizer and pesticides accompanied by frequent irrigation. They need more frequent irrigation for the desalinization. For this matter they have to pay higher irrigation fee. They also paid more for hired labor.

The lower yield, higher expenses for a given amount of land, monotonous rice culture and lack of non-farm income opportunities are major factors of low farm income in reclaimed farming zones.

Table 14. Revenue, Expenditure and Income in Rice Production on Sample Farms Per Household.

Region and Farm Size	Area Planted	Value Produced*	expense Paid for Purchase of;					Total Expenditure	Income	
			Fertilizers	Pesticides	Materials	Seeds	Labor			Other
Nam Yang										
Less than 1.5 ha	11.4	965	233	78	11	70	361	110	864	101
1.5 ha to 2.5 ha	20.3	2,083	146	11	25	56	429	229	877	1,207
2.5 ha and more	32.6	4,998	320	207	56	77	826	521	2,006	2,992
Average	24.6	2,499	251	59	38	69	608	352	1,377	1,122
Aa Saan										
Less than 1.5 ha	4.8	551	29	18	9	8	28	116	208	338
1.5 ha to 2.5 ha	14.4	1,406	99	77	25	23	137	266	626	780
2.5 ha and more	13.2	1,121	82	68	26	22	196	255	649	472
Average	10.1	978	65	50	19	20	106	201	461	517
Dai Chun										
Less than 1.5 ha	7.1	967	66	56	8	1	195	59	385	582
1.5 ha to 2.5 ha	10.9	1,554	148	152	15	8	332	69	724	830

Region and Farm Size	Area Planted	expense Paid for Purchase of;					Total Expen- Income diture
		Value Pro- duct*	Fertili- cides	Pesti- cides	Ma- teri- als	Seeds Labor Other	
2.5 ha and more	7.5	872	110	108	15	6 250 54	543 329
Average	8.4	1,154	98	93	11	4 246 63	514 639
Dong Chin							
Less than 1.5 ha	12.5	1,283	121	92	47	36 254 130	653 630
1.5 ha to 2.5 ha	20.0	2,301	186	144	68	58 426 156	1,037 1,264
2.5 ha and more	28.8	4,858	264	185	147	115 657 278	1,645 3,212
Average	18.2	2,303	171	128	73	58 390 166	985 1,318
Total Average, A	16.4	1,816	157	59	35	41 366 215	874 942
Nat'l Average (Crops) B	12.5	1,484					363 1,120
Ratio A/B, %	131.5	122.4					240.4 84.1

Table 15. Revenue, Expenditure and Income in Rice Production Per Tanbo.

Region and Farm Size	Yield Kg	Value Produced	Expense Paid for Purchase of;					Total Expen- Income
			Fer-tili	Pesti- cides	Ma-teri- als	Seeds	Labor	
<u>Nam Yang</u>								
Less than 1.5 ha	210	85	20	7	1	6	32	10 76 9
1.5 ha to 2.5 ha	255	103	7	1	1	3	20	11 43 59
2.5 ha and more	380	153	10	6	2	2	25	16 62 92
Average	252	102	10	2	2	3	25	14 56 46
<u>Aa Saan</u>								
Less than 1.5 ha	284	115	6	4	2	2	6	24 43 72
1.5 ha to 2.5 ha	242	98	7	5	2	2	9	18 43 54
2.5 ha and more	211	85	6	5	2	2	15	19 49 36
Average	240	97	6	5	2	2	11	20 46 51
<u>Dai Chun</u>								
Less than 1.5 ha	338	136	9	8	1	0	28	8 54 82
1.5 ha to 2.5 ha	353	143	14	14	1	1	30	6 66 76

in thousand won

Region and Farm Size	Yield Kg	Value Pro-duct	Expense Paid for Purchase of;						Total Expen- Income diture	
			Fer-tili	Pesti- cides	Ma-teri- als	Seeds	Labor	Other		
2.5 ha and more	288	116	15	14	2	1	33	7	72	44
Average	340	137	12	11	1	0	29	8	61	76
Dong Chin										
Less than 1.5 ha	255	103	10	7	4	3	20	10	54	48
1.5 ha to 2.5 ha	285	115	9	7	3	3	21	8	52	63
2.5 ha and more	419	169	9	6	5	4	23	10	57	112
Average	328	127	9	7	4	3	21	9	54	72
Total Average A.										
	275	111	10	4	2	3	22	13	53	57
Nat'l Average (Rice Prod) B.										
	388	156	5	3	2	1	9	23	44	113
Ratio A/B, %										
	70.7	70.8	185.3	125.1	94.0	185.8	248.1	57.4	122.4	50.9

2. Changes of Salinity

Whenever seashore is reclaimed the salinity of the soil is usually higher compared to inland or existing soil. Unless the salinity is reduced to a certain level crop production is impossible. However the salinity to which a crop can grow differ by crops. On the other hand crop yield differ by the degree of salinity even though a crop cultivation is possible.

As we can see in Table 16, even the reclamation is completed in the same year the salinity differ by region and by soil class in the same region. And also we can see that salinity drops as cultivation continues. This is true because irrigation for the rice production has desalinization effect.

According to a study^{1/} on agriculture in reclaimed area, it takes about ten years to reduce soil salinity to the level of 0.3‰ which is the highest limit for the normal rice production when the salinity is 2‰ at the completion of the reclamation. Of course this estimate is based on desalinization by

^{1/} National Agricultural Economic Research Institute, A study on the Development of South-West Coast Reclamation, 1977, p. 95-99.

Table 16. Changes of Surface Salinity after Reclamation (Paddy Rice Cultivation)

Location	Soil	Com- pleted Year	Cultivation Year												unit: %
			1	2	3	4	5	6	7	8	9	10	11	12	
Mi myon	LS (II)	1967	-	-	-	-	*5.88	4.77	1.20	1.42	2.53				
"	SL	1967	-	-	-	-	*4.88	2.91	1.18	1.17	2.26				
"	SIL (I)	1967	-	-	-	-	-	0.47	0.66	0.64	0.60				
"	SIL (II)	1967	-	-	-	-	*5.11	3.25	1.95	1.74	1.38				
"	LS (I)	1967	-	-	-	-	-	-	*1.21	0.56	0.66				
"	SIL (III)	1967	-	-	-	-	-	-	*2.81	1.60	3.83				
Kwang Hwa, A.		1962	2.0	1.0	-	0.9	0.6	0.5	0.4	0.4	-	0.3	0.3	0.3	
Kwang Hwa, B.		1958	-	-	-	-	-	-	→ 0.61 0.48						
Kwang Hwa, C.		1958	-	-	-	-	-	-	-	-	-	-	-	0.78	

Dot (*) Indicates the year of first Cultivation.

Source: Agricultural Development Corporation; Mi myon Office, Evaluating Report on Agricultural Mechanization Pilot Project, 1975.

Seoul National University, College of Agriculture; A study on Saline Resistance of Crops, 1967 and 1968

Table 17. Salinity of Reclaimed Land by Soil Depth

Soil Class \ Depth	in %		
	0 - 10 Cm	- 30 Cm	- 50 Cm
High Salinity	0.78	0.86	0.93
(%)	(100)	(110)	(119)
Low Salinity	0.61	0.70	0.86
(%)	(100)	(115)	(141)

Source: National Agricultural Economic Institute,
ibid., p. 101.

surface irrigation and drainage. If some facilities are installed under ground the desalinization will be promoted. However, if salinity is about 5% at the early year of cultivation it takes about 15 years to reach normal soil condition for the rice production.

The growth of crops depend on the root development. Therefore the salinity should be reduced to a certain degree up to a certain depth of soil from the surface ground. The salinity increases as depth increase. But the difference in

salinity between high saline soil and low saline soil is greater near the surface than deeper part. Therefore the growth of crops depend largely on salinity on soil surface.

3. Soil Salinity and Crop Yield

Crop yields in reclaimed land depend highly on salinity of soil. The most ideal crops to introduce in reclaimed land would be saline resistible and promote desalinization through the cultivation. In this respect paddy rice is best crop to plant on reclaimed soil in the early stage of cultivation.

In almost all cases rice was planted in early period of cultivation on reclaimed land. It is argued that the cultivation of barley and white potatoes is possible as secondary crops in Southern part of Kyunggi Province. Barley, white potatoes and rape can be introduced as secondary crops in Jula province and Southern coast area. As we can see in Table 18, salinity succeedingly decreases as cultivation continues. And also estimated yield of all crops increases as soil salinity is reduced. One estimates that yield of rice per 10a increase by 25 kilograms as soil salinity declines by 0.1

Table 18. Estimation of Crop Yields by Salinity on Reclamaid Land, (Desalinization b
by Surface Irrigation and Drainage)

Salinity and Crop Yields	Year of Cultivation												
	1	2	3	4	5	6	7	8	9	10	11	12	13
High salinity, ‰	5.0	3.3	2.0	1.7	1.4	1.1	0.9	0.7	0.6	0.6	0.5	0.4	0.3
Low salinity, ‰	2.0	1.5	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.3	0.3	0.3
<u>Yield</u>													
Rice, High salinity, Kg	100	150	200	224	250	270	300	320	335	350			
Low salinity, Kg	200	225	250	275	300	320	340	350	380	400			
Barley, High salinity, Kg	-	-	-	-	-	100	130	160	180	200	220	240	250
Low salinity, Kg	-	100	130	150	170	190	210	230	240	250			
Rape, Low salinity, Kg	-	-	65	70	75	80	90	100	110	120			
Potatoes, Low salinity, Kg	-	-	550	600	650	700	750	800	900	1,000			

Source: National Agricultural Economic Research Institute, *ibid.*, p. 118.

percent^{2/}. But it was not possible to confirm this result. It was also argued that rice yield reaches to average level when salinity is less than 0.3 percent.

4. Rice Yield by Year of Cultivation

Successive cultivation of rice has desalinization effect through irrigation and drainage. Therefore we can expect that rice yield will have increasing trend year by year unless production is suffered by bad weather or disease.

Table 19 presents the relationship between paddy rice yield and years of cultivation. Although it is not definitely clear, we can see that yield increases successively. It has been argued that rice yield reaches to the level of common paddy after about ten years of rice cultivation on reclaimed land. This was not confirmed by our survey. Even after 15 years of cultivation, the yield was lower compared to that achieved in common paddy. It seems that at least 15 years of successive cultivation of rice, accompanied by surface irrigation, is required as much productive as common paddy.

^{2/} National Agricultural Economic Research Institute, *ibid.*, p. 109.

Table 19. Paddy Rice Yield on Reclaimed Land by the Year of Cultivation

Location	Year of Reclama- tion Completed	Water Resource	Year of First Cultiva- tion	in Kg ^a of Polished Rice per 10a												
				Years of Cultivation												
				1	2	3	4	5	6	7	8	9	10	11	12	13
Kwang Hwa, Kilsang	1962	Ordinary	1963	85	107	204	208	190	257	164	287	204	296	298	321	372
Bo Ryung, Dai Chun	1971	Rich	1972	257	319	325	320	-	304*	337*						
Bu An, Dong Chin	1965	Rich	1966	-	131		182	277	313	328	333	376	455	416	292*	314*
Mi Myon	1967	Ordinary	1972	60	151	208	154									
Aa Saan, In Chu		Rich	1976	100*	209*	232*										
Hwa Sung, Nam Yang		Rich	1977	245*	272*											

Source: Yields with star mark (*) are from sample survey in this study. Other data are obtained from Farmland Improvement Associations.

VI. REASONABLE FARM SIZE

There has been a hot discussion concerning to the upward adjustment of ceiling of cultivated land^{1/}. Present land law prohibit an individual farmer to own more than 3 hectares of cultivated land. The ceiling was settled by the Farmland Reform Law registered in early 1950's. The main objective of the legislation was to achieve equitable distribution of income through more equitable holding of farmland. Although it intended to improve the efficiency in agricultural production through establishment of owner-operated farms, this purpose of legislation was largely neglected and failed to achieve it.

At the time of legislation agriculture was dominant sector in the national economy with respect to composition of population and share of national products. Further, land was scarce resource while labor was abundant input in rural area.

Nowadays atmosphere surrounding agriculture and rural areas has changed materially compared to that in 1950's. The labor is

^{1/} Korea Rural Economic Institute, Seminar on Perspectives of Agriculture in 1980's and Farm Land System. August, 1979

no more abundant or redundant resource in rural sector. Problem of income distribution between rural and urban sectors is becoming a social issue.

To meet changing circumstances of economic structure a group of scholars and policy makers began to consider an amendment of the Land Reform Law legislated in early 1950's. The major content of the amendment is upward adjustment of ceiling on farmland ownership.

The advocates of the upward adjustment of the ceiling resort their assertion on two grounds, farm mechanization and equitable income distribution between rural and urban sectors.

To solve shortage of labor supply, farm mechanization is inevitable if agricultural production is to be continued. However farm machinery will be introduced when it is economically feasible on the part of farmers. Economic feasibility of farm mechanization depends largely upon the utilization rate of a machine for a year. Assuming a machine owner utilizes his machine only on his farm, the profitability of having a machine will depend greatly on his farm size.

In Korea, rice transplanters and harvesters are badly needed to cope with labor shortage problems during busy

agricultural seasons. One study shows that break-even point for a four-row rice transplanter is 7.7 hectares. By normal operation this machine can perform transplanting of rice on 10 hectares in a season. It argues that this case 11% of cost could be saved compared to conventional method of transplanting. If it is operated at maximum capacity it can transplant rice to 15 hectares saving 26% of cost compared to conventional method^{2/}. It is predicted that per capita GNP will increase substantially in the coming years^{3/}. It is estimated that an attainment of per capita income on full-time farm equivalent to 70% of per capita GNP in 1991 requires 6,320 thousand won of farm income. And to earn this amount of income by farming 4.6 hectares for monotonous rice cultivator or 5.5 hectares of farm land for mixed crop cultivators are needed. To be per capita income on farm people equal to 80% of per capita GNP in 1991, sufficient farm income is 7,220 thousand won and required

^{2/} Korea Rural Economic Institute, *ibid.*

^{3/} Korea Development Institute, *Long-Run Perspective of Economic and Social Development, 1977-91, 1977.*

farm land is 5.2 hectares for monotonous rice producing farmer and 6.2 hectares for mixed cropping farmer^{4/} (see Table 20).

In deciding reasonable farm size on reclaimed area it should not be followed just same formula as discussed above. Farming in reclaimed regions has distinctive characters different from farming in general region. Farmers depend their living heavily on rice production. However this condition will be changed as cultivation continues.

Table 20 present required farm size under various conditions. Major factors affecting on the farm size are (1) Percentage of per capita income on farms to predicted per capita GNP in 1991. (2) Required farm income to satisfy condition described in (1). (3) Rice income per 10a. (4) Percentage of rice income to farm income.

Under the various conditions required farm sizes are presented in Table 20. Considering land productivity on reclaimed land the rice income of 74,000 won per 10a is acceptable. This figure is average of middle two villages average

^{4/} Korea Rural Economic Institute, *ibid.*

per farm income. Eighty percent of rice income to farm income is acceptable, in a sense that farmers in reclaimed region will have some off-farm income opportunity in the future. Under these restrictions the required land sizes are 6.8 hectares for farm income to be 6,320 thousand won, and 7.8 hectares for the farm income to be 7,200 thousand won in 1991. This size also meet to the efficient operation of 4 row rice transplanter discussed in this chapter. Therefore it could be concluded that reasonable farm size in the allotment of reclaimed land would be 7 to 8 hectares.

Table 20. Land Requirement to Achieve Targeted Income Level
According to Rice-Production-Income Per 10a on
Reclaimed Land in 1991

Rice Income per 10a (1,000 won)	% of Rice Income to Farm Income	Targeted Annual Farm Income	
		% of per Capita Income on Farms to Predicted per Capita GNP in 1991, %	
		70%	80%
		Required Average Farm Income at 1975 price, in 1,000 won	
		6,320	7,220
		Required Paddy Land per Farm, ha.	
Average of	70	7.8	8.9
Sample Farms	80	8.9	10.1
57	90	10.0	11.1
Average of	70	6.0	6.8
Middle Two	80	6.8	7.8
Village 74	90	7.9	8.8
Highest of	70	4.0	4.5
Sample Farms	80	4.5	5.2
112	90	5.1	5.8
National	70	3.9	4.5
Average	80	4.5	5.1
113	90	5.0	5.7

Note: Targeted Income was from Korea Rural Economic
Institute; Perspectives of Agriculture in 1980's
and Land System, 1979

VII. SUMMARY AND CONCLUSION

1. In spite of the self-sufficiency in staple food grains of rice and barley achieved in 1977, the degree of self-sufficiency in all grains has been deteriorating in the past. An increased production of food grains is necessary to meet the increasing demand for the food due to the growth of population and an increase of per capita income. To achieve this goal an expansion of land base is imperative.

2. It is predicted that the cultivated land will decline 16,400 hectares annually unless reclamation is undertaken. This will result in total cultivated land of 1,838 thousand hectares in 1991 which is equivalent to 82 percent of 2,231 thousand hectares of total cultivated land in 1977. If this trend of changes in area of cultivated land in the recent past continues, the total cultivated land will decrease to 2,147 thousand hectares in 1991 or equivalent to 96% of that in 1977.

3. Potentially reclaimable area in seashore is estimated to be 605 thousand hectares. If this is developed approximately 405 thousand hectares of paddy could be formulated.

It is necessary to analyze management aspects of farms in reclaimed regions. The following few conclusions are results obtained from analysis of sample farms in reclaimed regions.

4. Average farm family size in reclaimed regions was more or less the same as national average farm family size.

5. Average acreage of operating land per farm was 2.23 hectares or 2.23 times of national average farm size. The paddy accounted for 92% of total cultivated land compared to national average of 62 percent. Heavy concentration on paddy had led monotonous rice culture. Therefore income derived from rice production was dominant determinant factor of farm income.

6. The operating land was consisted of 57.5% of allotment of reclaimed land, 28.8% of originally owned or purchased land and 13.7% of rented land. However in regions of Nam-Yang and Dong-Chin reclaimed land had dominant portion of the operating land.

7. Multiple cropping index was 103%. Only 3% of paddy was planted to barley. Therefore income from reclaimed land depend heavily on rice production.

8. Livestock enterprises are far less developed. The average inventory value of livestocks was 168 thousand won or equivalent to 43% national average farm inventory value of livestock in 1978. This average farm inventory value of livestock in reclaimed regions is equivalent to 25.3% that of national average owned by large farm size, i.e. 2 hectares and more of cultivated land.

9. The average per farm inventory value of farm machinery and implements was 449 thousand won exceeding by 46% to that of national average of large farms. This indicates that farm mechanization in this area has advanced compared to other farming zones. However this also caused to raise production cost of rice in a sense that they do not utilize their own draft cattle that need not to pay for. Farm mechanization is easier in these farming zones due to better land arrangement, large plot size, concentration of farm land and better condition of farm feeder roads.

10. Average farm income was 1,534 thousand won, or 81.4% of national average farm income of 1,884 thousand won, or only 42.2% of national average farm income of large farms. The reasons for low farm income are: (a) Monotonous rice cultivation accompanied by low land productivity and higher expenses per unit of land. (b) stagnant production of livestock and cash crops at low level. (c) lower level of off-farm income.

11. Average rice yield per 10a was 275 Kg equivalent to 70.7% of national average in 1978. However the expense per 10a exceeded that of national average by 22.4% leading to income for a given unit of land 50.9% of national average. This indicates that twice of paddy is needed in reclaimed area to have the same amount of income from rice production. The higher expense is incurred due to the more application of fertilizer and pesticides accompanied by more frequent irrigations. They need more frequent irrigation for the desalinization. For this matter they have to pay higher irrigation fee. They also paid more expense for hired labor.

12. Crop yields in reclaimed land depend highly on salinity of soil and the degree of saline resistance differ by crops. The paddy rice is most suitable crop to plant on reclaimed soil because it promote desalinization. According to a study, it takes about ten years to reduce soil salinity to the level of 0.3%, which is the highest limit for the normal rice production, when the salinity was 2% at the time of the completion of the reclamation. However it was found that it takes about 15 years after the first cultivation of crops to reach normal productivity.

13. When we assume the composition of farm income as 80% from rice production, 10% from other agricultural products and 10% of off-farm income, for per capita farm income to be equal to 70% of predicted per capita GNP in 1991, the required acreages of paddy are estimated as 7 hectares.

Appendix Table 1. Inventory of Farm Implements by Region and Farm Size, 1979

Unit % = % of holding farms
to total farms

Value, in thousand won

Region, Size	Items		Power Tiller				Duster and Sprayer		Water Pump		Power Thresher		Straw Rape Machine		Other*	Total Value
	%	Value	Manual		Power		%	Value	%	Value	%	Value	%	Value		
			%	Value	%	Value										
Nam Yang																
Less than 1.5 ha	14	112	29	5	14	17		-		-	14	7	9	151		
1.5 ha to 2.5 ha	40	211	30	6	30	39	50	12		-	10	5	6	281		
2.5 ha and more	82	563	6	1	82	145	12	7	24	46	6	1	163	927		
Average	59	367	18	4	53	88	9	7	12	23	9	3	85	577		
Aa Saan																
Less than 1.5 ha	20	150	30	2	30	24	30	40	10	10	20	8	14	248		
1.5 ha to 2.5 ha	50	381	13	1	75	77		-		-		-	23	482		
2.5 ha and more	50	367	50	3	100	90	17	25	17	17	33	10	13	525		
Average	38	281	29	2	63	58	17	23	8	8	17	6	18	395		
Dai Chun																
Less than 1.5 ha	8	67	92	13	8	7	33	11	8	13	66	20	63	193		
1.5 ha to 2.5 ha	57	321	100	12	57	84	43	18	57	70	29	9	261	775		
2.5 ha and more	100	950	50	8	100	110	100	40	50	50		-	11	1,168		
Average	33	236	90	12	29	42	43	15	29	35	48	14	124	480		
Dong Chin																
Less than 1.5 ha	20	128	30	4	30	37		-	10	17		-	2	187		
1.5 ha to 2.5 ha	13	95	13	1	38	42	25	6		-		-	33	176		
2.5 ha and more	100	687		-	75	178	50	20	75	138	25	15	40	1,077		
Average	32	217	18	2	41	64	18	6	18	12	5	3	41	345		
Total Average	42	287	36	5	48	66	20	12	16	24	5	7	48	449		

* Others includes manual threshers, motors, 4 rice transplanters, 1 polishing machine, 2 harvesting machines.

Appendix Table 2. Off-Farm Income per Farm.

in thousand won							
Region, Size	Items	Wage & Salary	Donation & Subsidy	Rent & In- terest	Machinery Rental Receipts	Other Include Other Busi- ness	Total
Nam Yang							
Less than 1.5 ha	96	340	-	-	103	539	
1.5 ha to 2.5 ha	71	-	-	-	-	71	
2.5 ha and more	-	224	-	12	39	274	
Average	41	182	-	9	41	269	
Aa Saan							
Less than 1.5 ha	150	110	30	95	-	385	
1.5 ha to 2.5 ha	-	-	-	-	6	6	
2.5 ha and more	-	200	219	-	-	419	
Average	62	96	67	40	2	267	
Dai Chun							
Less than 1.5 ha	-	-	-	-	353	353	
1.5 ha to 2.5 ha	-	-	-	14	263	277	
2.5 ha and more	-	-	-	-	-	-	
Average	-	-	-	5	290	294	
Dong Chin							
Less than 1.5 ha	62	-	-	10	5	77	
1.5 ha to 2.5 ha	25	-	3	20	-	49	
2.5 ha and more	-	88	266	193	-	457	
Average	37	16	50	47	2	152	
Total Average	37	87	27	23	75	248	

Appendix Table 3. Farming Expenses by Region and Size

in thousand won

Region, Size	Ferti- lizer	Pesti- cides	Feed	Seed	Mate- rials	Rental Fee for Machine	Agricul- tural Fuel	Veteri- nary	Deprecia- tion & Repair	Rent	Wage Paid	Tax & Charges	Total
<u>Nam Yang</u>													
Less than 1.5 ha	119	78	-	143	11	51	7	-	7	36	361	65	879
1.5 ha to 2.5 ha	146	111	35	185	25	86	15	-	30	-	439	184	1,256
2.5 ha and more	320	207	19	367	64	52	74	-	63	196	785	283	2,430
Average	227	152	20	267	42	62	43	-	42	105	596	209	1,766
<u>Aa Saan</u>													
Less than 1.5 ha	54	31	13	15	11	65	16	-	47	-	42	84	379
1.5 ha to 2.5 ha	144	97	23	33	32	101	12	2	14	366	193	216	1,233
2.5 ha and more	207	155	43	41	39	99	17	3	32	143	378	342	1,499
Average	122	84	24	28	25	86	15	1	32	158	176	193	944
<u>Dai Chun</u>													
Less than 1.5 ha	141	141	19	16	19	28	16	-	1	348	374	74	1,177
1.5 ha to 2.5 ha	218	188	29	7	47	56	19	3	9	287	511	165	1,538
2.5 ha and more	315	245	75	5	45	10	40	3	20	-	345	270	1,373
Average	183	167	28	12	31	35	19	1	5	295	417	123	1,316
<u>Dong Chin</u>													
Less than 1.5 ha	121	92	4	38	47	86	13	-	11	30	264	86	794
1.5 ha to 2.5 ha	391	144	6	47	68	117	24	1	9	249	428	133	1,617
2.5 ha and more	274	214	2	90	148	119	83	-	66	256	703	262	2,218
Average	247	133	4	51	73	103	30	-	20	151	403	135	1,352
Total Average	197	135	19	110	42	71	28	1	27	167	417	171	1,387