

PEMIKIRAN BARU

IRRIGATED AGRICULTURE IN INDONESIA BEYOND 2000¹⁾

by

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Ringkasan

Status ketersediaan air irigasi yang makin terbatas, kebijakan swa-sembada pangan (beras), dan keadaan cadangan pangan di dunia dalam dekade terakhir ini telah mewarnai pemikiran dalam menentukan status lahan beririgasi di masa datang.

Suatu tinjauan pemikiran telah dilakukan untuk menentukan status lahan irigasi di Indonesia sampai dengan tahun 2000-an dengan mengadakan analisis status teknis, manajemen irigasi, agro-ekonomis, sosio-kultural, dan lingkungan. Atas dasar analisis yang dilakukan, perspektif lahan beririgasi di masa datang dapat dinyatakan dengan menyatakan sebagai lima pokok isu. Kelima pokok isu tersebut adalah, kebijakan pilihan pengembangan sektor pertanian, status pulau Jawa sebagai pusat produksi padi, partisipasi sektor swasta/masyarakat dalam manajemen dan pengembangan sistem irigasi, penerimaan konsep satuan pengembangan wilayah sungai, dan pilihan teknologi irigasi di masa datang.

Pemikiran ini dimaksudkan sebagai salah satu bahan masukan untuk menyusun kebijakan pengembangan irigasi dalam Pembangunan Jangka Panjang Tahap II (PJPT-II).

Introduction

Since the emergence of the New Order as the ruling government in Indonesia irrigation development has been one of the major development priorities of the country. For

more than 20 years, during the First Long Term Development Plan (LTDP-1), from 1968/69 — 1992/93, massive funds was invested to rehabilitate and to construct new irrigation schemes (Table 1) The success of the New Order government to develop irrigation is well recognized as one of the main contributors in attaining prestigious agricultural development, as it is marked by selfsufficiency on food (rice) in 1984 which had never been achieved before.

Despite the gained benefits, rapid physical development policy of irrigation scheme created many problems dealing with sharing responsibility in operation and maintenance with farmers. As results many irrigation structures last in very short time, the financial burden of government for O&M become heavier, and inefficient water utilization. These problems have to be overcome in the earliest stage of LTDP-2, starting in 1993/94.

The paper contains an overview of irrigation development during LTDP-1, and the perspective development for the coming LTDP-2 by considering all experiences gained during the past and the estimated of future condition according to the given scenario.

Present Status of Irrigation System In Indonesia

Technical Status

The policy of irrigation development dur-

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ing LTDP-1 was tightly attached to the commitment of government to achieve self-sufficiency on food (rice). Within the framework of the policy, the objectives of irrigation development were: (1) to fulfill irrigation water demand for intensive lowland rice cultivation, and (2) to expand irrigated areas of lowland rice rapidly. In line with the objectives, irrigation development program during LTDP-1 was focussed on physical works (to improve service capability of the existing irrigation structures and to built new irrigation structures).

The existing irrigation scheme in Indonesia roughly covers 4.5 million ha command areas, comprises of 3.8 million ha government managed irrigation system and 1.1 million ha of farmers managed irrigation system. In the areas where gravity irrigation technically was not feasible, for the sake of poverty allevation, government developed pump irrigation systems. By 1990, 592 medium and deep well-pump irrigation units have been developed with command areas of 30,140 ha (DWRD, 1990). The existing schemes mostly reflect the result of irrigation development during LTDP-1.

To date the technical status of irrigation schemes are attributed by:

- (1) the irrigated areas are concentrated in Java (2,535,000 ha or 57.8% from the total irrigated areas), comprises of 31.5% technical irrigation, 10.5% semi technical irrigation, and 15.7% simple irrigation (farmers' managed irrigation) (Haerah, 1991);
- (2) water demand of 10 river basins in Java and 3 river basins in Madura, Bali, and Lombok have already/exceeded the potential supply (DPP-DGWRD, 1981);
- (3) ineffective utilized of the irrigated ricefield as indicated by low cropping intensity, it ranges from 64% (in Kalimantan) to 224% (in East Java) (Pusposutardjo and Sunarno, 1990);

- (4) the establishment process of newly developed irrigation schemes are very slow because farmers are not capable to develop ricefield by their own effort due to financial, and land properties right constraints;
- (5) the total irrigated ricefield in Java now is steadily decreasing, converted into industrial areas and living areas;

All of these technical attributes have to be considered as the anticipated problems in LTDP-2.

Irrigation Management Status

Extensive irrigation development program in Indonesia have been undertaken for more than 25 years. However sharing responsibility on operation and maintenance (O&M) between farmers as beneficiaries and the government have not been established yet. Many factors are influencing to the prevailing situation. Among the suspected factors are:

- (1) the policy of irrigation development during LTDP-1 limits the opportunity of farmers to participate in the implementation of program;
- (2) at the early phase of irrigation development was conducted (from 1967/1968 to 1982) officially there is no rules and regulations which compel farmers to share the responsibility on O&M of irrigation scheme;
- (3) the timeframed program on physical works lead the government to take over the construction works of the whole system, from main system to tertiary development.

Without any contribution from the farmers, the government will be overburden for carrying out the O&M. For example, at present the real O&M cost at 1991 prices (based on Needs- Based Budgets) are an average Rp 35,000 to Rp 55,000 per hectare, and more at complicated sites. From

those required amounts, the government only capable to provide Rp 10,000 to Rp 25,000 per hectare (1US \$ = Rp1.950,00 in mid of 1991), or approximately 50% from the real requirement (Soenarno, 1991; Gerards, 1992). Result from this condition is obvious:

- (1) irrigation facilities are broken very soon due to improperly operated and maintained;
- (2) service performance of the system is poor;
- (3) farmers are not satisfied with the management of the system and try to stay away from their responsibility on O&M.

Aware to the existing unfavourable situation, starting in the fourth of Five Years Development Plan (FYDP-4), 1988/89 the government changed the policy of irrigation development from focussing on the physical works into improving the O&M, included the institutional of irrigation management as a whole. The step of improvement covers: (1) strengthening and improving the organization of DWRD which attached to O&M, (2) clarifying the right, authority, and responsibility of the agencies involved in the implementation of O&M, (3) enforcing rules and regulations on sharing responsibility of O&M between government and farmers (included the funding of O&M by issuing irrigation service fee), and (4) strengthening the function of irrigation committee in monitoring and evaluation of irrigation management performance.

Recently, government turned over the management responsibility of small scale irrigation scheme (less than 500 ha, 15.2% of the total irrigated areas) to the farmers (water users association- WUA). By turning over the small scale irrigation scheme to the WUA, the private-sector control, authority and responsibility, resource mobilization and profit-sharing in the management of irrigation will substantially changed (Vermillion, 1991). The

government is expecting that the focuss of program activity on O&M can minimized the required fund for rehabilitation, while the service capability of irrigation system is being kept sustainable.

Agro-Economic Status

The effect of irrigation development on the performance of agricultural development was remarkable. Under the condition of more reliable and sufficient water supply provided from the improved irrigation scheme can stimulate farmers to adopt new cultural technology of farming. As results the total harvested areas of rice (especially the area of intensification program), secondary crops of the complement of irrigated rice (paddy, soybean, and groundnut), as well as their yield/unit areas are steadily increasing (Table1).

From agro-economic stand point, the status of existing irrigation scheme can be described as follows:

- (1) investment cost per unit area of irrigated land (both for construction new scheme or for rehabilitating the old scheme) are steadily increasing unproportional to the revenue of food crop farming (Pasan-daran, 1991);
- (2) degradation of the catchment area of water source causes high fluctuation of flow discharge which very often create serious either water shortage or water excess problems on crops;
- (3) the financial and social status of rice as a staple food in subsistence farming dictate farmers to grow rice with high water consumed at the most possible opportunity;
- (4) although the revenue from secondary crops in irrigated ricefield during the last 7 years was increasing relative to the revenue of rice, insufficient drainage facilities of the irrigated ricefield hampered the flexibility of farmers to

Table 1. Irrigation development, harvested areas, yield, and total cost for development durring Pelita I — IV

No.	Name of Project	Total Areas in 1 000 ha per Pelita				
		I	II	III	IV	Total
1.	Irrigation improvement	836	528	935	117	1,876
2.	Irrigation extension	191	326	437	138	1,092
3.	River betterment and protection	289	435	578	116	1,418
4.	Swamp/tidal areas development	119	179	455	114	867
5.	Tertiary development	—	—	1,688	—	1,688
		1968 *	1973	1973	1983	1988
6.	Total irrigated area in 1 000 ha	3,388	3,546	4,018	4,238	4,423
7.	Harvested areas, in 1 000 ha	1968 *	1973	1983	1988	
a.	Rice:					
	— intensification	1,597	3,988	4,848	6,695	8,283
	— non intensification	6,423	4,415	4,081	2,467	1,855
	— total	8,020	8,403	8,929	9,162	10,138
b.	Maize	3,220	3,433	3,025	3,002	3,406
c.	Cassava	1,503	1,429	1,383	1,221	1,303
d.	Sweet potatoes	404	379	301	280	248
e.	Groundnut	395	416	506	481	688
f.	Soybean	677	743	733	640	1,177
8.	Production (ton/ha)	1968 *	1973	1978	1983	1988
a.	Rice (**):					
	— intensification	2.21	3.26	3.47	4.43	4.54
	— non intensification	2.12	1.92	2.21	1.55	2.19
	— average	2.13	2.56	2.89	3.85	4.11
b.	Maize	0.98	1.08	1.33	1.69	1.95
c.	Cassava	7.56	7.80	9.30	9.90	11.87
d.	Sweet potatoes	5.85	6.30	6.90	7.90	8.71
e.	Groundnut	0.73	0.70	0.88	0.96	0.97
f.	Soybean	0.62	0.72	0.84	0.84	1.08
Pelita						
		I	II	III	IV	Total
9.	Cost (Rp. milyar)	114	564	1,908	513	3,099
10.	Average cost/ha (Rp. ribu)	79	384	537	1,057	
11.	Total areas (000 ha)	1,435	1,468	3,553	485	6,941

Source: Appendix of President speech in the Parliament on 16 Agustus 1990, and DGWRD, Jakarta (Asnawi, 119).

Note : *) At the beginning of Pelita I. **) Dried store-grain.

adopt profitable farming.

Considering: (1) agro-economic status of the irrigated land, (2) resource availability for developing irrigation scheme, (3) scarcity of water due to increases number of different kind of users and their respective requirements, reconciliation of the strategy of agricultural development with irrigation development program is a necessity. The reconciliation process was begun in fourth Five Years Development Program (FYDP-4) by policy statement of Ministry of Agriculture on 4 basic strategies of agricultural development. These basic strategies comprise of (Wardojo, 1989):

- (1) to sustain and to improve the food self-sufficiency;
- (2) to increase agricultural production in order to provide raw materials for industry and export;
- (3) to increase farm productivity and value added of agricultural products; and
- (4) to increase farmers income as well as their welfare.

The implementation of those 4 basic strategies are expected to decrease the pressure on O&M of irrigation system during dry season when water shortage is commonly occurred.

Socio-Cultural Aspect

Despite of all the success of the country irrigation development, the government of Indonesia is currently facing a second generation problem in irrigation development. This problem can be best formulated in the following question, namely, how can the government motivate the farmers who have been benefitted by the irrigation development to participate *in sustaining* the irrigation infrastructures that have been built by the government?.

There are several reasons why the problem emerges. First, culturally the villages

where irrigated areas are concentrated have been experiencing quite a drastic change. In the command areas of farmer manage irrigation system (FMIS) of Java for example, the traditional institution and its traditional law which had been used to managed the irrigation scheme had been abolished by the colonial government to meet the needs of the sugar industry, an industry which then became the backbone of the Dutch economic development.

The Dutch government decision to abolish the old institution and traditional law on FMIS had also abolished the general agricultural management capacity of the Javanese peasants, including their capacity to manage the village irrigation system autonomously (Angoedi, 1984). The Dutch colonial government functioned as the landlord making all the necessary decisions related to agricultural activities to allow the sugar industry access to the village agricultural resources, viz, land, water and labor. The *Subak* system in Bali remained intact as the physical natural resources of the island was not suitable for sugar cultivation. However, the subak system in this island has been experiencing changes as a result the Indonesian government intervention in connection with the government efforts to increase the efficiency of the island irrigation system. Furthermore, the country development process itself in the last two decades had further weakened the peasants agricultural management capacity. New regulation concerning the structure of village government introduced by the New Order government which practically made the village head the single development agent in the village has made him also the single decision maker in the village. As a result of all those changes a strong dependent mentality toward government initiative emerged within the community. Peasant for example do not want to repair broken irrigation canals unless ordered to do so by the government officials as they believe that irrigation

maintenance is and has been the responsibility of the government.

Irrigated areas all over Southeast Asia including Indonesia are always characterized by skewed land distribution which manifested in the high degree of share cropping incidents. As share croppers realize that they could not fully benefit from the increase in the agricultural yields they are also reluctant to invest their time and labor to maintain the irrigation facilities within the village. The condition is further worsened as absentee landlordism is currently emerging in the irrigated areas, who are detaching themselves from village customs and regulations. Moreover, the green revolution caused social change of Javanese farmers in form of land acquisition among farmers, without changing landholding status in order to attain the economics scale of food crops farming (Tjondronegoro, 1990).

Skewed landownership has generated inequality of income between landowning and landless peasants which resulted in the village community being divided in terms of who is to be responsible for maintaining irrigation facilities in village. The land owning peasants particularly those who sharecrop their land, consider that it is the responsibility of their tenants to maintain irrigation facilities. While the tenants think that it is the mutual responsibility of both tenant/sharecroppers and the land owners to maintain irrigation facilities in the village.

Peasant communities in the irrigated areas in Indonesia usually are the most monetized communities. Monetization has created pressure upon peasants to earn more cash through working in non-farm jobs in the village or outside the village. Consequently peasants have less time to do communal works for the village. Traditionally village irrigation (FMIS) maintenance was done through communal works. Peasants'

reluctance to conduct voluntarily communal works affects negatively the village activities in maintaining irrigation facilities at the village level.

The government of Indonesia has established water users association as a venue for landowning peasants to participate in the operation and maintenance (O&M) of tertiary system of government managed irrigation and the village irrigation (FMIS) facilities. Despite the good intention of the government, the organization so far has not achieved the objective set up by the government.

The Environment Aspect of Irrigated Area

Like the socio-cultural aspect of the irrigated areas, which have been experiencing changes so does the environment of the irrigated areas in Indonesia.

In the last two decades of the history of development process in Indonesia, the environment of the irrigated areas have been experiencing major changes which might in the future affect irrigation development. The first change in the environment concerns with the steady decline in the area of land used for farming. Most of the loss has taken place in Java where expansion in housing and factories in the vicinity of large cities has been more rapid than in other island. The Department of Agriculture had estimated that some 55,000 ha of agricultural land (mostly are irrigated ricefields) is lost to other forms of land use every year. While the Department of Public Works had estimated that 0.3 million hectares out of 1.2 million hectares of ricefields for which irrigation was provided between 1969 and 1985 is no longer being used for farming (Hardjono, 1991). The highly productive coastal plain of Northern Java, for example, from the industrial complex of Cilegon in the West Java to the

manufacturing zone around Surabaya in the East Java, is being rapidly transformed by the process of development. The construction of a toll road from Jakarta to Cikampek in West Java said by Joan Hardjono further had meant the loss of thousands of hectares of ricefields in which considerable investment was made during the early 1970's, when an irrigation network was constructed to carry water from Jatiluhur dam.

Although the changes in the function of agricultural land appear at first glance not to have a direct impact towards the environment, there are serious hydrological consequences (Hardjono, 1991). One serious hydrological consequences has been the increased frequency of wet season floods, particularly in the urban areas such as Jakarta and Semarang in Central Java. As land becomes increasingly built up, most of the rain that fall flow straight into the urban areas that are almost completely empty in dry season. This condition will stimulate to the occurrence of saltwater intrusion along the coastal plain areas.

Another factor that contributes to the deterioration of environment in the irrigated areas in Indonesia is the country population growth. The direct consequences of population growth could be seen in the high rate of land degradation located in Java and the outer island watersheds. Most of the cause is *deforestation*. The annual deforestation rates in Indonesia is estimated running between 600,000 and 1,200,000 ha (Potter, 1919). Aside from population pressure most of this deforestation is the result also of other factors such as logging activities conducted by logging companies which receives concession from the government. The result is extensive soil erosion which may affect the future sustainability of the irrigation system in Indonesia. In South Sulawesi, erosion of the Bila and Walanae valleys, has reduced the capacity of Lake Tempe to provide irrigation water in the dry season, sedimentation in making the lake increasingly shallow with the

result that flood inundates the agricultural settlements near the river during the wet season. Increasing sedimentation also shortened the life expectancy of several dams in Java which the government has invested much money to build them.

Rapid industrialization that is taking place in Indonesia has changed the function of rivers in the country from sources of municipal water and irrigation water into a waste dump of the industrial waste. Some major rivers in Java have been heavily polluted by industrial waste so that the water becomes unsafe for human use as well as for irrigation water (Mahbub et al, 1990). Meanwhile, the large scale tapping of groundwater, pumped up by individual companies for industrial purposes is causing the water table falling down every year (Hardjono, 1991). In Central Bandung according to Joan Hardjono, where factories have been extracting water by tapping groundwater had resulted the drop in the water table at 25 metres between 1981 and 1986, while in the heavily industrialized region of Eastern Tangerang the water table had dropped by 0.4 metre a month. The polluted rivers and the drop in groundwater table might in the future create serious problem in the country water supply for municipal as well as for agriculture uses.

Confronted with those environment problems the government of Indonesia does not remain idle. Various programs including strict Environment Protection Law have recently been launched by the government to combat the country environment problems. However, to combat environment problem in Indonesia can not be done only through provision of environment protection legislation and commitment from the government due to the many factors which generated the problems. One important factor is unemployment. People invaded the forest because there is no other employment opportunities available for them. Industries which have

been established are mostly capital intensive industries, thus absorb only a few people while there is no yet a concerted efforts from both the public and private sectors to reindustrialize the country rural areas. In fact what is happening is the opposite. Modern industries produce products which were traditionally had been produced by small scale rural industries which than resulted in deindustrialized rural society in Indonesia. Lack of alternative job outside the agriculture sector has forced the unemployed and underemployed peasants to move to the forest areas to open new land for agriculture activities or invading the cities to find job.

Perspective of Irrigated Land Beyond 2000

In the coming April 1993, people and government of Indonesia are going to start the second phase of Long Term Development Plan (LTDP-2), for the next period of 25 years. As a continuation of LTDP-1, LTDP-2 is still focussing on economic development with the target priority is to attain a balance economic structure of the capability and the power of developed industry, supported by the capability and the power of integrity agriculture. Irrigation development during LTDP-1 was one of the principal policy options to establish the integrity agriculture which it was well recognized successful. Therefore, the national commitment on LTDP-2 is to promote the establishment of a developed industry while maintaining the achieved national capability for providing sufficient food and other basic needs.

Referring to the national commitment on LTDP-2, the prospect of irrigated land beyond 2000 will be reflected by the resultant influences of: (1) the recent status of irrigated lands at the end of LTDP-1, before entering LTDP-2, (2) the effect and the impact of transitional process from agricultural society to industrial society, (3) resource limitation, and (4) the increasing pressure for

satisfying better environment quality.

Many problems in the development of irrigation system during LTDP-1 had not been completely solved would be carried over in the coming LTDP-2. While the time proceeded these unsolved problems changed their properties and created other associated problems. Among of these problems are:

- (1) deficit water supply in several irrigation schemes due to limited data information (both in term of quality and quantity) concerning with water resources potential and demand orientation policy on irrigation development during LTDP-1;
- (2) unbalanced progress between physical development of irrigation facilities and farmers capability to utilize those provided facilities in a maximum way, as well as their willingness to share the O&M duties; and
- (3) disagreement among different sectors on resources allocation and utilization as resulted from unclear defined of land unit concept either in term of contained characteristics or administrative boundary, or any form of conformation between the two concepts, at national as well as regional level.

The option policy of industrialization as the basis of the future economic development will transform the agricultural society into industrial society. Dissanayake (1990) noticed that this society transformation changes various aspects of community life. For example the transformation agricultural society into industrial society changes: (1) product orientation from food into good, (2) production factor from land into capital, (3) actors from farmers/artisan into factory workers, (4) guiding factor of the economic activity from tradition into economic growth, and (5) the preferred rule in the community life from hierarchical/authoritarian into representative democracy. Attached to these society changes, evidently will change the present

status of irrigated lands and the corresponding irrigation system.

Considering: (1) resources limitation, (2) the need of having better quality environment, (3) the attached problems of the existing irrigation system, and (4) the affect and the impact of society transformation from agricultural into industrial society, the prospect of irrigated land in Indonesia beyond 2000 can be formulated into the following issues: (1) policy option on agricultural sector development, (2) the status of Java island as rice production center, (3) the private participation in the management and the development of irrigation system, (4) the adoption of river basin concept as a land unit in regional development planning, (5) policy option in maintaining the functional status of the existing irrigation facilities.

The Policy Option on Agricultural Sector Development

The Directorate General of Food Crop (DGFC), Department of Agriculture estimated the required irrigated agricultural land in 2018 enable to maintain food (rice) self-sufficiency would be in range of 6,073 — 7,852 thousand ha. To attain this required areas 1,685 — 3,464 thousand ha of new irrigated land (ricefields) have to be developed. Beside expanding the irrigated land, the cropping intensity index of the existing irrigated land have to be increased by 23%, from 152% to 175% (Haerah, 1991). The estimated additional water requirement corresponds to the increases irrigated and cropping intensity would be 28,308 — 58,195 million cu.m per year.

Although the estimation of the required irrigated land on 2018 by DGFC is quite realistic, the objective of the policy seems very difficult to be accomplished due to lands and water constraints. Most of the remaining lands (60,3%) are considered conditionally suitable for irrigated ricefield (marginal lands)

or located in the drier areas of Eastern Indonesia.

The Status of Java Island as Rice Production Center

At the end of LTDP-1 Java as the rice production center shares 68.4% of national rice production. Issue dealing with the status of Java island as rice production center emerges after considering that this island would be a center of industry in the LTDP-2. While agriculture sector and industry sectors require same resources of land and water, conflict on natural resources utilization may not be avoided. The conflict is underway as indicated by high conversion rate of ricefields into settlement areas, urban expansion, industrial areas, and other non-agricultural uses (Jezeph, 1992). Aside of reducing ricefield areas, rapid development of urban areas which is attached to industry development will change the existing farming system from rice-based cropping into peri-urban farming (Higgins et al., 1988). Therefore the rate of decreasing harvested area of rice in Java is more rapid than the decreasing ricefield areas due to conversion.

In term of water balance, the DGWRD predicted that the ratio of demand to supply in Java and Madura by the year 2000 will reach to 121%. Within this value of demand to supply ratio, it is impossible to keep the irrigated areas of ricefield sustained.

Private Participation in the Management and Development of Irrigation System

Since 1987/1988 (the fifth Five Years Development Plan Pelita V), the Government of Indonesia's (GOI) policy in water resources development is to develop water resources in a planned and coordinated manner, taking into account the projected requirements and interdependencies of all the sectors of economic and social development

which depend on enhanced availability of water of suitable quality to meet their respective goals. Within this broad framework of policy, the GOI:

- (1) facilitates private sector and community participation in water resources development and, to this end, to strengthen the Government's capacity to identify opportunities for, to regulate and to support, private and community initiatives;
- (2) institutes and gradually enforces the transfer of responsibility for O&M of water development infrastructure to the beneficiaries, based on contributions from them, and
- (3) balances the distribution of resources for the development of physical water resources infrastructure, its operation and maintenance (O&M) and improved administration of services to the public.

To facilitate the implementation of this policy the government decreed several Government Regulations: No. 22/1982 (dealing with Water Resources Development), No. 23/1982 (dealing with Irrigation), No. 20/1990 (dealing with Water Pollution Control), No. 27/1991 (dealing with Swamp) and, No. 35/1991 (dealing with Rivers). All of these government regulations mention clearly the right and the responsibility of farmers, Water User Association (WUA), or private enterprise in sharing the management and the development of water resources as a whole, included irrigation system.

One of the policy implementation is turning over the O&M responsibility from government to beneficiaries (farmers group - Water User Association/WUA) in accordance to the Government Regulation No. 23/1982. Considering the present capability of WUA in O&M, the management transfer holds for the irrigation scheme equal or less than 500 hectares. The policy for transferring O&M responsibility will be expanded to larger areas. Another example of privatization of

water resources development is the establishment of two semi-government enterprises with the assigned authority to manage river-basin.

The Adoption of River Basin Concept as a Land Unit in Regional Development Planning

The concept of river basin as a land unit will be adopted in the future regional development planning. Reasons for adopting this concept are:

- (1) to encourage and to secure multi-purpose and integrated water resources development, based on formulized planning and with due regard for water balances and water quality requirements in the country's river basins, and in close coordination with land use plans and policies;
- (2) to maintain a clear separation of approaches between water resources development and user-sector development, and to ensure that user-sector development is consistent with water resources development.

Among of the total 90 river basins, 6 river basins in Sumatra, 12 river basins in Java, 1 river basin in Madura, Bali, Lombok, and Sumbawa, 3 river basins in Sulawesi have already had negative water balance. These river basins which have negative water balance correspond to the existing irrigated areas. By studying water balance in each river basin it can be located the possible areas for ricefield expansion.

Policy Option to Maintain Functional Status of Existing Irrigation Facilities

The latest inventory study conducted by the Directorate Irrigation I of DGWRD in 1988 showed that the number of structures of Indonesian irrigation systems were enormous in quantity and diversity (Table 2) (Pusposutardjo and Djunaidi 1990). Ques-

Table 2. **Physical infrastructures of irrigation networks, 1990.**

No.	Items	Quantity	Unit
1.	Number of irrigation schemes	6,731	units
2.	Total command areas	4,819,470	ha
3.	Water resources: rivers, reservoirs, springs, and others	14,859	units
4.	Intake structures: pumps, moving weirs, fixed weirs, free intakes, etc.	21,874	units
5.	Structures in the delivery canals: sand traps, flushing gate, diversion, structures, syphons, chutes, drop structures, etc.	157,196	units
6.	Structures in drainage canals: bridges culverts, spillways, etc.	10,968	units
7.	Structures in the side canals: bridges culverts, spillways, etc.	668	km
8.	Secondary canals	62,823,680	km
9.	Drainage canals	19,582,112	km
10.	Supply canals	988,913	km
11.	Side canals	623,286	km
12.	Road inspections	10,353,948	km
13.	Coverdikes	2,540,994	km

Source: DGWRD, 1990.

tions are addressed to the existing irrigation networks with respect to their functional capability to meet the service requirement of various kind of cropping practices, under the pressure of water scarcity. Enable to anticipate the condition such a new technology on water allocation, water distribution, and water application has to be developed which fit to small scale farming. Otherwise the physical investment on irrigation during the LTDP-1 will be useless.

The basic principle of new irrigation technology can be derived from the two distinct differences of the Indonesian agroclimatic condition. The first irrigation technology is provided for the western parts of the country where rainfall are abundant. In this case the technology is merely focussing on water conservation practice to maximize the utilization of rainfalls. The second technology would be developed to anticipate water shortage problem in the dry regions of the country, especially in the eastern part. The new technology of irrigation would at-

tributed by minimum water application to attain maximum water yield, and the technology of rainfall catchment system for multipurpose uses.

Closing

The future prospect of irrigated lands (ricefields) in Indonesia will be determined by the government's policy on food self-sufficiency. For national security and national economic stability reasons the attained condition of self-sufficiency on food, with a certain value of either negative or positive balance between supply and demand will be maintained for at least until the first decade of year 2000. Enable to achieve self-sufficiency on food, 2 — 3 millions hectares of new ricefields have to be developed. Beside expanding the existing irrigated ricefield, massive investment is also needed to increase the cropping intensity from 152% to 175%. This massive investment is required to:

- (1) improve the physical infrastructures of the existing irrigation to be more compatible for crop diversification farming;
- (2) improve O&M of the irrigation system by strengthening the institution of WUA and to enforce on sharing responsibility on O&M according to their right in utilizing water;
- (3) increase the assurance in providing water by developing conjunctive irrigation pumping system in gravity irrigation scheme.

The higher increasing cropping intensity can be achieved the lesser new irrigated ricefield required.

Due to rapid industrial development in Java, its status as the center of national rice production can not be maintained longer. The remaining irrigated system in Java have to be modified in such away so that they can facilitate the requirement of peri-urban farming mixed together with rice-based cropping system farming. Strong pressure of efficient water utilization dictates areas composition of those two farming systems.

In the coming LTDP-2 the right and responsibility of farmers, WUA, and other private organizations on the management and development of irrigation system as well as on the development of water resources system, have been legally defined. This means that more opportunity will be offered to private and community to participate in management and development of irrigation system with sharing benefit correspond to their contribution.

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