ISSN: 0976-3376

Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 07, Issue, 08, pp.3281-3304, August, 2016

RESEARCH ARTICLE

FINANCING IRRIGATION DEVELOPMENT IN CAMBODIA: EMERGING OPTIONS

***Raju, K. V.**

ICRISAT Development Center, International Crop Research Institute for the Semi-Arid Tropics, Patancheru, Telangana, India

ARTICLE INFO

Article History:
Received 14th May, 2016
Received in revised form
26th June, 2016
Accepted 19th July, 2016
Published online 12th August, 2016

Key words:
Cambodia, Financing, Irrigation,
Water user Organisations,
Sustainability, Governance reforms,
Project design.

ABSTRACT

This paper focuses on current status of financing irrigation development in Cambodia, water users organizations across its provinces and their field situation and functions. Stress is on identifying options to fund the irrigation development in Cambodia more aggressively and its long term sustainability. Also discussed are possible approaches, project design, governance reforms required in water sector, and supportive policy and legal aspects.

INTRODUCTION

SECTION-1

Status and Emerging Needs

1.1. Background

Financing irrigation development in Cambodia suffers from two distinctive problems: (a) the funding for construction of ongoing or new canal networks has been shrinking, leading to undue delay in completion of projects, in turn raising the costs and reducing the benefits; (b) the resources for normal operation and maintenance are under severe pressure. The national budget is unable to allocate more funds because of the overall fiscal crunch. This state of affairs points towards impending financial crisis in Cambodian canal irrigation. Unless urgent steps are taken to reverse this trend, irrigation is likely to be heading for a situation of near collapse or it would remain much below its potential.Resource constraints are not unique to Cambodia. Both irrigation and domestic water supply projects worldwide face situations of serious under-funding, particularly from conventional development assistance and government expenditures. The World Water Commission (2000) made a strong plea for public–private partnerships and tapping international capital markets for financing water sector development and for creating more efficient management system. Much of the emphasis in these discussions has been on international financial markets, particularly the role of multinational corporations in financing water-related infrastructure.

1.2. Irrigated Agriculture in Cambodia

The total irrigated area in Cambodia is nearly 473,000 ha (in 1997); it is 16% of the total cultivated area (2.7 million ha). The potential cultivable area is estimated to be 3.7 million ha. There is about 950 irrigation schemes in the country, most of which were developed by the government.

****Corresponding author: Raju, K. V.***
ICRISAT Development Center, International Crop Research Institute for the Semi-Arid Tropics, Patancheru, Telangana, India.

An inventory conducted in 1997 found that only about 20% of them are 'fully operational' and 14% were not functional at all. There is a huge potential to improve the infrastructure and management of existing irrigation schemes and, unlike other countries in Southeast Asia, there is much potential to expand the irrigated area. In Cambodia's irrigation systems, normally one crop is grown per year. Well-drained areas cultivate during the rainy season. Lowland areas normally cultivate only during the dry season, due to flooding during rainy season (June-December). Irrigation is normally used to supplement rainfall. Only about 12% of the total area is cultivated during dry season (January-April). There is a widespread potential to increase the area served by supplemental irrigation. The irrigated area (16% of the cultivated area) produces more than half of total agricultural production. Average rice yields in Cambodia are only 2 tons/ha. Maize yields are about 1.6 tons/ha and soybean yields are about 1 ton/ha. However, in special project areas where water control and agricultural practices are enhanced, rice yields have risen to 3-3.5 tons/ha (such as in PRASAC project areas). Cambodia's relatively low levels of agricultural productivity are mainly due to lack of good water control, highly variable rainfall, poor soil fertility and low levels of fertilizer use. Annual rainfall varies from 975 to 2068 mm, but large part of the country gets around 1000 mm; across the 17 river basins, 15 of them get 1000-1300 mm, one river basin receives 1644 mm and another is bestowed with 2068 mm rainfall. Cambodia has 42 river sub-basins with a total area of 181,086 sq km (range 365-17835 sq km).

Groundwater use

Availability of groundwater across Cambodia is uneven. Availability at lower depth is better in South region (at 50 meter depth) and Northeast region (around 70 meter). Both respectively fall in unconfined and confined aquifers. Groundwater recharge levels are not readily available[1]. However, the country has some 60,000 wells, mainly used for domestic water supplies, and specifically in urban areas of all provinces. At provincial level, the government is encouraged to use groundwater, owing to better water quality standards, compare to river water (owing to high level of sand content and iron levels).

For agricultural use, groundwater is used in southern and eastern Cambodia, but not used in the northeast. Also, it appears, there is no accurate data about the irrigation wells in the country. However, some reports indicate in the total irrigated area in the country, groundwater share is 68%.

Rainfall and water resources availability in Cambodia

Year	Rainfall (mm)	Total water resources (10x8 m3)	Groundwater recharge (10x8 m3)	Recharge rate %
2001	1605.6	2894	639	22.1%
2002	1321.6	2382	452	19.0%
2003	1488.3	2683	400	14.9%
2004	1417.0	2554	447	17.5%
Average	1458.1	2628	485	18.4%

Though groundwater is available at 7-15 meter depths in canal irrigated command areas, farmers are less aware of groundwater use, and required groundwater extraction units – pumps, pipelines and either diesel or power operated low horse power pumps. Countries with similar situations and delta areas like Bangladesh, Southern Pakistan, Gangetic plains in Eastern India, has been enormously using and benefiting from groundwater use. Farmer's income levels can double up by using groundwater in dry season. Presently, large tracts of lands within canal command areas are uncultivated in dry seasons. Since most of these lands are at the down stream of small-scale reservoirs, groundwater recharge levels are high, and farmers can utilize the available and regularly recharged groundwater. Groundwater at lower depths (50-70 meter) is available largely in South and northeastern parts of Cambodia. Annual recharge estimates are not readily available with the groundwater department. Though, the department likes to estimate recharge levels at regular intervals (both pre and post-monsoon periods), they are unable to do so owing to lack of adequate funds and manpower support. The groundwater department is yet to establish observation wells. At present, at least one hand pump (depth 4-10 meters) per village (in some cases more than two) has been established mainly for drinking water purposes across the country. Large number of bulk consumers (like industries, hotels and multi-storey buildings) have been extracting groundwater from deeper depths (>100 meters). Even most of the small town water supplies for domestic use are based on groundwater pumping. Large parts of south and eastern part of the country is flooded with filter wells owing to sandy loamy soils.

1.3. Financing water sector

Cambodian water Sector gets financial support from two sources: One, from its national budgetary allocations on annual basis, and another from the external assistance –both bilateral and multi-lateral agencies.In terms external assistance, irrigated agriculture (mainly irrigation system rehabilitation) has got US$ 176 million over the last 26 years (1980-2006). This assistance in the form of both loans and grants was meant for capital investments. The grants for technical assistance during 1993-2006, were up to US$ 24 million[2]. All projects/ programs related to capital investments and technical assistance were implemented under the former Directorate General of Irrigation, Meteorology and Hydrology (Ministry of Agriculture, Forestry and Fisheries) before it was upgraded to the Ministry of Water Resources and Meteorology (MOWRAM) in 1999 are currently implemented under the current MOWRAM. Similarly, all technical assistance grants and the loans were directed by the Directorate General of Irrigation, Meteorology and Hydrology are currently directed by MOWRAM. In recent years (2000-2007), various donors have jacked up

[1] We were told that the groundwater department has neither made any assessment nor has plans to do it, owing to severe financial and staff constraints.
[2] Source: ADB and MOWRAM, 2007

their share of contribution (mainly for capital expenditure) up to US$ 20 million/year, from 10 million during 1990s. Most of these funds are going for construction of new physical works; Mr. Chinn Sinath, deputy director-general of the MOWRAM, pegs the actual need at US$ 70 million/year for the next 10 years, largely for construction of potential irrigation projects. In 2007-08, the government got US$ 30 million from various donors. But it still requires another US$ 40 million/year for operation and maintenance of these systems. Current expenditure pattern indicates, of the total expenditure nearly 30% is being spent on construction of small-scale irrigation systems and another 30% on its operation and maintenance.

1.4. Budgetary Support

Cambodia has been witnessing raising expenditure for water resources development. Over the last few years, the annual expenditure in water sector has gone up to US$ 3.6 million (in the year 2008) from US$ 2.5 million (in 2005). Interestingly, these investments are only on operation and maintenance of its country wide irrigation structures; while the requirement is around 12 million US$ per year. This excludes any capital investments. The Figure-1.1 shown below (also see Table 1.1 and 1.2) indicates growing annual expenditure –including administrative, O&M cost and pumping cost (mainly for diesel). Across the items of expenditure (see Figure-1.2 and Table 1.2), operation and maintenance costs (14% of the total in the year 2008) has gone up by nearly 40% over the last 4 years (2005-08). On the other hand, pumping cost has reduced to 35% (in 2008) from a high of 51% (in 2005)[3]. But, administration costs have zoomed to nearly 52% in 2008 (from 39% in 2005) of the total expenditure; the massive jump by 11% (from 38% to 49%) in administration expenditure registered in 2007.

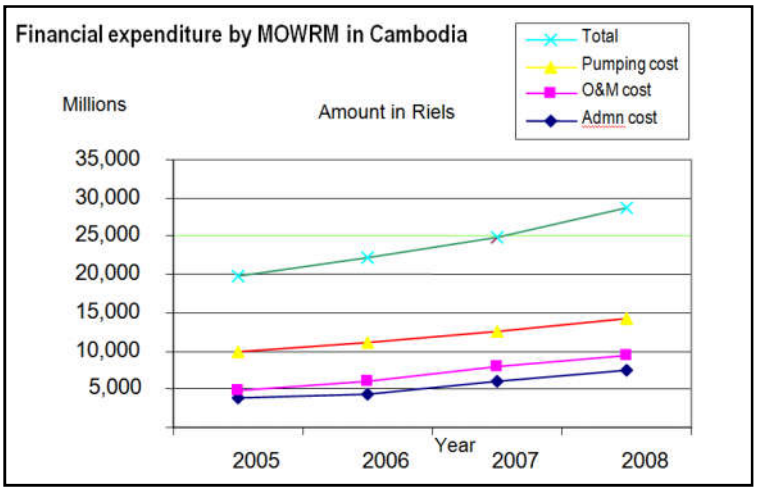


Figure 1.1. Financial Expenditure by MOWRAM in Cambodia during 2005-08 (Amount in US $)

Year1	Administration cost2	O&M cost3	**Pumping** cost4	Total(2+3+4)
2005	952,016	262,481	1,249,999	2,464,497
2006	1,059,932	469,532	1,249,985	2,779,450
2007	1,527,616	449,909	1,143,874	3,121,400
2008	1,844,175	500,000	1,237,525	3,581,700

Source: Collected from Finance section of the MOWRAM, Phnom Penh, during Jan 2008.
Note: 1 US$ = 4000 Riels
a) Administration cost includes staff
b) O&M cost includes operation and maintenance cost of all irrigation systems
c) Pumping cost includes fuels, largely of diesel used in pumping water from rivers and canals by government installed and operated pumps.

Table 1.2. Expenditure of MOWRAM over the years in Cambodia (amount in US$)

Year	Administration cost	in %	O&M	in %	Pumping	in %	Total
1	2		3		4		(2+3+4)
2005	952,016	38.63	262,482	10.65	1,249,999	50.72	2,464,497
2006	1,059,933	38.13	469,532	16.89	1,249,986	44.97	2,779,451
2007	1,527,616	48.94	449,909	14.41	1,143,874	36.65	3,121,400
2008	1,844,175	51.49	500,000	13.96	1,237,525	34.55	3,581,700

Source: Collected from Finance section of the MOWRAM, Phnom Penh, during Jan 2008.
Note: 1 US$ = 4000 Riels

1.5. Irrigation Investment Fund (IIF)

Estimations by various studies (by MOWRAM and other donor studies) have indicated that approximately one million ha of land could be irrigated from surface water, by low-lift pimps, small diversion weirs and 'calmative' canal systems. Owing to

[3] Average consumption of diesel for irrigation water pumping incurred by MOWRAM is reported to be 3 million litres per year (Chinn Sinath, 2008, personal communication on 09-05-08).

inadequate financial support, most schemes are not being managed routinely by the MOWRAM. Even senior officials feel the pinch of growing financial crunch, and thereby affecting the O&M of irrigation systems. There is a strong felt need, among the senior officials of the MOWRAM, to create a separate fund for long-term growth and sustainability of irrigation systems. Cambodia is not the first country to plan for creating irrigation investment fund. Several countries have successfully ventured on this path with different approaches. These countries have made necessary policy and legal modifications to support such ventures. For example, the Indian government has been successfully promoting market borrowings to finance irrigation sector through its various measures. The Working Group on Major and Medium Irrigation Projects for the Eighth Five Year Plan examined the issue of inadequate funding for projects in the Seventh Plan. Against the spillover liability of US$ 6.5 billion for major and medium projects that remained incompleted from previous Plans, the outlay was only US$ 2.8 billion. To enable a more positive role by the Central Government, in 1988 the Ministry of Water Resources formulated a proposal to establish an Irrigation Finance Corporation to provide financial assistance to projects of national importance in the irrigation sector (GOI 1995). Although the proposal was supported by a large number of states, the Planning Commission did not approve it. Over the years, the states that had important ongoing projects established autonomous irrigation finance corporations. States such as, Gujarat, Maharashtra, Karnataka are the prominent states in this regard. Indeed, a detailed case study on Krishna Bhagya Jal Nigam in Karnataka state of India by Raju, Gulati and Meinzen-Dick (2002)[4], have clearly identified positive factors in such a fund creation effort: a) successful mobilization of funds, b) financial burdent reduced on the state, c) timely implementation of the project, d) freedom to increase water rates, and e) water service fee levy and collection. Cambodia may learn some lessons from these experiences to create its irrigation investment fund.

1.5.1. Justification

The Royal Government of Cambodia has plan[5] to increase its irrigated area to 872,000 ha (by year 2025) from, it's proposed level of 672,000 ha (by year 2015) as shown in table 1.3. The plan also likes to cover 100% of the country's rural areas with safe drinking water by the year 2025.

Table 1.3. Targets for Planning

Item	Year2015	Year2025
Population ('000)	16,935	20,611
- urban	4,173	6,309
-rural	12,762	14,302
GDP per capita (US $)	810	1436
Land under Crops ('ooo ha)	3550	3912
Cultivated rice area ('000 ha)	2600	2600
Irrigated area ('000 ha)	672	872
Rice Yield (tons/ha)	2.8	3.2
Rural areas		
- Safe drinking water access (%)	50	100
- Access to sanitation	30	-
Urban areas		
- Safe drinking water access (%)	80	90
- Access to sanitation	74	-
Domestic Water Use in lpcd		
c) Rural	40	40
d) Urban	120	150
Unaccounted System Losses and Leakage (%)	42	42
Number of industrial workers ('000)	433	949

Source: Establishment of a Master Plan of Water Resources Development in Cambodia, by Korea Water Resources Corporation, June 2007.

The Plan has made following projections for water demand in the country: a) Irrigation – paddy -2.6 million ha fixed with wet irrigated: 20,000 ha increase per year; b) secondary and commercial crops, orchards not included in the proposed plan – low irrigation rate in 2025 (35.5%).

Table 1.4. Performance indicators of water sector in Cambodia

Indicators	Current	Target
1. Are under irrigation	16% of agricultural land	24% of agricultural land
2. Economic losses from floods and droughts	No major flood or droughts	Significantly below 2001/02 level for events of similar magnitude
3. Sustainability of irrigation schemes	Decentralized management and cost recovery models under development	At least 50% of irrigation area under sustainable participatory management
4. Progress in the development of policy and institutional framework	Reforms initiated (e.g. land law, water law and Policy, general fisheries plan, etc) but regulatory framework and implementation	Policy reforms achieved, institutional efficiency improved and links between sector policies, strategies and investment plans strengthened
5. Progress in the development of information management system	Institutional capacity improved but quality of data still poor and weak linkage with planning	Data collection, analysis and sharing substantially improved and effectively supports sector planning

Source: Country Strategy and Program 2005-2009 Kingdom of Cambodia, ADB paper, Jan 2005[6]

[4] Raju K.V, Ashok Gulati, and Ruth Meinzen-Dick, 2002. Institutional Reforms in Irrigation Financing**:** A Case Of Krishna Bhagya Jal Nigam Limited. Journal for Social and Economic Change, ISEC, Bangalore.

[5] Proposed Master Plan of Water Resources Development in Cambodia, Draft prepared by the Korea Water Resources Corporation (2007).

However, there is no data for use levels; c) livestock (1.7% of demand); d) aquaculture, not included (0.12% of demand); e)domestic water (9.9% of demand); f) industrial water (3.3% of demand); g) but requirement for environmental flows is not included. To meet future demands (also see table 1.4), the country requires huge fund, specifically committed to develop required water infrastructure and its maintenance.

1.5.2. Stress on irrigation infrastructure

The overall objective is to reduce poverty levels in the country through provision of better and sustainable access to irrigated agriculture and safe and adequate water supplies in rural and urban areas. The objective will be achieved by rehabilitation of existing infrastructure, including construction of additionally new and necessary facilities in each river sub-basin of the country. Technical performance of the irrigation systems will be evaluated to determine the need for improvement to maximize its efficiency and effectiveness. The advantage of the country is, its majority of the projects are medium to small-scale in nature, which have short-term gestation period from design to operate. This is unlike Three-Gorge project in China or Narmada project in India[7] with long gestation periods and large-scale rehabilitation and resettlement issues involved. Though accurate estimates of total funds required at the country level is not readily available, some examples based on a few projects are available, based on different studies. One of the recent studies[8] has estimated US$ 32.13 million (civil works cover 73% of the total cost) for 27 selected sub-projects in three provinces (Kampong Thom, Siem Reap, and BanteayMeanchey). Owing to the reasons, as listed in the above sections, Cambodia needs to create and operate an irrigation investment fund for medium and large scale irrigation systems. Economic analysis on maintenance, rehabilitation and upgrading of large and medium scale irrigation systems and the capacity of FWUCs to assume irrigation operation and management costs in Cambodia.

1.5.3. Fund Size

A) Rehabilitation and construction: The national irrigation potential has been estimated at 1.6 million ha as shown in Table 1.6. The National Project Management Office (NPMO) of MOWRAM estimated the existing irrigation coverage at about 1,050,000 ha, of which 160,000 are served by small-scale irrigation schemes, 620,000 ha by medium-scale schemes and 270,000 ha by large-scale irrigation schemes. However, only about 56% of these irrigated areas are effectively served. The effective irrigation coverage is therefore about 588,000 ha or about 21% of the total area of 2.8 million ha under food crop production. Based on the irrigation coverage target of 650,000 ha in the strategy for agriculture and water (2006-10), the coverage gap to be filled is about 62,000 ha, by the year 2010, and the remaining 350,000 ha in the next five years (2010-2015). Additionally, 50% of the existing irrigated area (i.e. 244,000 ha) needs rehabilitation for efficient utilization of water resources. Cambodia has three types of irrigation schemes. They are categorized on the basis of area irrigated as shown in Table 1.5.

Table 1.5. Type of irrigation schemes

Type of irrigation scheme	Command area in ha
1. Small-scale	< 200 ha
2. Medium-scale	200-5000
3. Large-scale	> 5000

Table 1.6. Types of schemes in the existing irrigated area

Type and Number of Schemes	Existing in ha	Effective irrigation ha	Gap area ha	Gap to be covered in ha
All schemes	1,050,000	588,000	412,000	62,000 (a)
a) small-scale	160,000			350,000 (b)
b) medium-scale	620,000			
c) large-scale	270,000			
Rehabilitation required for 50% of the existing irrigated area (ie.588,000 ha)				244,000 (c)
Total area to be rehabilitated in the existing irrigated area				656,000

Source: Based on: TEAM Consulting, 2007 and MOWRAM, 2008.

a) Gap area identified for the strategy for agriculture and water 2006-2010.
b) Remaining gap area of 412,000 ha.
c) Rehabilitation required for 50% of the existing irrigated area.

Table 1.7. Total area for rehabilitation

Type of area	Area in ha
Rehabilitation of existing area	656,000
Unutilised from potential irrigation area(1,667,000 -1,050,000)	617,000
Total	1,273,000

[6]As quoted in Appendix-2 of the Water Sector Analysis (TA No.4848-WRSMP), November 2007.
[7] These large-scale projects have taken more then 3-4 decades to complete the entire project, which in turn had huge escalations on its cost and duration.
[8] Carried out by the TEAM consulting engineering and management company limited and SDC consulting company limited with support of the Asian Development Bank and RGC/MOWRM (November 2007).

Table 1.8. Investment costs for utilization of potential irrigation area

Water Resources	Potential Irrigation area in ha	Currently Utilised in ha	Gap area in ha	Gap area in ha and Construction cost in '000 US$			Total costs in '000 US$
				Small-scale (US$ 2500/ha)	Medium scale (@US$ 500/ha)	Large-scale (@US$ 5000/ha)	
1. Main stream	734,000	400,000	334,000	111,333 (278,332)	133,600 (467,600)	111,333 (556,665)	1,302,597
2. Mekong tributaries	253,000	200,000	53,000	17,666 (44,165)	21200 (74,200)	17,666 (88,330)	206,665
3. Mekong flooded area	179,000	100,000	79,000	26,333 (65,832)	31,600 (110,600)	26,333 (131,665)	308,097
4. Tonle Sap tributaries	358,000	250,000	108,000	36,000 (90,000)	43,200 (151,200)	36,000 (180,000)	421,200
5. Outside Mekong Basin	142,000	100,000	42,000	14,000 (35,000)	16,800 (58,800)	14,000 (70,000)	163,800
Total	1,666,000	1,050,000	616,000	205,333 (513,332)	246,400 (862,400)	205,333 (1,026,665)	2,402,397

Note:

a) Cost per ha and gap area across three types of schemes (small, medium, and large-scale) are based on MOWRAM (Mr. ChannSinath) suggestions. Cost estimates have considered examples of recent years in India, Cambodia, and Sri Lanka, particularly for small and medium scale reservoir projects. For all three types of schemes, costs include-resettlement and rehabilitation, formation of users organization, and capacity building.
b) Scheme-wise gap area and utilized area is based on MOWRAM estimates
c) In case of potential irrigation area, Korea Water Resources Corporation's estimates (in 2007) indicates, by the year 2025, Cambodia will have 875, 000 ha.
d) Figures in paranthesis indicates amount in US$.

Table 1.9. Investment costs for rehabilitation area

Types of schemes	Proposed Rehabilitationarea in ha	% to total area	Rehabiliatationcost per ha in US$	Total costsin '000 US$
1. Small-scale	196,800	30	2500	492,000
2. Medium-scale	262,400	40	3500	918,400
3. Large-scale	196,800	30	5000	984,000
Total	656,000			2,394,400

Therefore, total investment costs required are:

a) for utilizing the potential irrigation area in US$ = 2,402,397,000
b) for rehabilitating existing irrigated area in US$ = 2,394,400,000

Total = 4,796,797,000
Say, US$ 4.8 billion for 10 years
@ US$ 480 million per year.

B) Assumptions for cost estimates

Following assumptions are based on recent rehabilitation costs of small reservoirs of various sizes in recent years in: a) various parts of India[9], and b) recent projects and studies carried out in Cambodia[10].

a) Catchment area - US$ 500/ha
b) Water spread area - US$ 1000/ per sq km
   (Improvements to reservoir bund, sluices, weirs, desiliting)
c) Command area development - US$ 500/ha
   (including field channels, outlets)
d) Rehabilitation costs may be provided in the above unit rate basis. This cost will constitute 75% of the total project cost. The remaining 25% of the cost toward institution and maintenance and management is to be arrived and added to get the total project cost.
e) The allocation in the total project cost is:
   - Institutional development 10%
   - Physical rehabilitation 75%
   - Maintenance and management 15%

f) Based on the above, unit cost of US$ 2500/ha for small and US$ 3500/ha for medium scale reservoir projects and US$ 5000/ha may be adopted for project formulations.

Benefits from the small reservoir have to be worked out based on a few sites on actual basis. However, some of the key benefits can be divided into two parts – i) Agriculture dependent and ii) Livelihood options:

i) Agriculture dependent:

a) Income from agriculture production

[9] Asian Development Bank, 2006. Rehabilitation and Management of Tanks in India: A Study of Select States. Publication Stock No. 122605.
[10] TEAM Consulting Engineering and Management and SDC Consulting, 2007. Water Sector Analysis. Cambodia: TA N04848: Water Resources Management (Sector) Project.

b) Wages earned in rehabilitation work
c) Wages earned as agriculture labour

ii) Livelihood options

a) from livestock (dairy)
b) from duck/poultry rearing
c) from fish culture
d) from fuelwood cutting

When agriculture and livelihood contributes to enhancement of mean per capita income of the villagers, it increases their income levels in the range of 30-60%, as demonstrated in various parts of South and southeast asian regions.

1.6. Small-scale Irrigation Financing Fund (SIFF)

1.6.1. Justification

In the present set up, financial allocations for physical works in the water sector, across various levels of the government, is based on criteria indicated in Table 1.10.

Table 1.10. Expenditure limitations across levels

Agency Responsible	Expenditure level in US$/year
1. Government of Cambodia	>5,000
2. Provincial government	3,000-5,000
3. Farmers groups (like FWUC)	<3,000

Currently, the MOWRAM is contemplating a package of funding for irrigation sector in view of its long-term strategy and sustainability both at macro and micro levels. At micro level, this fund is being planned as a tool for improved operation and management by FWUC[11]. With a budget of less than 3000 US$ per year, FWUC should be able to handle all activities related to system operation and management, particularly within the jurisdiction of FWUC command area.In the long-run, the government is planning to reduce its role and increase thereby, users' role, in irrigation system management and its operation. Irrigation management transfer is step towards this route, being contemplated by the government. Even at the medium and large irrigation systems, besides small-scale systems, FWUCs should be enabled to have access to required operation and management funds. This is in addition to Irrigation service fee (ISF) being collected by the FWUCs. Indeed, all the 11 FWUCs currently on a pilot basis are regularly collecting ISF.

1.6.2. Participatory Irrigation Management and Development(PIMD)

PIMD is emerging across various countries as a practical way to encourage farmers to take over responsibility for managing their own irrigation systems and to make better use of limited government and donor resources. The logic, as mentioned in PIMD training module-1 (MOWRAM, 2003) is that farmers will invest more in irrigation management and development if they are in control of decision-making about the irrigation service and are able to increase agricultural productivity through making water delivery more responsive to their needs.PIMD proposes a new partnership (MOWRAM, 2001), where the government regulates, facilitates and supports, but farmers take primary responsibility for irrigation management. Irrigation development will be a joint activity with investment shared by government, donors and farmers. In Cambodia, PIMD means that Farmers Water Users Communities (FWUC) take over primary responsibility and authority: a) to manage, repair and improve existing irrigation systems and; b) to develop new irrigation systems. Till December 2007, PIMD (Participatory Irrigation Management Department of the MOWRAM) has formed a total of 355 FWUCs, including 114 registered. Out of them, during 2002-05 PIMD has promoted 11 pilot scheme based FWUCs in 10 provinces. Rapid Assessment study (MOWRAM, 2007) indicates the performance levels of these FWUCs. In five out of the 10 selected provinces, the project team has completed data collection on the present status and has carried out monitoring and evaluation, participatory rural appraisal in later part of year 2007.

1.6.3. Financial status of FWUC

During January 2008, six FWUCs, one each in six provinces were visited[12] to understand their current financial status and constraints. These six FWUCs (shown in Table 1.11 and also table 1.13) are categorized by MOWRAM as comparatively better performing water user organizations.

[11] Farmers Water Users Community (FWUC) was officially formed through an official circular (No.1) issued during June 2000. This circular prepared by the MOWRM has details on a) implementation policy for sustainable irrigation systems, b) policy for sustainability of operation and maintenance irrigation systems, and c) steps in the formation of a FWUC.
Till January 2008, MOWRM has formed 11 FWUCs and their command area range from 500 to 4500 ha.

[12] Help of Mr. SornSerey and Mr. ThanSopheak, both National Consultants in MOWRM is gratefully acknowledged in facilitating the field trip and local language translation.

Table 1.11. Key features of FWUCs

FWUC Name	K'puoy	Barrai-right	Sne	K'Damrey	O'Trang	O'Raka
Province	Buttambang	Siem Reap	Prey Vang			Pursat
Project	K'puoy	Barray	Sne	K'Damrey	O'Trang	O'Raka
Command area in ha	2599	4000	714	500	2000	4500
No of villages	9	25	7	8	20	8
Members	1465	1500	972	551	952	760

Source: Raju, K.V. 2008. (based on field visits during January 2008). Also see table 1.14.

a) Over the last five years, since the formation of FWUCs, focus was on improving physical conditions of the irrigated system. Thereby, FWUCs could witness enhanced irrigated area during the dry season (e.g., from 100 to 500 ha in O'Trang and from none to 50 ha in O'Raka area). In case of wet season, increase is ranged from 200 ha (from none owing to perennial floods in K'Damrey) to 1500 ha (in O'Trang area (for more details see Table 1.14).
b) In all six FWUCs, both treasurer and president have acknowledged the receipt of funds from the MOWRAM. However, variations were observed in the bank passbook entries made in the respective FWUC account; Grants received from MOWRAM varied from US$ 6000 (K'Puoy) to mere US$ 500 (O'Raka). While these two FWUCs got only one time grant, other FWUCs got for two years (till Jan 2008); Barrai-right FWUC got US$ 3198 in the first year, and US$ 497 in the second year, while Sne FWUC got US$ 3600 and 775 respectively. Based on these initial records (which are readily available), it appears that grants are neither based on per ha basis, nor on guidelines suggested by the PIMD (also see table 1.12). Owing to financial crunch faced by the MOWRAM, it could not allocate funds as per the guideline norms (as in Table 1.12) and whatever grants given to FWUCs, to a large extent, were considered as motivational support.

Table 1.12 Share of Government and FWUC in O&M costs

Year	Government Share in %	FWUC share in %
1	80	20
2	60	40
3	40	60
4	20	80
5	0	100

c) Interestingly, percentage of water fee paying farmers has been increased from 80 to 100% across the FWUCs. But, water fee payments are not regular on crop season basis and in some cases (e.g., in Sne) after the year 2004, it is not collected. Also unclear is reason for variation in water fee levels – in four out of six FWUCs reported US$ 1.2/ha, two FWUCs (Sne and K'Damrey) collected US$ 2 per ha. Clearly there is willingness to pay more water fee (almost twice the current level, particularly in dry season), since profit level has gone up to US$ 40-80 per ha. But willingness to charge and collect them is inadequate. Even 4- 5 times more water fee can be levied to groundwater users, who are incurring around US$ 240 per ha per season. They largely use diesel pumpsets.
d) There is a clear demand from all FWUCs to know design and actual quantity of water flows in their designated canals. As of now, these FWUCs have no records to show on actual flows. Nor they are able to work out allocations and distribution based on flow quantity. None of the six FWUCs have gauge recorders.
e) All six FWUCs water distribution was handled by sub-group leaders (7 in Sne to 32 in Barrai-right). FWUCs feel they help a lot in distributing water across the command area and in turn reduction in water conflicts. None of the FWUCs have reported any payments made for the services of these sub-group leaders. It is all free service. But, three office bearers (president, secretary and treasurer) receive fixed monthly salaries from FWUC funds.

f) As part of their future plan, FWUCs have following plans:

- FWUCs would like to take over the management transfer of their irrigation system from MOWRAM.
- FWUCs are willing to pay 20% of the total water fee collections to the government and the rest they would like to utilize for improvements in physical structures and their regular maintenance.
- All FWUCs have clearly acknowledged the need for capacity building and exposure visits to successful IMT sites in south Asian countries.
- As a pre-condition, all FWUCs insisted to have secondary canals in their command areas, alignment of all related canals, minors, and outlets, regulatory structures, and gauge records.
- FWUCs are willing to sign the agreement to take over the management transfer along with the responsibility of water fee collection, operation and maintenance, water distribution and additionally, facilitating better procurement and distribution of farm inputs, and working towards providing forward linkages to enhance better returns to its members.

1.6.4. Users share in system rejuvenation

In Cambodia, it appears, there is no single policy on mobilizing users share in developmental projects. It is also true in other countries. E.g., The State governments (also the central government) in India have no single policy to suggest a single level of users share for all developmental programs. It keeps oscillating based on (mainly donor insistence) type of programme and level of

funding (see Table 1.13). In case of tanks, it differs from zero (in case of state funded projects) to 12 percent (in case of the World Bank funded projects in Karnataka) to 30 percent in DHAN (an NGO) supported projects. For the state government they are beneficiaries; hence when they are getting benefit, why can't they share some costs; maybe marginal or as a token amount. In many projects/schemes entirely funded by the state budget, the Minor Irrigation department does not even envisage users contribution as it is absent in the project design itself.

Table 1.13. Users contribution level in India

Scheme/project	Users share in %	Project supported by
Karnataka Community-based tank rehabilitation project	12 (6% cash and 6% labour)	The world bank
RaithaKayakaKere (one tank per hobli)	7%	Minor Irrigation Department of Karnataka
Neeru-MeeruProgramme	10%	Andhra Pradesh Government
Participatory Irrigation Management through WUAs	15%	APERP supported by the World Bank in Andhra Pradesh
Tank rehabilitation	30%	DHAN (NGO) Tamil Nadu
Tank Rehabilitation	25%	FERAL (NGO) in Pondichery

Source: Raju K.V.2006.

Cambodia may need to evolve a policy to suggest the level of users share for all water related projects. This is an essential step before planning for any irrigation system rejuvenation.

1.6.5. Irrigation Service Fee (ISF)

The responsibility to collect ISF from the water user farmers for irrigation service made available from the system shall rest on the committee of FWUC registered with the government. The rate of ISF has to be decided by FWUC, based on the following guidelines, as listed in the Policy for Sustainable Irrigation Systems, and prepared by the Ministry of Water Resources and Methodology (2000).

a) $Y = \frac{X1+X2+X3+X4+X5}{\text{Irrigation Service Area}}$ + 20% of the increased production in one ha.

Where, X is the O&M costs

X1 = expenditure on the maintenance and repair
X2 = expenditure on the fuel (in case of pumping)
X3 = expenditure on the contribution to the Community Board
X4 = expenditure on administration
X5 = expenditure on the contingency
Y = ISF per ha.

b) As per the O&M cost may vary from system to system and also within the system in different years, the ISF will vary accordingly and will be decided by FWUC. The 20% of the increased production shall remain in the bank account of the FWUC as a fund to cover the emergency repair and maintenance expenditure or the FWUC could spend it in the modernization of irrigation system or in farm water management improvement works.
c) For simplicity, in the current situation the increased production of wet season irrigated rice as compared to the rainfed rice is estimated to be about 0.7 t/ha. The FWUC will therefore collect annually 140 kg/ha or rice as the share of 20% increase in production. This should be continued for the initial five years following which, depending on the financial situation, the FWUC may reduce the percentage (but not less than 5% of the increased production).
d) The Committee of FWUC collecting ISF in the irrigation system shall have to keep records of the farmers receiving the irrigation facilities (area, crop type).
e) The incomes and expenditure incurred by the FWUC shall have to be annually audited by an independent auditor hired by the FWUC and the reports shall have to be presented in the general meeting of the FWUC for approval.

1.6.5.1. International experience

Clarity of objectives in formulating irrigation service fee is essential. Objectives of service fee may be summarized as follows, based on the international experiences.[13]

a) Service delivery- cost and accountability
   - To cover the costs of providing the service without subsidy –ranging from O&M costs to full supply cost, including capital expenses and replacement costs.
   - To fund adequate maintenance of infrastructure, preserving its productive function.

[13] Cornish G with B.Bosworth, C. Perry and J.Burke, 2004. Water charging in irrigated agriculture: An analysis of international experience. FAO water reports 28.

- To improve accountability of the water provider to users.

b) Demand management, water allocation and pollution control
   - To reduce excess demand.
   - To provide an incentive for the efficient use of scarce water resources.
   - To allocate water to the highest priority uses.
   - To provide incentives to improve water quality, reduce pollution levels or protect the environment.
   - To encourage wise investment decisions by public and private organisations.

c) Social objectives
   - To create a benefit tax.
   - To ensure equity of access to water or the benefits of its use.

The international review of irrigation service fee (see table 1.15) suggest that service fee levied should be financially feasible to recover full annual operation and maintenance costs from farmers. However, legal, political, social and administrative constraints may prevent the effective recovery of fees. What is important is, though farm budget data in several countries demonstrate that the average farmer on some schemes should be able to pay fees to cover full O&M costs, there will always be poorer farmers obtaining lower net incomes. Therefore, careful analysis is required before drawing general conclusions about 'affordability' (Cornish, Bosworth, Perry, and Burke, 2004).

Table 1.15. Current fee levels and fees required to cover annual O&M costs

Country	Net farm income (US$/ha)	Assumed water consumption (m3/ha)	Net water value (US cents/m3)	Present fee (US cents/m3)	Fee required to meet required O&M (US cents/m3)	Required fee as % of actual net income
India, Haryana	500	7000	7.1	0.04	0.11	0.5
India, Gujarat	800	6000	13.3	5.0	5.00	37.0
Former Yugoslav Republic of Macedonia	1000	5000	20.0	2.4	4.00	1-20
Morocco, Tadla,	865	7400	13.4	2.0	1.72	15
Morocco, Haouz	1705	6250	27.3	2.0	0.86	3.0
Nepal	200-250	2000	12.5	0.1	0.55-0.88	4.5-8.0
Pakistan, Sindh	236	8000	3.0	0.06	0.13	4.0

Source: Cornish, Bosworth, Perry, and Burke, 2004.

Notes: a) Income per ha after deduction of all production costs except water. In some cases, average of a range; b) An assumed annual irrigation depth has been used for each case study where field data were not available; c) Net water value is the farmer's net income per ha divided by water used; d) Based on an estimate of O&M fees in Haryana if cross-subsidy from other sectors were removed; e) Water consumption based on supplementary irrigation to monsoon crop.

1.6.5.2. Preconditions for effective irrigation service fee

Some key preconditions must be satisfied before water service fee can be implemented effectively. These preconditions are listed in Table 1.16. In addition, farmers should be ready to comply with the rules for water allocation. Institutions like FWUCs in Cambodia must measure and record effectively the parameters on which water service fee are based, and collect the charges.

1.7. Funding Sustainability

Four essential principles about PIMD (MOWRAM, 2003) as listed below necessitate creation of adequate financial supportive mechanism for its sustainability.

a) *Empowerment of FWUC:* This means that all water users served by a common irrigation system select FWUC leaders, establish the FWUC, agree on its constitution and rules and approve its basic policies. It means that the FWUC is established as an independent legal entity with the full decision-making authority to manage the irrigation system, based on the principles of 'one irrigation system = one system of management'.
b) *FWUC defines the water service and selects its service provider:* FWUC leaders and members agree on what kinds of water services will be provided by the irrigation system and how they should be provided. The FWUC has the right to choose who will provide its irrigation services and to negotiate the terms and conditions for service provision. It appoints and authorizes the service provider to perform its functions.
c) Partnership and mutual accountability between the service provider, FWUC leaders, members of the FWUC, government and other service organizations – the service provider serves the FWUC leaders, as authorized. If not, service providers can be removed from their position. The FWUC leaders follow the will of FWUC members, as authorized by them in elections and meetings. If not, FWUC leaders can be removed from their offices. The FWUC, government and other organizations interact with each other as partners, not masters and servants. Arrangements for services, training, etc, are formalized by agreements between the parties concerned.
d) Demand-driven support system based on cost sharing: The government withdraws from direct management of the irrigation system and focuses on regulating the water sector, providing assistance and support services to FWUC and building capacity in the FWUC. New arrangement is created to provide support services on basis of requests from FWUC and the principle of cost sharing.

Table 1.14. Financial details of Six FWUCs (as on January 2008)

Name of the FWUC	K'Puoy	Barrai-Right	Sne	K'Damrey	O'Trang	O'Roka
Province	Buttambang	Siem Reap	Prey Vang			Pursat
Project	K'Puoy	Baray	Sne	K' Damrey	O'Trang	O'Roka
Command Area in ha	2599 (2850)	4000	714	500	2000	4500 (3886)
No. of villages	9	25 (4 communes)	7	8	20 (6)	8
Meetings to discuss water regulation & distribution by FWUC	3 times/yr	3 times/yr	2 times/yr	10 times/yr	2 times/yr	2 times/yr
Total no of farmers in the command area	1500	1500	972	551 (235)	952	760 (560)
Farmer-members of FWUC	1465	1500	972 (625)	551	952 (510)	760
Any collective work done by FWUC	with govt help & donors	FWUC with govt help	FWUC (earlier farmers)	repair of dam bund and gates	FWUC (earlier farmers)	FWUC (farmers)
a) canal repair	(earlier farmers)					
b) water distribution	FWUC	FWUC	FWUC (individuals)	FWUC	FWUC	FWUC (individuals)
Area irrigated - ha	2800	4000	nil (floods)	200 (flooded 500)	2000 (500)	4500 (3886)
a) Wet Season-2007						
b) dry season-2007	1300	1500	714 (680)	100	500 (100)	50 (none)
No. of irrigation received	5 (1)	1	nil (floods)	3	1	2 (1)
a) in wet season-2007						
b)in dry season-2007	8 (none)	3 (none)	12 (1)	3	7	2 (nil)
% of farmers paid water fee	80% in 2006, 90% in 2007 (none)	95%	85% (collected only in 2004)	70%	80%	100% (See table)
water fee per ha in US $, collected from farmers	1.2/ha	1.2 $/ha	2 $/ha	2 $/ha	?	1.2 $/ha
Farmers spent on O&M in US $ during 2007.	(see table)		nothing	nothing	nothing	none
Amount got from MOWRAM for O&M in US$	6000	1st yr 3198, 2nd yr 497	3600 +775	?	4000 +1700	500
Condition of canal structures (a) good (b) bad	good	good	inadequate	good	bad	good
No. of persons appointed for water distribution	17	33	MOWRAM+7	14	16	11
Amount spent on those persons	none	none + see table on staff salaries	none	none	none	none
% of design discharge received at distributory level	not known	not known	floods	not known	not known	not known
a) in wet season -2007						
b) in dry season-2007	not known	not known	not known	not known	not known	not known
Major crops	rice	rice	rice	rice	rice + water melon (dry season)	rice
Crop productivity tons/ha	2-2.5	2 t/ha	3	2	2.5 t/ha	2 (1.5)
Net profit per ha in US$	50	40-75	80	75	50	50
Willingness to pay for water per ha in US$	1.5		floods	2		1.3
a) in Wet season						
b) in Dry season	2.5	3.5	2	4		2.2
Extent of groundwater use within FWUC area	nil	nil	30 BW, 45 mtr depth	nil	nil	nil
a) area irrigated in wet season in ha			floods			nil
b) area irrigated in dry season in ha			320 ha			nil
c) expenditure for gw use per ha/season			240 $			
d) total investment made for gw use (pumps, pipeline)			500 $			
Willingness to take over the entire project by FWUC	yes	yes	yes	yes	yes	yes
a) will undertake all O&M, fee collection	yes	yes	yes	yes	yes	yes
b) Required assistance (specify)	capacity bldg, more water, need secondary canals, rehab reservoir	more exposure to good FWUC	better infrastructure, regulatory gates, canal repairs	desilt the reservoir, increase storage, bund repair, need pesticides		repair structures, alignment of outlets, need BW,
c) amount willing to pay to the govt	20% of water fee collection	20% of water fee collection	20% of water fee		20-30% of water fee	10% of water fee
GW use for domestic use	Well maintained records, maps, hand pumps, 5 mtr depth	8-10 mtrs, handpumps		7-12 mtrs, handpump	4 mtrs, handpump	10 mts

Note: a) Numbers in Parenthesis refers to situation before formation of FWUC

b) Net profit/ha, goes up to US$ 200 in some individual cases, as reported by Mr. Mlob Bonn of MOWRAM. 1 US$= 4000 Riels

Table 1.16. Preconditions for effective irrigation charging

Aspect	Detail
Legal	Legally defined and enforceable water entitlements and basis for allocation. A clear and viable judicial and police system to ensure enforcement of agreements.
Administration	A clearly understood and agreed fee structure, to include: o When fees are to be paid. o Penalties for non-payment or late payment of fees. o How fees are computed. o How the fees are requested. o Mechanism for fee payment (to whom, and how). o Whether users can refuse payment for water delivered but not requested. o A specified mechanism to resolve disputes over deliveries or bills. o Adequate human, technical and financial resources to implement billing and fee collection.
Infrastructure	Infrastructure permits control and measurement of volumes delivered to users or a user group. Means exist for users to verify volumes. Infrastructure permits delivery of differential volumes to neighbouring users.
Administration	A written agreement between water supplier and user defining the water delivery service: o Advance time to order; change, or stop flow. o Flexibility in the frequency, rate and duration of water delivery service. o Accuracy of the flow-rate measurement devices. o Allowable percent variation in the actual flow rate from the agreed flow rate at any time. o Who can make the flow rate changes (the supplier or user) at the control structure. o How frequently the flow rate can be changed o How frequently the flow rate must be verified, and how. o Responsibility for maintenance of the measurement and control structures. o Penalties for the water supplier for poor quality of operation, structures, and water quality. o A procedure for when, and how, any volumetric limitations are determined.

Source: Modified from Burt (2002), as quoted in Cornish *et al*, 2004.

SECTION-2

Approach and Design

2.1. Introduction

In case of Cambodia, we may consider two possibilities for financial and governance reform options in water sector. First, setting up a financially autonomous irrigation agency (FAIA), and second an independent regulatory commission for water resources (RCWR). The suggestion of an RCWR has a recent genesis, prompted by the way many infrastructure projects like power, ports and roads are attempting to raise finances from markets and improve upon their operational efficiency by introducing some commercial principles. The National Strategic Development Plan (NSDP) (2006-2010) of the Royal Government of Cambodia (p.xiv) clearly underlines that "successful and timely implementation of NSDP strategies and achievement of NSDP targets would need substantial and well-directed additional investments and their focused and effective use. Such investments need to be made both in the public and private sector"; it also said (p.xv) "expected resources not being available particularly from External Development Partners". These suggested financial and governance reform options in the water sector are very much in tune with the strategy adopted by the NSDP.

2.2. Set up Financially Autonomous Irrigation Agency (FAIA)

The creation of FAIA can be an effective means of: a) introducing administrative and financial autonomy; b) increasing accountability; c) facilitating contacts with, and contracting out to farmers, NGOs and private firms; d) introducing less politicized procedures to set and collect water charges; and e) mobilising private sector funds. The key concept here is self-financing. After a pre-defined nascent period, such corporations must provide for O&M and recurrent expenditure out of their own revenues (capital expenditures may still continue to be "largely" funded by the state). They must have both the mandate and the authority to set water charges at a level adequate to cover their expenses and service their debts. Once such self-financing has been established and recourse to treasury funding for recurrent and O&M expenditure cut off, they can also sell debt in the bond market (World Bank, 1997a; 26).A review of irrigation financing in several countries (Small *et al*., 1989) identified FAIAs as one potentially powerful reform. Small and Carruthers (1991) argue that this approach is desirable from the efficiency perspective because a policy of user fees implemented by a FAIA creates the potential for improvements, both in the operation and maintenance of existing irrigation facilities and in the process by which investment decisions are made. The potential for improvements in O&M stems in part from the greater control that a FAIA can have over its budget. But the key to attain higher efficiency under FAIA lies in linking incentives of the agency staff with their performance in satisfying the demands of end users. If the income of these FAIAs is dependent on the revenue they themselves collect for irrigation service, this will provide incentive for more regular and stricter collection of revenues from user groups. Since users withholding payment in response to poor service will then have a direct impact on agency budgets (including salaries), it also creates incentives for better irrigation service to facilitate fee payment. Financial autonomy thus provides a functional link between collection of revenue from users of irrigation water and more effective irrigation performance by suppliers of water (Svendsen, 1991). Further, with financial autonomy, incentives are created to increase agency income, and to reduce costs. Taken together, these factors should help establish a relationship of mutual dependence between the supply agency (i.e. irrigation department) and FWUC. The irrigation agency provides an essential service to farmers, i.e., irrigation water in the quantity and quality desired by the user, while users, in turn, provide the agency with the financial resources necessary for its existence and operation. It is the possibility of creating this critical link that distinguishes the FAIA from the typical irrigation department approach. To be an effective FAIA, it is necessary to establish the link between incentives and performance, irrespective of the kind of financial autonomy it has. Structurally, FAIA can be an agency of

user groups, or a private company, or an autonomous corporation created by the government under the Company Act, or a combination of any two or more of these. So long as it can introduce commercial principles, link incentives with performance, meet the O&M costs (and a part of capital cost), and promote efficiency, equity and sustainability in the use of canal irrigation waters, we feel it serves the purpose. Four Indian states (Gujarat, Maharashtra, Karnataka, and Andhra Pradesh) have now set up corporations, or Nigams, that focus on mobilising funds for surface irrigation. All four states started their corporations mainly to overcome the reduced budgetary allocations for the irrigation sector. These corporations were broadly established on the lines of public sector companies, to mobilise funds. Emphasis was on mobilising funds from institutions, particularly those which are directly or indirectly regulated and/or are linked to government rather than individuals.The capital and debt markets have provided an important alternative source of funding. The debt markets trade bonds of public sector undertakings and corporate debentures. Major investors in these bonds are institutions, due to the investment pattern may be specified by the Cambodian government. There are prospects for such financing to become a major source of funding in the near future, but there are certain conditions to be met:

- Only companies and corporations can issue papers which can be traded in these markets to raise funding. State-issued papers are subject to the overall ceiling on state borrowing.
- The bonds must be professionally designed and issued, with terms, interests, and payment modes that attract the specific market segment to which a particular issue is addressed.
- The issuing companies or corporations must have the capacity to generate enough cash flow to service the bonds, which is constrained by the very low levels of water charges at present.

On similar lines, the states of Maharashtra, Andhra Pradesh, and Karnataka in India have established independent corporate bodies. The Maharashtra Corporation and the Karnataka company are the only ones which have placed bond issues recently. Both have been successful. Maharashtra's first two issues were substantially oversubscribed, allowing it to place a third issue privately. An innovative sort of government guarantee in both Maharashtra and Karnataka has satisfied investors that the bonds will get serviced. Thus, as the states have been forced to generate funds from outside sources, the capital market and debt market have become a major avenue for irrigation financing.

2.3. Set up Regulatory Commission for Water Resources (RCWR)

In recent years there has been growing interest in privatization as a solution to the financial crunch faced by the irrigation sector as well as other infrastructure such as power, ports, and roads. The NSDP of Royal Government of Cambodia (2006-10) supports private sector participation in all sectors. It had gathered sufficient support to privatize infrastructure projects like roads, ports, power, telecommunications, and urban infrastructure, including domestic water supply. In many cases, it is now the private sector which has the capability of sourcing large funds internationally. However, it is easy to underestimate the dangers of introducing commercial principles in a situation where the forces of competition do not work. The state continues to be responsible for providing appropriate regulatory frameworks which assist investors and infrastructure entities on the one hand and protect consumers from monopolistic exploitation on the other. The commercialization of infrastructure and unbundling also lead to a considerable increase in transaction costs which have to be mitigated through transparent and appropriate regulation. In a free market environment, costs of production/service are kept low by competition. But canal irrigation is more of a natural monopoly, and unless its costs are kept under tight control and its operations made transparent, it runs the danger of passing on the high costs to the users of water. Indeed, the corporate arrangement provides *less* accountability and transparency than for government (especially Plan) expenditures. The price for faster turn-around in expenditure appears to be a reduction in cross-checks. Thus, there is need for an independent regulatory body such as an RCWR as a complement to financially autonomous agencies, to ensure transparency in the operations of such an agency.The setting up of RCWR has been recommended for two reasons: first to bring transparency in the operations of FAIA, especially if it is to work on commercial lines, and second to ensure that pricing of water is distanced from political interference. FAIA represents a move towards bringing some elements of corporate culture in irrigation financing. It is better to charge the users of water to recover all costs of O&M at least, and if possible even capital costs. The first purpose of an RCWR, of creating transparency, is essential to keep costs down and prevent exploitation of water users by the corporation. However, this same transparency can also help distance pricing from political interference. When the current level water tariff is so low that even recovering O&M costs may require drastic increases in water rates (often more than four times), users are likely to object, obviously having political repercussions, which no political party can afford to ignore. It becomes essential to involve farmers in the entire exercise of fixing fees and checking on how they are spent, and convincing them that higher tariff would help the agency to render better service. Yet it is not an easy task to convince farmers that it would be in their interest to pay a reasonable water tariff. RCWR can help in this direction by playing the role of an independent judiciary between the farmers and the agency. A precondition for success is that it be headed by a well known person with a record of impeccable honesty, and should have representatives from both the farmers' side as well as from the agency's side. It can always take technical experts to work out the `appropriate' level of tariffs. But the prime function of such a body would be to ensure transparency in costs of canal irrigation, especially capital costs. It would make known the contracts between private builders and the agency to people at large, would ensure access to information relating to these contracts, would invite NGOs and farmer groups to scrutinise these costs and encourage them to participate in the bids. This would help create healthy competition amongst construction companies, and check the large leakages (rent seeking) that often characterise this sector. It may be useful for Cambodia to learn lessons from Maharashtra

state in India, which has already set up water resources regulation authority[14]. Other leading states of India, such as Gujarat and Andhra Pradesh are also firming their plans to establish similar regulation authorities.

2.4. Community-based approach for rehabilitation of small reservoirs:

International experience

South India has some 140,000 tanks[15]. In recent years, several Indian states have ventured in to rejuvenating these tanks on community-based approach (Raju *et al*, 2005)[16]. These states have also introduced policy and legal refinements, as shown in table 2.1.

Table 2.1. Policy and Legal Frame

State	Policy Focus	Legal Framework
Andhra Pradesh	a) Setting up WUAs and management transfer to Water User's Associations (WUAs) b) Integrated water resources development through 'Neeru-Meeru' programme c) Promote water conservation, tree cover and regulate the exploitation and use of ground and surface water.	a) Andhra Pradesh Farmers Managed Irrigation Systems Act, 1997. b) Andhra Pradesh Water, Land and Trees Act, 2002.
Karnataka	a) Setting up WUAs in and transfer of management responsibilities b) Community-based rejuvenation of tanks and management transfer c) improve rural livelihoods and reduce poverty by developing and strengthening community-based approaches to manage tank systems	a) Karnataka State Irrigation Act, 2000 (with amendments to promote participatory irrigation management. b) Community-based Integrated Tank Management Act (under preparation)
Tamil Nadu	a) Participatory irrigation management through Water User's Associations and move towards management turnover (includes both canal and tank command areas) b) Empowered the Public Works Department staff to administer the tank systems (under the earlier Tank Act)	c) Tamil Nadu Farmers Managed Irrigation Systems Act, 2001 d) Tamil Nadu Tank Act…….

Source: Raju K.V. 2005.

2.4.1. Conflicting legal acts govern multiple uses

The revenue generated from different uses in terms of tanks, fees etc., are going to different agencies and the legal framework and state policies (in all three southern states) are not clear (see Table 2.2). Owing to this paucity, both users and the agencies get into conflict situations. In case several Indian states (Karnataka, Tamil Nadu and Andhra Pradesh), some legal conflicts are given below. Owing to these conflicts, tank users associations (both formal and informal) are facing constraints in mobilising resources, thereby affecting the very survival of the tank users associations.

Table 2.2 Source of Income and Agency Responsible

Use and source of income	Agency responsible and focus of the conflict
1. Water fee	Imposed by irrigation department and collection by revenue department
2. Fishing	Fisheries department auctions and generally a trader sub-leases it at a much higher amount to a fishing group. No preference to TUA.
3. Silt	Mines and Geology department has control and ownership
4.Nursery and plantation in the tank bed at catchment area	Forest department claims its rights
5.Ownership and management of all water bodies in the village revenue boundary	According to the 73rd amendment of the Indian Constitution, Gram Panchayats have rights.

Owing to the above conflicting rights on the resources, tank users associations are in a dilemma in several places. This is even after the states have come up with a clear policy to support tank users associations and transfer management of tanks to the user groups. But these states did not focus adequately on the legal implications. For example, in Andhra Pradesh some tank users associations have been drawn into court cases by local village councils owing to claims made on fishing rights. This is also true in the emerging tank users associations in Karnataka state. While Andhra Pradesh state has issued the Government Order making provision for tank users' associations rights on fishing, in practice, it could not fructify. Now Karnataka sate is drafting a comprehensive Act exclusively for tanks rehabilitation. This would be the first comprehensive Act on tanks in south India.Cambodia may need to learn lessons from these experiences in promoting FWUCS and their responsibilities. Equally important is, making supportive policy and legal provisions for their better performance.

2.4.2. Redefining the Role of Stakeholder

[14] Maharashtra state is one of the leading states in the western part of India. Its ultimate irrigation potential both from the surface and underground sources would be about 7.08 million hectors out of which 5.26 million ha. (5.9 million ha as per revised estimate) would be from the surface sources and 1.80 million ha from groundwater. Maharashtra Water Resources Regulatory Authority bill has been passed by the Legislative Council on 7th April 2005. The Authority has regulated sectoral allocation, water rates, changes in water use/diversion of water use and compensation for such changes in water use. The bill is available on this web site: www.mahagovid.org.

[15] Both in India and Sri Lanka, man made small reservoirs, largely earthern bunds to harvest rain water, are called tanks. Their size vary from less than 4 ha to 2000 ha command area. Most of them are several centuries old.

[16] Raju K.V., GK Karanth, MJ Bhende, D Rajasekhar, KG Gayatridevi (2003), 'Rejuvenating Tanks – A Socio-Ecological Approach', Books for Change, Bangalore.

As part of the management transfer of irrigation systems to users organizations, it is essential to redefine the role of stakeholders and related agencies of government, NGOs, and users organizations. These roles may be summarized as shown in table 2.3.

2.4.3. Provides multiple benefits

Rejuvenation of small and medium reservoirs through community-based approaches has benefited more to local users. The benefits of silt amendments in the agro ecosystem, survey of 120 farmers (in Telangana region of Andhra Pradesh, India) across tanks indicate that it is beneficial, economically and environmentally. Thus, all the benefits and their economic equivalents terms have been given in Table 2.4. Possibility of similar benefits were also indicated during our field visits to various FWUCs across Cambodia.

Table 2.3. Change in stakeholders role

Institutions	New Role	Role to be dropped
State	• Rigorous regulation & enabling policy and empowerment of people's institutions • Encouraging market investments • Technical and managerial support • Resource augmentation • Transfer ownership over tanks to village councils/ FWUCs	• Implementation role and implementation staff • Outdated legal framework • Control perspective
Research & Resource Institutions	• Study and documentation of existing practices • Experimentation • Opening new frontier • Outreach and field oriented research and studies	• Conventional outlook • Outdated curriculum and policies • Exclusive reliance on campus based activities
NGOs	• Understanding people's needs and aspirations through committed work and pilot field works • Enlarging into research and resource institutional areas • Liaisoning with government research and resource institutions and people's organization	• Conventional 'social' outlook • Ordinary quality staff and programs • Conventional 'institutional' view
People institutions/ community institutions	• Internal regulation and managemt of resources • Managing interference and conflicts • Distribution of benefits to marginal sections • Vibrant civil society – sharing governance • Nurturing leadership with vision on a longer term basis • Setting agenda for mainstream institutions and social auditing of those institutions	• Expectations of 'doles' and subsidies • Divisive parochial views and 'tokenism'

Table 2.4. Economic Quantification of Benefits

Activity	Quantum	Economic equivalent	Remarks	Totalin US$
Tangible				
Paddy Cultivation	Additional area of 58 hectares	With yield of 5475 bags	Each bag @ US$ 13/-	68,437
Fisheries	Increased production		Average US$ 0.75 per kg	4,175
Non-Tangible				
Fodder production	One tractor load per acre	150 tractor loads	Each load @ US$ 50 and can support couple of cattle for one year	7,500
Organic manure production	240 cattle can be supported	120 cartloads of OM	Each cartload is @ US$ 2.5	300
Farm Traction	Weeding in cotton field	@US$1.5 per 150 days		27,000
Milk production	Assuming 2 litres @ US$ 0.25 and 50% of cattle are buffalows and milk production is only 6 months	240 litres per day	US$ 60 per day	10,800
Animal herders & Shepherds	US$ 75 to borewell owner	11 villages, expect Koppulla		825
Silt Amendments	Reduced fertilizers, Yield increase		Each bag is about US$ 5	20,000 146,262
Domestic water	1 hour per family for 8000 families	Loosing 1000 mandays in a day	3000 person days and each person days wage is US$ 1.5	3,375
Water-borne diseases	US$ 0.50 per family on medication			400
Washermen community	Assuming 25% of washer community denied to participate in other works	400 mandays lost		454
Total Benefits				182,417

Source: Manasi, Lenin and Raju, 2007.

2.5. Project Designfor irrigation systems rejuvenation

The creation and effective utilization of small-scale irrigation investment fund necessitates the long-term project to follow a robust design and execution. This project design needs to generate information and analyses on a variety of technical, socio-economic, and ecological relationships such as evaporation losses from surface and groundwater storage, recharge rates under different conditions, the pattern of water input in different structures in a watershed under varying rainfall regimes, and so on. Rehabilitation of each tank need not be viewed as a one-shot event; an ABC analysis of sorts needs to be done with farmer

participation to evolve a medium or long term programme of rehabilitation beginning with low-cost-high-pay-off repair works and building up to more expensive items of engineering. For effective implementation of the programme: a) FWUC should be formed first and should be involved in the planning of rehabilitation; b) Actual rehabilitation work should be undertaken by the FWUC with the support and guidance of the irrigation department; and c) FWUC should be enabled to acquire technical competence to manage the head-works, which should be turned over in one go in one go along with the distribution system. The irrigation department's presence as a professional support body which at present is minimalshould be greatly increased after the turnover. World-wide experience indicates that farmers lose interest in organizing and taking over management once irrigation systems are brought in a pristine condition. This experience also indicates that the best way of organizing water users for management rehabilitation is by involving them in planning and executing engineering rehabilitation. This implies that engineering-rehabilitation and management-rehabilitation should go side-by-side which, in turn, means that many policy level questions must be answered before the rehabilitation work is begun.

2.5.1. Four-Phase Implementation

The project implementation in the entire Cambodia is envisaged in four phases, spread over 132 months[17]. It will result in complete management rehabilitation of 950 irrigation schemes (hereafter, the scheme) starting with a three year pre-project, pilot and preparatory phases as outlined in table 2.5. A pre-project phase of 12 months should be provided mainly to experiment with a range of models and methods of farmer participatory rehabilitation of 30 tanks in an intensive action research format in five provinces carefully selected for the quality of leadership in the department, potential for involving NGOs, research institutions, and for experimenting with a variety of alternatives. The primary output of the pre-project phase will be a detailed project proposal enunciating a project goal; strategy, approach and method based on the documentation, and analysis of 10 action research projects.

Table 2.5. Suggested Design of the irrigation scheme management rehabilitation

Phases	Duration(months)	Objective
Pre-Project Phase I	12	To implement a programme of action-research on alternative approaches of rehabilitation of 10 schemes in five provinces with a view to evolving an appropriate design of participatory irrigation scheme rehabilitation project in collaboration with research institutions and NGOs.
Pilot and Preparatory Phase II	24	• To test, modify and refine the project design, approach and strategy so evolved in the chosen 100 irrigation schemes from all provinces. • To evolve a system of participatory monitoring of rehabilitation programme and the performance of rehabilitated irrigation schemes as socio-ecological constraints. • To redefine the role, competence base and organizational structure of the department for irrigation scheme level management rehabilitation. • To initiate a programme for training, reorienting and OD work in the department for participatory irrigation scheme rehabilitation.
Project PeriodPhase III	36	To undertake and complete participatory rehabilitation of 440 irrigation schemes.
Project Phase IV	60	To undertake and complete participatory rehabilitation of 400 irrigation schemes.

Note: Totally 950 schemes are taken into account.

A 24 month pilot and preparatory phase should follow the pre-project phase to rehabilitate 100 irrigation schemes in all provinces. This phase will be used to modify and perfect the approach, evolve suitable monitoring systems, and initiate a programme of organization development in the irrigation department aimed at retraining the staff for their new role. Verifiable indicators of goal achievement in this phase will include:

- A credible, pre-tested strategy and approach for participatory rehabilitation of irrigation schemes.
- A pre-tested system of monitoring and an internal capacity within the irrigation department to instal and operate it;
- An agreed programme of reorganization and institution building needs within the irrigation department for undertaking the rehabilitation programme, and the initiation of such a programme;
- Retraining of core staff engineers in the selected provinces for implementing participatory rehabilitation.

Project Phases III and IV will include the project proper; however, the project will be based on substantial amount of experimentation, action research and preparatory work. The bulk of the rehabilitation work proposed in this report however will get completed during these phases. However, the nature of rehabilitation may be different – and deeper and wider – than perhaps envisaged today. Before a large-scale intervention for irrigation scheme rehabilitation is undertaken, it is critical to generate, through action experimentation, applied knowledge about and replicable models of how best to implement management rehabilitation. Once it is completed, FWUC will take over the responsibility of managing the tank in a sustainable manner. This pilot project which will eventually result in a major programme of irrigation scheme management rehabilitation is designed to generate such applied knowledge and replicable models.

2.5.2. The Pre-Project and Pilot Phase

The pre-project phase of 12 months is designed to get the collaborations going, evolve management-rehabilitation models to be tried out in the pilot phase, and evolve and pre-test the instruments for research and process documentation. The pre-project phase

[17] This is because, mobilization of funds for the irrigation investment fund and its expenditure is envisaged for ten years, as discussed in Section-1 of this paper.

will lead to the pilot phase in which 2-3 FWUC designs and implementation models will be tried and tested, this in turn will result in the formulation of the main project strategy.The goals of the pilot project thus are to [a] help generate practical models of FWUC that can effectively take over the responsibility of managing irrigation scheme in a viable, equitable, and sustainable manner; and [b] develop improved understanding of methods and processes to be used in catalysing FWUCs and building their capacities for self-governance and self-management.

2.5.3. Project Assumptions.

The central issue to plan the project is the design of FWUC. As reviewed earlier, the experience with creating user organizations, especially in gravity flow systems, is still formative. It is yet to yield firm design principles which will ensure that the user organizations will be capable of self-governance and self-management. The project will be in jeopardy unless it begins with valid assumptions about the design principles that need to be followed to catalyse participatory user organizations. Designing energetic member organizations involves understanding their working through focusing on the interactions between their three constituent sub-systems: members, the governance structure (board or management committee) and the operating system which provides the services. User organizations succeed when their design ensures high levels of[18] :

a) GoalCohesiveness: Members are somehow able to ensure that, in all decision making the governance structure is cohesive around the goal to promote members' immediate, direct, and common interests;
b) Governance Effectiveness: the governance structure (management committee) is able to `govern' the operating system such that the goals of members get served;
c) Member-need Responsiveness: the operating system is able to devise new and innovative ways to strengthen the loyalty and allegiance of members to the user organization.

Extensive research in member organizations in various fields suggests that robust self-governing user organizations achieve high levels of goal-cohesiveness, governance effectiveness, and member-need responsiveness by satisfying the following four design principles: a) member-centrality of the goal; b) goal-cohesive governance; c) get the right operating system; d) secure and retain member faith and allegiance.The NGO action organizations that might be involved in the pilot phase need to be shortlisted. Similarly, interested research organizations and universities need to be shortlisted.

Table 2.6. Sequence of Work with a Typical Tank Community

Action Item	Core Task	EstimatedTime Required	Responsibility Center/Lead Institution	Parallel Activity
1	Base-line Socio-economic Study	2 months	Research Institution	
2	Base line Technical Survey	2 months	Action Institution	
3	Participatory Planning of Technical and Management rehabilitation resulting in registration of a User Organization and election of its Management Committee, including organizational development	3 months	Action Institution	Process documentation by Research Institution
4	Technical Rehabilitation: Distribution system	3 months	User Organization with support from Action Organization	Process documentation and feedback by research organization
5	Technical Rehabilitation: tank	3 months	User Organization with support from Action Organization	Process documentation and feedback
6	Establishment of a new Management System complete with water-charge levy policy, norms for distribution, operating manual, maintenance policy.	9 months	User Organisation with support from Action Organization as well as Research Institution	Process Documentation and feedback by research institution
7	Pre-withdrawal Participatory Assessment	1 months	Research Institution	
8	Management Rehabilitation Workshop	12 days (10 days preparation, 2 days for workshop)	Action Organization and Research Institution	

The pre-project phase will be planned and implemented as an action research intervention by action and research collaborating partners with equal emphasis on planned action interventions and participatory learning, research, and documentation. This can be categorised in eight action items each of which will entail a cluster of activities. The sequence in which different action items need to be taken up in working with a typical tank community is suggested in Table 2.6. Since several action items can be taken up simultaneously, the overall programme of management rehabilitation of a tank can be completed in nine months as suggested in Table 2.7. Each of these items represents a set of assumptions to be tested and verified before the main project is planned.

The action organization and the research institution will work together as co-equal and independent partners. Each will deploy a team of three professionals with separate lines of command; but each will have a well-defined `event-responsibility' as outlined in

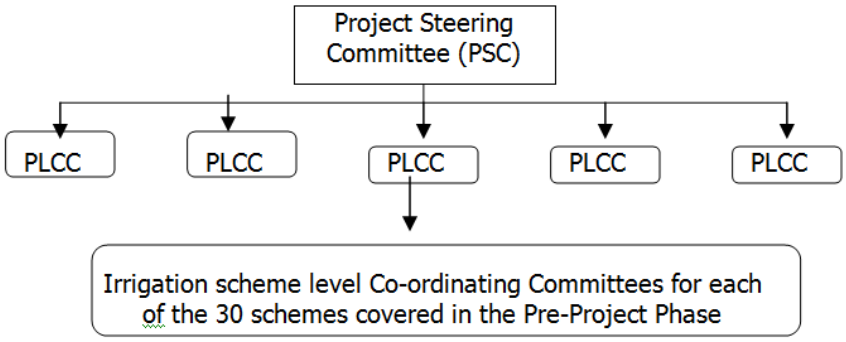
[18] Raju KV and Tushaar Shah (2004). Revitalisation of Irrigation Tanks n Rajasthan. ISEC Working Paper…. Bangalore.

Table 2.5. As soon as the FWUC is formed and its management committee elected, a irrigation scheme-level coordinating committee (SLCC) will be formed with the chairman of FWUC, the action team leader and research team leader as members. The SLCC will be responsible for the tank management rehabilitation programme for that particular tank.

Table 2.7. Time-framework for completing management rehabilitation in a typical irrigation scheme

Action Item	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1.Socio-economic study	✓	✓										
2.Study of TechnicalAlternatives	✓	✓										
3.From FWUC	✸	✸	✓	✓	✓							
4.Technical Rehab: Distribution System				✸	✸	✓	✓	✓				
5.Technical Rehab:irrigation scheme									✓	✓	✓	
6.New FWUC Management System			✓	✓	✓	✓	✓	✓	✓	✓	✓	
7.Pre-withdrawalParticipatoryAssessment											✓	✓
8.Management Rehabilitation Workshop												✓

Similarly, in each province, a provincial level coordinating committee (PLCC) will be chaired by the chief engineer; team leaders of action team as well as research team in each tank will be represented on the PLCC. PLCC will meet every month to review the progress, analyse the lessons learnt and do trouble-shooting. At the project level, there will be a project steering committee (PSC) chaired by the senior official of the irrigation department; its members would include representatives of partner NGOs, research institutions and the chief engineers of the districts concerned and a donor agency representative. PSC will be in overall charge of the project. The project management organization can be represented as:



An important objective of the pre-project phase is to secure a realistic understanding of the resource requirements in tank management rehabilitation work. Since a good deal of similar work is done on smaller water harvesting structures in several countries, their lessons and norms may be used with appropriate refinement to suit Cambodia. To start with they could be used to support tank management rehabilitation work in the Pre-project phase.

Processes

The scope of these works would vary across irrigation schemes or river sub-basins. However, in general, development and management of a irrigation scheme or sub-basin need to cover following steps[19]. Also see the chart 2.1.

a) **Community based rehabilitation of physical works:** This includes, wide-scale consultation of local communities (both upstream and down stream) to participate in designing the plans for rehabilitation and their active participation in all related works like: i) surplus weir, earth dike, raise or retain water for irrigation use, water control structures, ii) outlets, gates, iii) rehabilitation of drainage, main canals, distributory canals and related structures.
b) **Designing pilot projects:** The MOWRAM can promote a set of five pilot project levels schemes and execute it through community based organizations. This is in tune with the existing FWUC, which requires enormous capacity building in the process. A detailed process needs to be established to execute these pilot projects in different parts of the country. The entire pilot project should have a cycle of 24 months as part of Phase-I.
c) **Refine and replicate across the country:** With the lessons learnt from the pilot projects, and with increased capacity building, the country will be in a better situation to expand its operations in a more effective and efficient manner. In Phase-II (of 36 months cycle), the country can expand its operations to the entire country.
d) **Promote robust FWUC in 3-tier structure:** First level is at minor irrigation systems (more or less at the present FWUC level), and second level at a group of minor irrigation system (largely at a cascade or sub-basin level), and third level at the river-basin level. The 3-tier structure will have hydrological link and then administrative link to work with the MOWRAM. This will be giant step towards promoting irrigation management transfer. These FWUCs will have responsibilities of

[19] Owing to limitations of this study, focus is not provided on drinking water, sanitation, treatment of water and reuse of treated water both in urban and rural areas.

system operation, maintenance, and collection of water fee and retention of it. This would help to promote efficient water use, more productive irrigated agriculture and improved livelihoods through better linkages –both backward and forward.

e) **Establish effective linkages:** Irrigation alone will not necessarily lead to increased farm productivity and production. Unless specific assistance is given with farmers organizations, technical extension and demonstration. Mere increase in agricultural production will not lead to reduction in poverty levels and enhanced rural livelihoods. The processes need effective support to enhance value chain of agricultural and allied production at all levels. This also requires good network of storages and processing facilities in rural areas. Need to reduce gap between producer and consumer, through producer cooperatives. Lessons may be picked up from successful stories across several of countries of Asia, Africa, and South America.

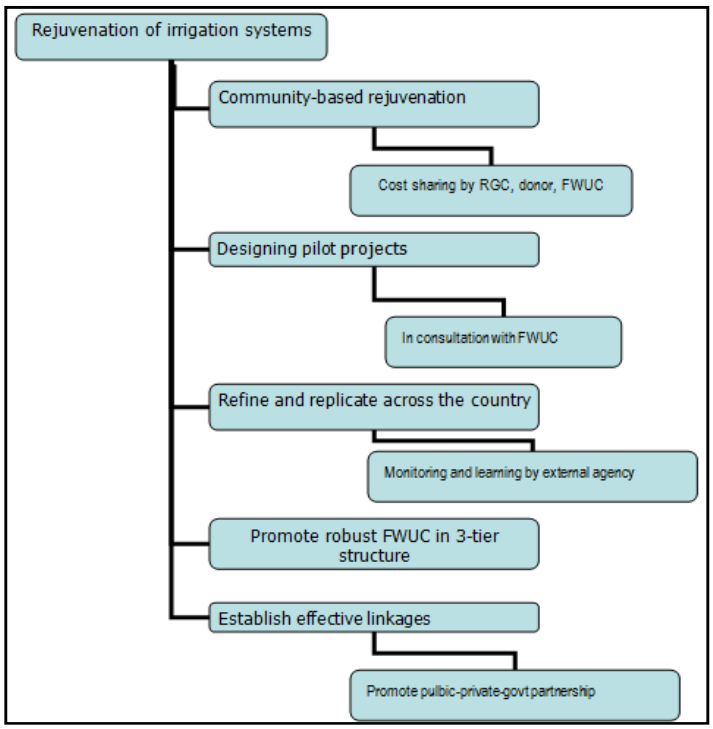


Chart 2.1. Steps for rejuvenating irrigation systems

SECTION-3

3. Strategy and Policy Options

The proposed strategy and policy options are in tunewith two important strategies of the Royal Government of Cambodia: one, the National Strategic Development Plan (2006-2010) suggested governance reforms[20]; second, the long-term vision identified in the Strategy for Agriculture and Water (2006-2010)[21]. What we have proposed in the following sections has taken care of these broad strategies for the water sector. Also proposed are supportive policy and legal provisions required for robust management of the water sector in Cambodia required for the next few decades. These proposed strategy and policy reforms would enable Cambodian irrigation sector and its stakeholders to move ahead of other countries in Southeast Asia.

3.1. Reforms in water sector governance

a) Set up Independent Water Resources Regulation Authority with following key responsibilities.

- Water allocations across sectors –domestic, industrial, agriculture, environmental.
- Design and implement efficient conveying mechanisms from source to consumer level – take overall view of the entire state.
- Water auditing at project level (all projects)
- Enhance water use efficiency levels.
- Rationalise water tariff across sectors

[20] NSDP (2006-10) clearly emphasizes good governance in all sectors. As part of its strategy NSDP says (p.45) "Good governance is the most important pre-condition for achieving sustainable socio-economic development with equity, equal opportunity and social justice.

[21] The Strategy for Agriculture and Water (2006-2010), prepared by the Ministry of Agriculture, Forestry and Fisheries and Ministry of Water Resources and Meteorology, in its long-term vision (p.iii) says, "to ensure enough, safe and accessible food and water for all people, reduce poverty, and contribute to economic growth (GDP per capita), while ensuring the sustainability of natural resources; to contribute to poverty reduction, food security and economic growth through: a) enhancing agricultural productivity and diversification and b) improving water resources development and management".

- Performance measurement criteria at all levels
- Convergence of all related schemes/programmes

b) Water Sector Reforms

- The water sector need to unbundle its functions into: a) water procurement, b) operation and maintenance, c) distribution & revenue collection, d) pricing.
- Restructuring the MOWRAM's irrigation branch into two departments – a) minor irrigation (since 90% of irrigation comes from small and medium reservoirs), and b) major irrigation (since the required skill, technology is different then the minor irrigation). Both these departments can be headed by a Chief Engineer and then unbundled its functions and staff as listed above.
- Water utility reforms would require suppliers to behave more like commercial undertakings. This will imply adoption of more active pricing, introduction to metering, tariff restructuring, improved cost-recovery, and greater self-financing. This will often entail managerial and organizational reforms.

c) Set up autonomous bodies: Handling ofany additional funding, and faster decision making and adopting improved processes, requires an autonomous body to be set up by the Cambodian government. The body may be headed by a retired and well experienced government official or an outside person, well-versed with government procedures. It can be under the direct supervision of the MOWRAM. But, more important is, this body will have all the powers to design new activities and projects, outsource skills and execution, have third party monitoring and evaluation and handle all required funding and mobilize funding on its own with active support from the government. This would enable the entire process, to move on a faster track, and reduce all the procedural delays, and enable to evolve innovative and efficient methods of improving water sector and livelihoods of farmers. Successful experiences of China (SIDDS) and India (JSYS in Karnataka, WASMO in Gujarat) may be adopted with refinement to suit local conditions.

d) Promote public-private sector participation: Cambodia needs to promote massive investments through public-private-commune mode. The NSDP (2006-2010) clearly promotes private sector involvement through BOOT basis (p, xiii) in rehabilitation of physical infrastructure, including irrigation facilities.

- Privatization is appropriate in some cases, though it can take many forms and full private ownership is an extreme and rare variant. The French model of concessions and lease contracts has influenced a number of developing countries, e.g, Cote d'Ivoire, Guinea, Malaysia, Morocco and Thailand. Regulated private companies also operate in Santiago de Chile and Guatemala city.
- Explore various options to design, execute, operation and maintain the systems
  - BOOT – Build, own, operate and transfer
  - ROOT – Rehabilitate, own, operate and transfer and any other

e) Promote River Basin Organizations: To move towards integrated water resources management, Cambodia needs to promote mechanisms to set up river basin and sub-river basin organizations (RBOs). These RBOs can take care of assessment of water resources (both ground and surface flows) availability, emerging competing water demands (drinking water, agricultural, industrial, livestock and fisheries, and environmental flows). RBOs need to develop systems for annual and seasonal allocations across the competing sectors.

The functions of River Basin Boards may vary ranging from

- Preparation of basin level and regional plans,
- Maintenance of the allocation of water supplies for different uses,
- Generation of hydroelectric power
- Investigations for further allocations if it is to be made
- Maintenance of the multi-purpose projects
- Monitoring etc.
- Promote integrated water resources management

Thus, different Basin Boards across Cambodia may have different motivations behind their formation, which are basically needs-specific. Moreover, the funding of these Boards differ: While some may generate their own funding and budget, others may depend on the government.

d) Reclassify irrigation systems: In Cambodia, irrigation systems below 200 ha command area is categorized as small-scale irrigation. These systems cater to 90% of the total irrigated area in the country[22]. Farmers groups, during extended discussions

[22] In India, administration of tanks (small reservoirs) are divided into three categories based on their command area size. Each category of tanks is taken care by a different agency: a) below 4 ha by the Taluk Panchayat (sub-province), b) 4-40 ha by the Zilla Panchayat (equivalent to provincial level), and c) 40-2000 ha by the minor irrigation department. A tank with more than 2000 ha command area falls under the medium irrigation category is taken care by the Department of Medium

across the six FWUCs expressed and field observations indicated that these systems require recategorisation for better management. In case of Cambodia, though categories (small, medium and large) are indicated, more clarity, in terms of management and functions, is required for the local commune, provincial office and the country government. What is essential to separate the category, based on size into two broad categories, Minor irrigation (0-500 ha) and Major irrigation (above 500 ha). The MOWRAM needs to restructure itself cater to these needs. Skills, technology, capacity building, information system, monitoring, water regulation mechanism, control over source and distribution varies across these two broad categories.While, all minor irrigation systems (0-500 ha) can have one FWUC, major irrigation systems (above 500 ha) can have 3 tier organization systems of FWUCs – FWUC at field canal level, FWUC group at branch canal level, and FWUC Union at the large-scale irrigation system level. In both cases, sub-basin or and river basin users organization need to be encouraged. At country level, they can a federated structure headed by an FWUC apex body[23].

e) Integrate small reservoirs with large-scale command areas, wherever technically feasible

- Prepare location, size and feasibility of reservoir filling in canal commands and through canals
- Develop estimates for additional storage to be gained across the projects and districts
- Need to estimate likely benefits by linking these reservoirs.

f) Stress on ecological and social dimensions in consultation of FWUCs: Across all provinces, the rapid assessment and our field observations, besides interviews with FWUC chair persons clearly stressed the need for physical rejuvenation of the entire system of each reservoir. It starts from the catchments area treatment, desiltation of reservoir bed area, strengthening of reservoir bund and plugging all leakages, stone-pitching wherever required, calibration of designed and actual flows in the canals, and installation of gauge records at all cross-regulators. None of the FWUC records indicate water flow levels and quantity. In fact, there are no gauge records installed in any of the FWUC systems.

g) E-governance and monitoring cell

- Promote GIS based systems for effective monitoring at all levels. Establish or out source the geographical information system based water resources (including tanks and groundwater) map to be accessible to all levels of officers (assistant engineer to State level)
- Provide and computerize all levels of offices (up to assistant engineer level)
- Enabling offices, at all levels (including regional and FWUCs) with computers and on-line formats.
- On-line grievance cell and 4 digit number for public use
- Pollution load estimates in river and streams and make it mandatory to install water treatment plants in all in-let points.
- Establish on-line monitoring systems and monitoring it on regular basis**.**
- Evolve a set of performance monitoring and evaluation indicators at all levels.

h) Carry out environmental impact assessment: Cambodian irrigation systems are mostly located in the ecologically sensitive region, and linked to different sub-basins of the Mekong River Basin. Thereby, each system needs to be carefully assessed for their ecological contributions and their links to local livelihoods. e.g., Field observations indicated, burning of 60% of rice straws in the field itself, rather than using them as fodder (as used in several Asian countries – India, Pakistan, Sri Lanka) and as natural manure.

3.2. Irrigation management transfer

a) Decreased role by the government and increased role by user groups: The Ministry of Economy and Finance has to cooperate in making funding available for the development of irrigated agriculture sector which also includes the establishment and operationalizing the FWUC until they can operate on a self-help manner. Sufficient operation and maintenance budgetary allocation as stipulated in the Policy (MOWRAM, 2000) will have to be provided. As per this policy, the responsibility of operation and maintenance and the emergency repair shall rest with FWUC in a gradual process, as shown below:

The above expenditure applies only for the irrigation schemes constructed by the government fund and or the support from the international and national agency. The Policy says, farmers' communities will be encouraged to plan and develop irrigation schemes by utilizing their own resources. Upon request technical assistance could be provided by the government to the farmers in this regard.

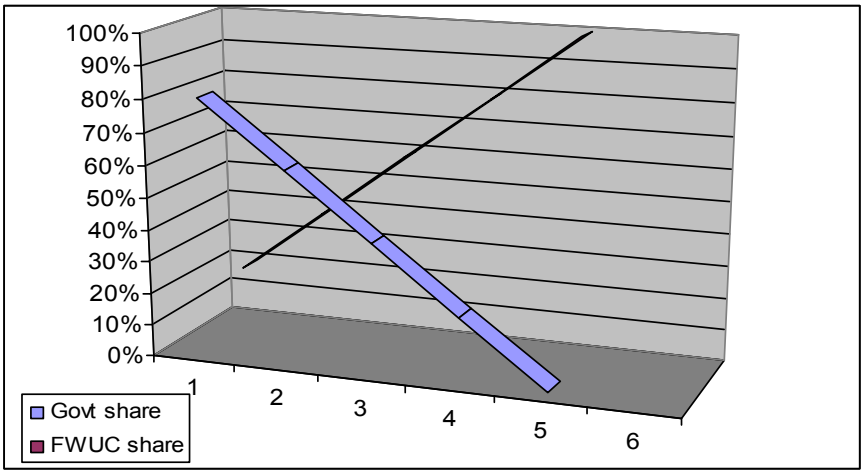
b) Management Transfer. Keeping in view of the global trend, and successful cases in several countries Cambodia needs to move towards management transfer.

- Select any 3-5 projects for pilot basis at the level of branch canals.

and Major Irrigation. Nearly 78 percent of the tanks Tamil Nadu and 92 percent in Karnataka are under the control of Panchayat raj bodies, with a command area of less than 40 ha.

[23] A recent publication from the Asian Development Bank (2008) on Irrigation Management Transfer presents experiences of various countries in this regard. Also see websites of INPIM for global experiences in this regard. www.inpim.org.

- Need to prepare action plan to cover the entire state in 2-3 years (details for the project design is discussed in section-2 of this paper).
- Set up Irrigation Management Transfer cell headed by a Engineer-in-Chief or Chief Engineer at the country level and convert one executive engineer at the provincial level in all projects to facilitate irrigation management transfer.
- Identify NGOs or professional organizations to facilitate the process.
- Need to cover both rural and urban water supplies.



Based on the capacity of the farmer organizations, the policy clearly states that, the irrigation systems shall be transferred to the FWUCs for their sustainable operation and maintenance and for the promotion of irrigated agriculture. Irrigation systems not fully transferred shall be jointly managed by the FWUC and the government. The right to operate the transferred irrigation scheme and related infrastructures and the responsibility of its protection shall be with the FWUC recognized by the government. After the scheme has been transferred, the Department of Agriculture of the MOWRAM shall conclude necessary agreement with the FWUC for proper utilization of irrigation facilities and related infrastructure. If FWUC need financial, technical or other assistance, the government or private sector may provide it. But in the future, PIMD requires that all assistance to irrigation systems will be provided in ways that encourage local investment by the FWUC. Assistance may be provided in ways that build the capacity of the FWUC to be self-reliant. Assistance need to be restructured so that it may be provided in ways that avoid creating dependence of the FWUC on the government.

3.3. Promote solar powered irrigation pumps to replace diesel use

Cambodia has indication of deposits of fossil fuels, natural gas and coal, and over 84% of the primary energy consumption is contributed by fuel wood. Less than 9% of rural households have access to a grid-quality electricity services. Per capita consumption of electricity is only about 48 kwh/year[24]. Those who depend mainly on rechargeable batteries and small diesel-fueled isolated generation have paid with very high unit prices of electricity. For more details see Box 1.Measurement during 1981-88 at Phnom Penh showed an average sunshine duration of 6-9 hours per day with high average of 5 kwh/m2/day indicating considerable potential of solar energy. The application of Photovoltaic system with total installed capacity of around 130 kwh is a recent development in Cambodia, as donated by international organisations such as UNICEF, Red Cross, SIDA and FONDEM who installed demonstration systems on health and rehabilitation centers. Solar Home Systems with an output of 12v, 50-70 Ah are being used for low income households in rural areas and require a US$ 40 investment per household. The cost of energy generated is approximately US 24.4 cents/kwh[25].

Box-1. Pumping Costs to farmers

- An employee of Water Resources Department, in Prey Veng area of the Mekong delta region in southern Cambodia, owns 6 hp diesel pumpset. In wet season the entire area remains flooded. Hence, the diesel pump is used in dry season, twice a month to irrigate rice fields. Each time operates for 8 hours, with a total consumption of 70 liters of diesel per month. Pump alone costs US$ 300, plus another US$ 200 for filter pipelines. Thus, total investment of US$500 per household. Total expenditure for diesel is US$100 per season. Pump renting would costs 0.75 cents per liter of diesel consumption. This is in addition to own diesel use. Each time, a 6 hp pump can irrigated 2.5 ha.
- In Prey Veng province, some 13766 wells are installed with diesel pumps. On an average, every year witnesses additional 100 wells in this province. Thus, an additional investment of US$ 50,000 per year in this province alone, to lift water.

[24] Cambodia Energy Sector Strategy (draft), 2004.
[25] op cit.

- Pump using farmers generally cultivate vegetables, sugarcane, water melon to make more money compare to rice crop. All of them feel the heavy pinch of water lifting costs in the absence of an alternative option.
- When we tossed the idea of solar powered pumps, they quickly jumped on it and expressed willingness to invest up to US$ 500 per household and there may be a total of 5000 households ready to pick this gadget. But they have hardly heard about solar pumps !.
- Source: Author's field visit during January 2008.

Large-scale use of solar powered pumps would reduce O&M costs to farmers and the government. In recent years, technology to use solar power for pumping from lower depths has been considerably improved. Field observations across six provinces indicated that farmers and even the MOWRAM agencies are pumping water from either rivers and or canals, at a depth of 1-4 meters. Solar pumps can lift up to 10 meters depth as its technology has been clearly demonstrated in recent years. Details of innovative efforts made by different agencies in Africa, South America, India, besides their technology and costs are shown in Box-2, 3, 4, 5. The Government of Cambodia and donor agencies may need to explore this option. Scale of operation at country level would enable the interested agencies to work out refined models to suit the local conditions.Till now, one solar powered pump has been installed (at US$800 in Kampong Chhang) in 2006 and works for most part of the day with 50mm wide pipe line. Both farmers across 6 provinces that we interviewed and officials of the groundwater department and of MOWRAM are keen to see more functional solar pumps across the country. They are sure about large scale reductions in costs currently incurred for pumping water and related fuel costs. But all of them prefer to have capital investments either from the external aid or through long-term loans with subsidy component built in. Farmers were willing to make down payment of 30% as their initial investment to these gadgets.In Prey Veng province of southern Cambodia, more than 13,000 diesel pumps are currently being used to extract water from the depths of 1-2 meters (directly from main canal) and 3-6 meters (directly from Mekong river). MOWRAM uses around 3 million litres of diesel per year for its 55,000 pumps of various sizes (depth range 1-10 meters) spread across the country. Use of solar pumps would help in replacing these diesel guzzling pumps. More importantly, solar powered pumps help to save critical costs to individual farmers.

Key Options

- Provide enabling policy and legal framework, in favour of encouraging solar energy in rural areas and particularly for water resources sector.
- **Loans with subsidy:** Provide easy access to financing solar energy equipment through banking and service providing agencies, with lower interest rates. In India, solar units are provided with 5% interest and a long-term loan.
- **Awareness creation**: Adequately provide information on market characteristics, resource potential and service providers.
- There is a need to conduct detailed resource assessment studies.
- **Promote private investment:** Promote large scale private sector participation, in install-maintain-operate-collect fee basis. Another option for large scale, or village level schemes, is Build-Own-Operate and Transfer (BOOT) basis. This would reduce user's burden on investments and technicalities.
- **Capacity building:** Strengthen institutional capacity for planning, implementation and maintenance at all levels. Lack of coordination among concerned stakeholders (government, donors, NGOs, private sector, financial institution) also acts as another barrier in the absence of a comprehensive policy on renewable energy development.
- **Exposure visits:** As part of capacity building, the government needs to support a delegation of some 12 persons-comprising 6 FWUC representatives and 6 concerned officials – to visit India and other places, where solar powered pumps are in operation (also see Box 1-4). For farmers, seeing is believing. Visits to Uttar Pradesh, where the government has set up an autonomous agency to promote renewable energy and other private agencies sites (e.g, Tata-bp solar) would be useful experience. Indeed, the on-going project of TCP-3101 may support such visit, subject to budget availability.

3.4. Promote property rights and provide legal provisions

Need clarity on property rights

To be effective, farmers groups need more clarity on property rights of canals, canal bunds, reservoir bunds, catchments area, reservoir bed area during dry season, common lands, rights of members and how to enforce it during both surplus and scarce situations of water levels in the reservoir. A reliable quantity and flow of water of suitable quality, and protection from pollution, are basic requirements for irrigation development. The issue of legal security has been evolving from existing or potential water conflicts and is addressed through legal mechanisms for conflict resolution. Security of water rights is, however, also required for non-conflicting situations related to market transactions, such as the commercial transfer of water rights among users or when using water right as collateral for bank credits. Water rights titles, through certain and clear legal instruments, are critical to prevent conflict and to stimulate market mechanisms for enhanced efficiency in water use.Transferability of water use rights is particularly important for irrigation, so as to encourage investment in water saving practices and permit alternative, higher-value uses of the saved water. However, to curb speculation in water rights, especially when water is scarce, irrigation water is commonly considered to be appurtenant to the irrigated land. Purely market-driven transfer systems are rare, and actual practices,

to be consistent with public policy objectives and water plans, are often limited to transfers under the direct control of government water administrations (FAO, 1995)[26].

3.5. Createcommitted fund for awareness creation and capacity building

Both officials and farmer groups (e.g., FWUCs) are in need of wide scale awareness creation and skill up gradation. This may be done through visits to locations in various countries, which are similar to Cambodian irrigation systems. Some of the best examples are available for small-scale irrigation systems in Southern states (Karnataka, Andhra Pradesh, Tamil Nadu, and Maharashtra) of India, Sri Lanka, South Africa, and China. Centuries old small-scale irrigation systems in these countries are currently being getting rejuvenated through active participation of water user organizations. These states/countries are also backing their efforts by refining their policy and legal frameworks to facilitate faster development. Learning lessons from their experience and regular visits by Cambodian officials and farmers to these countries/states would help motivate and learn better. Cambodia can explore options of utilizing the Indian government offer of training under technical and economic cooperation programme -2008-09. This programme can help both officials and farmers and others and this will take care of all basic costs[27]**.** Similar options from other countries may also be explored.

REFERENCES

ADB and MOWRAM, 2007. Water Sector Analysis. Prepared by TEAM consulting Engineering and Management Co., Ltd and SDC consulting Co, Ltd., TA no. 4848. November 2007.

Asian Development Bank, 2006. Rehabilitation and Management of Tanks in India: A Study of Select States. Publication Stock No. 122605.

Cornish G with B.Bosworth, C. Perry and J. Burke, 2004. Water charging in irrigated agriculture: An analysis of international experience. FAO water reports 28.

FAO, 1995. Reforming water resources policy: A guide to methods, processes and practices. FAO Irrigation and Drainage Paper No.52.

Ministry of Water Resources and Meteorology 2000. Circular No.1 on the Implementation Policy for Sustainable Irrigation Systems, Policy for Sustainability of Operation and Maintenance Irrigation Systems and Steps in the Formation of a Farmer Water User Community. Ministry of Water Resources and Meteorology, Kingdom of Cambodia, June 2000.

Ministry of Water Resources and Meteorology 2003. Introduction to PIMD, Module-1. MOWRAM, Kingdom of Cambodia, October 2003.

MOWRAM 2003. Design Standards for Irrigation Works: For Particular Application to Works of Small and Medium Scale. Draft Final Report. Prepared by Department of Irrigated Agriculture and Leighton Williams. Agricultural Sector Program supported by the Asian Development Bank, June 2003.

MOWRAM 2007. Inception Report for Strengthening the Participatory Irrigation Management and Development Strategy (TCP/CMB/3101), MOWRAM, Department of Irrigated Agriculture, October 2007.

Raju K.V, Ashok Gulati, and Ruth Meinzen-Dick, 2002. Institutional Reforms in Irrigation Financing: A Case of Krishna Bhagya Jal Nigam Limited. Journal for Social and Economic Change, ISEC, Bangalore.

Raju, K.V., GK Karanth, MJ Bhende, D Rajasekhar, KG Gayatridevi 2003. 'Rejuvenating Tanks – A Socio-Ecological Approach', Books for Change, Bangalor

Raju KV and Tushaar Shah, 2004. Revitalisation of Irrigation Tanks n Rajasthan. ISEC Working Paper. Bangalore.

Royal Government of Cambodia 2006. National Strategic Development Plan (2006-2010). Ministry of Planning, Phnom Penh.

Royal Government of Cambodia 2007. Strategy for Agriculture and Water (2006-10). Prepared by Technical Working Group on Agriculture and Water. Ministry of Agriculture, Forestry and Fisheries and Ministry of Water Resources and Meteorology. Phnom Penh.

[26] FAO, 1995. Reforming water resources policy: A guide to methods, processes and practices. FAO Irrigation and Drainage Paper No.52.

[27] For more details see, The Cambodian Daily (p.32) or website: www.itec.nic.in.

****