Equitable Distribution of Potable Water & Realization of Water Charges to make Water Supply Systems sustainable in South East Asia

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Abstract

The paper deals with the basic profile of the water resource at world level along with the four south eastern countries namely Cambodia, Vietnam, Laos and Thailand. Further, it explains about the quantum of water available for different uses including domestic, irrigation, hydropower and industries in these countries. The paper, also describes the reasons behind non-payment of water charges as it hampers the satisfactory functioning of the system. Accordingly, suggestions have been made, keeping in view the social and financial status of the water users.

1. Introduction

Water is the most important natural resource for sustainable development and quality of life yet its uneven distribution makes it a limited scarce commodity. Historically, Paleolithic settlements were located near sources of fresh water. It is well evident that some of the greatest civilizations in the past flourished on the banks of major river systems. Even in today's world, major political conflicts arising among nations find their root in the ever-increasing demand for water. Water is being mainly used for:

1.1 Agricultural/Irrigation: Worldwide, agriculture accounts for 70% of all water consumption. With growth in global population, the demand for food is increasing progressively. Thus, conscious efforts are being aimed at producing more food with less water through improvements in irrigation methods and technologies.

1.2 Domestic: About 8% of worldwide water is consumed for domestic purposes including drinking water, cooking, bathing, flushing, cleaning, laundry and gardening as well as for cattle.

1.3 Industrial: It is estimated that 21% of available water is used by industries. Major industrial users include hydroelectric dams, thermoelectric power plants, ore and oil refineries, tanneries and food processing units. Water withdrawal can be very high for these industries, but consumption is generally much lower than that of agriculture as water consumed by industries is generally recyclable.

1.4 Environmental: Environmental water includes water stored in impoundments, released for environmental purposes along with water retained in waterways through regulatory limits of abstraction. Though, explicit usage of water for environmental use is very small and non-consumptive but it reduces the availability of water for other users at specific times and places.

2. WATER RESOURCES IN SOUTH EAST ASIA

The South-East Asia is endowed with abundant freshwater resources. The sub-region receives 9.5 per cent of the total global precipitation volume every year and is blessed with 16.2 per cent of the world's total renewable water resources.

In this regard, it shall be noted that despite population pressure (with the region's population density being 2.6 times that of the world average), the annual per capita water resources availability exceeds 5,800 m^3 in all South East Asian countries. The average annual per capita water resources of 12,980 m^3 in the South East Asian region is almost double the world average. The total water withdrawal is 4.5 per cent of the available water resources, although variations exist among the countries, ranging from 0.9 per cent in Cambodia and Lao PDR, to 21.2 per cent in Thailand.
The agricultural sector is the major water consumer (85.5 per cent of total water use), followed by industrial (7.8 per cent) and domestic sectors (6.6 per cent). The region's rapidly industrializing and urbanizing countries (Malaysia; Philippines; Indonesia; Thailand) have relatively higher water productivity, reflecting the higher value of water in the industrial sector. Inhabitant's access to safe drinking water and improved sanitation facilities in the South-East Asia (except Cambodia and Lao PDR) are high, compared to the world average. The present status of freshwater resources in south East Asia is listed in the table 1 below:

Table 1: State of freshwater resources in South East Asia

Country or Region	Average precipitation (billion m^3/yr)	Total renewable WR (billion m^3/yr)	Per capita WR, 2004 (m^3/peson/yr)	Freshwater withdrawal (%)				Per capita withdrawal, 2004 (m^3/person/yr)	Water productivity, 1987-2004(US D/m^3)
				Total	Agri.	Indust.	Dam		
Cambodia	344.6	476.1	34,500.0	0.9	97.8	0.6	1.6	310.5	1.0
Lao PDR	434.4	333.6	57,517.2	0.9	90.3	5.5	4.2	517.7	0.6
Thailand	832.4	409.9	6,434.9	21.2	95.0	2.5	2.5	1,364.9	1.5
Viet Nam	604.0	891.2	10,841.8	8.0	68.1	24.1	7.8	867.3	0.5
South-East Asia	10,446.2	7,062.5	12,979.0	4.5	85.5	7.8	6.6	590.5	
World	110,000.0	43,659.0	6,859.2	8.8	70.0	20.0	10.0	603.6	8.6

(Source: FAO, 2007)

2.1 CAMBODIA:

As per the National Water Policy of Royal Kingdom of Cambodia, emphasis is on improving water supply in terms of both quality and quantity in response to market demands, while providing people with sustainable services. In this regard, the Government is now focusing on private company investment in this sector. Promoting investment by the private sector in irrigation, drainage and other aspects of agricultural water management and promoting appropriate and effective river basin management and water allocation systems are also envisaged. Accordingly, water supply by private companies has increased notably in last few years.
Cambodia has a predominantly rural population, with some 85 per cent of people living in rural areas. Half of its work force is employed in agriculture. Also, Water supply in Cambodia is characterized by a low level of access in rural areas (66%)

compared to relatively high access to an improved water source in urban areas (94%).
In Cambodia, surface water, groundwater and rain water comprise the major sources for drinking and other domestic purposes. It receives heavy rainfall and thus has a tremendous quantity of water to fill watercourses, wetlands, lowland areas, etc. With this large amount of water, Cambodia and other countries in the region flood annually, which affects human health, infrastructure and the environment. However, during the dry season, people in most rural areas are faced with water shortages due to which a lot of time is spent in searching for water in far flung areas for fulfilling daily demands. This also forces people to use contaminated water during emerge ncies.

2.2 LAO PDR:

The policy by the Lao PDR Government on management and development of the water sector describes a range of functions for the sector including the division of responsibilities on sector administration, the establishment of the Water Supply Authority's Regulatory Board, financing of sector operations and cost recovery and utility operation requirements. The government plans to meet its goal of reducing poverty and ensuring food security through the expansion of irrigated agriculture. Better water management and use will also help with flood and drought management protection, thereby assisting the country to address issues related to climate change and environmental protection.
Agriculture is the most important sector in its economy, contributing 53 per cent of GDP and occupying about 83 per cent of the income earning population. About five million hectares of total land area of 23.68 million hectares is suitable for cultivation. However, of this, only 17 per cent of the suitable land area, equal to less than 4 per cent of the total land area of the country (between 850,000 and 900,000 hectares), is actually cultivated. With Government efforts, the irrigated area has expanded significantly over last few years. 60% of urban population and 51 % of rural population has access to clean water.
Lao PDR has rich water resources, mainly good quality fresh water. Currently most of the water use occurs in the agricultural sector such as irrigation, fisheries, plantations and livestock rearing. The plenteous supply of water in this region, especially in the rainy season, provides good condition for water transport, industrial development and water supply. The water resources and topography give it great potential for hydropower development which forms an important part of the government's national socio-economic development strategy. Water resources are also valuable for other economic sectors such as the irrigation, rural and urban water supply, fisheries, tourism, mining, industry, transportation (navigation) and others.

2.3 THAILAND:

The Royal Thai Government's policies on water resource management and the solutions for development or rehabilitation is presented into three main categories based on area functions which are the upper (forest area), middle (agricultural area and community), and lower (downstream included coastal area) River Basin. The Nationwide, natural resources strategies emphasize on the preservation of bio-diversity, efficient use of water resources, and the restoration of soil fertility to support increased agricultural productivity, as well as to support conservation, and improved the effective use of energy. Subsequently, the water resources

development budget has been increasing and represents a large portion of the national budget for development.
The agricultural sector remains the main user of available water and accounts for 71 percent of total water demand; the industrial sector accounts for two percent, the domestic sector for five percent and the remaining 22 percent are for ecological balance.
Thailand is an agricultural based country. Water has been the main resource to support the expansion of agricultural activities and its increase in productivity. Water shortages and flooding are commonly reported during the dry and raining seasons respectively. Demand for water in other sectors, such as tourism and industry, continues to increase, having a major impact on the country's fragile water infrastructure and resources. Although, the quality of water resources in Thailand is in fair condition with a significant trend of improvement; agricultural run-off, coastal aquaculture, industrial effluents and domestic sewage are responsible for the pollution of groundwater. The lack of an appropriate pricing policy has led to over-exploitation of groundwater beyond sustainable yield levels.
The available water resources in these countries with reference to surface water and ground water are provided in the table 2.

Table 2: Profile of Water Resources Available

Description	Cambodia	Lao PDR	Thailand
Total Internal Renewable water resources (BCM)	**120.6**	**190.4**	**224.5**
Surface water	116	190.4	213.3
Groundwater	17.6	37.9	41.9
Total External renewable water resources (BCM)	**355.5**	**143.1**	**214.1**
Surface water	355.5	143.1	214.1
Groundwater	0	0	0
Total Annual Renewable water resources (BCM)	**476.1**	**333.5**	**438.6**
Surface water	471.5	333.5	427.4
Groundwater	17.6	37.9	41.9
Overlap between Surface and Groundwater	13	37.9	30.69

It is seen that there is still difference in the total area available for irrigation to that actually irrigated in these countries. There is hence need for infrastructure development to bring total area under irrigation.

Table 3: Profile of Irrigated Area

Country	Irrigation Potential (million ha)	Irrigated Area (million ha)
Cambodia	1	0.3
Lao PDR	0.6	0.14
Thailand	9.5	5

3. UNIVERSE OF STUDY

For the purpose of study, the universe comprises three countries covering 5 provinces and 19 districts spread over 30 communes. In these communes, a total number of 42 sampled villages were covered for collecting information from primary sources. Table 3 below shows the country wise villages covered under the study.

Table 3: Area under Study

Sr. No.	Country	Province	District	Commune	Village
1.	Cambodia	Siem Reap	Varin	Prasat	Kab Dei
			Soutr Nikum	Khua pon	Domrei Ckhlong
				Khaeh	Khaeh
			Svay Leu	Kan Tuot	Kna Krav
				Khnang Phnom	Preh Angthum
			Angkor Chhum	Nokor Pheah	Som bour
			Puok	Yeang	Kahn Chon khhuy
				Kaev Pour	Svay Chek
			Prasat Bakong	Kandaek	Spean Kaek
					Chres
				Bakong	Konk Trach
					Lolai
				Rolous	Doun Teav
			Bantaey Srei	Run La Ek	Run
				Prah Dak	Ta Koh
			Siem Reap	Kompong Pluk	Trout Kambot
				Sro Ngae	Sro Ngae
		Svay Leu	Siem Reap	Beong Mea Lea	Sakda
2.	Laos	Vientiane	Sisattanak		Sapanthong Tai
			Chanthabouly		Haeaybtong
			Xaythany		Khokyai
					Nomgviem Kham
					DonNoun
					Nongbouthone
					Nakay
					Phontong
					Dontnasokncu
3.	Thailand	Sa Kaeo	Aranyaprathet	Aranyaprathet	Aranyaprathet
				Ban Dan	Ban Dan
				Ban Mai NongSai	Ban Mai NongSai
				Ban Mai	Ban Mai
			Watthana Nakhon	Sae-o	Sae-o
				Tha Kwian	Tha Kwian
			Mueang Sa Kaeo	Sa Khuran	Sa Khuran
				Sa Kaeo	Sa Kaeo
			Khok Sung	Nong Waeng	Nong Waeng
				Nong Muang	Nong Muang

		Prachin Buri	Si Maha Phot	Si Maha Phot	Si Maha Phot
				Nong Phrong	Nong Phrong
			Kabin Buri	Wang Tabhian	Wang Tabhian
				Mueng Keo	Mueng Keo

(Source: enumerated by investigators)

4. METHODOLOGY

4.1 TOOLS

For collection of information from primary sources, two types of data collection tools i.e. Household Interview Schedule and checklist for having Focused Group Discussions (FGDs) were used. The Household Interview Schedule was used for collecting information in quantitative form, while, FGD checklist was used for collecting information in qualitative form. Both the tools were developed by incorporating different variables / indicators keeping in view the objective of the assignment. The tools, before canvassing in the field, were pretested and finalized by incorporating corrections emerged during pre- testing of the same.

4.2 SAMPLING

Information was collected from head of the households of different localities falling in the study area. A total number of 20 households in each country were selected randomly by using random table, for having in-depth knowledge of the perception about water supply and sanitation, health and hygiene, water tariff and charges of the concerned people in the study area.

4.3 DATA COLLECTION

For primary data collection, a survey team comprising of investigators and field supervisors were involved locally, who were well verse with the local conditions, traditions and culture of the study area. Data collected in the field was validated by the field investigators/ field supervisors, before making its entry in the computer. Data collection and its validation were completed under the overall guidance of the WAPCOS expert's team.

4.4 DATA ANALYSIS

Simple statistical techniques were used for data analysis purpose. The inferences were drawn, keeping in view the aims and objectives of the assignment. Thus, socio-economic profile of the project area and the households has been presented by analyzing the information mainly collected from primary sources. The survey was conducted by the study team to facilitate an in-depth understanding of the perception of people regarding payment of water charges and their capacity to pay the same in future. Based on the findings, suitable measures could be proposed to tackle the issues in an effective manner. In analyzing the data, it has been assumed that these households are true representative samples of the respective countries.

5. RESULTS

5.1 SOURCES OF WATER

As a part of the study, information regarding sources of water for the different purposes viz. Drinking, sanitation, washing, cattle etc. was gathered. It was found that main sources of water during summer and winter seasons were hand pumps

(25%) followed by wells (18%) and ponds (8%) respectively. It was also found that in Laos and Thailand, use of piped or bottled water is prevalent among local people. Similarly, main sources of irrigation in the study area were river, canal, well etc. in Cambodia and Laos while piped/ bottled water was used in Thailand.

5.2 PERCEPTION REGARDING WATER

Regarding perception of sampled households about quality of water and preference of water for different purposes, it was found that majority (73%) of the sampled households were satisfied with the quality of water. About 68% of the sampled households in the three countries preferred using sub surface water over surface water for domestic purpose.

5.3 HEALTH & HYGIENE

It was found that the study area lacked basic facilities relating to health services. There were limited number of health centres without qualified doctors and medicines. Occurrence of preventable diseases including water-borne diseases was significant as per the perception of sampled households. The present situation in the health education and awareness thus needs to be well notified. There are some topics related to hygiene and health care in the text books of the school curriculum. Health office also promotes the aspects of public health by posters, video, audio and group discussions from time to time.

Regarding hygiene, it was reported that in majority of the households in Cambodia, toilet facilities were not available. Only 42% of households have toilet facilities within the house while rest 58% households follow open defecation practices. In case of Laos and Thailand, sanitation facilities are found to be developed as all the sampled households contain toilets within houses.

5.4 MIGRATION

The study area follows subsistence agricultural economy, where paddy production predominates. Farmers are engaged in other income generating activities also including fishing, cultivation of vegetables, handicrafts manufacturing, earthwork and construction. The choice of activities depended on location and resources of the household. If no opportunities were available within or near the villages, people temporarily migrated to the urban areas in search of job opportunities.

During the focused group discussions with people, migration among the sampled households was found to be prevalent in Cambodia. Persons from about 30% of households migrated to other areas including 10% people moving out of country in search of better opportunities. Whereas migration is found to be very insignificant in Laos and Thailand which indicates availability of better employment opportunities along with basic facilities within or nearby villages for livelihood of the population residing in these countries.

It implies that insufficient water infrastructure impacts migration trends in an area as people tend to move out to places with better facilities in water supply, health and hygiene and sanitation.

5.5 EXISTING MODE OF PAYMENT FOR WATER

During the study conducted among the sampled households, it was found that all the households in the three countries follow monthly mode of payment for water supply as shown in table 4 and are willing to follow the same in future as well.

Table 4: Existing mode of payment of water charges

Sr. No.	Country	No. of Sampled Households	Mode of Payment
1.	Cambodia	20	Monthly
2.	Lao PDR	20	Monthly
3.	Thailand	20	Monthly

5.6 WATER TARIFF & WILLINGNESS TO PAY

The sampled households mentioned that the safe drinking water in rural areas is being provided by handpump installation, piped tank water supply and rainwater harvesting structures. The water supply is operated and maintained either by the local authorities or private entities which is available only in less than 20% areas of all the three countries under study area. The price varies from 0.13-0.25 USD/m^3 in Cambodia while, in Laos it is 0.17-0.24 USD/m^3 and 0.14-0.2 UD/m^3 in Thailand.

The recovery of domestic water tariff in urban areas through residential areas, commercial buildings, public and state authority and industries is good with around 90% due to rise in business activities in ASEAN countries. Based on the discussions held during the FGD, it was found that there is good recovery for water tariff for domestic water supply even in rural areas. The irrigation service fees imposed on farmers to use irrigation water from canals is presently available in limited areas and irrigation service fees depends upon the crop sown and cropping practices adopted by the farmers. It has also been noticed that due to poor recovery and low maintenance of irrigation structures and canals, concerned Governments are interested in uplifting the irrigation fees to enhance the cropping intensity. The sampled households under study believed the maintenance of canals and other small irrigation structures is necessary which can jointly be done by the Government of concerned countries.

It is inferred that the people are willing to pay the water tariff provided they get sufficient water of adequate quality for irrigating their standing crops. They were found satisfied with the tariff amount but payment will be possible only when water is available in their fields.

The sampled households were judged on the following aspects as listed in table 5 below:

Table 5: Suggestions by Sampled Households

Sr. No.	Suggestion	Frequency		
		Cambodia	Lao PDR	Thailand
1.	**Willingness to pay if water is available for irrigation**	1	2	2

2.	**Availability of plenty of surface water which can be used in summer season**	2	2	1
3.	**Need for restoration of canals and ponds**	3	1	2
4.	**Non-availability of water for sanitation and other purposes in remote areas**	1	3	1
5.	**Villages located in terrain of Kulen mountain range need to develop water sources**	2	-	-
6.	**Due to scarcity of water, dug - well are constructed by the local people**	1	2	2
7.	**Willingness to pay for piped water supply for domestic use**	2	5	3
8.	**Need for development of reservoirs for irrigation purpose**	2	2	1
9.	**Non-availability of surface water resource and infrastructure**	1	1	2
Total		15	18	14

It was found that people are satisfied with the availability of surface water which can be used during the lean season. For this purpose, they mentioned that there is a need of restoration of ponds and canals available in the study area. Further, they mentioned that in remote areas where scarcity of water is prevailing, the dug wells can be constructed. They perceived that there is a need of development of reservoirs for irrigation purpose as the surface water resources infrastructure is lacking. Lastly, it was mentioned that people are ready to bear the monthly expenses towards water tariff, etc. provided they are given water timely and adequately as per the demand.

6. CONCLUSION

From the study, it is concluded that there is a lot of scope of improvement in the socio-economic conditions of the people residing in these countries. Also, the residents are interested in diversification of the existing cropping pattern provided they get adequate and timely water for the same. They have shown willingness to pay water tariff given that there demand of adequate quantity of water for domestic as well as irrigation purposes is fulfilled.

It is proposed that the Governments of these countries shall emphasize on preparation of Master Plans which will further identify suitable projects in phase wise manner for implementation in next 20 years for development of the areas in respect of water, power and infrastructure in the respective countries. The Master Plan shall become a precious document for immense use of these Countries and the projects identified from the Master Plan would ultimately become helpful in raising the overall conditions of the peoples residing in South East Asian Countries.

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