WATER PRICING TO IMPROVE WATER PRODUCTIVITY AND ITS EFFECT ON CROP PRODUCTION: A STUDY OF THE MINIPE IRRIGATION SCHEME, SRI LANKA

TARIFICATION DE L'EAU POUR AMÉLIORER LA PRODUCTIVITÉ DE L'EAU ET SES EFFETS SUR LA PRODUCTION AGRICOLE: UNE ETUDE DU PROJET D'IRRIGATION MINIPE, SRI LANKA

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ABSTRACT

It is generally believed that water productivity in agriculture could be increases through effective water resource management. According to this belief, water is considered as an economic good and it has the potential to advance the objectives of Irrigation Water Resources Management (IWRM). However, the role of water as a basic need, besides its social, economic and environmental roles make pricing of water difficult conceptually and in practice. Growing water scarcity in both space and time increases the need of sound economic analysis. Further, there is a considerable confusion about the exact meaning of water as an economic good and its implication in the principles and practices in IWRM. Many of the water related problems arises as the actual price of water bears little relations to the cost of its extraction and distribution. Also, no attention is paid to water resources sustainability and equity.

In this context, the present study examines the determinants of of costing and valuation of irrigation water for rice cultivation in Minipe scheme and its effect on production. Data were collected from existing sources and from randomly selected farmer families. "With and without" approch was used to analyse the data.

The value of water was estimated in 2009 to be US$0.032/m^3. This indicates thst a large share of profit is attributed to retuens to water. The calculated full economic cost of water diverted to agriculture was US$ 0.024/m^3. This includs operation and management (O&M) cost. The

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big gap between the cost and values clearly indicates the lack of sustainable use of irrigation water. The profit from rice cultivation was calculated and compaired with the forcast water cost to the production. It was revealed that when pricing water, the income from production of rice became negative. Therefore more effort has to be put in crop diversification, particularly to those crops, which use less water than rice; improving water management through farmer participation and development of physical and infrasture facilities of the scheme.

Key words: *Water pricing, Minipe scheme, Sri Lanka, cost determinants of water, crop diversification*

RESUME

Il est généralement admis que la productivité de l'eau dans le secteur agricole pourrait être augmentée grâce à une gestion efficace des ressources en eau. Selon cette idée, l'eau est considérée comme un bien économique et il a le potentiel de faire avancer les objectifs de la Gestion des Ressources en Eau pour l'irrigation (IWRM). Cependant, à part son rôle social, économique et environnemental, le rôle de l'eau comme un besoin fondamental, rendre difficile sa tarification, conceptuellement et dans la pratique. La pénurie croissante d'eau dans l'espace et le temps augmente le besoin d'une analyse économique solide. De plus, il y a une grande confusion sur la signification exacte de l'eau comme un bien économique et son implication dans les principes et les pratiques d'IWRM. De nombreux problèmes concernant le prix de l'eau se posent vu que le prix réel de l'eau et le coût de son extraction et sa distribution ne sont qu'étroitement liés. En outre, aucune attention n'est accordée à la durabilité et à l"équité des ressources en eau.

Dans ce contexte, cette étude analyse les déterminants de l'évaluation des coûts et la valorisation de l'eau d'irrigation pour la culture du riz dans le plan Minipe et ses effets sur la production. Les données ont été recueillies auprès de sources existantes et des familles d'agriculteurs choisies au hasard. L'approche « Avec et sans » a été utilisée pour analyser les données.

La valeur de l'eau a été estimée en 2009 à 0,032 / m^3 $ US. Ceci indique qu'une grande part des profits est attribuée à la rémunération de l'eau. Un totale de US $ 0,024 / m^3 a été attribué à l'agriculture, y inclus le cout de l'exploitation et de gestion (O & M). Le grand écart entre le coût et les valeurs de l'eau utilisée pour l'agriculture indique clairement que l'utilisation des eaux d'irrigation n'est pas durable. Le bénéfice de la culture du riz a été calculé et comparé avec le coût de l'eau prévu à la production. Il a été révélé que les revenus venant de la production de riz étaient moins que le coût de l'eau et donc au lieu d'avoir un profit, une perte s'est produite. Conséquemment, plus d'efforts doivent être investis dans la diversification des cultures, en particulier à des cultures qui utilisent moins d'eau que le riz ; l'amélioration de la gestion de l'eau grâce à la participation des agriculteurs et au développement des installations physiques et de l'infrastructure du système.

Mots clés : *Tarification de l'eau, plan Minipe, Sri Lanka, déterminants de coût de l'eau, diversification des cultures.*

1. INTRODUCTION

Water has become a crucial and complex resource in view of its multidiciplinary utilization aspects. Growing water scarcity due to its competitive demand by various sectors increases the need of sound economic analysis of the planned water water utilization as well as of its present use.

The current water issue is often a crisis of governance rather than crisis of physical scarcity (Rijsberman 2006). Current concerns about climate change, believed to manifest in more intense floods and droughts, calls for an improved management of the water resorces.

Intergrated water resource management defines the systermatic process for the sustainable usage and monitoring of water. The allocation of water resources in the context of social, economic and environmental objectives are essential to ensure a fair destribution of this resource. The traditional approaches combined with modern technology and participatory decesion making enhance the fair destribution of the resource among all the users. But when it comes to evaluvation and monitoring, there should be a suitable measuring unit for gains and losses. Economic consideration, therefore, seeks to put a value on the use of water and asses the cost of allocating water in different sectors.

In Sri Lanka irrigation water is supplied free of charge to farmers. This has caused inefficient usage of irrigation water. It is estimated that 90% of the total fresh water resources are being used by agriculture.

In the above context, the main objective of this study is to present a framework for operationalizing the concept of pricing or costing and its valivation in the irrigation sector for sustainable crop production. The selected sample area is Minipe Yoda Ela Scheme.

In Sri Lanka, government policies have always emphasized the necessity of paddy production to become self-sufficient in production of the staple food grain. Since 1980, however, non-paddy crops, also known as other field crops (OFC) or subsidiary field crops have begun to assume greater importance in government polices. There are a number of reasons for encouraging the cultivation of OFC, especially in the dry zone irrigation systems like Minipe and major irrigation schemes like Mahaweli System H. However, there had been a big gap between the target and the achievement of OFCs cultivation in such schemes. An early study conducted in the Mahaweli System H, (Deegan and Herath, 1980) identified three categories namely physical, organizational and socio cultural aspects operative in farmers' decision about growing OFCs. The statistics suggest that the progress in OFC cultivation over time has been very slow (CBR 2008). This is more pronounced in marginalized areas like the Minipe irrigation scheme.

2. METHODOLOGY

Minipe is one of the major irrigation schemes in Sri Lanka, which irrigates nearly 10,000 ha in the Eastern part of central highlands. This scheme is fed by Mahaweli River, which is the longest river in Sri Lanka. The main canal of Minipe is 75Km long and feeds 140 distributary

canals. This scheme is one of the oldest schemes in Sri Lanka and this is the first diversion of Mahaweli river.

According to the farm settlement, the scheme was divided in to 4 sections. There are 60 farmer organizations in this scheme tocarry out operation, maintenance, farmer activities and administration of destributary canal level farm territories. After Mahaweli development program, the water in this river gained additional value due to hydropower generation and extended agriculture.

The study was conducted during the dry season (May - September) and data was collected by farmers and line organizations related to irrigation, agriculture and land. Focus group discussions with farmer organizations and key informant interviews were carried out. Governmental and non-governmental officials using semi-structured questionnaire collected other relevant data.

The difference between the net returns of production per unit area in irrigated agriculture and non-irrigated agriculture plots were considered as the criteria of calculating of water value for agriculture.

$$\text{Value of water In Agriculture(VWA)} = \frac{\text{Net output with irrigation – net output without irrigation}}{\text{Volume of water diverted for irrigation}}$$

There are different principles involved in assessing the economic value of water and the associated cost to provide water. Regardless of the method of estimation, the ideal situation for sustainable use of water requires that the values realized out of using the water resource and the cost should balance each other. In addition, the alternative uses are important to consider for the aspect of rational allocation of water as a scarce resource.

Charging is applied as an economic instrument to achieve multiple objectives such as to support disadvantaged groups, influence behavior towards conservation and efficiency, provide incentives for demand management, ensure cost recovery, and consumer willingness to pay (WTP) for additional investments in water service.

The following three important components have to be further explained in costing.

1 Full supply cost

2 Full economic cost

3 Full cost

Costs associated with its provisions helps in assessing the economic value of water. Even though all the components were not considered in the assessment, Fig. 1 illustrates schematically the general principal of cost and value of water. The full value of water is the sum of the economic value and the intrinsic value.

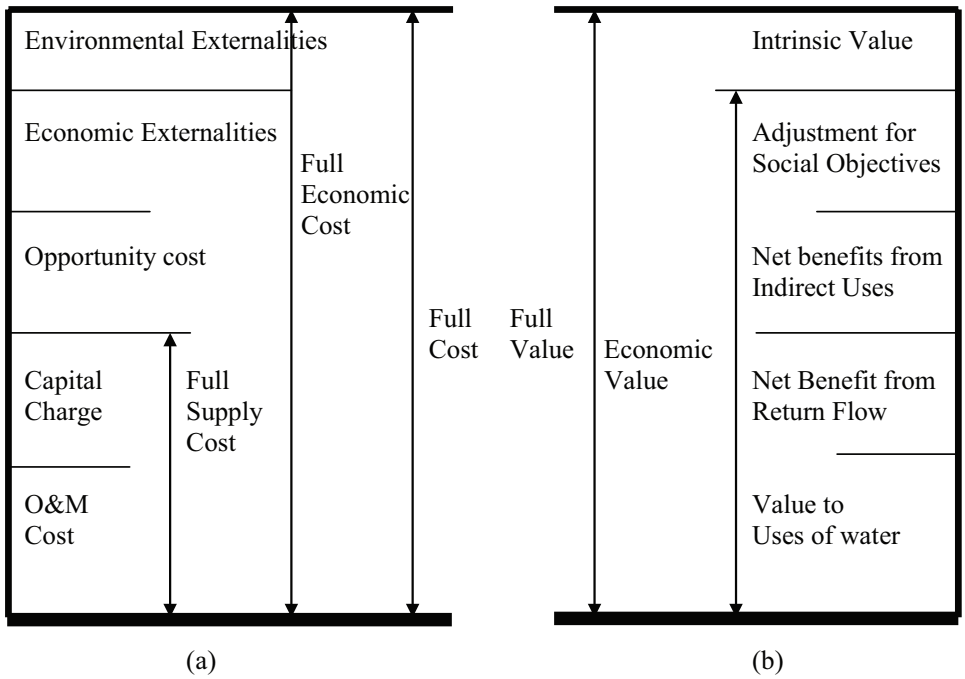

Fig. 1. General principles of cost of water (a) and value in use (b)

3. RESULTS AND DISCUSSION

The result of this study shows that the inequality of the economic conditions of the farmers are apparent between head end of the scheme (Stage I) and the tail end (stage IV).

Rice is the mostly cultivated crop in both wet and dry seasons. The average yield of unhushked rice (paddy) varies between 4.53 to 3.93 mt/ha. The cost production per hectare varies $ 500 to $560. Here the cost for water is not considered since the irrigation water is given free to farms. The net return per hectare varies $1350 to $1170.

Since rice is the staple food of Sri Lankans and due to convenience of cultivation, people tend to grow paddy. Due to high usage of water, it depends highly on continuous irrigation. The amount of water availability to the farms in the tail end of Minipe scheme is determined by several factors.

Among them, climatic conditions, damaged physical infrastructure, the length of waterways and illegal usage, interdependency and wastages of water are very important.

Value of water in Irrigated agriculture farmlands in Minipe

Following table shows the estimated additional net value of output in both dry and wet seasons of Minipe scheme

Table 1. Estimates of additional net values of output in rice production

Item	Value of output with irrigation	Value of output without irrigation	Additional value/cost
Gross value of output(US$/ha/year)	2925.28	894.79	2030.49
Cost of cultivation (US$/ha/year)	1831.52	324.79	523.76
Net value of output (US$/ha/year)	1831.52	324.79	1506.73
Estimated water input (m3/ha/year)	47611	0	47611
Net value of water (US$/m3)			0.032

It was estimated that the total water requirement was 23,805.5 and 47,611 ha m per wet and dry seasons respectively. The paddy yield is 4.9 and 4.7 Mton/ha during wet and dry seasons, respectively.

Compared to rain fed rice farming the estimated net economic value of water diverted to irrigated agriculture was US$0.032/m3. This indicates that a large share of profit is attributed to returns to water. In calculation of the following data were considered.

1	Price of paddy	$ 0.27/kg
2	Paddy yield in rain fed lands in rainy season	3,153Kg/ha
3	Paddy yield in rain fed lands in dry seasons	no
4	Average seasonal water duty in Minipe scheme	0.95 ha m
5	Average water duty for other farm crops in Minipe	0.369 ha m

Based on the above calculation of cost the government of Sri Lanka spends nearly US$ 55.75 per hectare per year as O&M expenses. O&M cost includes daily management cost such as salaries, repair expenses etc. Opportunity cost of irrigation is calculated based on net income of US$ 226.11/ha/season from other farm crop with water duty of 0.369 ha m. Capital cost is calculated based on average cost of annual repairs and rehabilitations.

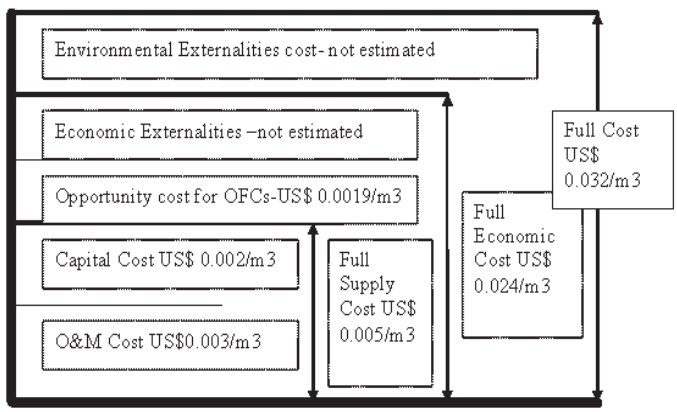

Fig. 2. Cost of water supply in Minipe Irrigation Scheme (Not to scale).

These findings show that a large share of cost for water is not considered in costing of rice and that cost should be further calculated and taken on to discussion table for an effective water management. To increase the water use efficiency and water productivity, the other crops such as Maize, Soya, Green Gram, Sesame and fruits such as Banana or Papaya have to be cultivated especially in water deficit areas and periods. However, selecting only rice cultivation is a challenge to water management and farm economy.

Irrigation water provides significant benefits in addition to its use in drinking, cooking, bathing, washing, or livestock raising. There are no empirical studies that quantify the additional value of these benefits in irrigation systems in Minipe scheme. However, it is anticipated that these additional benefits from the water diverted from irrigation will be much higher than the benefits to agriculture. A part of the return flows in Minipe goes to a sink. A substantial component is wasted due to broken structures but that recharge the groundwater.

In Sri Lanka, farmers do not pay for irrigation water. The government bears the full cost. Therefore, most of the farmers have no concern of water productivity. There is no clear system of calculation of the quantity of water to individual farmland. However, some time ago there was a discussion to charge a flat rate for irrigation water. Nevertheless, it solves a part of the problem.

Valuation of water at least in stages in the Minipe scheme will promote good water management and crop diversification. This will increase the income of the farmers and will provide higher support to Sri Lankan economy.

4. CONCLUSIONS

This study was carried out to examine water value and its effect on production. The study reveals that farmers get very large return to water US$0.032/$m^3$ and atleast the contribution to O&M cost of nearly US$0.003 /$m^3$ should be borne by the farmers. This will be about US$ 55.75/ha/yr. In this respect it is important to acknowledge the importance of considering the scarce water resource as an economic good, which should be used rationally. Pricing water help in economic development through better decesion making.

Absence of water pricing leads to inequity in water distribution, which translates into productivity differences, with lower productivity at tail reaches or downstream. Inadequate irrigation for paddy cultivation and significant proportion (27%) of non-farm income to total income were found to be the main reasons for not exploiting the potential of crop diversification in stage IV the tail end of the scheme. The determinants of crop diversification from paddy to other field crops (OFC) in dry seasons and exploring the reasons of income inequality in the Minipe anicut scheme is proposed.

Cultivation of rice twice a year is the normal practice in Srl Lanka and with good IWRM practice it may even be three times in a year. Thus, good IWRM itself makes 100% increament in annual income of the farmer and leads to a 30 % reduction in irrigation water usage per season. Therefore the farmers can possitively participate in water management while bearing a portion of cost of water. To achive this target, initially the system needs renovation of the structures for adquate measurement of water flows to each plot and ensure effective farmers' participation in IWRM.

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