

OPTIMAL ALLOCATION OF WATER IN VILLAGE IRRIGATION SYSTEMS OF SRI LANKA

Mohottala Gedara Kularatne

M.Sc. in Socio-Economic Information for Natural Resources Management, ITC,
University of Twente, The Netherlands, B.A. (Economics) Hons, University of
Peradeniya, Sri Lanka

Principal Supervisor: Associate Professor Clevo Wilson

Associate Supervisor: Professor Tim Robinson

Associate Supervisor: Professor Sean Pascoe

Submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy (Research)

ප්‍රවේශ අංකය:	866
වර්ග අංකය:	

QUT Business School
Queensland University of Technology
Gardens Point Campus, Brisbane, Australia

May 2011

Abstract

This PhD study examines whether water allocation becomes more productive when it is re-allocated from 'low' to 'high' efficient alternative uses in village irrigation systems (VISs) in Sri Lanka. Reservoir-based agriculture is a collective farming economic activity, which inter-sectoral allocation of water is assumed to be inefficient due to market imperfections and weak user rights. Furthermore, the available literature shows that a 'head-tail syndrome' is the most common issue for intra-sectoral water management in 'irrigation' agriculture. This research analyses the issue of water allocation by using primary data collected from two surveys of 460 rice farmers and 325 fish farming groups in two administrative districts in Sri Lanka. Technical efficiency estimates are undertaken for both rice farming and culture-based fisheries (CBF) production. The equi-marginal principle is applied for inter and intra-sectoral allocation of water. Welfare benefits of water re-allocation are measured through consumer surplus estimation.

Based on these analyses, the overall findings of the thesis can be summarised as follows. The estimated mean technical efficiency (MTE) for rice farming is 73%. For CBF production, the estimated MTE is 33%. The technical efficiency distribution is skewed to the left for rice farming, while it is skewed to the right for CBF production. The results show that technical efficiency of rice farming can be improved by formalising transferability of land ownership and, therefore, water user rights by enhancing the institutional capacity of Farmer Organisations (FOs). Other effective tools for improving technical efficiency of CBF production are strengthening group stability of CBF farmers, improving the accessibility of official consultation, and attracting independent investments.

Inter-sectoral optimal allocation shows that the estimated inefficient volume of water in rice farming, which can be re-allocated for CBF production, is 32%. With the application of successive policy instruments (e.g., a community transferable quota system and promoting CBF activities), there is potential for a threefold increase in marginal value product (MVP) of total reservoir water in VISs. The existing intra-sectoral inefficient volume of water use in tail-end fields and head-end fields can potentially be removed by reducing water use by 10% and 23% respectively and re-allocating this to middle fields. This re-allocation may enable a twofold increase in MVP of water used in rice farming without reducing the existing rice output, but will require developing irrigation practices to facilitate this re-allocation.

Finally, the total productivity of reservoir water can be increased by responsible village level institutions and primary level stakeholders (i.e., co-management) sharing responsibility of water management, while allowing market forces to guide the efficient re-allocation decisions. This PhD has demonstrated that instead of farmers allocating water between uses haphazardly, they can now base their decisions on efficient water use with a view to increasing water productivity. Such an approach, no doubt will enhance farmer incomes and community welfare.