ECONOMIC VALUE OF AN ANCIENT SMALL TANK CASCADE SYSTEM IN SRI LANKA

Shamen Prabhath Vidanage

2014/PhD/EC/01

Thesis submitted to the University of Colombo in fulfilment of the requirement for the degree of Doctor of Philosophy in Economics

Department of Economics

University of Colombo

2018

Abstract

Sri Lanka is well known for its hydraulic civilization, Small Tank Cascade Systems (STCS) are part of that heritage of the country. Investment into restoration of degraded STCS are often found financially not feasible due to narrowly defined assessment of benefits of these systems. The main reason for such is the bulk of the multiple benefits generated by STCS belong to ecosystem goods and services which are not provided through the market system; hence not reflected in the market determined monetary value. This research is undertaken to elicit the Willingness to Pay (WTP) for restoration and sustainable management of a representative small tank cascade system, to assess Marginal Willingness to Pay (MWTP) for selected cascade attributes and to develop and validate a Benefit Cost Analysis (BCA)[1] framework for decision-making in restoration and sustainable management of small tank cascade systems.

The research conducted on the *Pihimbiyagollewa* and *Kapiriggama* small tank cascades in *Malwathu Oya* basin in Anuradhapura district of Sri Lanka. The study has pioneered the use of state-of-the-art non-market valuation technique to a small tank cascade taking "the entire cascade" as the unit of analysis. Furthermore, this is also the first application of Choice Experiment (CE) non-market valuation technique in small tank cascade systems in Sri Lanka.

The research concludes that both on-site as well as off-site communities have positive WTP for restoration and sustainable management of the cascade as an integrated unit. Results indicate that, the people from the cascade have a higher total WTP compared to an off-site sample (LKR 78,865 per season per household vs. LKR 54,260 per season per household). Estimates for marginal improvements of different attribute levels of the cascade demonstrated the differences in preferences of two communities sampled. The on-site sample, community depends on the cascade for their day to day sustenance has placed a highest value on water for paddy followed by water for other uses and the cascade biodiversity (LKR 25,507, LKR 16,366 and LKR 5,880) respectively with attributing LKR 31,109 for the all the other factors outside of the four attributes

[1] In this thesis Benefit Cost Analysis has been used throughout which is identical to the Cost Benefit Analysis used in other literature.

considered. All estimates are per season per household. It is noted that the cascade dependent community's consideration for the level of cascade ecosystem in their assessment was irrelevant as the attribute estimate was turned out to be statistically insignificant.

On contrary, the off-site community sample - who didn't have direct benefits from the cascade, placed water for other uses as the highest priority, while cascade biodiversity, water for paddy and cascade ecology were identified as decreasing priorities for willingness to pay for marginal change (values were LKR 17,995, LKR 8,921, LKR 8,234 and LKR 4,000 per household per season respectively). It is noted that they consider all four attributes in their valuation including the cascade ecology which has not emerged as significant in such valuations by the on-site communities.

The findings suggests that both cascade dependent as well as other communities are willing to pay for cascade level restoration and sustainable management of small tanks. The conventional Benefit Cost Analysis performed with on-site benefits of restoration indicate that the paddy related incremental benefits alone cannot justify cascade-wide restoration investment. However, extended benefits of irrigated agriculture, including non-irrigation benefits arising from other uses of water in cascades and benefits associated with biodiversity in them clearly justify cascade level restoration as a feasible investment option even after taking into account the vulnerabilities usually associated with small tank irrigated agriculture in the Dry Zone. The estimated selection criteria (Benefit Cost Ratio -BC ratio, Net Present Value - NPV and Internal Rate of Return -IRR) demonstrate the economic feasibility of investment with sensitivity analysis performed. Base case BC ratio was 2.24, while NPV was LKR 204,920,854 with an IRR of 24%. With cross sensitivity of 40 % cost overrun and 40 % unrealized benefits over the project period of 20 years, resulted a BC Ratio of 1.47, and a NPV of LKR 108,729,307 and an IRR of 17%.

The study demonstrates that the restoration benefits of small tank cascade in taking cascade as an integrated unit of decision-making, overweigh the cost of such restoration. This result tends to promote such cascade wide restoration as the policy for small tank restoration in Sri Lanka.