Payment for Ecosystem Services to Sustain *Kudimaramathu* in Tamil Nadu

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The Tamil Nadu government is attempting to revive the institution of *kudimaramathu* by leveraging a scheme sponsored by the National Bank for Agriculture and Rural Development to rejuvenate small waterbodies in the state. How a payment for ecosystem services system can incentivise village panchayats to engage in tank management and, in turn, ensure the sustainability and longevity of the community-based programme beyond the life of the project is explored.

The authors thank Dinesh Kumar, A Narayanamoorthy, and K Sivasubramaniyan for their valuable reviews and comments.

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Due to changing weather patterns, several regions in India are experiencing frequent and prolonged droughts. However, most of these regions also face devastating floods caused by short but intense spells of rain. Both climactic extremes affect farmers adversely. To mitigate agrarian distress while trying to double farmers' income, effective national policies are needed. This article explores how a payment for ecosystem services (PES) system can complement the efforts of the government in reviving the age-old practice of *kudimaramathu*, a traditional participatory water management system, and can potentially help sustain the community-based programme at the grass-roots level.

Tamil Nadu, a highly water-stressed state, intends to revive the traditional institution of kudimaramathu, wherein farmers collectively contribute a percentage of capital or physical labour towards managing village waterbodies. This includes desilting tanks and feeder canals, raising the existing bunds, and regular maintenance work. The National Bank for Agriculture and Rural Development (NABARD) is to sponsor this project by disbursing a significant part of a ₹3,000 crore budget to rejuvenate 41,000 tanks by 2020. Under this scheme, the Tamil Nadu government will allocate funds for the rejuvenation work, and the beneficiaries—mostly farmers—will contribute 10% of the project cost. Where tank management interventions during the British rule and in the post-independence period by successive governments failed to revive the institution of kudimaramathu, will the government's efforts to revive it allow people in Tamil Nadu to successfully and sustainably manage the state's waterbodies?

History of Kudimaramathu

Traditionally, water users carried out kudimaramathu activities through collective action. As the Nobel Prize-winning political economist Elinor Ostrom (2010) has demonstrated elsewhere, community-based institutions like kudimaramathu have successfully and sustainably managed waterbodies over centuries. This is because the benefits derived from maintaining waterbodies were substantial, which gave the communities the incentive to maintain them. Besides using the water for irrigation, villagers harvested fish from the tanks, used the tank beds to graze their cattle during dry seasons, and used the silt from tank beds as fertiliser for their agricultural land; such activities typically led to an increase in household income.

The onset of the Green Revolution in the 1960s changed the face of India's agricultural landscape, and its traditional institutions too changed, but adversely. During the initial years of the green revolution, tanks were the primary source of water for irrigation. Realising that water supply through surface irrigation was often unreliable or inadequate for multiple cropping, many resourceful farmers switched over to tube wells—which were comparatively easier to operate—to draw groundwater for continued irrigation.

The withdrawal of these resourceful farmers from kudimaramathu activities adversely affected the cost of desilting, bund raising, and regular repair work, making sustainable tank management difficult. This withdrawal could have, perhaps, increased marginal benefits to the remaining farmers due to the availability of additional surface water, but the cost of maintaining the tanks would have also increased correspondingly, given the reduced number of farmers available for collective action. It was essentially the incentive mechanism—a part of the institution of kudimaramathu—that successfully and sustainably facilitated cooperation among farmers to manage tanks. This participatory tank management, however, broke down once the incentive was no longer available. To be precise, over the years, the widespread adoption of tube well-based irrigation has contributed to this breakdown. In addition, the hydrological changes taking place in the upper catchment areas of tanks—such as reduced run-off and increased exploitation of

groundwater—adversely affect the water flow into the tanks (Kumar et al 2016).

What will happen after the government-sponsored kudimaramathu scheme ends? Who will manage these rejuvenated tanks in a sustainable way? What incentives do managers and stakeholders of the tanks require to maintain them? These issues must be addressed. As far as tank management is concerned, the general deterioration of tanks can be attributed to government failure, illustrated by its inability to prevent encroachment on the waterbodies, solid and liquid waste dumping in the tanks, and the lackadaisical approach to the maintenance of the tanks, among others. In other words, having the government alone manage the tanks will make things worse.

Under the participatory irrigation management system, water users' associations (WUAs)—self-governed organisations of farmers—were created at the grassroots level in Tamil Nadu in 2004 to manage irrigation systems. The WUAs are supposed to be apolitical, but they are generally dominated by politically powerful farmers. Therefore, elite farmers taking over these institutions, on the one hand, and the rent-seeking behaviour of officials, on the other, occasionally in tandem, defeated the very purpose of participatory irrigation management. Many of these WUAs do not even exist at present, for various reasons, including the failure to conduct elections in order to select office bearers. There are also apprehensions that kudimaramathu, in its new avatar, is not quite participatory (Annamalai 2017).

Alternatively, making village panchayats key stakeholders in tank management could significantly improve the sustainability of the revived kudimaramathu-based water management system. Panchayats face two problems, however. First, they do not have de jure property rights to manage and reap the benefits from the large and system tanks fed by the rivers, as the public works department owns most of them—16,098 tanks in total, constituting about 39% of all tanks in Tamil Nadu. Second, under the existing arrangement, they have no economic incentive to ensure the sustainable management of waterbodies. Ideally, panchayats should not only have adequate finances to cover the costs of maintaining waterbodies in the long run, but should also reap considerable economic and ecological benefits from their tank management activities.

Payment for Ecosystem Services

How can village panchayats be incentivised to engage in tank management? This is an important question that arises in this context, to which PES provides an answer. PES is based on the "beneficiary pays" principle. It prescribes that individuals or communities manage natural resources and transfer ecosystem services to beneficiaries, who will, in turn, compensate them for their efforts, thereby generating economic incentives for the continuous supply of such services. This is a win–win situation for both parties involved in the exchange.

For PES to work efficiently, it is necessary to first assess the ecosystem services that waterbodies can offer. Traditionally, waterbodies in rural areas were known to supply water primarily for irrigation and livestock activities and, therefore, the policies on tank management were directed mainly towards that end. The Economics of Ecosystems and Biodiversity programme has identified multiple ecosystem services that derive from waterbodies, which can be classified into four categories: provisioning services (for example, fish, fodder, water for industry, and water for poultry), regulating services (for example, flood regulation, pollination services, microclimate stabilisation, and groundwater regulation), cultural services (for example, recreational services and religious services), and supporting services (for example, soil formation and nutrient recycling). These ecosystem services are highly valuable and are utilised by a wide variety of people at the local, regional, and global levels.

The nature and magnitude of the ecosystem services that can be offered by tanks vary, depending on their size and location. Most ecosystem services are not bought and sold in regular markets. As a result, their economic value is yet unknown. Identifying and quantifying the ecosystem services—both in physical and monetary terms—generated by each tank and utilised by different stakeholders, is a prerequisite for PES to work. Since the standardised monetary values of most ecosystem services have already been estimated by researchers (de Groot et al 2012), such values can be used to quantify the total economic value of the ecosystem services generated and utilised in the case of each tank. Once the values are estimated, the PES scheme can be adopted to transfer money from the beneficiaries to the panchayats that are managing and supplying ecosystem services.

Case Studies of PES

A large number of PES schemes implemented across the globe pertain to water-related services. Some examples from developing countries are highlighted here, including a couple from India. Water Trust Funds, an independent financial institution active in Ecuador, Columbia, and Peru, is an institutional arrangement to establish long-term contractual agreements between the sellers and buyers of water ecosystem services. The financial resources collected from water utilities, private brewers, bottling companies, donor agencies, non-governmental organisations (NGOs), and governmental organisations are channelled through the trust towards strengthening parks and protected areas, restoring degraded land, and adopting sustainable farming practices, which in turn help provide improved water supply to consumers (Stanton et al 2010).

In Bolivia, an in-kind PES programme influenced 46 upstream farmers who agreed to protect cloud forests by not cutting trees and avoiding hunting, which enhanced the water flow to the downstream farmers during dry seasons. The upstream farmers were compensated in kind: beehives supplemented with apicultural training. The beneficiaries paid the upstream farmers, too, through water cooperatives (Asquith and Wunder 2008).

In the Central American region, Costa Rica implemented PES (*Pago por Servicios Ambientales*, in Spanish) to compensate landowners for implementing sustainable forest management plans so that an increase in hydrological services—for

example, groundwater recharge—along with benefits that include reduced greenhouse gas emissions and increased biodiversity could be accomplished (Pagiola 2008). Mexico's Payment for Hydrological Services programme, implemented in different segments of its forest areas, aims at conserving forests to enhance the availability of groundwater and maintain the quality of water for consumption by different stakeholders. In this case, the compensation comes from the revenue generated by user fees. In some parts of Mexico, the implementation of PES has increased the participation of the local population, especially the poor, in conservation activities, thus, helping to reduce poverty (Alix-Garcia et al 2008).

PES in India

Even in India, a PES-like arrangement was introduced in the early 1980s to manage watersheds in North India. For example, villagers who participated in protecting the catchment area of Sukhna Lake, a major water source providing drinking water to the downstream city of Chandigarh, were compensated with increased benefits in the Sukhomajri watershed region in Haryana (Kerr 2002).

In Tamil Nadu, there are water users who utilise market-based instruments to manage tanks and allocate irrigation services in an efficient and equitable manner. The Rettaikulam Tank in the Tirunelveli district of Tamil Nadu exemplifies an efficiently functioning water tax system. In this case, the user groups managing the tanks levy *ayacut vari* (a tax based on landholding) and utilise the tax revenue to finance the costs of maintaining the tanks. The tax rate per acre is determined by the user groups based on the extent of repair and maintenance work required and the funds needed for such work. The tax is collected from water users in the command area (Sakthivadivel et al 2004).

Benefits of PES

In the case of kudimaramathu, when PES is implemented, the community managing the tank directly benefits, by being able to access more ecosystem services at the local level. Irrigation water, water for livestock and poultry, fish, fodder, topsoil for agricultural purposes, and minor forest produce from the tank-bed can be accessed locally by the users. At the regional level, ecosystem services, such as groundwater supply, flood regulation, and recreational and cultural benefits, can be enhanced.

Urban local bodies are increasingly appropriating water from traditional irrigation sources to be used in urban areas in order to meet the ever-increasing demand for water (Narayanamoorthy and Venkatachalam 2011). For example, Chennai Metrowater transfers 180 million litres per day (MLD) of water from the Veeranam Tank, located 145 km south of Chennai, to meet the city's drinking water requirements. Water transfer from the tank, which was traditionally used for irrigation exclusively, has adversely affected farmers in the command area. It has also reduced other ecosystem services, thereby having an impact on the welfare of the people dependent on those services. Schneider (2017) estimates that water users in Chennai spend ₹11,880 million per year on purchasing water from private suppliers.

Transferring even half this amount to villagers who can potentially manage the Veeranam Tank would result in a win–win outcome for all. A part of the money transferred can also be used to incentivise farmers in the upper catchment area. This would encourage them to discontinue harmful land-use patterns and the overuse of groundwater, thereby enhancing the flow of water into the tank. Introducing a PES scheme can produce a non-zero-sum outcome for villagers, farmers, urban consumers, and governments (Venkatachalam and Balooni 2017).

Besides, when farmers remove a minimum level of topsoil from the tank bed and utilise it as a natural fertiliser, they lower their use of chemical fertilisers. Consequently, the adverse effects of chemical fertilisers on the quality of soil are reduced. Also, the nitrogen emitted in the use of chemical fertilisers is curtailed, which helps in abating global warming. There are also opportunities for claiming carbon credit payments from developed countries under various carbon-trading programmes.

In a nutshell, while implementing the NABARD-assisted kudimaramathu scheme in Tamil Nadu, as in the case of similar water conservation programmes in the country, policymakers could envisage a PES scheme that involves panchayats along with other stakeholders—water users, NGOs, researchers, businesses, and the government—to conserve and manage the water bodies on a sustainable and enduring basis. Employing PES at the grass-roots level has the potential to produce efficient outcomes in the area of sustainable water management in the coming years (and in a more market-driven economy).

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