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Resource-based development: Experience from Mahaweli

by

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Contributions are most welcome - in English or in Bahasa Indonesia.

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Summary

This paper provides an introduction to the comprehensive resource-based development of the Mahaweli Basin and adjacent areas, initiated some 40 years ago and still in a healthy state of progress.

The Mahaweli Authority of Sri Lanka (MASL) was established in 1979. MASL operates in the Mahaweli basin as well as several other basins and areas, covering 25,600 km², or 39 percent of the country's land area.

The authority develops land, water resources and hydropower in support of livelihoods and income generation. Hereby, MASL applies a holistic perspective and comprehensive approach to resource-based social and economic development. It is involved in land development for agriculture, including irrigation and drainage systems, as well as related operation and maintenance. It also provides agricultural extension services, inputs, and support to marketing. Furthermore, MASL has built roads, urban centres and schools.

Revenue generation for the farming households remains an overruling challenge. Apart from improved global commodity prices, this can be supported by appropriate technological adaptation and development, aiming at higher yields and diversification (including livestock and, perhaps, aquaculture and capture fisheries), preferably based on site-specific research and pilot activities, covering production as well as processing and marketing, and also control of pests and post-harvest losses.

There is an open-ended need of continuous education and capacity-building at all levels, and including the farmers.

Acronyms and abbreviations

DSWRPP:	Dam Safety & Water Resources Planning Project
IWRM:	Integrated water resources management
MASL:	Mahaweli Authority of Sri Lanka
NARBO:	Network of Asian River Basin Organizations
NGO:	Non-governmental organization

1 Introduction

This paper has been compiled for the sake of sharing knowledge and thoughts with colleagues involved in basin-level IWRM. It provides an elaboration of a presentation by the author at the 4th General Meeting of NARBO in Makassar, South Sulawesi, in November 2010, and captures some of the related discussion.

2 The Mahaweli Basin

Mahaweli Ganga¹ is 330 km long. It is the longest river in Sri Lanka, and its basin is the largest, covering 10,300 km², or 16 percent of the country's land area, with a population of around 2.8 million people, or 15 percent of the country's population.

The southwest monsoon (yala) prevails from May to October and the northeast monsoon (maha) from December to February. The annual rainfall varies from more than 5,000 mm per year in the upper, mountainous parts (which benefit from both monsoons) to around 1,600 mm per year in the downstream areas (which mainly benefit from the northeast monsoon).²

The basin includes several national parks and other protected areas with a high biodiversity and a rich wildlife.

Characteristic traditional crops are rice (in the lowlands) and tea (in the highlands). The forests provide timber, fuelwood and various non-timber forest products. A large part of the basin is suited for paddy cultivation, but only a minor part is immediately suited for other crops. Some areas are in need of drainage.

An advanced irrigation infrastructure has been applied for more than 2,000 years. The first master plan for was formulated in the 1960s with support from UNDP. It recommended development of agricultural land, irrigation and hydropower by a sequenced implementation of schemes designated from A to H. Since then, a comprehensive development has taken place, comprising land, irrigation, storage capacity, hydropower, and other facilities and services.

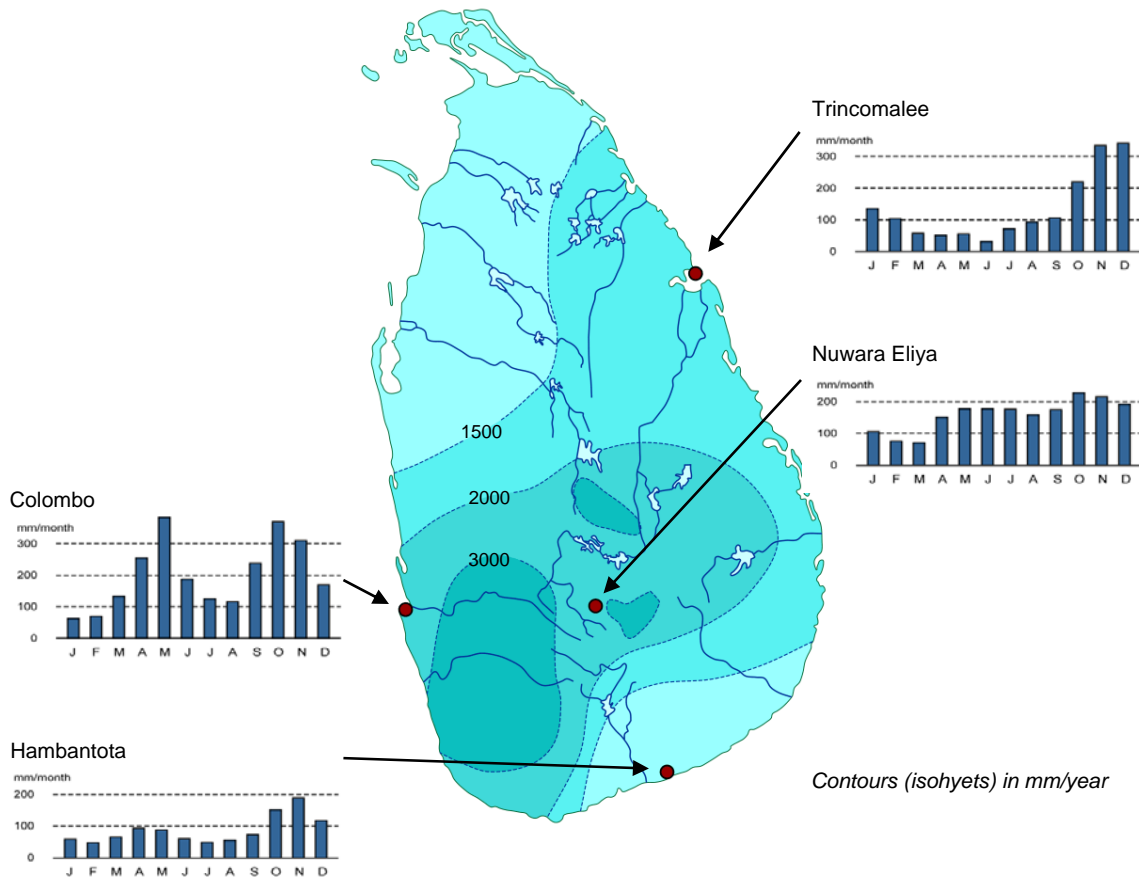
3 Water - a national asset

Like so many other countries in Monsoon Asia, Sri Lanka has an abundant average rainfall - only it is unevenly distributed over time and area. The figure below illustrates the rainfall distribution. It is seen that almost all year there is plenty of rain - but at a different place from one season to another - typical for islands.

¹ Ganga = perennial river; oya = seasonal river

² Two thirds of Sri Lanka are conventionally classified as '*arid*', although the rainfall exceeds that of many other countries

Figure 1: Sri Lanka's rainfall distribution



The figure illustrates an important part of the background for the national development agenda. Most livelihoods are water-dependent, and making water available when and where it is best used has been a social and economic management challenge throughout Sri Lanka's history. King Parackrama Bahu The Great (who ruled from 1164 to 1196) made the famous statement that *'not a single drop of rain should be allowed to flow into sea without being utilized for human benefits'*.³

Old irrigation works

Sri Lanka's first rainwater reservoir was built some 2,500 years ago, and the first major canals and tanks were built some 1,900 years ago. In the following centuries, the irrigation infrastructure was continuously expanded, with great hydraulic engineering skills, for example the 90 km Jaya Ganga (or Yoda Ela) Canal, built some 1,500 year ago, which has a gradient of less than 20 cm/km.

A major setback occurred around 1220, when the Mahaweli Ganga abruptly changed its course. Yet, still today, several of the old structures remain operational.

From Waterworld: Ancient Sinhalese irrigation,
<http://www.mysrilankaholidays.com/ancient-sinhalese-irrigation.html>

3

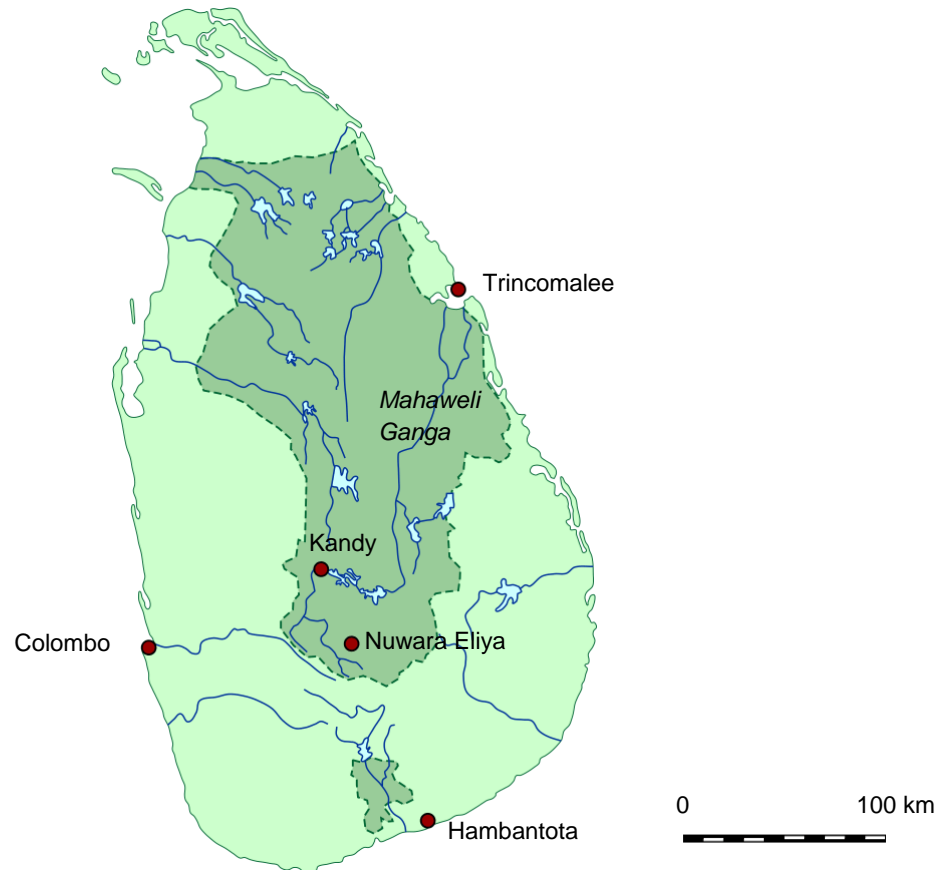
This king built or restored no less than 165 dams, 3,910 canals, 163 reservoirs and 2,376 tanks!

4 A broad management perspective

The Mahaweli Authority of Sri Lanka (MASL) was established in 1979 under Ministry of Mahaweli, Lands and Irrigation. Today, the organization has almost 4,800 employees, 2,500 buildings, and 14 site offices.

MASL operates in the Mahaweli basin as well as several other hydrologically connected river basins and special areas, covering 25,600 km², or 39 percent of the country's land area.

Figure 2: The area for planning and development by the Mahawela Authority



MASL activities

- Construction, maintenance and operation of dams, reservoirs, canals, irrigation distribution systems and other structures
- Land development and settlement
- Agricultural development
- Post settlement activities, including public health, livelihood support and microcredit
- Watershed management, environmental conservation
- Rehabilitation, maintenance and dam safety

The authority undertakes water resources management as well as general socio-economic development. It develops land, water resources and hydropower in support of livelihoods and income generation. Hereby, MASL applies a holistic perspective and comprehensive approach to resource-based social and economic development. It is involved in land development for agriculture, including irrigation and drainage systems, as well as related operation and maintenance. It also provides agricultural extension services, inputs, and support to marketing. Furthermore, MASL has built roads, urban centres and schools.

Key achievements include provision of

- 93,000 ha of irrigated farmland and 80,000 ha of non-irrigated farmland, serving some 144,000 households;
- increased production of rice and other crops;
- livelihoods for thousands of landless households;
- a substantial storage capacity (more than 2,275 million m³);
- 9,750 km of canals;
- 2,850 km of roads;
- 617 MW of hydropower capacity, producing 1,200 GWh per year;
- water for households and industries; and
- institutional capacity and skilled staff available for operation and continued development.

Benchmarking

In 2004, MASL conducted a benchmarking of the performance of its recently upgraded Irrigation System C. The analyses addressed cultivation practices (inputs and yield), irrigation system operation, extension services, post-harvest and marketing aspect, and collaboration between system operators/service providers and the farmers.

Source: IWMI (Oct 04)

In 2006-07, MASL participated in an RBO benchmarking, conducted by ADB and NARBO on a pilot basis. The exercise included a self-assessment and a review with participation by invited peers from elsewhere in Asia. A set of 14 criteria was applied, as follows:

Mission:	RBO Status
	RBO Governance
Stakeholders:	Involvement
	Feedback
	Environmental awareness
	Basin livelihoods
Learning and growth:	Human resources
	Technical development
	Organizational development
Internal business process:	Planning
	Water allocation
	Data sharing
Finance:	Cost recovery
	Financial efficiency

Source: ADB (Apr 09)

5 Making water available at the right time and place

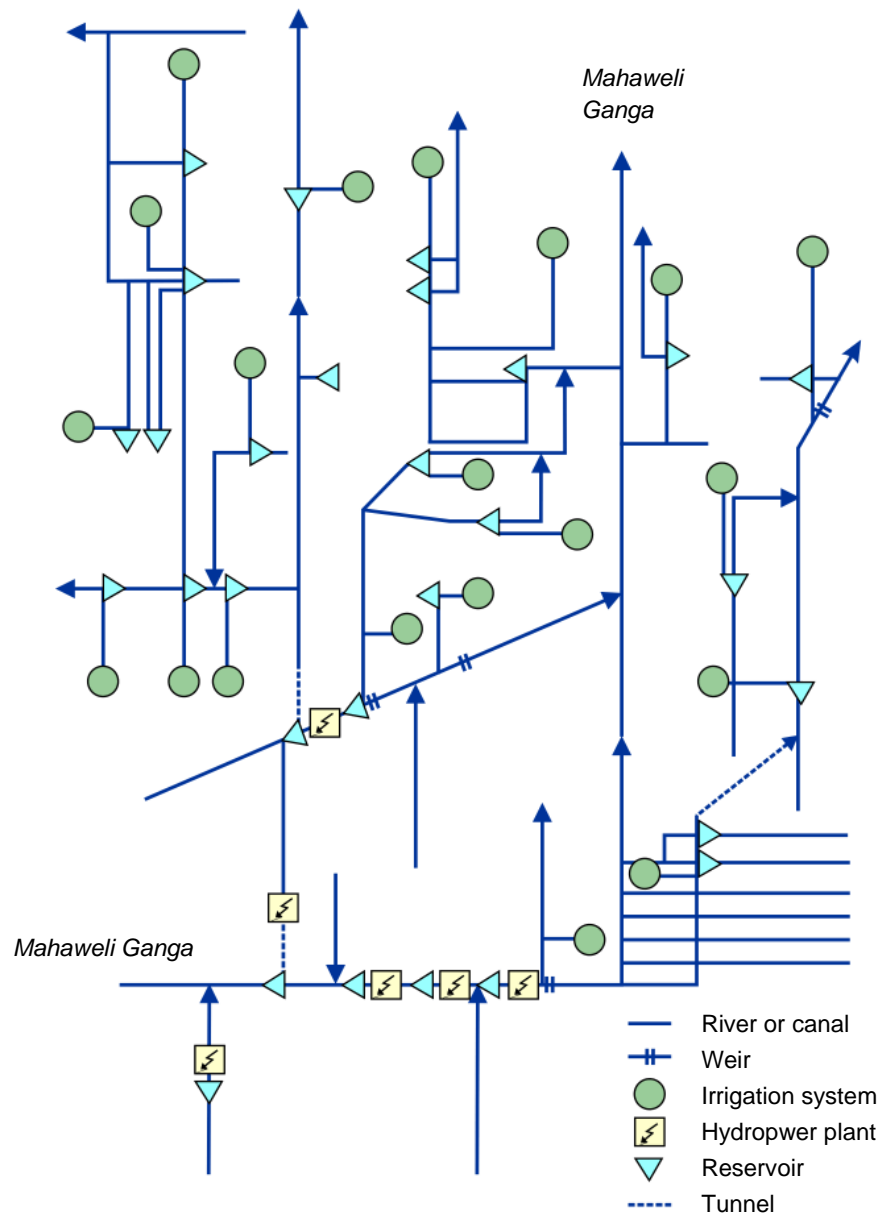
System operation

The water infrastructure in the Mahaweli area is complex, with numerous options for storage and routing. Its operation is not easy.

Irrigation supplies must be *reliable* and *predictable*. On the other hand, an overly safe operation strategy will give benefits that are less than the potential ones.

The Seasonal Operational Planning (SOP) is undertaken by the Water Management Secretariat (WMS) of MASL.

Figure 3: Network diagram



Interaction between farmers and operators

A good collaboration, including knowledge-sharing and guidance, is needed between the headworks operators, the distribution, and the scheme level. Demands (for cultivation) and supplies (of irrigation water) are interrelated, and a balance must be maintained by mutual adaptation within given practical limits.

The Water Panel of MASL is a forum for consultations and consensus-building. It has participation by the Water Management Secretariat, key institutional stakeholders in the water sector and the farmers. It meets before each cultivation season (yala & maha) to make ends meet between water demand and availability.

For operational purposes, weekly meetings are held with officials of various operating agencies (such as Ceylon Electricity Board, Irrigation Department, and the National Water Supply and Drainage Board). These meetings monitor the supplies and make decisions on timely adjustments if needed.

These procedures have worked well for the last 15-20 years, with various improvements, such as the recent introduction of computerized decision support.

A water allocation practice in the Minor Irrigation Systems is the responsibility of Agrarian Services Department, who hold '*kanna meetings*' with the participation by the Divisional Secretary, irrigation engineers and farmer leaders. These meetings are held before each cultivation season to agree on water allocation and scheduling.

Particularly during a drought, the '*kanna meeting*' decides how to share the available water among the farmers in each system. This may involve a traditional Sri Lankan method called '*bethma*', where a part of the whole cultivation area will be shared among all users and managed jointly for the season.

In this process, conflicts may arise while implementing the approved plans, in case that water is not available as expected (due to lack of rain). Further, some farmers may cultivate more than envisaged in the plan, while others may cultivate at a later time than planned. Both cases can lead to over use and inequitable water sharing. If so, the disputes must be sorted out and the plans revised according to needs.

Climate change - a new challenge

There are indications that the climate of Sri Lanka has changed in recent decades. Expected implications include a sea level rise that will, initially, cause increased coastal erosion and saline intrusion (while a still higher level will affect drainage and flood risk). Other primary impacts are higher temperatures, more frequent and prolonged droughts, high-intensity rainfalls, and increased thunder activities. Consequential impacts include floods, land slides, erosion and adverse morphological changes.

An appropriate preparedness will comprise elements such as

- adaptation of crops and cultivation practices (perhaps towards short-term varieties, and/or more resilient crops, and/or diversification to spread the risk);
- contingency planning for drought events;
- responsive operational water allocation with a view to erratic rainfalls;
- targeted monitoring of water availability and demands (for all purposes); and
- continued research and location-specific development.

Mahaweli's comprehensive, functional water infrastructure with ample storage capacity will be a valuable measure to reduce some of the direct impacts of a changed climate, as well as expanding the options for appropriate response.

6 Lessons learnt

Many valuable lessons have been learnt (and are being learnt) during the continuous planning, design, implementation and operation:

- Many of the development activities took longer time than anticipated. This affected their synchronization - for example the timely supply of water and other services to new settlers.
- Farm sizes (around 1 ha per household) are on the low side for sustainable income generation.
- The farmers remain dependent on public support for operation and maintenance of the irrigation infrastructure. Cost recovery is far below expectations. The beneficiaries readily provide support by sharing the work, but cash contributions are small, due to low household earnings.
- Dialogue and active collaboration with beneficiaries, other stakeholders, NGOs and the private sector can highly support the design, implementation and successful implementation of planned developments, as well as maintenance of a healthy river basin.

7 Observations

The following observations are listed in random order:

- Revenue generation for the farming households remains an overruling challenge. Apart from improved global commodity prices, this can be supported by appropriate technological adaptation and development, aiming at higher yields and diversification (including livestock and, perhaps, aquaculture and capture fisheries), preferably based on site-specific research and pilot activities, covering production as well as processing and marketing, and also control of pests and post-harvest losses.
- There is a scope for improved soil management and cultivation practices to reduce erosion in general, and to protect reservoirs against excessive siltation related to land degradation in their drainage basins.
- There is scope for improved environmental management, including conservation of remaining forests and their wildlife. Also, good practices must be encouraged regarding solid waste disposal and use of agricultural pesticides. Fertilizer residues in drainage water cause eutrophication in reservoirs which affect the fish yield (and can, at worst, render the water poisonous for livestock).
- There is a scope for management of fuelwood production, aiming at sustainable demands as well as sustainable supplies.
- Public health services can amplify the social and economic benefits of technological and infrastructural developments ...
- ... and so can financial (microcredit) services.
- There is an open-ended need of continuous education and capacity-building at all levels, and including the farmers.

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Sri Lankan rivers (Lakpura Travels): <http://www.lanka.com/sri-lanka/rivers-of-sri-lanka-97.html>

Appendix A: Chronology of national water resources management

- 474-453 BC: First rainwater reservoir (under King Abhaya)
- 65-108: First major irrigation works (under King Vasaba)
- 100-1200: Construction of numerous canals, reservoirs and tanks
- 1220: Mahaweli Ganga changed its course, whereby many facilities became useless
- 1901: Irrigation Department
- 1946: Irrigation Ordinance
- 1952: The Gal Oya Scheme and the Senanayake Samudra Reservoir
- 1958: 1st Mahaweli Ganga Development Program
- 1964: National Water Supply and Drainage Board
- 1964-68: Formulation of the 30-years Mahaweli Master Plan
- 1965: Walawe Ganga Scheme
- 1970: Mahaweli Development Board and Mahaweli Ganga Scheme
- 1975: Mahaweli-Kaya Oya diversion
- 1977-83: Accelerated Mahaweli Development Scheme and revised master plan
- 1978: Water Resources Board
- 1979: Mahaweli Authority of Sri Lanka (MASL) established by Act 23/1979
- 1981: 3rd Mahaweli Ganga Development Project
- 1984-86: Construction of major reservoirs: Uhiyya-Ratkinda, Maduru-Oya, Victoria, Kotmale, Randenigla and Lunugamwehera
- 2002: Public Utilities Commission of Sri Lanka (PUCSL)
- 2005: Disaster Management Act
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- 2008: Dam Safety & Water Resources Planning Project (DSWRRP)

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