Overview: Institutions and Policies for Water Resources Management

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Background of the Conference

This is the third volume of the proceedings of the national conference on 'Water for Food and Environment', which was held from June 9 –11, 2009 at the Bandaranaike Memorial International Conference Hall (BMICH). The volumes 1 and 2 have been produced as separate documents of this report series. In response to a call for abstracts, 81 abstracts were received from government institutes dealing with water resources and agriculture development, Universities, other freelance researchers and researchers from the International Water Management Institute (IWMI). Forty seven of the eighty-one abstracts that were submitted were accepted for compiling full papers.

Need for the Conference

In the past couple of years the sharp increase in food prices worldwide has raised serious concerns about food security, especially in developing countries. To effectively address these concerns a holistic approach is required that encompasses improved agricultural water productivity, adaptation to climate change, targeted and appropriate institutional and financial measures, and a consideration of environmental issues. The main purpose of the conference is to share experiences in these areas and to find opportunities to improve farmers' incomes and food production, and to promote environmentally sustainable practices in Sri Lanka in the face of growing water scarcity and the challenges of climate change. The conference brought together researchers, policymakers and practitioners to address these key issues.

The conference had several inter-linked objectives, which were to:

- provide a level platform for participants to share experiences and lessons learned;
- develop practical approaches for sustainable development;
- promote partnerships among disciplines and organizations on land and water management for food security; and
- identify future directions on key issues such as water scarcity, food security and climate change in Sri Lanka.

The conference was structured so as to focus on three main themes for presentations and discussions.

Theme 1: Irrigation for Food Security (Volume 1 of the Conference Proceeding)

The role of irrigation in the progress towards food and environmental security in Sri Lanka cannot be overemphasized. The following sub-themes were focused on, at the conference under this main theme:

- Revitalizing Irrigation Systems for Food Security
- Rain-fed Agriculture and Food Security: Opportunities and Constraints
- Enhancing Water Productivity on Irrigated and Rain-fed Lands

Theme 2: Water Quality and Environment (Volume 2 of the Conference Proceeding)

The three sub-themes mentioned below were discussed in the light of their effect in Sri Lanka:

- Water Quality, Irrigation, Environment and Health
- Water Recycling for Productive Use
- Climate Change and Agriculture

Theme 3: Policies and Institutions for Water Management (Volume 3 of the Conference Proceeding)

The sub-themes that were discussed under this theme were:

- Policy Interventions to Improve Water Productivity and Access to Water
- Data and Information Management for Water Management
- Methodologies for a National Water Resources Assessment
- Policies and Institutional Reforms to Enhance Rain-fed and Irrigated Agriculture

Synthesis of Papers Presented under Volume 3 - Policies and Institutions

Ten papers on the different aspects of policy adaptation and institutional mechanisms for water resources and agriculture system management were presented at the conference. This introductory paper includes a synthesis of the key issues highlighted in the 10 papers that were presented at the conference (one of the 10 papers is written in Sinhala - the local language).

The following main areas have been highlighted in these papers:

- Policy issues on water resources management
- Participatory irrigation management, capacity building of farmer organizations and also irrigation infrastructure systems managed by public institutions

- Groundwater use in conjunction of irrigation water
- Economic valuation of irrigation water
- Spatial variation of water supply and demand in Sri Lanka and also the need for national level water resources assessment/audit in the country.

Policy Issues on Water Resources Management

The issues surrounding the adoption of policies on water resources development and management were discussed by Nanayakkara in the paper he presented at the conference titled 'Sri Lanka's Water Policy: Themes and Issues'. Other papers that were presented at the conference also discussed certain policy-related issues such as policies relating to participatory irrigation management, groundwater development, economic values of water and also water resources assessment/audit etc. Nanayakkara's paper exclusively focused on the water resources policy of the country and included his opinions and views on the issue.

The author argues that in the case of water, the question of 'ownership' is not as important as determining and regulating its use, given that user rights of this common property resource is always in a state of flux. According to Nanayakkara, abstraction of bulk water from its natural state in a regulated manner that is left to the will of individuals and agencies, virtually results in the creation of a 'free for all' situation. Commenting on the existing institutional mechanisms of water resources management, he points out that the domain of water is characterized by over 50 legislative enactments and a plethora of agencies numbering over 40, but lacks a single neutral agency to determine the appropriate balance between the demands for off stream consumption and the volume of water flows needed by the river system. Water rights are linked to land ownership and, as such, in Sri Lanka, a landowner is regarded as owning the water underneath his land and has the right to pump all the water from the common aquifer, lowering the water table. Furthermore, he may use or abuse all the rain which falls on his land. In Sri Lanka, all the streams that flow across a private land fall within the public domain.

The lack of a clear policy on water allocation is another issue raised by Nanayakkara. He says that there is no proper bulk allocation system. Some large consumptive users allocate water to themselves. The agency that operates the water abstraction structures also controls the water allocation. The most serious deficiency observed in water allocation has been the tendency by large water users to allocate water to themselves regardless of the needs of others.

He refers to the proposal made by the water resources secretariat once established under an ADB funded project, and points out that the challenge for the national water resources authority proposed under the ADB project is to establish a set of allocation principles that are rational and that can accommodate long-term demands. The share of water used by the urban population in Sri Lanka is projected to increase to 45 % by 2015 and 65 % by 2030. Such expanding water requirements in the growing urban populations will aggravate the institutional conflicts in re-allocation of water that were previously devoted to agricultural use, particularly in the dry zone. According to Nanayakkara, the absence of any principles for sharing water between the upper and lower riparian as well as between drinking and irrigation purposes has hindered the developmental planning efforts of both the Irrigation Department and the National Water Supply and Drainage Board (NWSDB).

Policies on groundwater use are another area on which Nanayakkara expressed his views. A water policy should address both surface water and groundwater resources. Currently, a doctrine of territorial sovereignty is applied in groundwater extraction, which means that 'what is beneath our feet is ours to use'. Groundwater use is rapidly increasing, intensifying smallholder cultivation and improving the standards of living of poor farmers in the dry zone. Nanayakkara mentions that a survey conducted by IWMI revealed that "…in Sri Lanka, some aquifers are already being pumped dry by the end of the dry season, and some communities have been left without drinking water. The implications of stream-aquifer connectivity and the need for a conjunctive management approach are the most under-appreciated issues in Sri Lanka. A management policy should stipulate that groundwater should not be regarded as a resource separate from surface water. The policy should recognize that both surface and groundwater are hydrologically connected and are complementary components of a larger single system."

In his final analyses of the paper, Nanayakkara suggests that there is a need for an institutional arrangement at the national level, such as a proposed National Water Resources Authority (NWRA), capable of defining the overall directions when devising water policies, and adjudicating disputes. He points out that water resources planning and management frequently fails to consider the river basin as the natural unit for hydrologic management, resulting in the inefficient use of water and inadequate concern for stream and ecosystem values. Therefore, it is imperative to recognize the environment as a legitimate user of water.

Jinapala et al., in their paper on '…Participatory Irrigation Management (PIM) in Sri Lanka' argue that institutions/policymakers need to lend careful attention to enhancing the effectiveness of institutional mechanisms used for participatory irrigation management in the country. The major conclusion in their paper is that, despite its partial failure to achieve some of the main goals, participatory management has clear benefits and should be continued and supported. The study team suggests that the government should have an effective way of keeping track of the progress of Farmer Organizations (FOs), Joint Management Committees (JMCs) and the turnover of irrigation management that they generate.

Participatory Irrigation Management, Capacity Building of Farmer Organizations and also Irrigation Infrastructure Systems Managed by Public Institutions

Jinapala et al. summarized/synthesized the results of a national level study on the 'Participatory Irrigation Management (PIM)' approach in the country. The analyses of their paper represent the current situation of PIM and its relevance and impact as an institutional mechanism in managing irrigation systems.

This paper aims to review participatory irrigation management (PIM) approaches adopted in medium and major irrigation systems in Sri Lanka with a view to identifying past and present trends and future directions of such management. The authors point out that the need for pursuing irrigation development and management has become more important in the country in the face of rapid population growth and increasing food prices in the world market. In this context, managing irrigation schemes for productivity improvement is becoming increasingly important.

The results of the study indicate that farmer involvement is much more relevant and essential in irrigation schemes where water is a scarce resource. A participatory management

policy has clearly succeeded in getting farmers much more involved in system management than they were in the past, except in the case of some of the MANIS (Medium Irrigation Systems Managed by the Irrigation Department) systems that were studied, which had been somewhat neglected by the irrigation agencies. Improving the turnover of irrigation management (operation and maintenance or O&M) below the distrbutory canal was one of the main objectives of the PIM policies in the country. However, turnover has not progressed as expected for two major reasons:

- On the one hand, the agreements reached in all programs are fewer than the expected number. Only the Integrated Management of Agricultural System INMAS program has progressed in achieving some form of turnover, although the Sri Lanka Mahaweli Authority MASLprogram is now seriously trying to improve turnover. There has been very little progress in the MANIS schemes, although the National Irrigation Rehabilitation Project (NIRP) mandated improved turnover in its post rehabilitation phase.

- On the other hand, full turnover has not occurred in any of the three systems and progress has stopped at a joint management stage. In particular, both agencies and farmers are reluctant to bear the full responsibilities for maintenance turned over to the FOs. Payments continue to be made by agencies for operation and maintenance (O&M) activities to FOs that have taken over responsibilities, either informally or formally.

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Badra Kamaladasa, in her paper on' Interventions Necessary in Capacity Building in Existing Water Organizations to Improve Productivity and Access to Water', points out that institutions need to play a critical role in managing water in the irrigation systems of the country in order to enhance the productive capacities of these systems. She highlights the role of individual and institutional capacities in determining the quality of water management and service delivery. The paper emphasizes the need for addressing poor capacities by devising more project proposals to effectively meet today's water sector challenges. She makes the point that good sector performance is also the responsibility of civil society and can be promoted in terms of individuals' water use practices, and that capacity can be increased by improving the public's awareness on water conservation and use. This would entail not only awareness in the personal use of water but public participation in decision-making processes for the management of water as a resource. Finally she observes that this process highlights the importance of having policy and institutional frameworks that enable public participation in decision-making.

The paper of S. Thiruchelvam (Enhancement of Capacity of Farmer Organizations for Sustainable Irrigation Systems in Anuradhapura and Kurunegala Districts) focuses on the same aspects as mentioned above, and highlights the need for enhancing the capacity of farmer organizations (FOs) in order to ensure sustainable irrigations systems. He has studied irrigation schemes in the Anuradhapura and Kurunegala districts to provide evidences for his arguments in the paper. A stratified random sample of 48 FOs selected from major, medium and minor irrigation systems in the Anuradhapura and Kurunegala districts were studied during 2008.

The author argues that over the past decades public investment in major, medium and minor irrigation systems has not yielded the expected results. The solution to the growing water crisis lies in the institutional changes of social systems established to manage the demand for water. Poor participation of farmers in FO activities is common and the paper reports that about 38 % of farmers participate in FO activities in both districts. The most common causes for such low participation were the lack of accountability and transparency of the FOs functions.

The author recommends that FOs need a lot of capacity-building on technical and institutional aspects to sustain irrigation systems. There is a need to establish strong linkages between the FOs and the Irrigation Department for successful irrigation management.

Thiruchelvam highlights in his paper, one problem common to all the irrigation rehabilitation projects of Sri Lanka. Irrigation development funds were initially used to provide physical structures to the irrigation systems, but little attention was extended to the efficiency of the investments in economic terms. As a result, the return of investments in this sector has fallen below expectations. Very few attempts have been made to develop the management capacities of FO leaders, their members, and village extension workers. Community organizations and facilitation skills are not part of staff training programs. Most of the services and resources were usurped by the elite of the rural communities, while the poor and women were left out or received little benefit.

Another area contributing to the poor irrigation management capacity of FOs is the lack of clear understanding of the Agrarian Development Act of 2000 and the registration process. There is, therefore, an urgent need to give more attention to the formalization of the registration process.

Thiruchelvam also found that women's participation in FOs was low in both districts. The presence and behavior of drunken men in the FOs, the lack of benefits attached to FO membership and the overall malfunctioning of the FOs are some of the existing problems in FOs. . Even when women attended FO meetings, their participation was limited to listening only.

There was a lack of accountability and transparency of the functions of FOs, which had led to only 34 % and 25 % of the farmers being satisfied with FOs in the Anuradhapura and Kurunegala districts, respectively. There was no real networking of Community Based Organizations (CBOs), which would have helped in sharing and exchanging information and ideas on water management.

Although FOs had been established in all irrigation schemes, they are hampered by various problems such as lack of maintenance activities for irrigation facilities, low member participation in FO activities, lack of good leadership and poor communication.

The weak status of FOs in minor tanks schemes in both districts was reflected in the inadequacy of infrastructure facilities and extent of undeveloped land for cultivation in both districts. Membership fee and money earned through various contractual activities was low and the accounts of such details were not available in the majority (78 %) of FOs, indicating the lack of accountability and transparency.

The analysis shows that small and homogeneous FOs had better methods of conflict resolution in O&M.

Comparing the head and tail-enders of the irrigation canals shows a higher degree of disparity in income in the tail end of the irrigation canal. Inequitable distribution of irrigation water was the major cause of the disparity.

The difference in water productivity between major and medium irrigation schemes was insignificant but was considerably lower in minor systems.

The Irrigation Department (ID) plays a significant role in managing the irrigation infrastructure of medium and major irrigation schemes in the country. Namalee Madawalagama and Badra Kamaladasa describe the degree of importance of the ID's role in irrigation scheme maintenance in their paper on 'Irrigation Infrastructure Management by Public Funds –How it Can be Made Justifiable'. This paper aims to compare the actual annual fund requirements and the available funds to operate and maintain (O&M) an irrigation scheme. The Hurulu Wewa Irrigation Scheme was selected as the study area. The study shows that the labor input from farmers and their families in O&M is enormous, but suggests that this labor input is frequently ignored in the financial analysis due to difficulties in accounting. By comparing actual needs against funds available for repair and improvements to the system, the authors show that due to inadequate funds, general improvements and immediate repairs cannot be attended to when needed. Delays in attending to repairs and improvements eventually lead to a self-sustaining cycle of more damages and an increased demand for funds for maintenance, which undermines the guaranteed life span of the systems. The authors also argue that further contributions from farmers for improvements and repairs cannot be expected as their income is marginal. The study also shows that when compared with government expenditure on O&M activities, the value of production of the scheme is very high. However, inclusion of the fertilizer subsidy amounting to Rs. 122 million (the hidden cost) in the calculations, significantly reduces the value of production in Huruluwewa. The authors thus argue for an increase in the government's input for O&M to reduce the rehabilitation costs and improve system performance. Further justification for this is provided by showing that the contribution to the national economy by an irrigation scheme is much higher than the investment in O&M by the government. They also suggest that this scenario may apply to a large percentage of the paddy production area in the country as 80 % of paddy production occurs under major and medium irrigation schemes.

Groundwater Use in Conjunction with Irrigation

Use of groundwater in conjunction with irrigation water is becoming popular in countries like India. Sivakumar in his paper on 'Policy Alternatives for the Management of Minor and Medium Irrigation Schemes to Develop Groundwater Systems in Restricted Catchments for the Improvement in Food Productivity in the Dry Zone of Sri Lanka' discusses the possibilities existing in the country. Recent studies reveal that in some irrigation systems, less than 50 % of the family income is derived from irrigated agriculture and a greater part of the family income is derived from non-agricultural activities. Furthermore, it was revealed that, 10 acres of irrigated agriculture has to ensure at least 250 person-days of employment to be the major source of income for farmers. In order to overcome this situation, the availability of irrigation water must be increased economically.

Probably the most profound challenge facing world agriculture today, and in the foreseeable future, is producing more food with less water. Over 90 % of liquid fresh water that is available at any given moment, lies beneath the land surface. Groundwater, unlike surface water, is available in some quantity in almost every place that man can settle in, and is a more dependable source of water than surface water during periods of drought.

Sri Lanka is the world's second highest user in terms of the percentage of the overall population, in utilizing fresh water withdrawals for agriculture. The combination of the surface

irrigation water and groundwater is the best alternative for improved water productivity. It was observed that the water table will reduce by 60 % to 70 % in between two consecutive seasons in 95 % of the catchment area under study. This implies that the boundary treatment combined with changing the operational policy of minor and medium irrigation schemes by foregoing a part of the cultivation is an economically feasible policy alternative with certain limitations such as a minimum project life period of 20 years and a maximum borrowing rate of 7.5 %. After completion of the project investment, the average cost of irrigation water will reduce considerably due to lower energy costs and this in turn will increase the extent of cultivation per unit of irrigation water.

Minor/medium irrigation schemes conserve surface runoff and convey the most part of it to recharge groundwater and, as such, serve as a recharge shed for the wells situated in the zone of influence. It is an insurance against water scarcity, as the yield increases considerably for every unit of rainfall. The minor/medium irrigation schemes prevent soil erosion and depletion of soil fertility. In the context of impending and looming water deficiency, the construction of minor/medium irrigation schemes will be a dependable infrastructure in the development of water potential in any catchment. Acknowledgement of the remarkable role played by the minor/medium irrigation schemes on replenishment of groundwater and its spread over a large area would be a great asset in planning and execution of settlement and crop production projects.

This research leads to the conclusion that a change in the operational policy of minor/ medium irrigation schemes by foregoing one-third of the cultivation under minor/medium irrigation schemes. Retaining one-fourth of the storage of these irrigation schemes at any season will gain an average of 45 % to 65 % of the loss of water table. Construction of new or reconstruction of abundant minor /medium irrigation schemes, reserving 25 % of the storage exclusively for recharging groundwater, and changing the operational policy to retain 25 % of the present storage of existing minor/medium irrigation schemes to recharge groundwater. The sill of the sluice can be raised to store 25 % of the total capacity of the scheme as dead storage, which in turn will reduce considerably the average cost of irrigation water for Other field Crops (OFC) cultivation, given the lower energy costs, and thus increase the extent of cultivation per unit of irrigation water and lead to an overall increase in water productivity.

Hence, the authors recommend constructing new irrigation schemes, which can accommodate a dead storage of 25 % of the full capacity. Furthermore, during any reconstruction of existing sluices, the sill has to be raised to retain 25 % as dead storage in the future.

Economic Valuation of Irrigation Water

The paper by P.Sivarajah and A.N. Ahamad titled 'Economic Valuation of Irrigation Water under a Major Irrigation Scheme (Gal Oya) in Eastern Sri Lanka' deals with the economic valuation of irrigation water. The authors attempt to highlight the value of water used for producing food with irrigation water. The study estimated the value of irrigation water using the principle of 'Marginal Value Product in a Linear Programming Approach' that maximizes net returns for a specific farm plan. The analyses are based on a survey carried out at the Right Bank System in the Gal Oya Irrigation Project using a sample of 30 farmers.

The 'Shadow' or 'Dual Price' of water was used to estimate the economic value of irrigation water for paddy and chili cultivation. It was found that the farmer can obtain a

maximum profit of Rs. 59,127.88 per season by cultivating paddy and chilies on 2 acres of land. The water constraint had a Shadow/ Dual Price of Rs. 6,159.76, which implies that the farmer can increase his net profits by this amount by using additional acre-feet of irrigation water in his optimal farm plan. This suggests that it is profitable for the farmer in the area to purchase water at a price close to or less than Rs. 6,159.75 per two acre-feet. Water has such a high Shadow/Dual Price because of its limited availability.

Spatial Variation of Water Supply and Demand in Sri Lanka and also Need for National Level Water Resources Assessment/Audit in the Country

Upali Amarasinghe of IWMI in his paper titled 'Spatial Variation of Water Supply and Demand in Sri Lanka' analyzes the spatial variation of water supply and demand based on time series socioeconomic data. His analyses at macro-level conditions are useful in generating an understanding of water supply and demand in the country as whole. This paper discusses spatial variation of water supply and the increased demand situation in Sri Lanka in recent years and assesses regional and seasonal water stresses.

Amarasinghe shows that renewable fresh-water resources of Sri Lanka vary significantly across river basins and seasons. For example, water availability varies significantly even within some water-rich basins, most significantly in the Mahaweli River. Of the 103 river basins, 12 river basins with 46 % of the geographical area generate 72 % of the total renewable water resource (TRWR) in the country.

The TRWR of 75 basins including Mahaweli and Gal Oya has significant seasonal variation where rainfall in the *maha* season contributes to two-thirds of the runoff. Intra-annual variation in water availability is the major constraint for productive agriculture in these basins. Thus, storing water for irrigation in the *yala* season (April to September) is essential in many river basins.

Water storage is even more important due to inter-annual variation of TRWR. The 75 % probability dependable runoff is only 83 % of the average TRWR. Thus, in the presence of increasing intra- and inter-annual variability of rainfall due to climate change, water storage in these basins becomes very important. In spite of large intra- and inter-annual variation of rainfall, Sri Lanka's storage capacity is very low at present. By 1996, Sri Lanka had developed about 6 bcm of storage capacity. This translates to a per capita storage of only 291 m^3 in 2005. However, this capacity is very low.

Water security through higher storage was a crucial base for early economic development in many developed countries. However, many of the potential sites for large surface storage in Sri Lanka are already exploited. Moreover, social and environmental concerns for new large storage structures are also increasing. Thus, increasing natural groundwater recharge by exploiting the resource in the non-rainy seasons, or through artificial groundwater structures in the rainy seasons could increase the storage capacity much more.

Most of the water-scarce basins are located in the dry zone. A large part of irrigation withdrawals recharges groundwater. However, in Sri Lanka reuse of this water in terms of groundwater withdrawals is negligible at present. Many river basins are already physically water-scarce, where even irrigation water withdrawals are a significant part of the TRWR. Physical scarcity will exacerbate the situation in many basins if domestic and industrial water withdrawals (10 -15 %) are also taken into account. This situation is very severe in water-scarce basins in the

dry zone, and can be further aggravated if estimates of utilizable water resources exclude environmental water needs. The environmental water demand of many river basins in Sri Lanka could be about 15 - 30 % of the TRWR and, if this amount is subtracted from TRWR for estimating productive use of Water Resources (PUWR) , many of the basins in the dry zone could fall into the physically water- scarce category.

In this context Amarasinghe attempts at answering the question of what options are available for Sri Lanka in meeting future water demand? At the present rate of growth, Sri Lanka's population will peak in the early 2040s, with an increase of 15 % from the current population (UN 2006). If the present self-sufficiency levels of different crops are to be maintained and the present level of crop productivity persists, the irrigation demand for meeting food demand for this maximum population could increase by, at most, 15 %.

Given the high level of water development for irrigation, increasing irrigation efficiency is one of the feasible options available for meeting future water demands. If irrigation efficiency is increased to 45 % from the currently assumed level of 35 %, the irrigation demand shall decrease by 22 %. If irrigation efficiency is increased to 55 %, irrigation demand will decrease by 35 %.

The paper presented by Matin et al. at the conference highlights the need for 'Development of a Water Resources Assessment and Audit Framework for Sri Lanka' The authors point out that to meet the growing problems of water resources, it is necessary to carefully assess the existing water stocks and future trends in a country. The accuracy of such an assessment highly depends on the quality of data and information used for it. In most developing countries, the lack of readily accessible and quality controlled data is the major obstacle for scientifically-based water resources assessments, water development planning and evaluating the status and trends of water resources. Sri Lanka is in a similar position. Sri Lanka experiences high seasonal and spatial variations in rainfall due to the bi-monsoonal climatic pattern (north-east monsoon from October to March and south-west monsoon from April to September) — (Amarasinghe et al. 1999). Large tracks of the country are drought-prone. Therefore, a better understanding of the national water situation is critically important. The IWMI researchers are in the process of developing this framework, taking Sri Lanka as a case study in the hope of extending the application of methodology to the situations in other countries.

Interventions Necessary in Capacity Building in Existing Water Organizations to Improve Productivity and Access to Water

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Introduction

To improve the accessibility, productivity and sustainability of water services, capacity-building of existing organizations and stakeholders has become a priority requirement in the water sector. Installation of physical infrastructure and implementation of direct training sessions alone will not fully consolidate the social and economic benefits of the water services unless proper interventions are made to improve the legal, regulatory and institutional environments. The dynamic nature of the water sector, demands that institutions handling water management also be dynamic institutions that can adapt to changing demands and circumstances. It is possible to transform the existing institutions into more responsive and accountable entities by enhancing their capacity without undermining their current position within the sector. Sustainability of the physical infrastructure depends entirely on the capacity of the institutions, organizations and individuals. Proper social behavior is also needed to complement the improved institutional and organizational capacities. It is time to identify the requirements of capacity development referred to as the 'software component' in the current water sector investments that would address the current needs of the country. The objective of this theme paper is to discuss gaps apparent in the current system and interventions necessary for capacity-building in the Sri Lankan water sector to fill these gaps.

Definitions of Knowledge and Capacity

The knowledge of an individual relates to the individual's ability to identify and describe issues, challenges or problems confronted and to articulate effective solutions to them. At the same time, the individual must possess the skills to communicate and share relevant information and ideas with other experts, peers and decision-makers before any action is taken (Alaerts and Kaspesma 2009).

Capacity can be defined as the capability of an individual, institution or society/ community to identify and understand its development issues; to act to address and learn