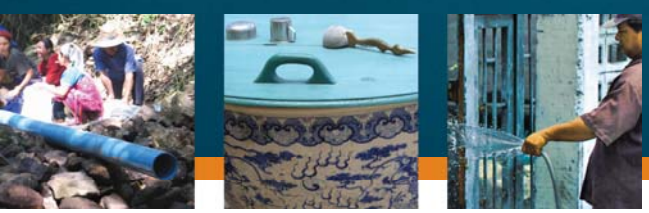
triple-S
WATER SERVICES THAT LAST

LESSONS FOR RURAL WATER SUPPLY

Assessing progress towards sustainable service delivery



Thailand

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Thailand

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IRC International Water and Sanitation Centre,
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EXECUTIVE SUMMARY

Water and sanitation have been a high priority in the development agenda for Thailand, and a substantial portion of the national budget has been allocated to it in the last three decades. This has resulted in the availability of water in sufficient quantity, but not always of satisfactory quality. Nationally, access to an improved water supply in Thailand rose from a low 10% in 1973 to the current level of over 90%—an improvement that has led to a positive change in the life of many women and children in rural areas, who do not have to travel long distances anymore for water.

Many agencies are responsible for water supply and sanitation, but they often have overlapping responsibilities, with resultant duplication of effort coupled with a lack of collaboration. Over time, the quality of urban water supplies has developed rapidly, but water supplies in rural areas have lagged behind.

In rural areas, only 15% of all households drink water from piped systems, and nearly 50% drink rain water. This is partly due to the fact that, despite the increased access to piped water, water quality remains a problem. High turbidity, colour, and contamination by micro-bacteria and chemicals affect both ground- and surface water sources. Contamination from industrial waste, landfill and mining is also increasing. A broad knowledge of handling environmental change and guarding against hazards is a requirement for the local administration—the TAOs (Tambon Administrative Organisations)—which was put in charge of rural water supply following decentralisation at the end of the 1990s.

In reality, however, the transition of responsibility to the TAOs is a difficult project. With the construction phase now nearly completed, ensuring that systems continue to work—and work effectively—poses another challenge. TAOs have few staff, and limited skills to handle the broad spectrum of services for which they are responsible. While decentralisation has brought fiscal transfer, there is no equivalent transfer of human resources. A more effective approach is a priority, especially in terms of vertical support from technical departments, so that reliable water services can be ensured for the 74,000 rural villages countrywide.

At present, much discussion in Thailand on rural water delivery has centred around service scale and, in the context of decentralisation, the appropriate management structure. Options include elevating the management of rural water service delivery from local commune to intermediate level—for example, the Provincial Waterworks Authority. Another option is to organise local cooperation, consolidation, or even a merger of operations between weaker and stronger TAOs, to gain the benefits of economies of scale and ensure good water quality. Cooperation between local authorities can represent an effective solution to these challenges, but the environment surrounding local cooperation is not favourable. In reality, a local authority is prohibited from using its budget funds outside its own territory, and no guidelines exist for the establishment of formal inter-local associations for joint water service delivery.

The TAOs have tried many management models, according to their relative human resources and financial capacities. These have ranged from self-management to privatisation. Identifying a workable solution is a pressing issue, since local authorities are under increasing pressure to deliver basic public services more effectively in the context of the near-completion of decentralisation.

Other lessons learnt include:

- While investment in hardware is important, ultimate success in service delivery lies in the software employed during and after construction;
- The scale of delivery must be placed at the level at which water capacity can support its own sustainability, not only in financial terms, but for quality assurance too;

- Decentralisation of responsibility for public service delivery must be accompanied by both financial transfer and human resources transfer, and supported by arrangements for vertical accountability and oversight; and
- The increasing role of the private sector in service delivery is a promising option as incomes rise, and people are able to afford and request higher-quality services.

ACRONYMS

BARD	Bureau of Accelerated Rural Development
BMA	Bangkok Metropolitan Authority
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
DGR	Department of Groundwater Resource
DLA	Department of Local Administration
DOH	Department of Health
DWR	Department of Water Resource
DUWR	Department of Underground Water Resources
EIA	Environmental Impact Assessment
EGAT	Electricity Generation Authority of Thailand
GDP	Gross Domestic Product
HDI	Human Development Index
IWRM	Integrated Water Resources Management
MOI	Ministry of Interior
MONRE	Ministry of Natural Resources and Environment
MOPH	Ministry of Public Health
MWA	Metropolitan Waterworks Authority
NESDB	National Economic and Social Development Board
OPM	The Prime Minister's Office
PAOs	Provincial Administrative Organisations
PDA	Population and Community Development Association
PPP	Purchasing Power Parity
PWA	Provincial Waterworks Authority
RBC	River Basin Committee
RBO	River Basin Organisation
ROT	Rehabilitation-Operate-Transfer
SDA	Service Delivery Approach
SDMs	Service Delivery Models
TAOs	Tambon Administrative Organisations
THB	Thai Baht, currency of Thailand
WHO	World Health Organization

1 INTRODUCTION

1.1 OVERVIEW OF THE SECTOR

Over the past two to three decades, there has been relative success in providing new rural water infrastructure—building the physical systems—and driving increased service coverage levels. Despite this positive trend, there has to a large extent been a failure to find durable solutions to meeting the needs of the rural poor for safe, reliable domestic water. Rural populations face continuing and unacceptable problems with water systems that fail prematurely, creating false expectations and leading to wasted resources.

Although figures vary, studies from different countries indicate that somewhere between 30% and 40% of systems either do not function at all, or operate significantly below design expectations. Construction of a workable physical system is an obvious requirement, but it is just one factor in a more complex set of actions needed to provide truly sustainable water delivery services. Increased coverage does not necessarily equate to increased access.

A tipping point may now have been reached, however. National governments and their development partners are beginning to recognise the scale of the problems associated with poor sustainability, as well as the real threat this in turn presents to achieving the WASH Millennium Development Goals. Discourse on sustainability is now shifting from a focus on one or two individual factors, to defining the requirements for addressing the underlying issues in a more holistic, systemic way.

The rural water sector in most countries in the developing world has experienced a period of profound change over the last 10 to 15 years—often involving major policy and institutional reforms driven by the broader processes of decentralisation. In some countries—South Africa and Uganda, for example—decentralisation of service provision authority has been relatively well planned and supported. However, in other countries, including Burkina Faso and Mozambique, the decentralisation process has proved much more problematic. In almost every country, serious challenges to ensuring adequate water services have been presented by the lack of capacity and resources at decentralised levels.

Other significant factors affecting the water sector include the drive for increased harmonisation, particularly in more aid-dependent countries, and for the 'professionalisation' of community-management approaches. The latter involves provision of supporting technical capacity and increasing management efficiency, but not necessarily within the context of privatised approaches. Many of these change drivers—decentralisation in particular—are not unique to the water sector. Rather, they are part of broader changes in governance and public sector administration to which the rural water sector (as well as other sectors) must respond.

1.2 THE TRIPLE-S INITIATIVE AND COUNTRY STUDIES

Sustainable Services at Scale (Triple-S) is a six-year learning initiative which commenced in early 2009, with the overall goals of improving the sustainability of rural water services and bringing about greater harmonisation through increased sector capacity. The initiative is managed by IRC International Water and Sanitation Centre in The Netherlands, and works in partnership with international, national and local organisations. Further details can be found at: www.irc.nl/page/45530.

Triple-S aims to act as a catalyst for the transformation of current approaches from piecemeal projects that often involve one-off construction of a water system, to indefinitely sustainable rural water services delivered at scale. Working in two initial focus countries—Ghana and Uganda—the initiative will seek to encompass a further two countries by 2014. As part of the Triple-S start-up, a broader research and scoping exercise was conducted between late 2009 and mid-2010. The main objectives of the research was to review and better understand the trends within rural water supply, and to identify the factors that

appear to contribute to, or constrain, the delivery of sustainable services at scale. The study also sought to identify organisational incentives and barriers that affect the way in which sector institutions approach rural water services. The study was undertaken in 13 countries, supported by a parallel process of documentation and review of the literature on rural service provision and aid harmonisation.

1.2.1 Case study countries

The case studies were conducted in 13 countries: Ghana, Uganda, Honduras, Colombia, India (three states), Thailand, Sri Lanka, Burkina Faso, Benin, South Africa, Mozambique, Ethiopia, and the USA. Three broad groupings can be identified from this selection: a set of *least-developed* countries—Ethiopia, Mozambique, Burkina Faso and Benin—with highly aid-dependent WASH sectors (more than 50%); a *middle group* of countries—Honduras, Uganda, Ghana—with mixed aid dependency and income levels; and finally, a group of *middle-to-higher-income*, non-aid-dependent water sectors that include the USA, Colombia, South Africa, Thailand, Sri Lanka and India.

The selection of such a broad range of countries was intentional—firstly because it was known that individual country studies included interesting examples of different elements in rural water service delivery; and, secondly, because, taken together, these cases studies represent a valuable continuum of sector maturity across a variety of coverage levels, aid dependency and decentralisation experiences, from which lessons could be learned. This document presents the findings of the country study for Thailand.

Understanding the causes of poor service sustainability necessarily involves an assessment of the political economy of the country in question, in terms of the broader socio-economic, governance, and political dynamics within which the water sector operates. It can also be related to the way in which groups with common economic or political interests influence the development of the water sector—for example, the promotion of, or resistance to, sector reform and the decentralisation of service delivery. These country studies therefore look beyond a simple description of the situation in a specific country. They examine the broader attendant processes of decentralisation and political leadership, in an attempt to identify successes, or, as in many cases, failures within the rural water sub-sector.

1.3 KEY CONCEPTS

The concept of **sustainability** is used liberally in the water sector, and there are numerous interpretations of what this term may mean in the literature. In the more specific context of the rural water sector, many organisations have defined sustainability as the maintenance of the perceived and intended benefit of investment projects (including convenience, time savings, livelihood or health improvements) following completion of the active implementation period. In other words, this definition is close to one that simply describes sustainability as: '*whether or not something continues to work over time*' (Abrams, 1998): in this particular case, water service supply, and whether or not water continues to flow over time.

Sustainability of service is affected by a range of factors. These include not only the technical or physical attributes of the system, but also the financial, organisational (support functions) and managerial capacities of the service provider, which together influence the likelihood of the continuing provision of service over time. For this study, sustainability is defined as the indefinite provision of a water service with certain agreed characteristics over time, although different countries may use their own (proxy) definitions and indicators for sustainability.

The country studies are based on a number of key concepts regarding rural water service delivery. The starting point for providing sustainable service at scale is the realisation that there is a need to move towards a **service delivery approach (SDA)**—a conceptual ideation of the way in which water services can best be provided. At its core is a shift in focus from the means of service delivery (i.e. the water supply system or infrastructure) towards the actual service accessed by users. Water service is defined in terms of a user's ability to *reliably and affordably* access a given *quantity* of water, of an acceptable *quality,* at a given *distance* from the user's home. A water service consists, therefore, of both the hard (the physical system and technical aspects) *and* the soft systems (the institutional, policy and financial frameworks) required to make such access possible.

A key assumption of the approach is that, in a given context, the principles behind the SDA should be applied through one or more commonly agreed **service delivery models (SDMs)**. SDMs provide a framework—or the 'rules of the game'—for service delivery. Such models are best guided by a country's policy and the legal frameworks which define the norms and standards for rural water supply; institutional roles, rights and responsibilities; and financing mechanisms. One of the major challenges for the delivery of services is that, in many countries, such models are neither clearly defined nor supported by sufficiently clear policy and legislation, or that they are simply ignored by organisations which continue implementation according to their own individual approaches. Depending on the level of development of a sector, a variety of different SDMs may be appropriate, centred on different management

approaches that might include public sector, private, or community management.

What is the distinction between the service delivery *approach* and a service delivery *model?*

The underlying *concept* of the water delivery approach is defined as sustainable water services, delivered in a harmonised and cost-effective way, at scale, within a district. This is clearly a universal approach, or paradigm, with common principles and benefits that can help to overcome the problems of the past. However, when applied in practical terms in any given context, a suitable *model* must be researched and developed to reflect the realities of the country and service area concerned, as well as the type of rural population; levels of social and economic development; and the relative strength of the public and private sectors. In simple terms, the water service delivery **approach** represents the concept, while the water service delivery **model** defines the specific application.

Decentralisation is a process which can take many years or even decades to reach a level of maturity at which the lower tiers of government are not only given a mandate to deliver services, but are also provided with adequate resources, capacities and indeed decision-making power to achieve service delivery. Decentralisation has many interpretations, but for the purposes of this study it can best be captured as *'the transfer of authority and responsibility for governance and public service delivery from a higher to a lower level of government.*

The definitions of decentralisation that follow are based on the World Bank's Independent Evaluation Group definitions (World Bank, 2008).

In reality there can be a number of pathways leading to decentralisation. These range from well planned and resourced processes that take place over many years, with progress indicators, to the so-called 'big bang' decentralisation where central government announces decentralisation, swiftly passes laws, and then transfers responsibilities, authority, and/or staff to sub-national or local government in rapid succession—without the provision of adequate time to embed real capacity. The various aspects, or dimensions, of decentralisation are set out in the left-hand column in Table 1. Typically, they consist of the transfer from central to lower levels of government of administrative decision-making; financial control; and political or decision-making authority.

In the study, reference is made to a number of different institutional levels within rural water service delivery. The definition of these levels is based on **functions** related to service delivery. Depending on the degree of decentralisation, and the specific administrative hierarchy of the country concerned, functions may or may not be linked to one or more specific institutional levels, so the levels can therefore vary from country to country in terms of their precise formulation. This is particularly true in larger federal states such as India or the USA, where intermediate levels such as states, regions or provinces may exist, which often house de-concentrated representation of central ministries. Broadly speaking, three distinct groups of functions can be identified with the corresponding institutional levels:

1. **Policy and normative functions—national (state) level.** This represents the overall enabling environment where sector policy, norms, and regulatory frameworks are determined; service levels defined; and macro-level financial planning and development partner coordination take place. This can also be the level at which learning, piloting and innovation can be funded and promoted. Overall sector guidance and capacity building are set by this level of authority. Nearly always, this takes

TABLE 1: DIMENSIONS AND MODES OF DECENTRALISATION

Dimensions of decentralisation	Modes of decentralisation
Administrative decentralisation—The way in which responsibilities and authority for policies and decision making are shared across different levels of government, and how they are translated into allocative outcomes	**Deconcentration**—The shallowest form of decentralisation, in which responsibilities are transferred to an administrative unit of the central government—usually a field, regional, or municipal office
Fiscal decentralisation—The assignment of expenditures, revenues (transfers and/or revenue-raising authority), and borrowing to different levels of government	**Delegation**—Here, some authority and responsibilities are transferred, but in the context of a principal-agent relationship between central and lower levels of government, with the agent remaining accountable to the principal
Political decentralisation—The way in which the voice of citizens is integrated into policy decision making, and the ability of civil society to hold accountable authorities and officials at different levels of government	**Devolution**—The deepest form of decentralisation, in which central government devolves responsibility, authority, and accountability to lower levels, with some degree of political autonomy

Source: World Bank, 2008

place at national level, although in federal countries, states may also undertake some of these functions.

2. **Service authority functions—intermediate level.** This represents the level where service authority functions such as planning, coordination, regulation and oversight, and technical assistance are undertaken. The generic term 'intermediate level' is used to describe this key level between national and community level of local government, which may be a district, commune, governorate, municipality, or whatever the exact administrative name is used in a particular country. In some cases, local government entities have ownership of the physical assets of rural water supply systems, but this varies from country to country. Service authority functions may be split across different administrative levels, depending on the extant degree of decentralisation or mix between decentralisation and de-concentration of functions—for example, between provincial and district authorities.

3. **Service provider functions—local level**. This represents the level at which the service provider fulfils the functions of day-to-day management of a water service. Under certain arrangements, this level may also involve asset ownership (but this is rare), and investment functions. Typically, the service provider functions are found at the level of a community, or grouping of communities, depending on the size and scale of the water supply systems in question. The service provider function may be executed directly by a committee acting on behalf of the community. Where there is professionalisation of community management, the tasks involved are increasingly delegated or sub-contracted to an individual (plumber or technician), or to a local company acting under contract to local government. This is the level at which day-to-day operation of the physical system takes place, and includes preventative and corrective maintenance, bookkeeping, tariff collection, etc.

2 METHODOLOGIES AND ANALYTICAL FRAMEWORK

The methodologies for data collection followed a similar format in all study countries, employing a combination of secondary data collection, such as document and literature reviews, with primary data collection gathered through interviews. Each study was coordinated by an IRC staff member and contained substantial input from interviews and questionnaires completed by key sector players, including government officials, national- and intermediate-level organisations, donors, and NGOs operating in the water sector.

Because the picture 'on paper' can differ significantly from the reality on the ground, the studies focused primarily on *theory versus practice* in order to highlight the difference between 'how it should be' and 'how it actually is'. In order to validate the studies and gain sector acceptance, the majority of countries included a *check-in* process, in which a group of sector experts shared and discussed the preliminary findings in validation workshops throughout the course of the study. This often involved a two-step process, in which key issues identified at national level meetings were subsequently discussed with a group of experts and practitioners from district and regional levels, in similar workshops.

This type of validation exercise serves to enrich the conclusions reached in the studies, and, importantly, initiated a process of dissemination and dialogue around the key issues facing rural water service delivery in the countries concerned.

2.1 METHODOLOGY FOR THIS STUDY

This report is based on a review of both white and grey literature; research reports; and 36 books, manuals and guidelines from government agencies related to water supply. It also includes key interviews with informants from key ministries, as well as focus group interviews at the local level.

2.2 COMMON ANALYTICAL FRAMEWORK

In order to provide a common point of reference for the various countries involved in this study, an analytical framework was developed for all the country teams. The three prime levels of analysis in the framework correspond to the three functional levels

BOX 1: OBJECTIVES OF THE STUDY

- To define and describe existing service delivery models (SDMs) in rural water supply, and to gain a better understanding as to how these SDMs have developed.
- To analyse the strengths and weaknesses of these SDMs in terms of their implications for sustainability and achieving scale.
- To identify and analyse underlying principles, success factors, and challenges.
- To identify and describe successful (or unsuccessful) processes of change undertaken in pursuit of the coordination and harmonisation of policies for, and approaches to, service delivery.
- To identify and analyse triggers, incentives, drivers, barriers, and processes that appear to influence organisational behaviour in the specific context of improved harmonisation and coordination of service delivery.

defined in Chapter 1, and include a range of elements, or principles, designed to prompt questions and discussion around a better understanding of sustainable service delivery. In total, the framework consists of 18 elements, each of which carries a short definition, that address issues such as sector decentralisation and reform; institutional roles and responsibilities; financing mechanisms; service delivery models; learning and coordination; and monitoring and regulation.

The application of this common analytical framework has enabled Triple-S to compare key issues and elements across the full range of countries, and thus to identify common trends or factors which may be important—either as positive drivers of improved sustainability, or as constraints to various service delivery approaches.

2.3 STUDY OUTPUTS

For each country involved in the Triple-S study process, a stand-alone document, or **country working paper,** will be produced and circulated to interested stakeholders at national or regional level. Additionally, brief individual country summary case studies of four to six pages—offering a more accessible resource for policy makers, and for international dissemination—will also be produced. Finally, a **synthesis document** has been published, which contains the main output from all the 13 country study analyses. It compares key factors and principles across the different experiences, and captures trends and emerging lessons around the decentralisation and sector reform processes, as well as the development of the community-based management approach. The synthesis document will also help to inform the ongoing Triple-S action research process, both at country level (in Ghana and Uganda) and internationally.

3 OVERVIEW OF RURAL WATER SUPPLY IN THAILAND

3.1 SOCIO-ECONOMIC DEVELOPMENT

Thailand is a mid-level-income country in Southeast Asia. It borders with Lao PDR and Myanmar in the north, Lao PDR to the east, Malaysia and Cambodia to the south and southeast, and Myanmar to the west. Thailand Gross Domestic Product (GDP) was worth US$274 billion in 2008 (US$627 billion on a purchasing power parity—PPP—basis), which classifies Thailand as the second-largest economy in Southeast Asia after Indonesia. Thailand ranks midway in the wealth spread in Southeast Asia, being th fourth-richest nation after Singapore, Brunei and Malaysia.

The country has an area of 513,115 sq km, equivalent to the size of France, with a population of 66 million (Wikipedia, 2008). The capital, Bangkok, has a population of 10 million. Two thirds of the population live in rural areas, provincial towns, communes or villages. Administratively, the country is divided into 76 provinces, covering 877 districts, 7355 communes (Tambons) and 74,944 villages (Department of Provincial Administration, 2010).

Thailand has seen remarkable progress in human development over the last 20 years. It now has a Human Development Rating of 0.77 and will achieve most, if not all, of the global Millennium Development Goals well in advance of 2015. The country has reduced poverty from 27% in 1990 to 9.8 % in 2002, and the proportion of underweight children has fallen by nearly half. Most children attend school, and universal primary school enrolment is likely to be achieved within a few years. Malaria is no longer a problem in most of the country.

The economy is heavily export-dependent, and exports make up more than two thirds of GDP. A well-developed infrastructure, a free-enterprise economy, and generally pro-investment policies, have made Thailand one of East Asia's best performers (Morgan, 2009). Per capita GDP in 2008 was THB136,511 or US$3,900 (National Economic and Social Development Board, 2008).

Thailand has successfully reformed and improved its administration in a number of sectors, including public health; and, as a result, the quality of life has improved for Thailand's people. Thailand's Human Development Index (HDI) rating was 0.715 in 1990, ranking as medium, at no. 76, from 177 countries worldwide. This has further improved to 0.784 in 2004, ranking at no. 74.

The poverty rate, which was 57% in the 1960s, had reduced to 11.4 % by the 1990s, although after the economic crisis in 1997 poverty slipped back to 15.9%. Once the economy improved again, and incomes increased, the percentage of population living below the poverty line fell to 9.8% in 2002. This suggests that economic conditions have a significant impact at grass-roots level. Among the poor, 86.2% live in rural areas; and two thirds of the country's poor population lives in the northeastern region.

Population was 62.8 million in 2006, and is forecast to reach 70 million in 2019 (Institute for Population and Social Research, 2006). Infant mortality rates were 84.3 in the 1960s, but fell to 16.3 in 2007. Life expectancy is 67.9 for males and 75 for females (Research Institute of Population and Society, 2003). These factors have changed the structure of the population dramatically. The proportion of older people has risen rapidly from 7.2% in 1990, and is forecast to reach 16% in 2020.

3.2 WATER SERVICES DELIVERY

3.2.1 The history of water supply services in Thailand

For the past four decades the government has attached a high priority to safe water supply. The supply of water to rural areas was initiated by the Ministry of Public Health (MOPH) and, between 1983 and 1992, 20% of the rural development budget was spent on rural water.

Piped water systems began in Bangkok in 1909. The system employed was part of a major effort to

modernise infrastructure and public services. In the years that followed, the service was expanded to the nearby Thonburi municipality. Expansion continued until 1946, when it could no longer be supported by the limited supply of electricity, and service growth was temporarily halted.

In 1967, water works and electricity services were transferred into a state enterprise for improved operation and efficiency. The Metropolitan Waterworks Authority (MWA) was established in August 1967 in accordance with the Metropolitan Waterworks Authority Act 1967. It represented a consolidation of four prior agencies—the Bangkok Waterworks Authority of the Municipal Public Works Department; Thonburi Waterworks Authority of the Thonburi Municipality; Nonthaburi Waterworks Authority under the Provincial Waterworks Division of the Municipal Public Works Department; and Samut Prakan Waterworks Authority of the Samut Prakan Municipality.

Work on rural water supply began 39 years after supply was available in Bangkok. The Public Works Department, within the Ministry of the Interior (MOI), was responsible for the set-up and expansion. Piloting was carried out in a few provinces in each of the sub-regions—north, north east, and south. The budget at the time consisted of a loan from the government savings bank.

Rural water supply subsequently received greater attention from government, and a special committee was established to coordinate the many agencies involved in construction and service delivery. Key actors were the Department of Public Works, the Ministry of the Interior, and the Department of Health (DOH) within the Ministry of Public Health (MOPH).

The Bureau of Civil Work under the Department of Health was responsible for the design and construction of water treatment facilities, as well as for the identification of raw water sources. The MOPH's and MOI's mandate was to cover remote rural communities.

The initial phase of comprehensive rural water supply: 1960s-mid 1970s:

Under the Second National Development Plan (1967–1971), rural water supply at village level was identified as a strategic programme, with specific budget allocation. The budget for village water supply was channelled through two key government agencies, charged with building, operating, and managing water services.

Communities or towns with populations in excess of 5,000 were the responsibility of the Bureau of Waterworks/Department of Civil Engineering, under the MOI. Communities of 1,000-5,000 people were served by the MOPH through the Bureau of Rural Water/Department of Health.

From the outset, there was a plan to transfer of the system to local authorities was, from the outset, planned once construction was complete and the system had been tested. However, this strategy had limited success due to a lack of skilled staff, funding for maintenance, and management capacity.

In 1979, as demand for better service increased, the water delivery services to cities and municipalities became the responsibility of a state enterprise called the Provincial Waterworks Authorities (PWA) through a cabinet resolution in 1978. The aim was to increase flexibility and enhance efficiency by having everything under one agency. Smaller rural communities with populations below 5,000 remained the responsibility of the DOH.

The second phase (1982–1992)

The government declared this to be the decade for 'clean water supplies to rural areas' under the fifth and sixth National Economic and Social Development Plans. The national development plan set a high target for water access, aiming to cover 90% of the rural population with 45 litres of water per capita per day for all domestic uses, of which at least five litres were to be for drinking water. From the beginning, a clear distinction was made between the prescribed quality of water for domestic uses, and that of drinking water, and this distinction continues to exist today.

Between 1982 and 1992, the government allocated THB 36,547.6 million (20% of the total budget for rural development) to the creation of water supply infrastructure in rural areas. Central government, through its line departments, was responsible for water service delivery. The DOH revived its water supply programme and extended the service beyond small towns into remote villages. By this time, the DOH had learnt—with the benefit of 15 years' experience of implementation—that successful water delivery depends not only on infrastructure, but also on good management systems, staffing, operation, and financial administration. A key factor is also the involvement of the system stakeholders, whose effective participation should commence at the planning stage, and continue through construction.

Following completion of the construction phase, the DOH provided training on the operation, maintenance and basic administration to village water committee members. This process contributed to significant success for village water committees, and many villages also benefited from fee collection, creating a fund which could be used to further expand service to

new members, or for other village development activities.

Third phase: 1991–2001

In the two successive five-year national development plans, clean water and sanitation were among the highest priorities on the national agenda. A cabinet resolution in 1991 called for a special plan for more concerted effort to accelerate the expansion of safe water and sanitation as a basic service to everyone. This was important, since the targets set in the two previous plans had not been achieved. The new target demanded that, by 2001, an additional 41,150 village water supply systems should be built, to provide service to 70% of villages in Thailand. The National Development Board recommended that five related government agencies should be responsible for the expansion: the DOH, the Department of Civil Works, the Bureau of Accelerated Rural Development (BARD), the Department of Geology, and the Provincial Waterworks Authority.

The government's guiding principle for water delivery demanded that communities should have full ownership of their own water services, and eventually become financially independent and capable of managing their own services. Following this principle, in 1992 the government adopted an approach and process, developed by the DOH, for community participation. All the agencies involved were required to undertake common processes and steps for community participation in the planning, construction, and rules for operation before the transfer of a water system to community ownership.

Fourth phase: 2001 to the present

The process of decentralisation began in 1995 with the establishment of sub-district bodies, the Tambon Administrative Organisations (TAOs). On average, one TAO covers about ten villages, or populations in the range of 10,000 people. The TAO has revenue-raising powers, and at the same time has taken responsibility for a broad range of local government functions. Rural water supply is one area of a TAO's responsibilities.

The new Thai Constitution in 1997 encouraged public participation in natural resources management and conservation, especially at a local level. The water sector is one key sector where active involvement of local stakeholders is essential. In 2002, the government reorganised all its agencies. The Department of Water Resources (DWR) was set up within the new Ministry of Natural Resources and Environment (MONRE). The DWR is responsible for implementation of the cabinet resolution of 2000, which called for the acceleration of the water law enactment. Some staff from the DOH and BARD were transferred to DWR. From this point on, village water supply was largely the responsibility of TAOs for overall management, and the DWR for technical advice and training. Groundwater technical support comes from the Department of Groundwater Resources (DGR).

3.2.2 Current status of water services delivery

About 90% of the population now has access to safe water, with a higher rate in cities and towns. There are two models for water services delivery in operation:

4. Community self-supply by rainwater harvesting and storage in family water jars, and
5. Piped water systems.

It is, however, unclear as to whether, or to what extent, rainwater harvesting—traditionally practised in most rural communities—is formally taken into account when piped water systems were planned and built in villages and communes.

Piped water is currently provided by three main agencies, depending on the area to be covered and its population. Urban areas are served by two state enterprises: Bangkok and its vicinity are serviced by the Metropolitan Waterworks Authority (MWA); and other provincial and district towns are served by the Provincial Waterworks Authority (PWA). The local administrative units, the TAOs, are the third main agency through which rural communities can receive a piped water supply. The village water committees and the TAOs receive training and technical support from two main ministries: the Department of Water Resources; and the Department of Local Administration. It should be noted, however, that since decentralisation, technical support from central government is now decreasing due to changes in the budgetary system.

The Metropolitan Waterworks Authority is a state enterprise under the Ministry of the Interior. The MWA has the longest experience, and the greatest expertise, in water delivery in the country. Its mission is to provide quality water to residents, businesses and industries in Bangkok, Nonthaburi, and Samut Prakan. The MWA serves approximately 1.9 million users in Bangkok and its two neighbouring municipalities. In 2008, the MWA delivered 1.7 billion m^3 of water. The average selling price is THB12 per m^3 (around 30 US cents). The MWA employs over 4,000 staff and has had a net income of THB10-12 million per year since 2005.

The Provincial Waterworks Authority (PWA) became a state enterprise in 1978, with the aim of increasing efficiency in responding to growing demand for water

service. It was supported by the cabinet resolution of 1997, and by the Eighth National Development Plan (1997–2001), which emphasised the increased roles of the private sector in the provision of public services. At the same time, the economic objective was to reduce the financial burden on government for new investment and further public debt. This change in the management regime was to mobilise funds from the financial markets for local investment—both from domestic and international sources.

In 2001, just under three million users living in over 640 cities, towns and commune municipalities (Tesabans), 77 TAOs, and 171 villages received their water from the PWA: a total volume of 102 million m^3 of water.

Rural villages and communes outside municipalities: Today nearly 90% (about 61,000) of all villages in Thailand have access to safe water, but 18,000 villages are still not yet connected, or have a system which is not functioning as it should. Water service has either been transferred to the village water committee or, in some cases, is owned and managed directly by TAOs. The average selling price is about THB5 per m^3.

4 KEY FINDINGS

4.1 DECENTRALISATION, WATER POLICY AND WATER SERVICE DELIVERY

Decentralisation in Thailand in the last decade is one of the key factors that have shaped the administrative system and public services—including rural water supply.

4.1.1 Decentralisation and local administration in Thailand

As stipulated in the State Administration Act of 1991, Thailand had five types of local authority before the fully-fledged decentralisation process began in the mid-1990s. The first of these was the *Tesaban*, the basic unit of local authority in urban areas. The second was the sanitary districts (*Sukhaphiban*) in semi-urban areas. The third was the Provincial Administrative Organisations (PAOs) in rural areas. The fourth was the Bangkok Metropolitan Administration (BMA) for Bangkok; and the fifth was for the City of Pattaya.

Sanitary districts (*Sukhapiban*) and PAOs were established during the 1950s and the BMA and the City of Pattaya during the 1970s. The mid-1970s were characterised by progress in the democratisation in the country—but, at the time, local authorities did not play an important role in public service delivery in comparison to central government and its branch offices. This remained true until the 1997 Constitution. Expenditure by local authorities accounted for less than 10% of the national total, and a similar proportion applied to the number of employees in local and central administration—a ratio of one to ten.

Decentralisation in the 1990s coincided with the democratisation process in Thai politics. The 1992 'Bloody May Incident' ousted the military regime and signalled a return to party politics. Decentralisation was a major issue in the general election campaign held in the same year. Pro-democracy parties waged a campaign pledging to introduce a system of public election of provincial governors, and advocating local autonomous entities as part of the Tambon Council (an advisory body to the Tambon). The autonomous status of the Tambon Council was established by the Tambon Council and Tambon Administrative Organisation Act of 1994.

Following the success of local authority organisational reform, the Thai government embarked on the development of the Decentralisation Plan—a move based on the 1997 Constitution, and the Decentralisation Plan and Process Act of 1999. Under this act, the National Decentralisation Committee (NDC) was convened in 2000. The NDC took the leading role in drafting the Decentralisation Plan. The Decentralisation Act of 1999 set the target for fiscal decentralisation to local authorities for expenditures of 20% of the national budget by 2001. This was to be further increased to 35% by 2006. The decentralisation mandate included both the transfer of responsibility for public services and fiscal transfer.

External factors also played important roles in supporting decentralisation. Various 'bail out' packages following the Asian financial crisis of 1997 increased the importance to local government and rural development. For example, the structural adjustment suggested by the World Bank called for decentralisation. After the financial crisis, funds were injected into the TAOs in an effort to reduce unemployment. Successful decentralisation will therefore depend on the capacity of local authorities to reach their targets of maintaining (or even upgrading) the levels of public service delivery that were in place before decentralisation.

Local authority structure in Thailand

The Thai state administrative structure embraces three systems: central administration, local administration, and local autonomy. Central administration consists of ministries and departments. The local administration system consists of provinces and districts. Central ministries have their branch offices within provincial and district offices, and despatch their officials to these units.

Provincial governors and district officers, despatched by the MOI, have the statutory authority to direct and supervise government officials from central ministries at the provincial level. The vertical relationship (between field staff of the ministry and their central supervisor) carries more weight than horizontal coordination among officers in the field.

The local autonomy system is different and consists of some 7,800 local authorities nationwide (as of March 2006). These local authorities were placed under the supervision of provincial governors and district officers, who have the authority to approve their annual budget and local regulations, to dissolve local councils, and dismiss local councillors.

In short, the decentralisation process in Thailand represents an attempt to reorganise the state administrative structure, which was highly centralised in authority, but decentralised in function. It is a paradigm shift from centralised administration that emphasises bureaucratic compliance to that of decentralised administration that builds on local capacity. The decentralisation reform changed the roles and functions of local authorities.

Progress in implementing the decentralisation plan

The Decentralisation Act of 1999 indicates the length of the process of decentralisation as, in principle, four years, but allows up to 10 years for completion. A total of 50 central departments and 245 services are subject to the Decentralisation Plan, and 180 functions have been transferred, or are in the process of being transferred, starting in 2007.

The Decentralisation Action Plan has a three-tier structure. *The upper tier* divides the services to be transferred into six categories: (i) infrastructure; (ii) quality of life; (iii) order and security of communities and society; (iv) planning, investment promotion, commerce and tourism; (v) natural resources and environmental protection; and (vi) arts and culture, traditions, and local wisdom. *The middle tier* identifies the central ministries and departments, and the specific services to be transferred from them. The *lower tier* identifies recipient local authorities by type, and defines the target year for service transfer completion. It also classifies these services into 1) those that are mandatory, and 2) those that are optional for local authorities.

Thailand attained the target of increasing expenditures by local authorities to 20% by 2001, as required by the Decentralisation Act, but failed to achieve the second target of a 35% expenditure share by 2006. In reality, the 2001 target was attained largely by increasing the tax collected by the central government, and by increasing grants to local authorities.

Decentralisation in Thailand has faced a number of challenges, one of which is a full assessment of the 'receptive capacity' of local authorities. The administrative services to be transferred to local authorities include those that have to be provided by a group of local authorities and those that are optional.

In practice it is difficult to distinguish between mandatory and optional services. For example, the Department of Fisheries within the Ministry of Agriculture and Co-operatives, transferred the management of some 10,000 rural fishing ponds to local authorities, but most local authorities abandoned them. Farmers are now demanding, directly or through politicians, that the department should now carry out pond maintenance, including dredging. The Department of Irrigation transferred the management of many weirs and irrigation canals to local authorities.

TABLE 2: NUMBER OF LOCAL AUTHORITIES BY TYPE

Type	Number	Remarks
PAO	75	One PAO in every province
Tesaban (municipality) Tesaban Nakorn (city municipality) Tesaban Muang (town) Tesaban Tambon (sub-district/commune)	2006 23 142 1841	City municipalities must have a population of 50,000 or more, and a provincial city hall. The district office is in the Tesaban Muang.
TAOs	5770	
Special Municipalities Pattaya Bangkok Metropolitan Authority (BMA)	2	The special municipalities are under the direct control of the Interior Minister.
Total	7853	

Sources: Department of Local Administration, 2009

BOX 2: MANDATORY AND OPTIONAL SERVICES FOR TAOs

Mandatory services:

1. Provision and maintenance of roads and canals
2. Clean-up of roads, canals, pavements, and public spaces; waste and sewage disposal
3. Prevention and control of communicable diseases
4. Prevention and mitigation of pollution
5. Promotion of education, religion, and culture
6. Promotion of the development of women, children, youth, the aged, and the disabled
7. Protection, supervision, and maintenance of natural resources and the environment
8. Conservation of arts, traditions, local wisdom, and good culture
9. Services commissioned by the central government as necessary, which provides financial and human resources

Optional services:

1. Supply of water for domestic use and agriculture
2. Provision and maintenance of electric or other streetlights
3. Provision and maintenance of drainage channels
4. Provision and maintenance of meeting places, playing fields, recreational rest areas, and parks
5. Establishment and promotion of agricultural groups and co-operatives
6. Promotion of family industries
7. Protection and promotion of people's livelihoods
8. Protection, supervision, and maintenance of properties as national public goods
9. Profit-seeking from the properties of the TAO
10. Provision of marketplaces, levees, and ferry landing stages
11. Services related to commerce
12. Tourism
13. City planning

Source: constructed by authors

The Bureau of Budget of the Prime Minister's Office made the corresponding transfer of budget funds.

Most local authorities, however, have spent their funds on developing new infrastructure rather than on maintaining existing infrastructure; and more and more farmers are demanding that the central department should conduct maintenance operations. Although the prevention and mitigation of pollution is now a mandatory function of the TAOs, they do not have the necessary equipment for an Environmental Impact Assessment (EIA). The provincial offices of the Ministry of Natural Resources and Environment lack not only the equipment, but also EIA experts. Most officials at provincial halls originated from the Royal Forest Department. For this reason, TAOs have no choice but to resort to the 16 regional offices of MONRE (Ministry of Natural Resources and Environment).

All these examples lead to a dilemma. Local authorities may avoid allocating budget funds to an 'optional service' (e.g. funds for maintenance costs). On the other hand, a 'mandatory service' may be beyond the capacity of small-scale local authorities such as TAOs. In terms of local finance, the dilemma is a choice between two options: (i) transferring funds as general grants, in the expectation that local authorities will make effective use of them; and (ii) granting purpose-specific grants for delivering standardised services throughout the country.

4.1.2 Water policy in the decentralisation context

The new constitution in 1997 encouraged public participation in natural resources management and conservation. Water was defined as one of the most important sectors within this constitution; and, in 2002, the government reorganised all its agencies and the DWR was set up within the new Ministry of Natural Resources and Environment. The DWR was made responsible for the implementation of the cabinet resolution in 2000, which called for the acceleration of water law enactment, and some staff from the DOH were transferred to the DWR.

With the move to decentralisation, the role of managing water resources was allocated to the local level. This aimed to increase efficiency, and to protect the rights of users. Integrated Water Resources Management (IWRM) became the approach used for all river basins and sources in Thailand.

At the basin level, 29 River Basin Committees (RBC) were set up to coordinate water allocation in 25 sub-basins. They are supported by the DWR through its ten regional offices across the country. The RBC water allocation plan aims to coordinate water demand with provincial development plans. In reality, there is a long way to go until basin planning and water resources management are effectively mainstreamed into provincial development plans.

The first draft water law was prepared and submitted to the cabinet in 1994 but, to date, the legislation has still not been passed. This is partly due to the controversial nature of certain issues related to water pricing and governance. The new draft water law devolves water management authority to river basin level. It legally recognises the river basin committee as the apex management authority for all water management decisions within the river basin. One of the essential clauses in the law requires water users to ask the RBC for permission to use any amount of water above that deemed for 'social' purposes (i.e. drinking water, household needs). It is in the granting of this permission that a water rights system can be established. However, water rights have been a contentious issue in Thailand, as some groups fear that they will make the poor worse off and give private enterprise better access to resources. In the absence of water law, it is difficult for the RBC to enforce water allocation. Raw water sources are in high demand for a variety of uses. In many basins, water sources for tap water are contaminated, or insufficient during the dry season.

4.1.3 Rural water delivery in the decentralisation context

National policies on water supply have the following characteristics:

- An integrated approach to water supply and sanitation within the framework of integrated water resource management, to control water quality as well as quantity;
- Expanded water supply through approaches that are demand-driven and responsive to users' willingness to pay;
- Decentralised planning, implementation and community-based management of water and sanitation services;
- Greater participation of the private sector, combined with targeted subsidies to ensure basic levels of service.

The DWR is tasked with national water resources management, including setting up and supporting the work of the RBC and rural water supply management. The DWR is also tasked with technical support for domestic water to TAOs during the transition period.

The budget to support rural water services is transferred to the TAOs through the Department of Local Administration (DLA) of the MOI. The budget for training and support is provided to the DWR as 'earmarked' for this specific purpose.

The assets from the four central departments to the TAOs come in many forms. They may be piped water systems, deep wells, or large rainwater storage tanks, depending on the geographical location, community and water availability. The majority, however, are piped water systems. Following transfer, water delivery under the TAOs takes many forms and many management modalities. In one model, the TAOs take over the operation, management and financial responsibilities from the village water committees.

Another model is that individual village water committees continue to take responsibility for production, management and maintenance of their systems. TAOs oversee and intervene when needed.

Both these systems have their strengths and weaknesses, as shown and discussed in the following section.

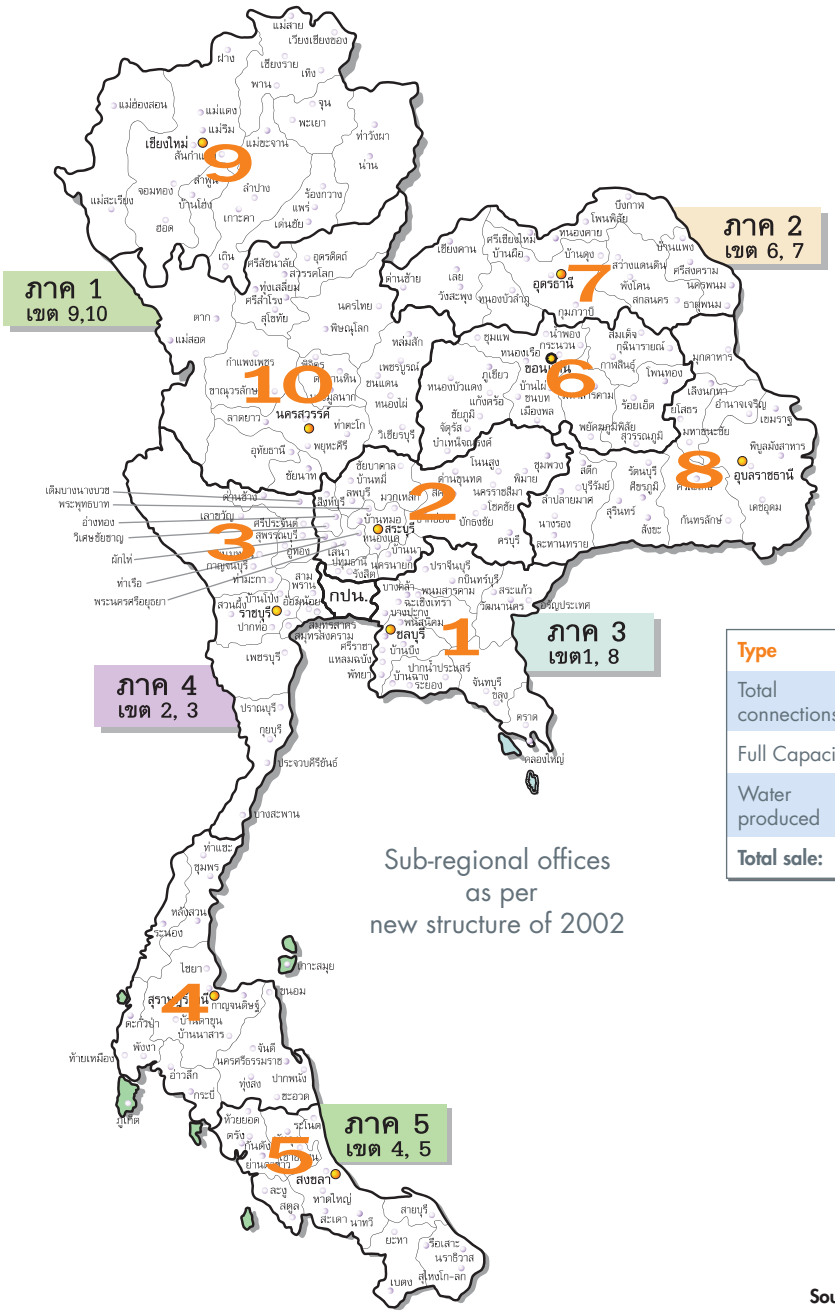
4.1.4 Service delivery models and oversight

Thailand's focus is on increasing effectiveness in water delivery by devolving responsibility to local government and increasing private sector roles. At national and intermediate levels, the oversight and regulatory roles are played by the PWA and MWA. Both are state enterprises which work closely with the private sector to set up and operate service delivery systems. Currently, state enterprises act as facilitators for private companies to be awarded permits to build facilities for production. State enterprises buy the water from companies under the BOT and ROT schemes (see below) and distribute it to households. There is a strong trend towards the gradual movement of distribution/selling to the private sector. At rural local level, the more modern TAOs are taking roles in oversight and subcontracting services to private companies. At the national level, central government (through its line ministry agencies) is now playing two roles: regulation and technical support. Regulation is in the form of the issue of licences and permits to private companies, and the provision of technical support /training to the TAOs and water committees.

The current PWA approach to increasing the roles and involvement of the private sector in municipal water delivery takes the form of three models as follows:

a) **BOT (Build-Operate-Transfer):** A private company invests in constructing the infrastructure, identifies water sources, and is responsible for system maintenance. This includes setting the price structure and timeframe for the handover, which is

FIGURE 1: THE PWA (PROVINCIAL WATERWORKS AUTHORITY): REGIONAL OFFICES AND SERVICE AREAS



Type	Number	Unit
Total connections	2,935,356	Connections
Full Capacity:	3,588,576	M^3/day
Water produced	104,974,378	M^3
Total sale:	**76,951,778**	**M^3**

Source: Provincial Waterworks Authority, 2008

normally about 25 years. Thereafter, the system transfers to the PWA. An example of this model can be found in Prathum Thani province, a neighbouring province of Bangkok.

b) **BOO (Build-Own-Operate)**: A private company invests in building a service system. Here, the price of water is normally cheaper than under a BOT scheme, because the company does not have to transfer the system to the PWA after 25 years. The contracted company takes sole responsibility for the profit or loss of the operation. The PWA supports private companies in obtaining permits from related government departments. The BOO model is applied in several provinces of Thailand. The PWA buys water from the contracted private companies, and distributes it for resale to users. The aim is for the PWA to transfer both production and sale to a private company in the future.

c) **ROT (Rehabilitation-Operate-Transfer).** In many provinces, the price of water charged by private companies is too high, for the reason that some companies charge at prices to cover their investment costs, without making use of the land, property or existing systems of the PWA. When

this occurs, the PWA offer a joint investment, using existing assets as part of the investment, to save on costs and therefore thus reduce the unit price *of water. The steps under ROT are:*

- Contract only one company for one location/ delivery system. The selected company then undertakes production, system management, leakage reduction, sale management and fee collection. PWA staff work for the contracted company, but the PWA pay their salaries and benefits for up to 3–5 years.
- Provide an opportunity for smaller local companies to subcontract by invitation for the bid covering a smaller area, rather than a cluster of municipalities.
- Move towards a management contract by hiring the private sector to administer a newly-established infrastructure.

Service delivery models at local level

Most rural people use at least two water sources: rainwater from jars and tanks, and shallow groundwater from tube wells. However, increasing numbers of villages access water connections to PWA- or village-piped systems, which means in effect that a significant number have access to three water sources. However, groundwater is always used for non-drinking purposes. Drinking water is sourced from rain water. Piped water is used for drinking and non-drinking purposes.

a) **Piped water:** The government's guiding principle in rural piped water delivery was that communities should have full ownership, and eventually become financially independent and capable of managing their own services. With decentralisation, infrastructure assets were transferred to local authorities for service delivery. Three main agencies at national and regional level are responsible for oversight: DWR, DUGR, and DLA. The DWR provides training and the production and dissemination of handbooks and guidelines, as well as technical support. The DWR also provides technical support in appraising raw water, drilling and groundwater. The DLAs support the TAOs in budget allocation and overall management.

From the 1970s to the mid-1990s, piped water systems were constructed for rural communities by several departments. The DOH has had the longest experience and thus has defined a comprehensive participation process to ensure sustainability. In 1992 the government adopted this participation process, and all other agencies were required to follow it in system establishment and operation. The steps

FIGURE 2: PROCESS FOR ESTABLISHING RURAL WATER DELIVERY AT VILLAGE LEVEL

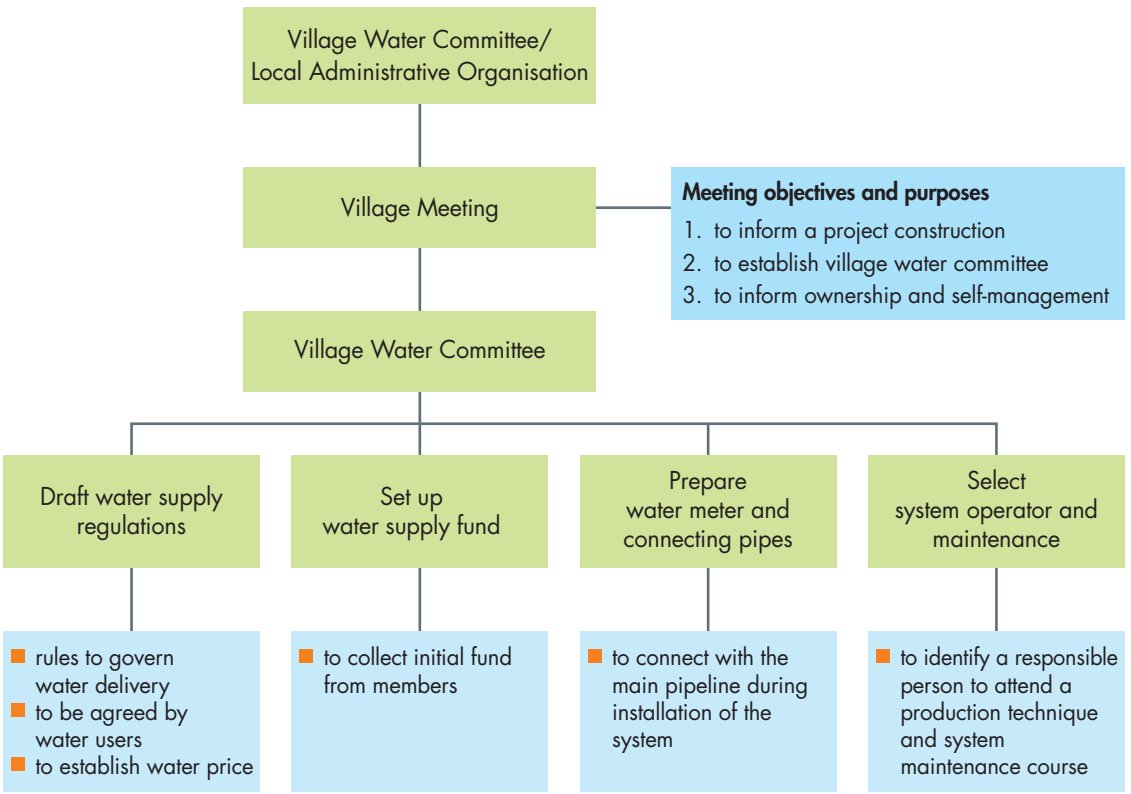
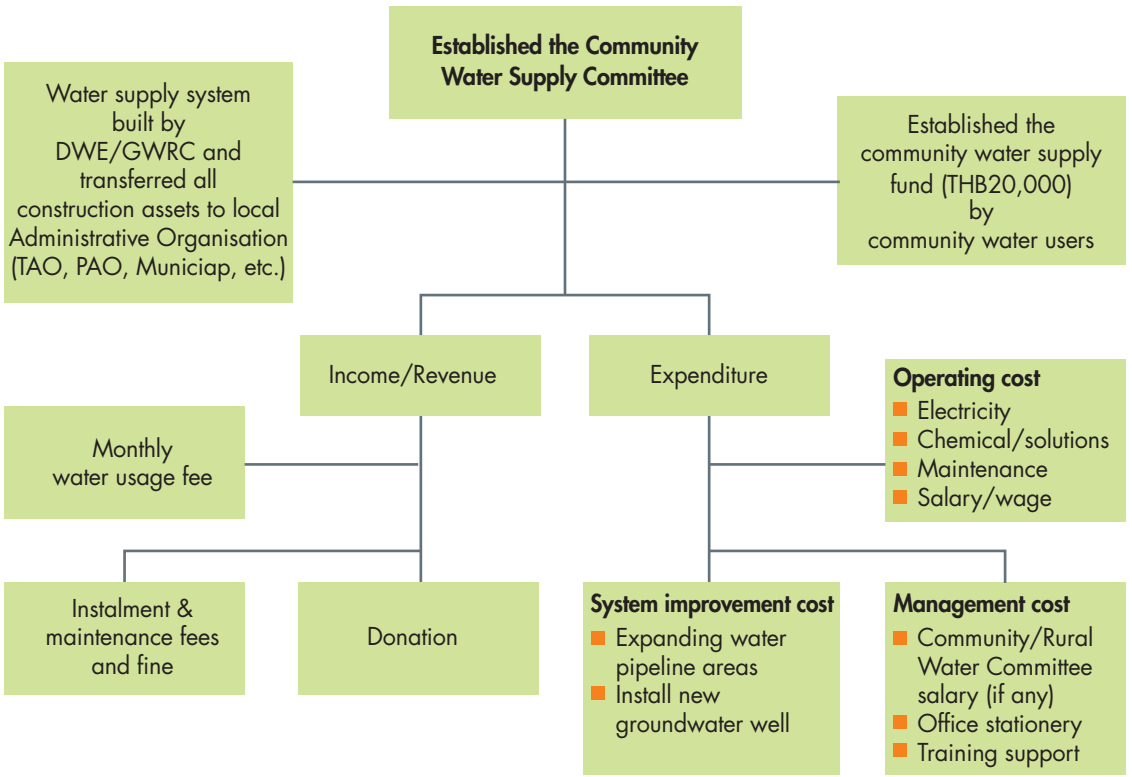


FIGURE 3: VILLAGE WATER COMMITTEES AND FINANCIAL MANAGEMENT



included informing/consulting during the planning stage; setting up committees and establishing initial funds; and giving basic training to committee members. The actual practice and depth of participation may vary from one department to another. The steps are shown in detail below.

The village water committee is an independent body representing water users. Normally it consists of between three and six members—the chairman, the vice-chairman, accountant, and system operator / maintenance person. Many committee members work on a voluntary basis, with the exception of the system operator, who receives a moderate salary. The system operator is nominated to receive training from the DOH or other central agencies.

The village water committee mobilises resources and sets up community funds to cover the initial set-up of the operation. These funds also represent a 'backup' financial source in addition to the income from water fees. Generally, the start-up fund is THB 20,000 per village. Monthly operating costs include electricity generation, chlorine, alum and lime powder, and the system operator's salary.

Planning: The TAOs' Development Plan is a one-year plan which cuts across many sectors. Planning for village water supply is just one part of this, and is included in the annual development budget. Typically, the plan covers both infrastructure building and, to a lesser extent, repair work. The TAOs make their development budget request (which will include funds for rural water supply) to the Department of Local Administration. Since decentralisation, many TAO budget requests have been for funds to increase the coverage of hardware for piped water systems, thus extending the infrastructure to those villages under TAOs which do not yet have coverage. Models for systems to be built are illustrated by the DWR in a set of guidelines, defining the appropriate size for the population, the necessary specifications, and the related costs. The selected model then is submitted with a budget request. However, the real challenge is to build a true picture of how many systems that are already in place actually deliver reliable water services to households in rural communities, and to what extent they do so. In addition, it is unclear as to how much drinking water from household rainwater harvesting is factored in to the equation before a system is supplemented with new sources. Over half of the rural community drink rainwater, and only 15% use piped water for drinking (National Statistic Office, 2005).

TAOs tend to be practical, action-oriented organisations, and are strong in long-term planning—so support for their activities is essential.. Important

FIGURE 4: DIFFERENT AGENCIES' MODELS FOR WATER TREATMENT PLANTS (AND TANK TOWERS) AT VILLAGE LEVEL

considerations in planning for water services would need to include:

1. Protecting raw water from contamination,
2. Having water treatment systems account for such risks, and
3. Effective water quality monitoring.

These considerations would require the involvement of many related departments, which would have been previously involved in setting up the system and providing technical supervision. These 'mentor' departments have the necessary skills, but the TAOs need to understand all the implications of the considerations involved in planning for water services, so that they can effectively call upon the right support and services both vertically and horizontally.

Monitoring and evaluation of rural water supply implementation: Comprehensive monitoring and evaluation (M&E) are still required to keep track of the quality of service delivered by extant piped systems, and, at present, the DUWR and DWR are planning to jointly take up this role. They are making a request for funding from central government for comprehensive monitoring and evaluation of piped water established by all agencies in last three decades. The work will start with a few pilot TAOs before launching nationwide. The M&E role is seen as a fundamental 'future mission' for the two main water departments over the next decade. (Interview DUWR Deputy Director, March 2010)

The MOH has also played a monitoring role in the past, but it has not been comprehensive or systematic across the country. In the mid-1990s, the MOH conducted a one-off evaluation of the systems established in villages by the MOH themselves. This evaluation resulted in a single uniform water quality standard for drinking water, issued by the MOH, to which all actors now refer.

Monitoring and Information Systems have been established by the DWR and DUWR, but they are not harmonised. For example, data held by the two departments can be contradictory in such areas as the number of villages not yet covered by piped systems, or the number of villages with a piped system which only partially functions. This creates problems for planning and budgeting.

Online information is made available by some TAOs, but many information is out of date and not regularly updated. In principle, the TAOs are accountable to their customers, the water users, for reliability of service and water quality. However, there exists a gap in the roles for vertical oversight in the post-construction period, especially since decentralisation. In practice, it is it difficult for users who have a complaint to get results from the TAO. When a community has water supply problems (access or quality of service), it often resorts to the media to publicise their issues, which can be filmed and aired on national TV (or local radio) to get their TAO's attention. Needless to say, media coverage delivers good results.

TAOs and the budgetary processes: TAOs receive partial funding support from central government. The amount received relates to the population size of each commune, its capacity for revenue generation, and absorption capacity. According to the decentralisation plan, the government was required to achieve fiscal decentralisation by 35% by the end of 2006. The government did not meet this target due to the low absorption capacity of the TAOs.

Financial arrangements at service level: The tariffs are defined by village water committees at 5–8 THB/m^3. The fee is intended to cover operational costs, but not major maintenance. Typically, operational costs include chlorine and other chemicals; electricity costs for water pumping; salaries for operational staff such as fee collectors; and remuneration for the water committees. They do not cover the cost of pipe expansion, major repair work, or technical support to overhaul the system.

Service delivery models in practice: Several studies were carried out to assess village water service delivery at a small scale in different regions by various agencies—universities, different divisions of the health department, and the DWR. Most of the studies took place between the mid-1990s and 2005. These studies have focused on the overall operation of the systems; functionality; the efficiency and effectiveness of management; financial sustainability; and water quality.

A 1998 study by the DOH reveals that about 90% of village water delivery systems installed by the DOH between the 1970s and 1996 are still functioning. The study was based on 220 village water systems from a total 480 built in five provinces in central Thailand. In addition, three quarters make a profit from their operations, and are able to accrue village funds. More details from the study can be found in Box 3.

Water quality remains a major challenge in rural water supply. Studies show that water from many village piped systems is contaminated with bacteria at levels of 50–92%, heavy metals at 2–9%, and turbidity at 20% or more.

b) Rainwater harvesting: Nearly 30 years ago, rainwater harvesting and tube wells were the two main water sources for rural households. In the mid-1980s, approaches to rural water supply focused on three inexpensive supply technologies: 1) Drinking water supply: rainwater jar and community water

BOX 3: ASSESSMENT OF VILLAGE PIPED WATER SUPPLY SERVICES

Samples: 220 village water systems (from a total of 480) installed by the DOH from the 1960s to 1996 in five provinces in central Thailand. The supply systems sampled had been in operation on average for four years.

Overall situation: 94% of the sampled systems still function, and 77% are making a profit. The vast majority of villages charge water fees at THB5 per cubic metre (or 7 cubic metres per US$1). About half of all villages surveyed have running water 24 hours/day. However, the coverage of service is 61% of all households in these villages, leaving 39% without piped water access. The main reason quoted for this situation was lack of funds for expansion. Small village systems currently serve about 40 households, medium-sized systems serve about 80, and large systems serve 200 households.

Financial sustainability: income, and expenses. Income ranges from US$514 to US$2,857 per year (THB18,000 to 100,000 per year) for small- to large-sized villages. Over half of all the villages studied had a 'free water' scheme in operation—largely distributing water free of charge to local schools, temples, community clinics, and the water committee's households. The highest expense incurred was for electricity. In all, the cost of operation is: 45% electricity; 30% management fees (committee and system operators); and 22% on the consumable materials used in production, such as chemicals. The average village fund accrued is between US$30 and US$6,850 per year per village (THB1,000–240,000). About 22% of these funds are contributed to charitable and community services such as scholarships for students, loans to community members, and financing village events/ceremonies.

Structure: The village water supply committee consists of between four and six people, elected by the water users. The length of committee members' service term is not defined. All village water committees receive at least one training session—but only half of these villages have ever sent a sample of water for quality control and inspection.

Challenges: Electricity is often not sufficiently powerful and is unstable, and supply fluctuations had caused water pumps to break down in 55% of cases. They also caused weak water flow at the tap. Other challenges include lack of funds to expand systems to more families in the village, and some households were not willing to pay to connect to the main pipe. There is also the difficulty of finding a technician to repair the system in a timely manner.

FIGURE 5: HOUSEHOLD RAINWATER JAR 1–3 M^3 (2,000 LITRES (THB750): RAINWATER LASTS FOR UP TO SIX MONTHS)



tanks; 2) Water for domestic uses: shallow wells for domestic water; and 3) water weirs for agriculture. This was before village piped systems became the main driving model for water delivery.

For monsoon-prone Thailand, rainwater harvesting provides an alternative source of water, as average annual rainfall measures 1,400 millimetres, and rain is expected for six months of the year. Rainwater harvesting became popular in rural Thailand because the inaccessibility and unavailability of piped water supply.

Multiple sources of water: Most rural households use at least two sources of water: rainwater from jars and tanks, and shallow groundwater from tube wells. However, many more villages have PWA connections and village piped water, which could mean that households can have up to three water sources. However, groundwater is always used for non-drinking purposes, and rainwater for drinking.

Water programmes, economies of scale, government support, and private sector competition have all helped to push the price of a $2m^3$ household jar down to THB 300–400 (less than US$10). The price of a large water jar ($11m^3$) is about THB40,000 for a set of three jars (US$400 per jar). A locally-made $11m^3$ jar provides water for a household of six all year round. Though the practice of rainwater harvesting using such jars is thousands of years old, it has regained popularity as an inexpensive solution to the water problems of Thailand's northeastern provinces. Households are able to purchase jars for immediate delivery. By using some of their savings, some households managed to increase their storage capacity further by buying a second or third jar. This has helped the rapid expansion of rainwater harvesting throughout Thailand. Today, the manufacture of rainwater jars has also become an important booster of the rural community economy.

Rainwater harvesting programmes have been undertaken by several actors: by households themselves; village committees; NGOs; and government. By the late 1980s, 24% of rural people were using harvested rainwater, 63% were using wells, and the rest were using piped water. The proportion of people served by rainwater increased to 35% in 1990 (WHO, 2004); and the number of households using small water jars ($2m^3$) increased to 8 million in 1992 (National Economic and Social Development Board, 1992).

Quality of rainwater: Rainwater is commonly believed in Thailand to be pure and consumable without treatment, and this can be true in unpolluted rural areas. A study in Thailand in 1989 (Wirojanagud et al., 1989) examined bacteria and heavy metal contamination of rainwater and found that only 40% of 189 rainwater jars met WHO drinking standards. Despite this, it was concluded that, potentially, rainwater is the safest and most economical source of water. Hygienic practices of collection, handling and storage can improve the quality. It was also found that no heavy metal content exceeded WHO's standard, except magnesium, which has no significant health effect.

TABLE 3: DRINKING WATER BY SOURCE

Sources of Drinking Water	Town, Municipality (%)	Rural (%)	Average (%)
Rainwater	10.7	49.6	37.4
Bottled water	49	20	29
Piped water	36	15.3	21.7
Wells/underground	3.7	14.2	11
Natural surface water	0.2	0.4	0.2

Sources: National Statistical Office, 2005

4.2 MECHANISMS FOR COORDINATION, SECTOR LEARNING AND SUPPORT

4.2.1 Capacity support for TAOs and village water committees

After the official transfer of village piped water assets to TAOs, responsibility for technical support is transferred to the DWR at central level. At the same time, overall administrative support and annual budget allocations to TAOs are assigned to the Department of Local Administration, within the Ministry of the Interior.

Capacity support by the DWR (training of local managers in TAOs and village committees) comes in the form of handbooks/training materials. In fact, the DWR's first task was to conduct a situation assessment of village piped water (managed by TAOs and village committees) to understand the state of operation. It was found that, around the country, TAOs coordinated water services in different ways, depending on their human resources, budget capacity, and agreed arrangements with village water committees. For example, some villages that were making profits from their water supply were unwilling to let TAOs take over, while others which had problems with system breakdown, or were running a deep deficit, wanted the TAOs to take over the work. Thus, it is possible that one commune may have some villages running their own service, and others running under TAO management. Overall, the management arrangements between TAOs and village committees are still under negotiation. But largely they fall into four types:

1. Managed by a village water committee;
2. Joint management by TAOs and village water committees;
3. TAOs take over system operation and sale of water; and
4. TAOs subcontract to a private company for both production and sale of water.

Each type has its strengths, weaknesses and suitability for different TAOs. The following are lessons learnt and summarised by the DWR.

The DWR produces several handbooks to guide TAOs in planning and management. These training materials include:

1. Handbooks for planning new community water supply systems,
2. System maintenance guidelines for system controllers,
3. Water treatment procedures for village operators,
4. Six different models for construction of water delivery systems at village level suitable for different types and sizes of community.

TAOs use these prototypes and models issued by the DWR in requests for budget funds from the Department of Local Administration. The department considers allocation of the budget to TAOs to ensure that the six-step process suggested by the DWR guidelines are met in establishing a piped system and participation process. TAOs may seek technical support in the planning stage from one of the 10 DWR regional offices around the country.

From 2002–2008, the DWR delivered training courses for village committees and TAOs on operation, system maintenance and planning. In 2008, 3,000 people responsible for village water supply were trained, two from each TAO.

The role of TAOs in oversight and monitoring has not always been clear among technical departments at central level. There are continuing overlaps and confusion in the transition period of the decentralisation process. Related departments include DLA, DWR, MOH and DUWR (Department of Underground Water Resources). Within these four departments, only the MoH deals with the 'software' of service delivery, i.e.

TABLE 4: RURAL WATER SUPPLY: MANAGEMENT ARRANGEMENTS BETWEEN TAOs AND VILLAGE WATER COMMITTEES

Model	Strength	Weakness	Suitable for
Model 1: Village Water Committee (nominated by users)	• Sense of ownership and responsibility because managed by village representatives • Good flexibility—no need to follow bureaucratic procedures	• Operation can be ineffective and not accountable • Weak accounting system • Problems getting funding support for expansion or major maintenance costs as system not overseen by local authorities • Low water quality/local water users not able to monitor	• Strong community with village leaders very capable and committed • Village committee honest and transparent in its operation
Model 2: Joint management Village Committee and TAOs	• Good participation—users and local authority • Better record keeping / financial accountability as TAOs must be audited • Oversight by TAOs—more efficient problem solving • Funds flow from TAOs to services as needed • Suitable for transitional period • Better water quality assurance as more officers are involved in management	• More procedures to follow in TAO process—less flexible in operation than model 1	• Community and TAO with moderate capacity • For villages with problems in decision-making or where there exist problems in enforcing rules • Village committee busy: cannot fulfil tasks and needs support from TAOs
Model 3: **Under TAO management,** including production, staffing, maintenance, sale, accounting/ recording	• Systematic, proper documentation, financial management • Budgetary support to water service by TAOs • Able to pay higher salary to village water committee maintenance staff • Able to control water quality	• Less direct participation from users/villagers • May be slow to respond to demands due to prescribed procedures • Some villages are not willing to hand over their system to the TAO as they can operate it themselves, and make enough money to sustain the service • Operational costs are higher for water delivery and hence result in higher water fees	• For communities/villages not strong in finance/ self-organisation • Villages with little expertise or time for management • For organised TAOs with higher capability in management
Model 4: TAOs hire a private company to operate the system. TAOs oversee and monitor the delivery	• Efficient/effective in water delivery as the business is run by a specialised agency • TAOs are able to plan and control the service • Improved ability to control water quality and quantity	• High costs in hiring the company, which can result in higher water fees • Lack of participation, sense of ownership from users/ villagers	• Village/community not strong in self-organisation • Modern TAOs with a high capability, income and budget, but insufficient staff, or unsuitable skills

checking water quality, and related health aspects. The DWR deals with hardware system design and training for maintenance. However, neither post-construction monitoring of the functioning of the system, nor actual delivery of quality water is under the direct authority of any of these four departments.

MoH has no direct authority to monitor TAOs and village committees to ensure that they deliver a standard water quality across the country. It has only done so on the basis of a 'sample study' of systems installed by MOH the previous three decades. This means TAOs are rather autonomous, and only

TABLE 5: EXAMPLES OF DIFFERENT DESIGN AND COSTING MODELS FOR WATER SUPPLY SYSTEMS FOR VILLAGE LEVEL FROM THE DWR HANDBOOK

Type	Size	Criteria		
		Supplying Water	Household Cover (Household)	Construction Cost
Groundwater system	Small (2.5 m^3/hr)	>70 litres/min	30–35	THB1,000,000 (US$28,571)
	Medium (7 m^3/hr)	>150 litres/min	51–120	THB1,500,000 (US$42,857)
	Large (10 m^3/hr)	>250 litres/min	121–300	THB2,300,000 (US$65,714)
	Very large (20 m^3/hr)	>500 litres/min	301–700	THB3,500,000 (US$100,000)
Surface water system	Large (10 m^3/hr)	~45,000 m^3/year	121–300	THB3,000,000 (US$85,714)
	Very large (20 m^3/hr)	~90,000 m^3/year	301–700	THB4,200,000 (US$120,000)
	Extra large (50 m^3/hr)	~400,000 m^3/year	701–1,300	THB25,000,000 (US$714,285)

Note: US$1 = THB35

accountable to their customers. However, it remains a challenge to get a prompt response from TAOs to complaints by users households.

The roles of supporting and monitoring TAOs on water delivery are confused, not only between the DLA, DWR, and DUWR (Department of Underground Water Resources). The DUWR performed a prominent role in installing piped water systems in villages, since underground water constitutes over 60% of the water source for such systems. The construction and maintenance of piped systems using underground water is more complicated than that for surface water. DUWR owns the necessary equipment, expertise and experience in this field, but currently has very little budget to provide support after fiscal decentralisation. Sometimes, TAOs choose to employ technical support from local universities or private enterprise—without adequate understanding of the full requirements of underground water systems. This sort of 'disconnect' remains a challenge today.

4.2.2 Addressing rural water shortages—the special package 2006–2008

Between 2006 and 2008, a special budget was provided to the Ministry of Natural Resources and Environment to mitigate water shortages for domestic consumption in 14,500 rural villages. These are communities which had not been covered by village piped systems. The implementation of this special intervention was in accordance with the 2005 cabinet resolution, which aimed to have all villages covered by water systems, to be completed within four years. There was concern that during this decentralisation of services to local authorities, TAOs with their many responsibilities might not be able to address these pressing needs. The budget allocated was THB6.4 billion for groundwater in 2006 and THB26 billon in 2007. DWR and DUGR were to coordinate with related agencies, including the DLA and TAOs. The TAOs could choose to 'buy services' from the DWR and DUGR, or choose to implement their own system if they had sufficient capacity. Today most of these projects are at different stages of completion, and the delay in their transfer is a challenge.

Current financing: Presently the rural water supply sector is financed by the following mechanism: Investment and capital costs come from the national budget via the Department of Local Administration (DLA). The cost of maintenance, repair work and system expansion comes from TAOs—both from their own revenues and, in some instances, funds from water fees. The amount of available funds varies from one TAO to another, depending on the size of the population and revenue potential. The daily O&M costs are borne by the village committee, via funds from user fees. The cost of technical support (if required) is covered by the TAO and the DLA, largely employing national funds but, to a smaller extent, the TAOs' own funds.

4.2.3 Rainwater jar distribution by TAOs as a supplementary water supply

From interviews with TAOs, this study found that, as an intermediary measure, many TAOs are providing family water jars to their villagers. This is especially true for communes and villages where transfer of the water service is in transition and system implementation is encountering difficulties. Water jar distribution also represents a popular 'campaign gift' as TAO elections draw near. It could therefore be said that this particular water delivery model is cheap, popular, and timely in response.

The success of rainwater harvesting is attributed to many factors, including clarity, taste and affordability (cheap raw materials).

4.2.4 Decentralisation: successes and challenges for public services, including water supply

One positive result of decentralisation is that less money is allocated for infrastructure and more for quality of life. This is important because local authorities are held accountable for the policies they promise to implement during their campaigns. The second positive effect of decentralisation is an increased flexibility in policy for local authorities. Until recently, local authorities were required to formulate a five-year development plan in accordance with the five-year National Social Economic Development Plan. That is now replaced by a three-year rolling plan, with more emphasis on development strategy and outcomes. The TAOs have more freedom in programmes in the rolling plan, allowing more flexible budget implementation, so they are able to be more responsive to local needs.

Cooperation among local authorities is effective, but the environment for inter-local cooperation is still unfavourable. A local authority is prohibited from using its budget funds outside its territory. There is no guideline for establishing a formal inter-local association for joint service delivery such as water supply.

Any plan for large-scale decentralisation must take full account of the 'receptive capacity' of local authorities. Water treatment facilities must be placed at the appropriate decentralised level, possibly the inter-commune level, where the best management capacity lies. The fact that decentralisation is directly associated with the receptive capacity of local authorities indicates the need to carefully select the most effective approach to the process from the wide range of options. Exploring the possibility of inter-local cooperation—and even the merger and consolidation of local authorities—is an important issue now that local authorities are under increasing pressure to deliver public services more efficiently and effectively as the decentralisation process progresses.

It is a significant challenge for the government, given the current political and economic context, to decide if the scaling up of piped water delivery should be placed at TAO level. Much consolidation work from village water committees is required and a high level of specialised skills is needed.

5 ANALYSIS OF SERVICE DELIVERY MODELS (SDMs)

5.1 IMPACTS OF ADOPTION OF THE SDMs

Piped water: Nationally, access to an improved water supply rose from a low of 10% in 1973 to the current level of over 90%. Over the last three decades, this has made dramatic and positive impact on the lives of many women and children in rural areas who do not have to travel long distances to fetch water anymore. In rural areas the main sources of drinking water are rainwater (49%); bottled water (20%); and piped water (15%). This situation is partly due to the fact that, despite increased levels of access, water quality remains a problem, both in terms of physical parameters such as turbidity and colour and, increasingly, due to chemical contamination, which affects both ground and surface water sources. Contamination of water sources such as lakes, streams, and rivers is increasing due to industrial waste, improper garbage disposal, landfill, and mining.

Evidence discussed in the above sections shows that both the financial sustainability and quality assurance of rural water are problematical. TAOs, with their varying and limited capacity, are attempting to address this under three different management regimes: villages, TAOs themselves, and the private sector. It remains to be seen if TAOs, under these models, can turn the service around and cover all households in their villages with acceptable water quality. Economic progress means higher disposable incomes, and customers have more options and expect more. The fact that village piped water systems cover only 62% of all households may reflect not only those villages lacking funds to expand, but also the unwillingness of village members to pay for such systems, given the cost, quality and choice of other sources available to them. This proposition requires further study and analysis before further expansion of infrastructure.

Rainwater harvesting: Rainwater harvesting and storage has been practised for thousands of years in Thailand. It has been successfully revived in the last 25 years, due to many factors such as government support, affordability, and ease of use. This model is definitely financially sustainable, and good for both emergency measures and long-term use at household and village level. One water jar of 11m^3 costing around THB13,000 provides enough water for drinking for half a year. The jar itself will normally last for about five years. The only measure required to improve the process of rainwater harvesting is better, more careful storage. An awareness-raising campaign and community training on this would help improve quality.

5.2 POTENTIAL FOR SCALING UP THE SDMs

Piped water and local collaboration: Some models used by the TAOs have the potential to be scaled up:

Village-to-village cooperation: On a smaller scale of collaboration, this involves the rearrangement of water services among villages within a commune under a TAO. This is the case where a village with a successful piped system connects its system to a neighbouring village that does not yet have a piped water service, or where the raw water source is depleting. TAOs support this endeavour by constructing the main pipeline between the two or more villages which will share the same production facility. This kind of collaboration makes use of existing pipe systems and connections to households. However, it is essential for TAOs to ensure that raw water sources are sufficient in the 'production' village, and that electricity generation is strong enough to stabilise the strength of the flow in tap water, given the larger area of service.

Collaboration between TAOs, and between TAOs and Tessabans: Although the current budget system is not conducive for collaboration across TAOs for public services, some TAOs are still exploring this option. This move to service scale-up could improve the efficiency of services, in terms of both economies of scale and quality assurance.

Connecting PWA services to existing village piped systems: This practice is not uncommon for villages in

near proximity to a PWA service area, such as those in communes and villages located just outside city and town municipalities. TAOs pay for the main pipe connection to the target villages. This inter-local collaboration gives villagers access to a higher quality and more dependable level of water service. The unit cost of water from the PWA is THB8-10 per m^3, while costs from village systems are, on average, THB5 per m^3. However, as people's incomes rise, the price becomes more affordable for many semi-urban communities whose populations want to upgrade their public services.

Supporting rainwater harvesting for drinking water: Many TAOs have distributed water jars, free of charge, to families to enable them to conduct domestic rainwater harvesting. This is one example of a 'water delivery service' as a supplementary measure. Many other TAOs are exploring financial loan schemes, so that poorer families in more remote areas can purchase larger-sized jars of 11 m^3, which store sufficient water for one year. As implemented in the 1990s by the Population and Community Development Association (PDA)—a non-governmental organisation in northeast Thailand—a loan is repaid over a year in three or four instalments. The suitability and success of this model depends largely on the location of the village, the presence of the private sector in jar production, and/or artisan producers in the area. Rainwater harvesting has a double benefit. Firstly, it is the cleanest and most favourable water for drinking for rural dwellers. Secondly, making the jars creates rural employment, since the products have a well-defined market, and this bring income to rural communities.

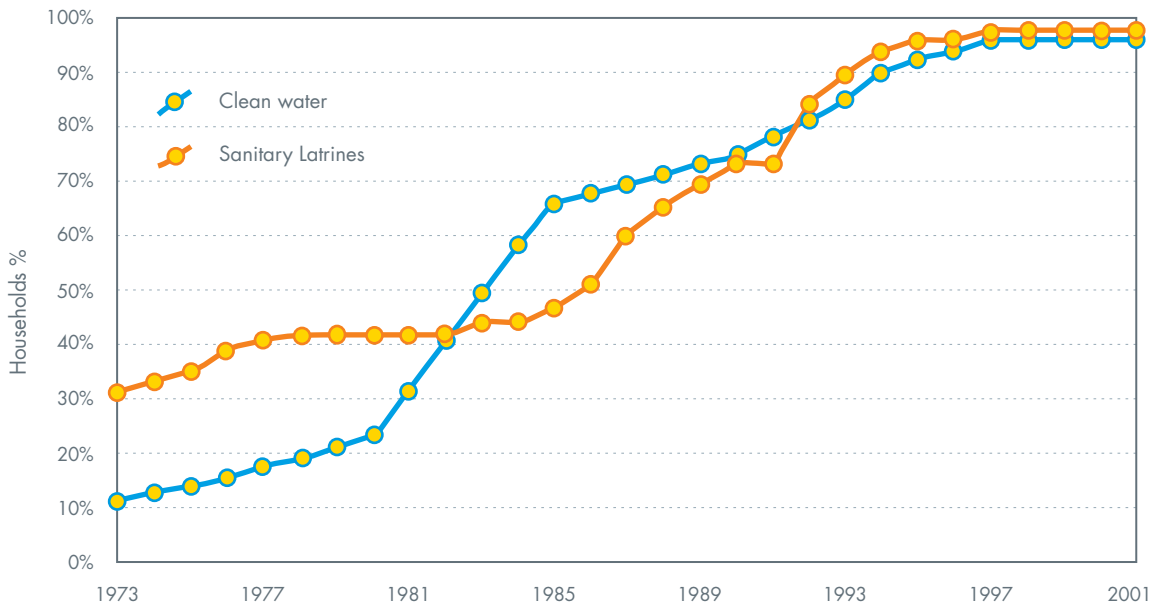
6 CONCLUSIONS

The importance of a safe and reliable water supply and effective sanitation have been recognised in Thailand for several decades. The country has achieved success in the provision of safe drinking water and the sanitary disposal of excreta, particularly in rural areas. The government also declared the period between 1981 and 1990 to be the 'Decade of Water Supply and Sanitation in Thailand', in line with the United Nations declaration. During this time, there was a marked increase in the socio-economic development of the country, particularly in terms of education and health. The Human Development Index has shown a continuous upward trend, despite occasional setbacks caused by temporary economic downturns.

Traditionally, some 5% of the national budget has been allocated to water and sanitation. This has resulted in the availability of sufficient quantities of water, though not always of a satisfactory quality. Many agencies are responsible for water supply and sanitation, but they often have overlapping responsibilities, which results in a duplication of effort and a lack of collaboration. Over time, while the quality of urban water supplies have developed rapidly, that in rural areas has lagged behind.

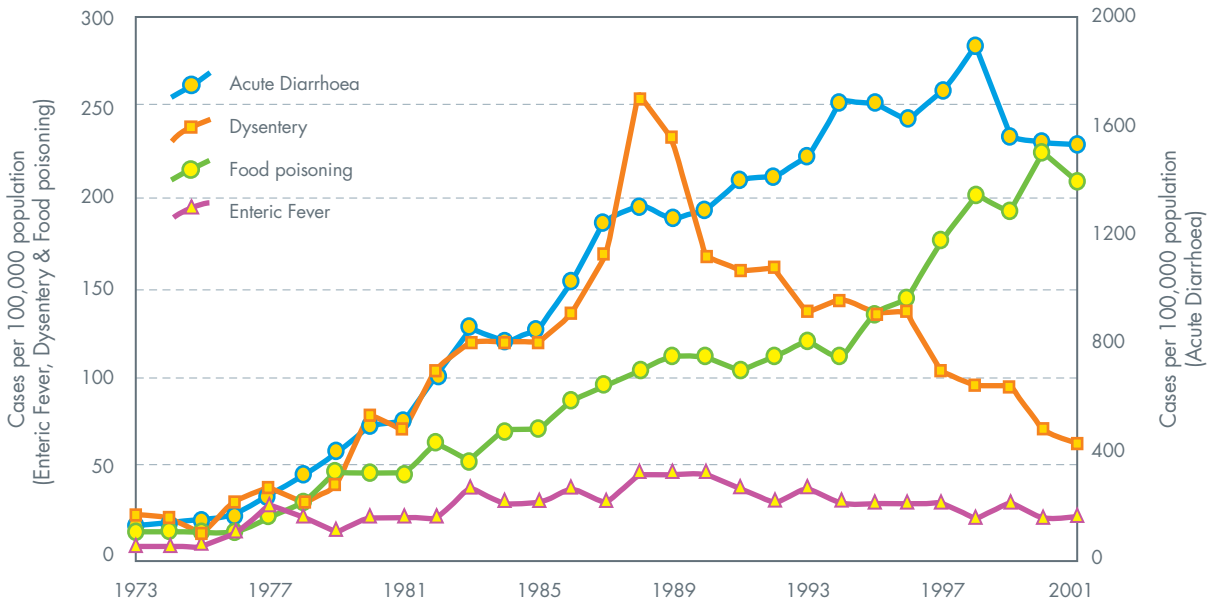
Access to an improved water supply rose from a low 10% in 1973 to the current level of over 80%. Despite these levels of access, many water quality problems remain. Thailand has achieved great success by investing in the 'hardware' for water supply and sanitation, but there remains much unfinished work to be done on the 'software'. Despite the improvements in water supply and sanitation, morbidity rates remain high, because of bacterial and chemical contamination.

FIGURE 6: WATER SUPPLY AND SANITATION TRENDS 1973–2001



Source: National Statistical Office, 2001

FIGURE 7: DISEASE TRENDS 1973–2001



Source: MOPH, 2003

Of greater concern however, is the dramatic increase in acute diarrhoea over the last 25 years—much of which has been attributed to poor water *quality*. Despite increasing water supply coverage, many supplies are contaminated by environmental factors such as toxic chemicals from poor waste management practices, or poor maintenance such as leakage from sewerage pipes.

Rural water supply is among the public services undergoing decentralisation. On the one hand, moving water delivery services from village level up to commune level is a positive move in that it presents a good opportunity for service improvement. But in reality the transition is difficult. Today, clean water delivery is not a mandatory service for the TAOs, and many village systems are left to continue the operational status quo, offering poor water quality and being unable to serve all households in the village.

In addition, there remains a challenge in institutional coordination, both vertically and horizontally, as development budgets are now directly channelled to the TAOs. Decentralisation has been accompanied by fiscal transfer, but not human resources. The TAOs have few staff and limited skills. This begs the question as to whether it would be more effective for rural water service delivery to be elevated to the intermediate level—that of the PWA. Different management models are being tested by TAOs, depending on their human resources and financial capacity, as well as on their location. The options are:

1. TAOs take over the service,
2. There is joint management with village water committees,
3. TAOs contract the private sector to run the system under TAO monitoring,
4. Connection to the PWA water system and services, for those villages located near cities and towns.

Each model has individual opportunities and challenges for different TAOs. With rural communities achieving higher incomes, users are demanding better service; and as many do not trust their present system, change is needed. On the other hand, a higher level of service is beyond the capacity of small-scale local authorities such as TAOs. In terms of local finance, their dilemma is to make a choice between two options: transferring funds as general grants in the expectation that local authorities will make effective use of them; or granting purpose-specific grants for delivering standardised services throughout the country.

Key lessons learnt are:

1. While investment in the hardware of water supply is important, the ultimate success in service delivery lies in the software during and after construction;
2. The scale of delivery must be set at the level at which capacity can support system sustainability,

not only in financial terms, but also for quality assurance;

3. Decentralisation of responsibility for public service delivery must be accompanied by both financial transfer and human resources; and
4. Increasing the role of the private sector in service delivery is a promising option as population incomes increase, and they can afford to pay for a higher level of service.

REFERENCES

Abrams, L.J., 1998. *Understanding sustainability of local water services*. Available at: http://www.thewaterpage.com/sustainability.htm.

Bunnoikor V., Santivej T., and Keawanukulkit, A., 2010. *Evaluation of the project on provision of clean water by operating village water supply of the department of health*. Available at: http://advisor.anamai.MOPH.go.th/242/24208.html [Accessed February 2010].

Bureau of the Budget, 2010. *Precipitation plan to provide purified water supply in rural areas*. Jointed Government Plans and Projects under Fiscal Year 2001. Available at: http://www.bb.go.th/budget/bud_manydept/menu3.htm.

Department of Environmental Quality Promotion, 2004. *MONRE solved the water shortage by constructing 520 community water wupply wystems*. Available at: http://www.ryt9.com/s/prg/141180 [Accessed January 2010].

Department of Local Administration, 2009. *General information on local administration in Thailand*. Available at: http://info.thailocaladmin.go.th/search/search1-1_tla.jsp.

Department of Local Administration, 2010. *Purify water system standard*. Available at: http://www.thailocaladmin.go.th/work/e_book/eb1/stan11/stan11.htm [Accessed January 2010].

Department of Local Administration in collaboration with Thammasat University—Research and Consultancy Institution. n.d. *Stand for purify water system*. Available at: http://www.thailocaladmin.go.th/work/e_book/eb1/stan11/stan11.htm [Accessed January 2010].

Department of Provincial Administration, 2010. *Provincial administrative information*. Available at: http://www.dopa.go.th/padmic/jungwad76/jungwad76.htm

Department of Water Resource, 2006. *Water shortage reduction project (520 communities) under DWR annual 2007 Budget. The 8th/2006 management meeting agenda*. Available at: http://www.dwr.go.th/agenda/08-2006-31/4-1-1_2.ppt#272,9,Slide9 [Accessed January 2010].

International Population and Social Research, 2006. *Mahidol population gazette*. Available at: http://www.ipsr.mahidol.ac.th/ipsr/PublicationGazette.aspx.

Jungrungruang, V., 2010. *History and rural water supply management pattern*. Available at: http://202.129.59.73/tambol/sara/090648/090648.htm.

Jungrungruang V., Wiwattanachaisang, V., and Kruakrai, T., n.d. *Purify water supply procurement and development for rural areas*. Rural Water Supply Division, Department of Health, Ministry of Public Health. Available at: http://advisor.anamai.MOPH.go.th/factsheet/wsup2-9.htm [Accessed February 2010].

Metropolitan Public Work Authority On-site MWA Training Courses, 2010a. *Water transmission system resolve and restore technique to improving community water supply management system*. Available at: http://www.mwa.co.th/fft_project_around.html.

Metropolitan Public Work Authority Regular MWA Training Courses, 2010b. *Community water supply management and maintenance for local "administrative authorities'* Available at: http://www.mwa.co.th/fft_thatsit_programKON.html.

Ministry of Public Health Epidemiological Division, Office of Permanent Secretary, 2003. *Summarized diseases surveillance report 1973–2001*. Available at: http://advisor.anamai.moph.go.th/factsheet/2003/4-2003.pdf.

Morgan, J.P., 2009. *Global economic research*. Available at: http://www.jpmorgan.com/pages/jpmorgan/investbk/solutions/research.

National Economic and Social Development Board, 1992. *Area development plan and strategic*. Available at: http://region.nesdb.go.th/nesdb/.

National Economic and Social Development Board, 2008. *National income of Thailand*. Available at: http://www.nesdb.go.th/Default.aspx?tabid=92.

National Statistical Office, 2001. *Population hygiene and welfare 2001*. Available at: http://service.nso.go.th/nso/nsopublish/service/survey/health44.pdf.

National Statistical Office, 2005. *Population hygiene and welfare 2005*. Available at: http://service.nso.go.th/nso/nsopublish/service/survey/hlth48.pdf.

Provincial Waterworks Authority, 2008. *PWA regional offices and service areas*. Available at: http://www.pwa.co.th/general/regional.html.

Provincial Waterworks Authority, Dej-Udom Branch, 2009. *Provincial waterworks authority's history*. Available at: http://www.pwadetudom.com/34.html [Accessed January 2010].

Water Management Bureau, 2008a. *Public waterwork management handbook*. Department of Water Resource, Ministry of Natural Resources and Environment.

Water Management Bureau, 2008b. *Water supply treatment controller handbook: surface water system*. Department of Water Resource, Ministry of Natural Resources and Environment.

Wikipedia, 2008. *Kingdom of Thailand*. Available at: http://en.wikipedia.org/wiki/Thailand.

Wirojanagud, W., Hovichitr, P. and P. Mungkarndee, 1989. *Evaluation of rainwater quality: heavy metals and pathogens*. Ottawa: IDRC.

World Bank, 2008. *Decentralisation in client countries: an evolution of World Bank support 1999—2007*. Washington: Independent Evaluation Group, Knowledge Programme and Evaluation Capacity Development (IEGKE). Available at: http://lnweb90.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewForJavaSearch/CB108AC5A1CACD30852574EF0050139B/$file/decentralization_eval.pdf.

ANNEX 1: LIST OF INTERVIEWEES

CENTRAL: (BANGKOK)

No.	Name	Organisation	Date of Interview
1.	Mr. Thammapong Nawabud	Department of Water Resources	18 Jan 10
2.	Mr. Kriangsak Bua-chang	Department of Water Resources	18 Jan 10
3.	Mr. Vicharn Tortakunwong	Department of Water Resources	18 Jan 10
4.	Mr. Trirong Phimpa	Department of Water Resources	18 Jan 10
5.	Ms. Suyanee Suthipong	Department of Water Resources	18 Jan 10
6.	Mr. Tewaraksa Kruakai	Department of Water Resources	18 Jan 10
7.	Mr. Trisit Witoonchawaritwong	Department of Water Resources	18 Jan 10
8.	Mr. Chaiyuth Suraphat	Department of Water Resources	18 Jan 10
9.	Ms. Penjuree Thitiwattanakul	Department of Water Resources	18 Jan 10
10.	Mr. A-nan Kate-ame	Department of Groundwater Resources	20 Jan 10

REGIONAL: (NAKHONRATCHSIMA PROVINCE)

No.	Name	Organisation	Date of Interview
1.	Mr. U-rom Chantkeaw	Groundwater Resource Office 5 (Nakhonratchsima)	21 Jan 10
2.	Mr. Thani Kunraset	Groundwater Resource Office 5 (Nakhonratchsima)	21 Jan 10
3.	Mr. Peerapon Eiamsa-ard	Regional Water Resource Office 5 (Nakhonratchsima)	22 Jan 10

LOCAL GOVERNMENT AND COMMUNITY			
No.	**Name**	**Organisation**	**Date of Interview**
1.	Mr. Rangsan Intra	Village headman – Baan Nong Bua Sala	21 Jan 10
2.	Mr. Songpong Panpru	Kok Kruad TAO	22 Jan 10
3.	Mr. Somchai Patanapuangsakul	Thai Samakhi TAO	23 Jan 10
4.	Mr. Santi Banpo	Makha TAO	23 Jan 10

About Triple-S

Triple-S (Sustainable Services at Scale) is an initiative to promote 'water services that last' by encouraging a shift in approach to rural water supply—from one that focuses on implementing infrastructure projects to one that aims at delivering a reliable and indefinite service. The initiative is managed by IRC International Water and Sanitation Centre in the Netherlands in collaboration with agencies in different countries and with funding from the Bill & Melinda Gates Foundation.

About *Thailand: Lessons for Rural Water Supply—Assessing progress towards sustainable service delivery*

This study, commissioned by Triple-S, seeks to shed light on the progress in achieving scaled-up sustainable rural service delivery. It examines a number of service delivery models currently being implemented in Thailand, by identifying their strengths, challenges and limitations. The study also identifies key conclusions for achieving more sustainable service delivery in Thailand. It is one of 13 country studies done as part of a broader international study.

For more information and access to the other country reports, literature reviews, and the synthesis document please visit http://www.waterservicesthatlast.org.

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