

Communications:

Water Resource Management in Malaysia and the Practices of Some Development Countries

*Noor Sharipah, S.S., and Nabilah, M.I.

Institute for Water and Environmental Resource Management,
Water Research Alliance, Universiti Teknologi Malaysia, Malaysia.

Abstract: Water is an important resource in life. As population grows, increasingly less water will be available to each individual. Statistics show that global water consumption increased steadily throughout the twentieth century and is expected to continue to rise. Generally, development affects water supply due to increased consumption, pollution and expansion of urban development. As such, water resource needs to be planned and managed accordingly. The water management practice in Malaysia depends heavily on the water supply management approach. This approach is unsustainable in the long run as water demand will eventually overtake supply. The assumption of this approach is the greater the demand, the more water has to be supplied, thus more infrastructures such as dams, water treatment plants and water distribution pipes need to be built and these require costs. Increasingly, the country is plagued with the problems of water wastage, water pollution, unscrupulous consumer behaviors, and encroachment of water catchment areas, climate change and a host of other problems which form major challenges for the government to cope. Integrated Water Resource Management (IWRM) and more recently Water Demand Management (WDM) are popular concepts adopted by many countries in the world. Most advanced countries adopted water resource management plan in their water management framework but not in Malaysia. This paper is an initial stage of a research project towards developing a practical water demand management framework in this country which involves an overview of water planning and demand management practices of some developed countries such as Canada, Japan, United Kingdom, Australia and New Zealand.

Keywords: *Integrated water resource management, Water demand management, Water resource planning, Water resource management in Malaysia, Water resource management in developed countries*

1. Introduction

Water is an important resource in life. As population grows, increasingly less water will be available to each individual. Statistics show that global water consumption increased steadily throughout the twentieth century and is expected to continue to rise. Generally, development affects water supply, due to increase consumption, pollution and expansion of urban development. As such water as a resource needs to be planned accordingly. The current era in water management requires increased preparedness to cope with the uncertainty induced by global changes. Water management practices should be flexible and able to adapt to current conditions by incorporating experiences from past water projects, as well as insights of the water system in planning (Pahl-Wostl 2007, Sharp 2006, Gleick 2000). Besides the supply sector, an equally important element in the planning process is managing the demand sector.

In the past, management of water resources in most countries of the world adopted the water supply approach. During the last decade, water management has evolved through a series of paradigm shifts. The conventional supply approach was found to be insufficient to cope with increasing water demand to meet changing standards in water utilization

that emerged from the concept of sustainable water use, as introduced by the Rio Declaration – UN (1992). As a result, issues like quality management, environmental integrity, efficient allocation of water resources, cost effectiveness were introduced in the water agenda and the efforts focused on water conservation, while the social aspects of water management are also being acknowledged (Kampragou and Eleni *et al.* 2010).

Presently, Water Demand Management (WDM) has become an integral part of water services planning by many countries in the world. WDM refers to the implementation of policies or measures which serve to control or influence the amount of water used. Derevill (2001) defined WDM as a practical strategy that improves the equitable, efficient and sustainable use of water which can be achieved through stressing equitable access to water, reflected in a strategy that is specifically designed to improve service delivery to the poor, treating water as both an economic as well as social good and managing and pricing it accordingly, balancing the management of losses and consumption with new or augmented supplies and managing the change from a supply driven to demand responsive culture. As a participating nation in the Rio Sustainability Agenda, Malaysia adopts the World Water Vision concept. A National Water Vision was formulated which states that: 'In support of Vision 2020 (towards achieving a developed nation status) Malaysia will

*: Corresponding author: noorsharipah@utm.my
81310-Skudai, Johor, Malaysia.

conserve and manage its water resources to ensure adequate and safe water for all (including the environment)'. The key objectives of the Vision are: i. Water for people, ii. Water for food and rural development, iii. Water for economic development and iv. Water for the environment. Based on the objectives, certain strategic orientations and actions were proposed and one of the significant policy decisions was adoption of WDM in the 8th Malaysia Plan (2001 – 2005).

2. Theoretical Framework of Integrated Water Resource Management

Integrated water resource management, or IWRM has emerged as a significant concept since the Earth Summit in 1992 and has more recently been given prominence by the Global Water Partnership (a partnership agency of World Bank, UNDP and Swedish International Development Agency) (GWP 2000; 2003). The GWP (2000) defined IWRM as "a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (Mitchell and Bruce 2005). In simple terms, the concept can be summarized as the integration of all elements concerned with water resource planning and development as depicted by Fig. 1.

Fig. 1. Water Resource Management Framework



3. Water Demand Management (WDM) Approach

WDM approach actually focusses on managing the water demand aspects of consumers. Nielsen (2002) defines water demand as the amount of water required for a given purpose, measured for example, according to number of litre per person per day, or mm per crop. The demand can be present or future and it can be actual (*i.e* related to an available infrastructure) or potential (assuming full infrastructural development and no raw water shortage). The serviceable demand is limited both by infrastructure and raw water availability. According to him, a distinction can be made

between consumptive demand (for households, industries and agriculture) and non-consumptive demand (for habitat preservation, fisheries, navigation and salinity control at the river mouth). A similar but slightly different distinction can be made between instream demand and offstream demand.

An important aspect of WDM is water use. The use (or consumption or utilization) of water is the part of the demand that is actually served at a given time. Many uses generate a return flow (for example sewage or irrigation tailwater). The return flow can occur at a different time or place than the withdrawal. The use of water can be increased by infrastructural development and reduced demand by management (Nielsen 2002). Water consumption on the other hand also refers to water that has been withdrawn and used in a way that prevents its immediate reuse (Environwiki, undated). Demand management refers to the invention on water in order to reduce the consumption of water (Nielsen 2002). It is applied in order to meet water shortage, shortage of money for infrastructural development or to improve water inefficiency.

WDM is a tool for achieving harmony between the demand for water and the availability of water. There are various tools which can be adopted in WDM and various mechanisms applied in managing water use by the consumers. Domestic consumption for example can be controlled by measures such as charging a water fee, applying different tariffs for different housing areas, generation of awareness about prudent use of water and rationing of water in case of critical shortage.

The demand of water for industrial consumption can be controlled by measures such as installation of water meters and charging water fee, applying different tariffs for different users and different seasons, promotion of new water efficient technology and rationing of water, normally in case of critical water shortage. As for the agricultural sector, measures such as water charging or fee depending of volume of water used, application of different tariffs for different seasons, generation of awareness about prudent water use, promotion of good operation and maintenance, promotion of new water efficient technology and water rationing are some of the mechanisms which can be applied.

Population growth and urbanization together with changes in production and consumption pattern have placed unprecedented demands on water resources. As such the World Conservation Congress organised by IUCN in October, 1996 discussed the issues through presentations of regional case studies which brought together from diverse countries such as Mali, Zambia, Morocco, Jordan, Bangladesh, Pakistan and Guatemala to discuss on water and population dynamics.

An important fact highlighted in the discussions was that population dynamics (such as growth, distribution, migration and other characteristics) and water resources interact through human uses of water and the most important demographic trend affecting water resource is population growth. A better understanding of the relationship between population dynamics and water resources is a first step toward designing policies that can make these relationships more sustainable (de Sherbinin 1998).

4. Water Resource Planning and Management in Developed Countries

Many developed countries have adopted the integrated approach in the planning and management of water resources towards achieving water resource and environmental sustainability, economic efficiency and social development within different contextual framework. This fact can be observed from the experiences of countries such as Canada, Australia, New Zealand, United Kingdom and Japan.

4.1. Canada

In Canada, different levels of government have different jurisdictional roles related to water management, while there are also many areas of shared commitment (Environment Canada 2012). The federal government has jurisdiction related to fisheries, navigation, federal land and international relations, including responsibilities related to the management of boundary waters shared with the United States, including relations with International Commission. It also has significant responsibilities for agriculture, health and the environment and plays a significant role supporting aquatic research and technology and ensuring national policies and standards are in place on environmental and health related issues.

Within the federal government, over 20 departments and agencies have unique responsibilities for fresh water. Environment Canada (the Ministry for Water) works closely with other federal departments to develop a more strategic approach to addressing nationally significant freshwater issues. The federal government passed the Canadian Water Act in 1970 and created the Department of the Environment in 1971, entrusting the Inland Waters Directorate with providing national leadership for fresh water management. Under the Constitution Act (1867), the provinces are 'owners' of the water resources and have wide responsibilities in their day to day management.

The legislations administered by Environment Canada in its water-related activities include:

- i. Canada Water Act
- ii. International River Improvement Act
- iii. Department of Environment Act

Other important federal legislation include: International Boundary Waters Treaty Act, Canadian Environmental Protection Act, Fisheries Act, Navigable Waters Protection Act, Northwest Territories Waters Act, Mackenzie Valley Resource Management Act, Nunavut Waters and Nunavut Surface Rights Tribunal Act, Arctic Waters Pollution Prevention Act, Canada Shipping Act and Dominion Water Power Act.

Besides the acts, there are certain regulations which form the rules of conduct which the governor-in council or minister is empowered to make and to facilitate the carrying of the Act of Parliament. Regulations exist under some federal water related legislation (*e.g.* Fisheries Act, International Water Improvement Act, *etc.*).

The Federal Water Policy was formulated after several years of intensive consultation both within and outside the

government. It addresses the management of water resources, balancing water uses with the requirements of the many interrelationships within the ecosystem. The federal crown also has ownership of the water resources in the Northwestern Territories and Nunavut. The Department of Indian and Northern Affairs Canada (INAC) has a mandate to manage those water resources.

The Mackenzie River Basin Board was created as a forum for cooperative water management within the huge Mackenzie River Basin (covering one-sixth of Canada). The Board was formed under the Mackenzie River Basin Transboundary Waters Master Agreement', signed in July 1997 by the Governments of Canada, British Columbia, Alberta, Saskatchewan, the Northwest Territories and Yukon. The Board is unique because of its inter-jurisdictional partnerships, the participation of Aboriginal members and its focus on maintaining the ecological integrity of the whole basin.

The Board has a strategic plan and a communications strategy and it has begun to address specific commitments in the Master Agreement. It has established committees, held public meetings, organised Water Forum and released a State of the Aquatic Ecosystem Report in 2003 for the Mackenzie River Basin.

4.2. Japan

In Japan, the national government is responsible for formulating and implementing water resources policies at the national level (Environmental Protection Department 2007). It formulates an overall plan of water resources development and environmental conservation. Under the framework of the national policy, local governments take charge of operation, maintenance and management of waterworks, water treatment facilities and water utilities (World Bank, April 2006).

In addition to planning, the national government also pays for most new construction, either directly or indirectly. The national government plans new water resource development, directly subsidises up to half of the construction costs and provides low-cost loans to local governments to allow them to pay for their share. Thus, national government also helps subsidize user fees to reduce the cost of water to end users. The national budget is primarily used for construction of flood control facilities and sewerage treatment systems. For a number of reasons (excess capacity; environmental concerns; budget concerns) the construction of new dams has been reduced.

The expansion of the sewerage treatment system is an important policy objective because the proportion of the population in Japan with access to sanitation in 2005 was only 66.7%, one of the lowest ratios of population with access to sewerage systems among the developed countries.

Five related ministries, *i.e.* the Ministry of Land; Transport and Infrastructure; Ministry of the Environment; Ministry of Health, Labor and Welfare; Ministry of Economy, Trade and Industry and the Ministry of Agriculture, Forest and Fisheries take charge of the various administrative areas and cooperate with each other to formulate water-related policies.

The Ministry of Land, Transport and Infrastructure prepares the Comprehensive Water Resources Plan also known as Water Plan. The Plan is formulated and revised according to the Comprehensive National Development Plan, which is stipulated in the Comprehensive Land Development Act and approved by the Prime Minister's cabinet.

The Water Plan is a multi-year plan and addresses basic medium to long term planning issues regarding water resources development, conservation and utilization as well as makes forecasts of long term water demand. The Ministry uses the Water Plan to formulate more detailed annual development plans and their related budgets. The latest Water Plan, Water Plan 21, stresses the efficient utilization of existing water resources facilities rather than the development of new water resources, hence indicating a shift in focus towards Water Demand Management (WDM).

The Ministry of Environment primarily plans and formulates policies and guidelines relating to water conservation including the setting of Environmental Water Quality Standards and water quality control measures (the Effluent Standard settings). The Basic Environment Plan clarifies long-term and comprehensive environmental policies related to water quality and quantity including water conservation.

The Local Governments in general operate, maintain and manage domestic, industrial and sewerage water utilities and related facilities. As of the end of FY2003, local governments managed 1,936 larger water utilities and 8,360 small-scaled water utilities. Local government agencies also continuously monitor public water quality and supervise private entities to ensure wastewater effluent standards are being met. The legal framework for water resources management in Japan is divided into five (5) major areas:

- i. Overall planning of water resources development
- ii. Development of water related facilities including the basis for subsidies
- iii. Water rights and water trading
- iv. Operation and management of water utilities including the basis for private sector participation contracts
- v. Conservation of the water environment

Overall Planning:

The Comprehensive National Land Development Law sets out the basis for the Comprehensive National Water Resources Plan (the Water Plan). The Water Resources Development Basic Plan (the Full Plan) stipulated by the Water Resources Development Promotion Law is also based on the Water Plan and implemented by the Japan Water Agency (JWA) as mandated by the JWA Law.

Water Rights and Water Trading:

Surface and ground water are managed differently. For surface water users, each public-owned water utility (for both domestic and industrial uses) and Land Improvement District (public entities for irrigation development and management) is allocated rights to river water, *i.e.* exclusive use of water in certain region, according to the River Law. There is no

comprehensive law regarding ground water and users are free to withdraw ground water from wells on privately owned lands. However, the Industrial Water Law and the Law for Ground Water Use in Buildings require permits from Local governments before users can withdraw/extract ground water in areas where serious land subsidence is a concern or where ground water resources are scarce.

Water Utilities:

Water utilities are categorised by the main purpose each serves. These uses include domestic water supply, sewerage water treatment, agriculture supply and industrial water supply. Appropriate sectoral law regulates the operation and management of water utilities.

Protection of Water Quality:

The basic principles of pollution control and nature conservation are stipulated in the Basic Environment Law. More detailed guidance is given in the Water Pollution Control Law, thus indicating that Japan has clear and well structured water planning system; laws, rules and regulations; governance; institutional set up and monitoring systems for managing water resources and the environment.

4.3. United Kingdom

The formulation of water resources policies in United Kingdom falls under the purview of the Department for Environment, Food and Rural Affairs. The Future Water: The Government's Water Strategy for England sets out the government's plans for water in the future and the practical steps to be taken by the country to ensure that good clean water is available for people, businesses and nature. It looks ahead to 2030 and describes the water supply system to be developed. The plan looks at water cycle as a whole, from rainfall and drainage through to discharge and treatment, vis-a-vis looking at every aspects of water use (Department of Environment, Food and Rural Affairs 2008).

The Environment Agency is the public body responsible to the Secretary of State for Environment, Food and Rural Affairs and a Welsh Government Sponsored Body responsible to the Minister for Environment and Sustainable Development. The principal aims of the agency are to protect and improve the environment and to promote sustainable development. The agency plays an important role in delivering the environmental priorities of central government and the Welsh Government through their functions and roles (www.environment-agency.gov.uk).

It is a statutory duty for water companies in UK to prepare, consult, publish and maintain a Water Resources Management Plan which needs to be reviewed annually and report any changes to the agency and Government. A new plan must be produced every five (5) years or if there is a material change at any point during the period. The Agency provides a set of guidelines and tools for the preparation of the plan. The guidelines set out good practice in developing a plan, the various approaches to follow and the information that a plan should contain.

Besides, there are also some Navigation tools for the smaller water undertakers/companies to follow, develop and

maintain their water resources management plans. An example of such a plan is the United Utilities 'Draft Water Resources Management Plan produced in July, 2008 (www.environment-agency.gov.uk/waterplans)

Water Demand Management (WDM) is an approach adopted for achieving sustainable water resource planning and management by many developed countries. In UK, Water Industry Research (1996) refers WDM as the implementation of policies and measures which serve to control or influence the amount of water used. Derevill (2001) defined WDM as a practical strategy that improves the equitable, efficient and sustainable use of water.

4.4. Australia

In Australia, the Water Act 2007, Water Amendment Act 2008 and Water Regulations form the important legislations, rules and regulations binding water resource planning and management in the country. The Illustrative Water Demand Management Plan and Guide for Preparation (Department of Environment, Queensland (June, 2000) provides the guidance for preparation of Water Demand Management Plan, a sub plan of a Total Management Plan (TPM) which should meet the requirements of Section 43 of the Environmental Protection (Water) Policy 1997 Act (Queensland Lake District Council, December, 2008).

A Local Government that operates a water supply system must develop and implement an environmental plan about water conservation that improves water use efficiency in the system, also indicating a clear focus towards water demand management. At a higher level there is the National Water Security Plan which is the over riding policy encompassing water planning and development.

4.5. New Zealand

In New Zealand the initial framework for water management is set out in the Resource Management Act 1991 (Watercare Services Limited, June, 2011). The aim of the Act is to promote the sustainable management of resources. The formation of the Auckland Council for example, provided an opportunity for Auckland and Watercare (the water and wastewater service provider for Auckland) to assess demand management, to identify water demand saving targets and to develop water demand programmes. The definition of demand management adopted is simply 'the effective and efficient use of water'.

The main principles of demand management are that Watercare should strive to supply water in an efficient and effective manner, customers should not waste water and should strive to use water efficiently and demand management should be considered as part of the water resources and water supply planning process (Watercare Services Limited, June, 2011). A water plan, Wanaka Water Demand Management Plan was prepared for Queenstown Lakes District Council in 2008 and was open for consultation for the public (www.qldc.govt.nz).

The above illustration clearly indicates that the main tool adopted by the developed nations in the management of water resources is the Water Resource Management Plan.

5. Water Resource Planning and Management in Malaysia

The water management system in Malaysia in the past adopted and depended heavily on the water supply management approach to cater for demand. This approach is unsustainable in the long run as water demand will eventually overtake water supply. The greater the demand, the more water has to be supplied, so more structures such as dams, water treatment plants and water distribution pipes need to be built. Supply and demand-side management has to be integrated. In addition, there is a need to look at water wastage and rates to change the appalling consumptive behaviour of most Malaysians towards water.

The need for a shift towards WDM was highlighted in Malaysia's Water Vision: The Way Forward, 2000 which mentioned that water -supply management shall be replaced by water-demand management in order to minimise the exploitation of new water resources to meet the increasing water demand. However, there is no specific framework or model adopted in this country for the implementation of the concept.

The need for implementation of Water Demand Management (WDM) Approach in Malaysia has also been raised repeatedly (The Star Online, March 26, 2011; BFM, Nov. 23, 2011; The Sun Daily, July 1st, 2011). James T. Cherian, an Environmental Consultant and an advocate for water and forest conservation highlighted that water conservation is essential in a country blessed with abundant rainfall such as Malaysia. He also emphasised the need to implement Water Demand Management in Malaysia, a system which advocates efficient use of water in order to maintain vital environmental flows and to reduce dependence on costly infrastructure projects.

One of the most comprehensive water study was that undertaken by Malaysian Water Partnership (MWP) and the Malaysia National Committee for Irrigation and Drainage (MANCID), a World Water Vision project carried out in 1996 culminating in the the formulation of Malaysia's Water Vision. Some other studies which have been undertaken were those presented during the Strategic Consultation on Water Demand Management organised by Academi Sains Malaysia.

The expected rapid pace of economic development, growing cities and population growth in Malaysia cause sustainability of water resource to become an increasingly important issue. The National Water Resource Policy (NWRP) outlines measures to ensure efficient and effective management of this resource. The NWRP marks an important milestone because it will establish a process for ensuring the security of water supply all of which have important implications on how Malaysia manages its water resources in the coming years. Other measures to be implemented, during the Plan period include expanding the implementation of the Integrated Water Resources Management (IWRM), including research and development effort in area of water conservation to support efforts to develop a sustainable water sector for the national economy (Economic Planning Unit, RMK 10, 2010)

Another major study was 'The Need for a Water Demand Management Plan for Selangor (2009) which also highlighted the fact that WDM is an essential part of the

challenge to sustain water resources. The principle that underlies WDM is “efficient use of water” in order to maintain vital environmental flows and to reduce on costly infrastructure projects. The study analysed the domestic and non-domestic demands for water in Selangor only (Malaysian Nature Society Selangor Branch 2009).

A comparative study of water resources usage by households in Georgetown, Penang and Pattaya, Thailand highlighted some interesting findings (Chan and Nitivattananon 2006). Firstly, there were many problems identified in both the cities as both received uneven rainfall throughout the year causing droughts at times while at other times causing severe flooding. Secondly, both cities depend on their hinterland for water supply. Thirdly, both cities are major tourist destinations which cause tremendous strain on water supply. Fourthly, both cities are affected by unsustainable water supply management approach and neglecting to employ WDM

The study by Chan and Nitivattananon (2006) also demonstrated excessive water demand by all consumers due to low level of awareness, low water tariffs and apathetic attitudes. They stressed that since the real issues dealt with consumers are their attitude and consumption patterns, the role of women is vital in addressing water resource sustainability. They also highlighted that both cities are facing precarious water supply sustainability in the long run and must come up quickly with plans to address the water problems. They concluded that the obsolete top-down Water Supply Management approach (WSM) has to give way to a more comprehensive strategy employing both WSM and WDM in order to sustain water resources.

A paper entitled ‘Migrating from Potable Water to Non-Potable Water Supply for Industrial and Non Domestic Uses’ by Ir. Mohd Adnan Mohd Nor (September, 2012) also emphasised the need for a comprehensive approach for Malaysia in the management of water resources.

6. Conclusions

Based on the literature review it can be concluded that most of the developed nations have developed and adopted certain framework for action whereby the management of water resources is based on the enactment of specific acts, laws, rules, regulations and other related mechanisms supported by the formulation of specific plan known as Water Plan, Water Resource Management Plan or Water Demand Management Plan. In Malaysia, the studies undertaken had been on ad-hoc and segregated basis not culminating towards producing a comprehensive plan of action for water resource planning and management. As such it is necessary for this country to develop and establish a formalised framework and mechanisms for the planning and managing of water resources as being practised by most developed countries. As an Islamic nation, the incorporation of Islamic principles, tenets, values, guidelines and so forth in the process of formulating the framework and preparation of plans for water resource management in this country is also pertinent.

7. Acknowledgement

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