# Myanmar Integrated Water Resources Management

## *Strategic Study*

"From Vision to Action"

## *Executive Report*

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November 2014

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## Key Boxes


**Figure 1** **Map of Myanmar**

# 1 Introduction

Development in Myanmar is fast, also in the field of Integrated Water Resources Management. The National Water Resources Committee (NWRC), advised and supported by its Expert Group, has developed a National Water Policy with a clear vision on sustainable water management. The Myanmar IWRM Strategic Study aims to further contribute, participatively, to the development of a national strategy for integrated water resources management (IWRM) in Myanmar. The fullest possible use has been made of insights into delta management, IWRM and adaptive water management as developed in the Dutch delta programme and elsewhere in the world. The strategic study assists in responding to the national IWRM challenges and opportunities in Myanmar. It provides options and recommendations as building blocks for further water resources development planning in Myanmar. It does not go into details as may be expected from a comprehensive master plan, but gives an overview, with respect to water resources management, of what the most important challenges and anticipated changes will be, what measures could be taken, what the impact of the measures is expected to be as well as economic and financial aspects of the possible measures. The recommendations, building blocks for strategies and proposed measures can be used by the Government of the Republic of the Union of Myanmar for its initial decision making on the national IWRM strategy, taking into consideration its priorities. The preferred strategy can then eventually be further detailed for implementation in future IWRM master planning at various regional and programmatic levels.

When looking at present day Myanmar, it can be observed that the country is still to a large extent unspoiled although signs of over- and mis-exploitation of Myanmar's natural resources are visible. With its abundance in natural resources, including water, the country has great opportunities to achieve a balanced and sustainable development. However, it is crucial that this is done wisely. Mistakes visible in neighbouring countries in terms of depleting natural resources and degradation of the environment can be avoided. Similarly, the international community has another chance to support and assist a developing country without falling into old patterns of uncoordinated actions.


**Figure 2** **Signing of MoU Myanmar - Netherlands**

The Dutch Ministry of Infrastructure and Environment has offered to support the Government of Myanmar in the development of an Integrated Water Resources Management (IWRM) Strategy for Myanmar and in May 2013 it signed a Memorandum of Understanding (MoU) with the Myanmar Ministry of Transport as focal Ministry of the Myanmar National Water Resources Committee.

The Expert Group of the NWRC as senior advisory group to the NWRC and chaired by U Ohn Myint, has been the immediate counterpart for a Dutch High Level Expert Team IWRM for Myanmar,

headed by former Minister of Agriculture, Mr. Cees Veerman. The secretariats of both the NWRC and its Expert Group have been the liaison between Myanmar and Dutch expert groups, the relevant Ministries and Departments of Myanmar and the Dutch Study Team who all gave guidance in the preparation of the Myanmar Integrated Water Resources Strategic Study.

The study team has prepared two reports. A comprehensive report 'Research and Analysis, Strategies and Measures' gives research and analysis results as well the details of possible Myanmar development scenarios and applicable strategies to cope with these possible futures from an IWRM point of view. Myanmar urgently needs to actually start development and leap "From Vision to Action". The report also contains a (long) list of no-regret and quick-win projects and activities for short term implementation. The Dutch Study Team has based its Strategic Study, with 'building blocks' for future policy development, capacity building and legal framework elements, on intensive stakeholder participation and discussions with experts in Myanmar.

This document constitutes the 'Executive Report' and being a shorter version of the Strategic Study, focuses on 'thoughts for future development' and translating "vision into action".


**Figure 3 Myanmar IWRM strategic study reports**

# 2 National Water Policy, Water Framework Directive, Water Law

The National Water Policy (NWP) of Myanmar is the first integrated water policy for the watersheds, rivers, lakes and reservoirs, groundwater aquifers and coastal and marine waters of entire Myanmar. The Expert Group of the National Water Resources Committee prepared the NWP, after which it was approved by the National Water Resources Committee on 13 March 2014. The NWP was formalised by the approval of the NWRC.

"The goal of the national integrated water resources management policy is to develop, share and manage the water resources of Myanmar in an integrated, holistic and socially inclusive manner, to contribute significantly to the poverty alleviation, to the green growth and sustainable development of the nation, by providing access to water of equitable quantity and safe quality for all social, environmental and economic needs of the present and future generations." The objectives are formulated as:

(i) Prepare and propose an overarching national water policy based on national water needs and national development policy.

(ii) Realization of a sector apex body and strengthening of inter-ministerial cooperation, communication and information sharing.

(iii) Invest in water sector by the government to properly manage the country's overall water resources and priority river basins, including development of physical infrastructure, institutions and capacity building.

(iv) Increase the efficiency and accountability of service providers in the water supply, sanitation and hygiene, hydropower and irrigation sectors.

(v) Disseminate knowledge and create awareness, develop responsible behaviors and create enabling environment for sustainable water use.

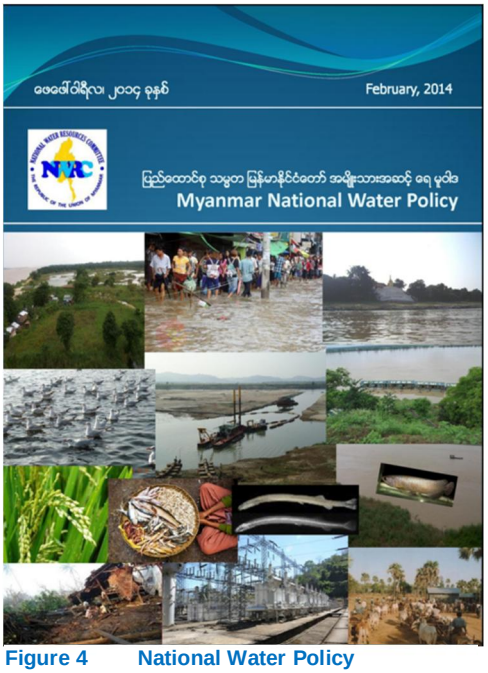

Figure 4 National Water Policy

(vi) Provide national policy and stand point on use of shared water resources and develop cooperation among riparian countries.

(vii) Enhance water information, knowledge, know-how, technology, cooperation, consultation and partnerships.

(viii) Invest in water, sanitation and hygiene education, vocational training, capacity building, monitoring and enforcement, and learning.

The strategic study aims to provide building blocks for eventual national planning for integrated development of Myanmar's water resources. Before such planning can start, agreement on the general principles on Integrated Water Resource Management needs to be reached and practicing with these principles on the basis of 'learning by doing' within specific projects is seen as the next step. Then insights and practices on IWRM can be translated back again towards a more abstract level in IWRM master plans for first regions and programmes in the immediate future.

The Myanmar National Water Framework Directive and subsequent Water Law(s) have a similar 'top down-bottom up' approach. The National Water Policy has taken cognisance of the existing situation, to propose a framework for creating a system of laws and institutions and for a plan of action with a unified national perspective including the Myanmar National Water Framework Directive (MNWFD). This MNWFD, to be approved in 2015, is to be an umbrella statement of general principles governing the exercise of legislative and/or executive (or devolved) powers by the Union, the Regions and the States, and the local governing bodies.

# 3 Myanmar water context

Myanmar is a country in a more or less favourable situation with respect to water resources. There are transboundary rivers however most water resources are within the national borders.

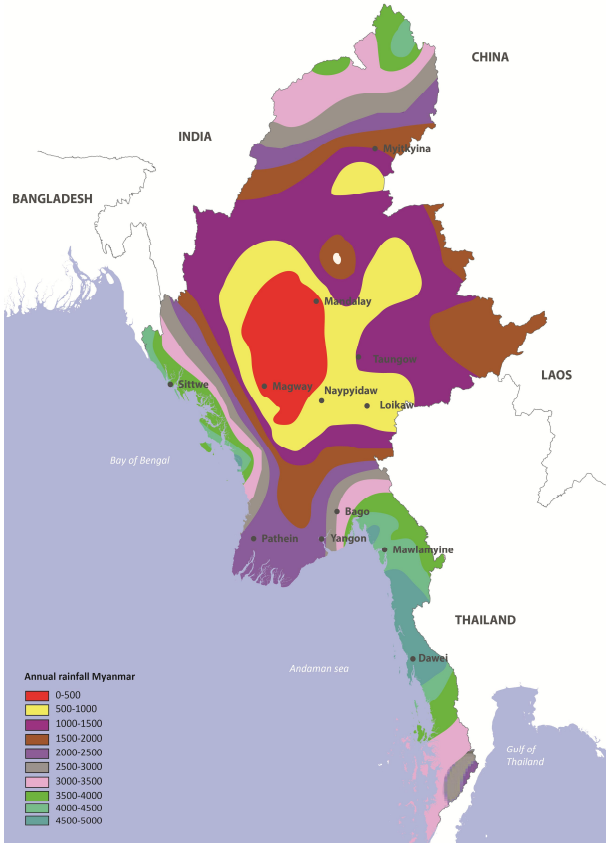


**Figure 5** **Annual Rainfall in Myanmar [source: MoT, DMH]**


**Figure 6** **Characteristic regions for water resources as distinguished by the Study Team**

Hence the country is in a most fortunate position to have full control over most of its water resources. Most waters are still unspoiled and clean in contrast to neighbouring nations. Myanmar has the chance to avoid the mistakes others have made and fully exploit its water resources for sustainable development. Although the overall availability of water is abundant, there are distinct regional differences with e.g. lack of water or rather difficult and costly access to the water resources (e.g. Ayeyarwaddy River) in the Central Dry Zone and salinisation in the Ayeyarwady Delta area, flooding in the deltas, flash floods in the mountains and Dry Zone, cyclones and surges along the coast are primary hazards [Figure 5 and 6]. Inadequate rural and urban drainage cause trouble and damage. The availability of – safe – drinking water depends on reservoirs, communal ponds, private collection of rainwater and groundwater. Many groundwater resources are either saline – in the coastal area – or contaminated, predominantly by – natural – arsenic.

Future socio-economic perspectives such as economic growth and population increase and the associated pressure these have on water, need to be taken into account when formulating a vision and concrete and feasible strategies for water resources management: higher demands for agricultural and domestic water, potentially a boom in the demand for industrial water and consequent pollution problems, a sharp increase in the demand for hydropower. Climate change tends to add to this pressure: increased risks of river floods, changing courses and magnitudes of cyclones, longer droughts are key factors to be considered for future integrated water resources planning, implementation and management.

The interrelation between water, food, and energy security provides a useful framework to analyse trade-offs, because food and energy production will have a large impact on the water resources, and vice versa. Regional differences require special attention. The different characteristics of each region require diversification of strategies per region which follow logically from the potential water supply in combination with the envisaged socio-economic development.

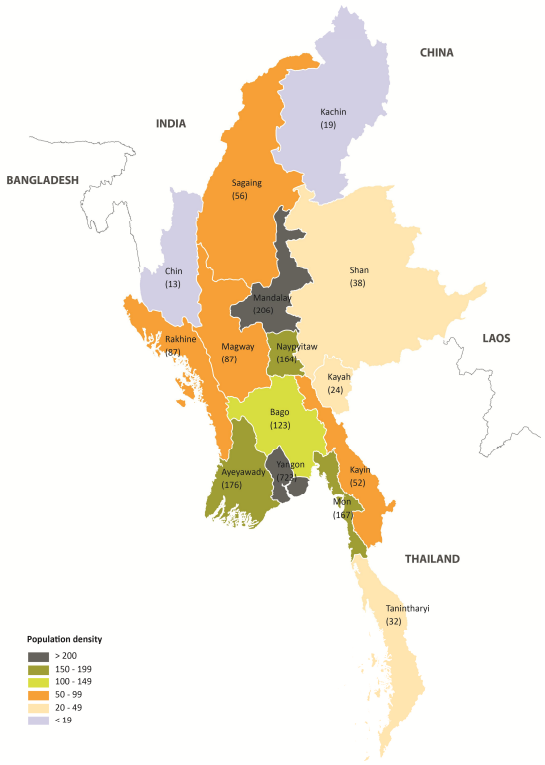


**Figure 7** **Population density [source Preliminary results census 2014]**

**Figure 8** **The 2014 census has provided an updated insight in the composition of the population**

# 4 Challenges and opportunities

When assessing the current water resources of Myanmar it may be concluded that, even though Myanmar's water resources seem abundant, in many aspects they are already to some extent problematic. Given a situation of economic growth, rising and shifting pressure on – in some regions often scarce – water resources, Myanmar faces major challenges for its water resources development. Such challenges may vary according to regional differences. For example, about 5% of the total amount of available water is used in Myanmar as a whole of which 91% is used for irrigation. Regional differences are however significant, e.g. possibly over 90% of readily available water is being used in the central dry zone (FAO 2011), where water used for hydropower can be re-used downstream. However, Myanmar's valuable water resources also offer opportunities for further economic development that serves the population and is, at the same time, environmentally sustainable. Good management of the water resources, backed by good (water) governance should set the right conditions to meet the challenges and opportunities of Myanmar's water resources.

This report distinguishes between the mountain area, the dry zone, the coastal zone, the Ayeyarwady delta, rivers, reservoirs and lakes, and towns. The following challenges and opportunities are defined according to regional differences.

## Drinking water and sanitation

Safe drinking water, according to WHO standards, and sanitation is a nationwide priority. This the greatest challenge for all regions, with no exception, although there are regional differences. In the future, more drinking water supply needs to be based on piped water systems. Presently rain water harvesting and deep tube wells are the major sources for drinking water, even in urban areas. The transition for solid waste collection from individual to collective responsibility is an important challenge, as is sewage water treatment. In some urban areas water is being priced, but overall in Myanmar hardly. Water pricing in order to fund safe water supply and sanitation, stimulate water savings should be considered seriously. Higher quality of the water supply system will also decrease the non-revenue share.

## Agriculture and irrigation

- In all agricultural areas, the main challenge is to provide the people with more profitable and therefore more sustainable forms of livelihood. Often problems are well known, but people have no alternative. Furthermore, improvement of agriculture can lead to land and water conservation only when applying proper and sustainable land and water use practices. Water User Associations are an existing phenomenon, but can be improved upon by turning them into true consumer/water users' organisations. Another opportunity might be to install a drought early warning system.
- In the mountain area, the major challenges are the implementation of integrated watershed management, the change from slash and burn agriculture towards more sustainable forms of agriculture and thereby halting deforestation. Degradation of the high and low mountain bio-diversity and related erosion of its slopes might be the most serious threat to sustainable

water resources development in Myanmar with effects on flood, sediment (landslides), water supply management and on navigability and the delta area. To halt this degradation and reverse this process is a most urgent challenge and a pre-requisite for future IWRM.

- In the dry zone, existing irrigation systems need to be upgraded. Dams, both present and future, need to be (re)designed for multi purposes (power, irrigation, drinking water, water transport). Irrigation systems can be hugely improved when there is less loss of water. Proper drainage could reduce widespread salinisation of the soils.
- In the coastal area, extension of agriculture and aquaculture jeopardises the mangrove habitat, which is so valuable for the marine ecosystem and coastal protection.
- More specifically, in the Ayeyarwady delta only 14% (relative to 1925) of the original mangrove forests survive. The main challenge here is to modernise the agriculture polders. Improvement on aquaculture/sustainable shrimp farming is a good opportunity as an alternative basis for economic growth.
- In the reservoirs and lake areas reversal of the deterioration of the water quality and excessive sedimentation forms an important challenge. The integrated approach needs to be reinforced. There are significant opportunities, for example in Meiktila and Inle lake, to integrate township and lake development with IWRM, thus creating a stepping stone for tourism, agriculture, small scale industry services and logistics.

### Integrated Watershed Management

The objective of Integrated Watershed Management is to improve farmer's livelihoods and protect the environment in poor and often highly degraded watersheds in the mountainous and hilly regions of Myanmar by promoting a replicable model of sustainable rural development. Through a participatory design process activities will be packaged into an integrated set of interventions for individual sub-watersheds.

(1) Soil and water conservation through physical investments for public interest including minimum capital farmland, sediment retention structures, afforestation and vegetative cover, and village infrastructure such as water supply facilities.

**Figure 9 Integrated Watershed Management**

(2) Livelihood improvement with physical investments designed to improve the income of farmers including: terracing slopes, horticulture and fruit and nut trees, grasslands, livestock development, irrigation and drainage and renewable energy supply.

(3) Project management and support services ensuring the participatory design process with inclusion of vulnerable groups, quality of implementation, the right institutional setting for sustainable operation and maintenance, the mitigation of environmental and social risks, and strong monitoring and evaluation.

## Hydropower

- The challenge will be to develop Myanmar's vast hydropower potential in a proper and responsible way.
- Existing dams can have their lifetime prolonged, for example based on improved watershed management.

- The larger existing dam schemes could be revitalised when based on a broader, more integrated approach, taking other IWRM opportunities (river transport, irrigation, flood management), environmental impact, stakeholder participation and social inclusiveness into account.
- The installed power generation capacity could be raised considerably to meet the country's rapidly increasing need for energy and utilise this enormous potential for clean, sustainable energy.
- Despite lack of knowledge, capacity and shortcomings in reliable data, dam projects require the implementation of all inclusive environmental and social impact assessments to support investment decisions with a view to sustainable green development.
- Hydropower development offers real opportunities for an IWRM approach; mutual gaining is easily achieved and could bring broad social support and better economic justification.

### River improvement and inland water transport

- In the mountain area a challenge will be erosion control to reduce sedimentation in reservoirs and rivers.
- In the Central Dry Zone, close integration and cooperation between Ministry of Agriculture and Irrigation (MoAI) (responsible for irrigation) and the Ministry of Transport (MoT) (responsible for river systems, water ways and water resources) for river water irrigation supply show promising opportunities. Along with the improvement of irrigated agriculture and food production, improvement of water depths for navigability, transport, river ports may be pursued to create new perspectives on economic growth. In the Ayeyarwady Delta area the river branches may have multi-purpose use for drainage, irrigation, flood evacuation and navigation. The east-west connection in a multi-modal system is very important to use the economic strength of the Delta.
- In the rivers, the main challenge is the improvement of the navigation channel to create a reliable and efficient cargo transport route throughout the year. The inland river ports need to be stabilised, as need the river banks. Modern hydrographic and navigational information will reduce risks for shipping and improve navigation. The rivers and waterways are the main transport routes for cargo in Myanmar, so reliable navigation will provide a boost to the economy. Rivers and canal where necessary may well provide a cheap, efficient alternative to other modes of transport, especially for bulk cargo and containers.
- In the towns, harbour and waterfront development combined with spatial planning, drinking water and waste water management will provide great opportunities, both for creating a sustainable living environment as for economic progress. At the same time, it will be a challenge to make or keep enough room for the river(s) for safe discharge of water during periods with heavy rains or floods.

### Flood and cyclone hazards

- Protecting the large population living in flood prone areas against flood disasters poses a major challenge for Myanmar's government.

- The development of (an integrated) early flood warning system is a need. For the mountain area and the dry zone, this system needs to be developed, for the coastal zone, the delta and the rivers, the system(s) need(s) to be harmonised and installed.
- In the mountain area and the dry zone, reservoir operations can prevent flash floods. Integrated watershed management is an excellent way to offer flood protection, but this is proving to be a challenge at the moment.
- In the coastal zone, rivers and the delta, the existing chain from 'data collection via warning to evacuation' can be improved. Strengthening of public resilience and improvement of civic response are important challenges here.
- More specifically in the coastal zone and the delta, the challenge 'post Nargis' is to continue and reinforce efforts to improve the shelter scheme, in combination with public resilience (multipurpose shelters to improve use of shelters both in times of normalcy and crisis) and livelihood improvement.
- In the reservoir and lake area, dam operation needs to be improved to ensure that dams can also be used for flood management. This offers opportunities for multi-purpose dam operation.
- In the towns, drainage systems are to be improved.

**Figure 10 Inland water transport, drinking water and sanitation**


**Figure 11** **Challenges and opportunities in the Ayeyarwady Delta: mangrove conservation and restoration, agriculture and aquaculture food production, water and road transport, salinisation, disaster risk reduction**

## Forestry and mangroves

- In the mountain area and dry zone, deforestation provides the main challenge, reforestation the main opportunity. Integrated watershed management is the best way forward.
- In the coastal zone and delta, the deterioration of the mangroves (especially in the Ayeyarwady delta) is problematic, since mangroves are the only natural protection against floods of the scale of Nargis (approximately 140,000 casualties). Mangroves are mainly cut down to provide firewood and to clear the land for agriculture. Increasing awareness of the vulnerability of mangroves is therefore a major challenge. This cannot be done without offering livelihood improvement for the residents of area at the same time, as well as developing alternative sources of energy. The conservation of the habitat of mangroves and other forest needs to be embedded in larger schemes for agricultural water management and aqua culture. Combinations between sustainable aqua culture and mangrove restoration can be made.

## Industry and mining

- The main challenge for industry and mining in relation to water management is to protect water quality. Water quality should be controlled based on set standards, and standards should be enforced.
- Furthermore it will be a challenge to save water and prevent waste
- An opportunity might be to develop water foot printing as a (data) base for IWRM, and possibly also as a basis for water pricing.

# 5 Governance Myanmar

When analysing water governance, aspects such as 'knowledge based, well-informed decision making', 'interdepartmental collaboration', 'capacity building', 'stakeholder participation' and 'embedment in rule of law' are important parameters (Figure 12).

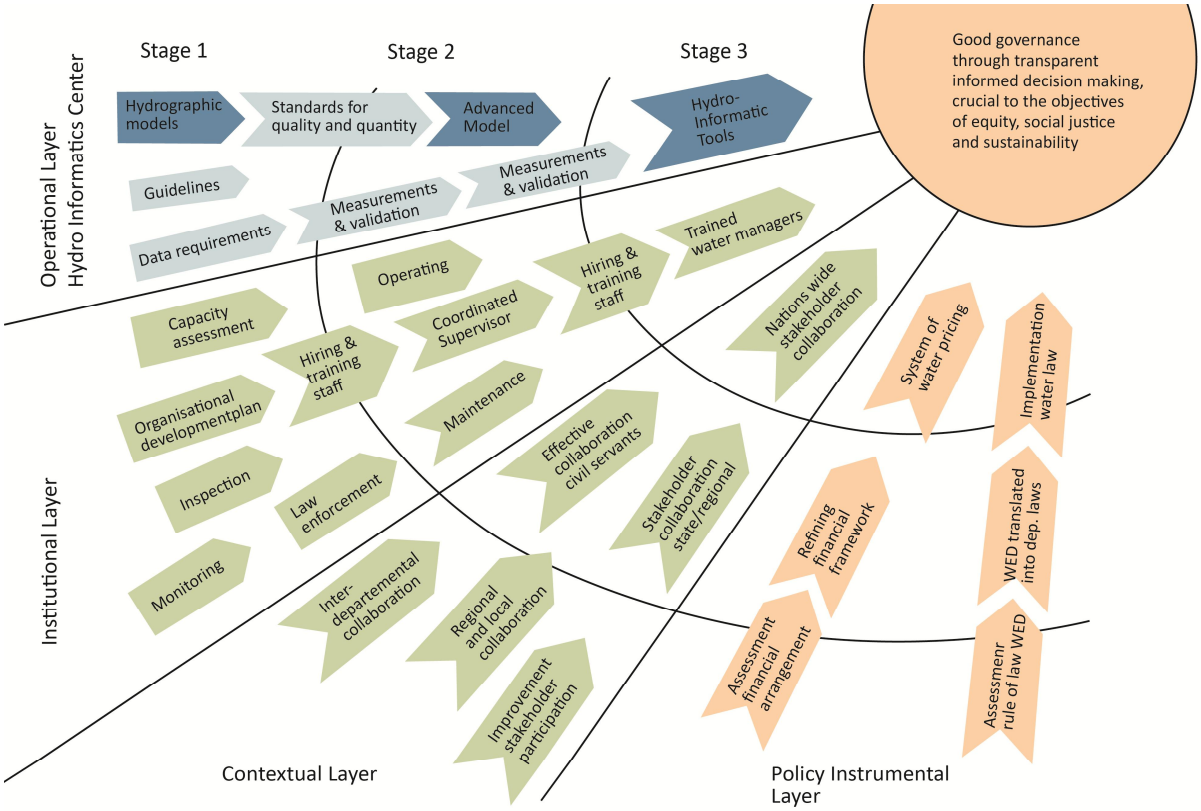


**Figure 12 Ideal focus on good water governance**

Following an analysis of the current situation of Myanmar governance structures has revealed a number of issues as described below.

- Decisions on integrated water management should be based on knowledge and facts. Transparency and accountability in decision making is felt by most stakeholders to be very important, but is difficult to achieve. Data, models and standards for water quality or – quantity need to be either set or coordinated and improved upon, so it is difficult to understand the exact working of the current water system or predict the effect of new developments. Without the actual information and models it is also difficult to perform for example reliable environmental or social impact assessments.
- There is a lot to be gained by better collaboration between departments that have a responsibility towards (parts of) water management. For example between the Ministry of

Environmental Conservation and Forestry (responsible for mangrove rehabilitation in the Delta or reforestation of slopes and mountains in the central dry zone) and the Department of Irrigation of the Ministry of Agriculture. Or between the Ministry of Electric Power (responsible for Hydropower dams) and the Ministry of Transport, directorate of Water Resources and Improvement of River Systems (DWIR). There might be conflicts of interests and policy gaps that are not resolved automatically when each department tries to achieve its own goals and fulfil its own obligations. A broader view is needed! Joint fact finding and joint problem formulation among the sectors will open up new perspectives for integrative management of scarce resources and integrated solutions.

- There is also a lot to be gained by better coordination between the national, state/regional and local (township) level. It is important to realise that most national departments have their regional and even local representatives, while there are, at the same time state/regional and township civil servants as well. If the aforementioned policy gaps and conflicts of interest have their effect on the interdepartmental collaboration, this effect is doubled or tripled when regional and local officials are, or should be, involved as well.
- Capacity building needs are great. Knowledge on every aspect and level of IWRM needs to be updated.
- Legislation is an important building block of water governance. A well-designed and principled legal framework supports the operationalisation of IWRM. At present, the legal framework in Myanmar is still following a sectorial and operational approach and is consequently not well coordinated and fragmented. The first steps have been taken towards the formulation of a Myanmar National Water Framework Directive, which has to be understood as a legal guideline for embedment in a water law and more specific partial water rules and regulations.
- Financial arrangements are underdeveloped. The relation between taxation, the price for certain water services (e.g. irrigation water or drinking water), use and pollution of water on one hand and budgeting of projects, subsidies, loans and grants on the other hand has not been developed in analyses of costs and benefits in support of the ratio behind programmes and projects.

# 6 Vision, Scenarios and Strategies

Myanmar is a vastly changing society, with great opportunities but also major challenges where IWRM is concerned. Nobody can predict precisely at what speed economic and social developments will take place, or at what rate the impact of climate change will come.

In order to be able to consider different possible outcomes, scenarios are being used. Scenarios are to be understood especially in terms of uncontrollable circumstances. Ideas about where Myanmar should be in, say, 2030, are called visions. Consequently strategies are plausible development pathways that connect the present to the envisioned future, while taking different scenarios into account. The more diverse scenarios are taken into account, the more robust the strategies become. As the future unfolds, certain scenarios may become obsolete.

## Vision in Myanmar's National Water Policy

The National Water Resources Committee has formulated an IWRM vision for Myanmar in in the National Water Policy:

> "A water efficient nation in 2020 with well-developed and sustainable water resources".

To achieve this by 2020 will be a challenge, and is to be done gradually. It will be a great achievement to sustain this in a later future.

President U Thein Sein has also expressed his vision for Myanmar "*to strive for a green economy and green growth*". He has reiterated this vision in his address on the occasion of the World Environment Day on 5th June, 2014.

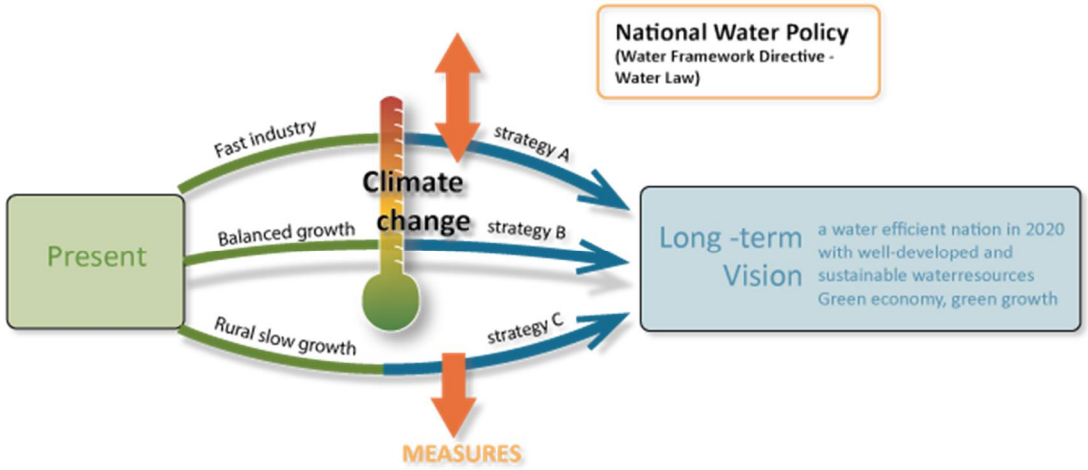


**Figure 13** **Possible development scenarios require distinguished strategies to fulfil the ideal situation as formulated in the long-term vision. Following the National Water Policy and the required strategies, appropriate measures may be formulated. The future practice of the evolving scenarios may also require review of the National Water Policy.**

## Socio-economic development scenarios

In order to get from the present day, as a starting point, towards the ambitions formulated in the 'long-term vision', first several scenarios are developed. The scenarios are based on prognoses of future socio-economic developments including population growth and land use changes. Climate change is another aspect to be taken into account and which, for each strategy, may require specific measures. Three different scenarios are considered, covering a broad spectrum of possible future developments.

- Progressive shift towards a balance between agriculture and small to medium scale industry. This scenario is based on the assumption that faster development of agricultural production and improved conditions in the rural areas are joined with more moderate industrial growth and urban development.
- Rapid shift towards industrial development. In this scenario certain parts of Myanmar (especially in the 'Special Economic Zones') will experience a rapid shift towards industrial development. Developments in the world market, the investment policies of neighbouring countries, the end of the financial/economic crisis and the vast natural resources and unique strategic location of Myanmar in SE Asia mean that the basic conditions for fast industrial growth might be present.
- A prolonged agriculture-based development. This scenario is based on the assumption that large parts of Myanmar will remain oriented towards agriculture and agricultural innovations in the coming thirty years.

## Climate change scenarios

In all of these scenarios, possible impacts of climate change need to be taken into account. Long-term impacts on the Myanmar water resources due to climate change generally follow the regional patterns of:

- erratic occurrence of rainfall with respect to intensity and seasonal and spatial distribution;
- later start of wet monsoon or prolonged periods of droughts;
- consequently higher flood levels and lower low water levels in rivers;
- sea level rise with increase in salt water intrusion;
- rising sea water temperatures may cause more or deeper depressions;
- changing trajectories of cyclones from the Bay of Bengal.

## Water allocation perspective in view of potential economic development scenarios

Different scenarios for Myanmar's future will mean different demands from the various sectors on the available water. Of the total amount of presently utilised water almost 91% is for agricultural use and 6% for domestic use. The now 3% share of industrial use is growing and important for future water resources management.

Depending on a more or less speedy economic development, including more industrialisation, the absolute demand for water will grow. Although Myanmar uses only 5% of its total water availability,

the exploration of the remaining 95% for growth is not so obvious, rather a major challenge. The actual availability of water depends very much on the capacity of the country and, in various intensity and forms, of each region to retain the abundant precipitation amounts of the wet monsoon and make them available in the rest of the year. Already the country has taken many measures to retain and store water: reservoirs for hydropower, drinking water and irrigation water, smart irrigation systems to prolong the growing and cropping seasons, communal ponds for drinking water supply and domestic storage for household water. The challenge is to rehabilitate the existing systems, wherever possible to improve them and expand the storage as a whole. In this process it is of great importance to combine objectives for energy production, agriculture and domestic and industrial use: combined and integrated project design and financing is important to use the surplus of the wet monsoon and thus cope with the scarcity of water in the dry season. More efficient use of water, water saving should become a regular issue; water pricing is in any situation a good instrument to consider.

The relative demand for water for energy production, industry, agriculture and domestic use will change with Myanmar's further development. Figure 14 shows the relative water use in countries with different stages in terms of agriculture, industrialisation and economic development. Even in highly industrialised countries that could serve as an example of development for Myanmar, the demand for irrigation water remains high (50 to 60% or more), but there is a gradual shift to a higher demand for industry. This shift will have to be managed in terms of water quantity, without affecting the availability for other sources, but very importantly also in terms of water quality, for intake as well as for effluents.

Water allocation depends only to a certain extent on the degree of socio-economic development of a country. In most countries the use of water for agriculture exceeds 50% of the total, especially in the world's warmer regions. Only very industrialised countries need more than 50% of their water for industry in the moderate climate regions. Water for domestic use is generally much less. Myanmar needs 90% for agriculture; this – relative – figure will change only slowly, where the absolute water consumption needs will still increase. An important water resources management issue will be for example that where industry needs much process water, this industry will only settle in an area where its water needs will be satisfied by an increase of water availability in absolute sense, not in competition with agricultural or domestic use.

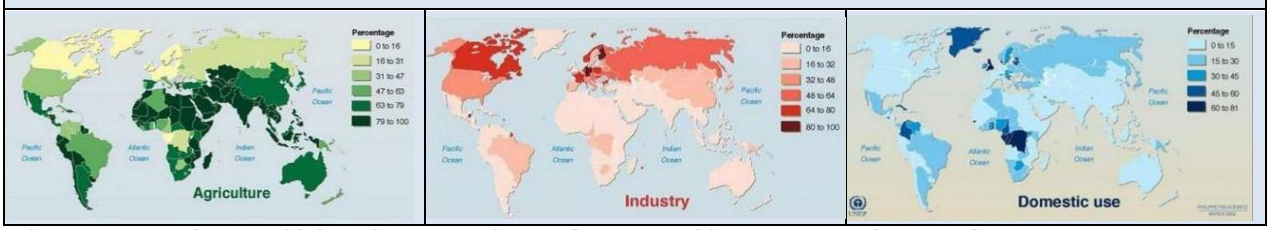


**Figure 14 Freshwater withdrawal per sector in 2000 [source World Resources Institute 2000]**

## From scenarios to strategies

Having analysed potential development scenarios, it may be concluded that

- from the present-day situation no sharp changes in developments will occur: trends will develop slowly; in other words, whatever scenario will develop, initially the difference between them will not be very significant;
- different regions will experience a different development and also a different speed in their development;
- water use for agriculture will still dominate water resources management in terms of water quantity;
- the need for – hydropower – energy is already important, and will play an increasingly important role: the need for hydropower will be more than doubled from 4.3 GW today to 9.4 GW in 2030;
- water transport capacity and water supply for industry, enforcing and maintaining good water quality are important factors, especially in the regions where a scenario with more industrialisation will develop;
- demands on water management are dominated by
    - the geographical and demographic water situation in Myanmar; this includes the water-related hazards;
    - the present state of water resources management, including water governance;
    - socio-economic developments;
- climate change is an important factor to be regarded, which can be evaluated in different intensities; the climate change adds to the demands posed by the economic developments and the present-day water situation of Myanmar.

## Guiding principles and inspiration for strategies

From the above, it is clear that the demands for water resources management depend highly on strategies in other sectors (e.g. agriculture sector, energy sector) and yet uncertain socio-economic and climate developments.

The present geographical, demographic and socio-political situation versus the present state of water resources management in Myanmar requires continuous political focus on the demands for proper water resources management.

Strategies consist of planned action on the present and desired situation in Myanmar and of planned reactions to – yet uncertain – scenarios. Strategies have to be sufficiently flexible to accommodate major changes; strategies have to be adaptive. Strategies set rules for the way forward, set goals for the future, and describe 'pathways' for implementation of the vision into action.

The Union Government of Myanmar and its National Water Resources Committee are in an intensive process to set the rules for future integrated water resources management. Where it is still difficult to formulate concrete strategies, great steps have been made in setting the guiding principles for water resources management and the strategies.

### Guiding principles for Integrated Water Resource Management in Myanmar based on its National Water Policy

"To develop, share and manage the water resources of Myanmar in an integrated, holistic and socially inclusive manner, to contribute significantly to the alleviation of poverty, to the green growth and the sustainable development of the nation, by providing access to water of equitable quantity and safe quality for all social, environmental and economic needs of the present and future generations."

This means the following principles of IWRM should be met when appraising an initiative:

- Triple-bottom line: planning, development and management of water resources need (1) to take the local, regional, state and national context into account; (2) have an environmentally sound basis and (3) keep the human, social and economic needs in view. In other words, every decision concerning water resources should be based on this triple-bottom line. In short, it should be
    - economically viable;
    - environmentally sustainable and
    - socially inclusive.
- All elements of the water cycle, i.e. evapo-transpiration, precipitation, runoff, rivers, lakes, soil moisture and groundwater, lakes and sea, are interdependent.
- Good governance through transparent informed decision making, based on objective standards, data-collecting and monitoring, is crucial to the objectives of equity, social justice and sustainability. Meaningful intensive participation, transparency and accountability should guide decision making and the regulation of water sources. Water policy making and implementation should be based in the rule of law. A fair pricing mechanism for water should be found and implemented, for example based on the 'user and/or polluter' pays principle.
- Fair, transparent allocation of water should also be based on the triple base line, to achieve food security and support livelihood. The impact of climate change on water resources availability must be factored into water-management related decisions.
- Prioritisation: water, after meeting the pre-emptive needs for safe drinking water, sanitation and high priority allocation for other domestic needs, achieving food security, energy security, supporting sustenance agriculture and minimum eco-system needs, may be treated as being economically good for promoting conservation and efficient use.
- Water quality and quantity are interlinked and need to be managed in an integrated manner, consistent with broader environmental management approaches inter-alia, including the use of economic incentives and penalties to reduce pollution and waste.

The vision for a green economy and these guiding principles will be applied on many issues. The threats, or in more optimistic wording the challenges *and* the opportunities in Myanmar's land and water resources management are manifold (see Chapter 4 and Figure 15). These challenges and opportunities are specific, but not unique for Myanmar only.

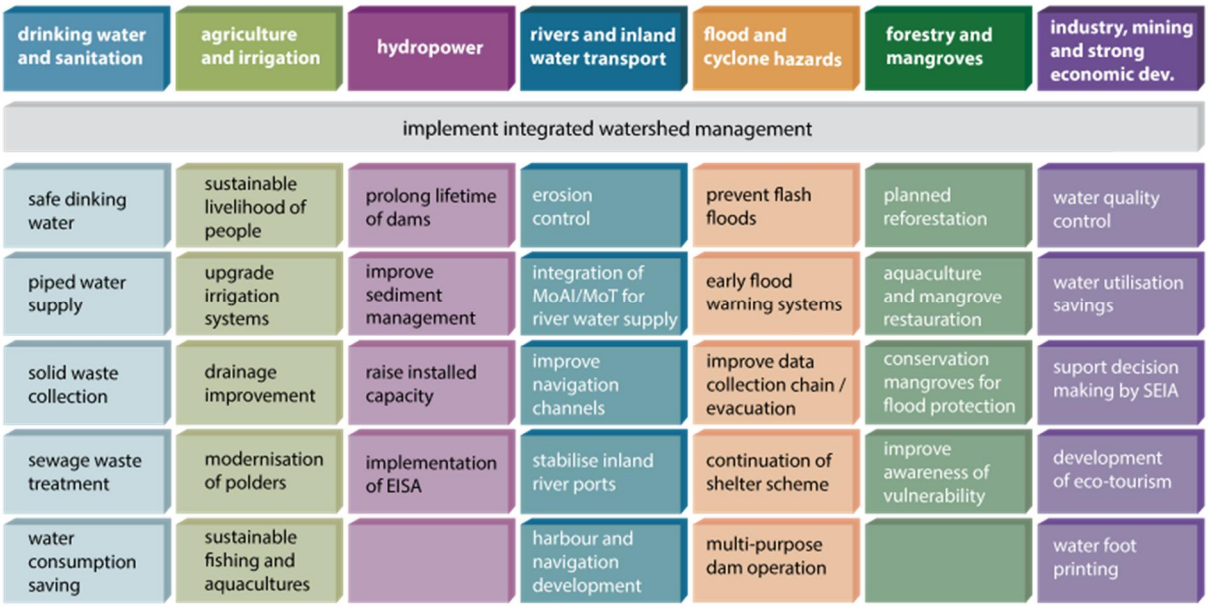


**Figure 15 Overview of challenges and opportunities for integrated water resources management in Myanmar.**

For its formulation of strategies, Myanmar may be inspired by its rich history in water resources management and the related infrastructure, by its present relatively unspoiled state, and last but not least by international practice.

## "Development depends as much on where you are as on where you want to go"

Myanmar boasts important water infrastructure, such as dams, canals, sluices and pumping stations, dykes and river training works. Some of this infrastructure dates back hundreds of years and some has been put in place relatively recently. The works vary in their state of repair and operational efficiency. Inadequate maintenance and sometimes incomplete- and single sector designs have contributed to this situation. Nevertheless, this infrastructure represents a large investment which, when taking the proper measures, has a good potential to create a positive return.

**Figure 16 Bago-Sittaung Canal**

## Water – Food – Energy Security Nexus

A nexus approach can enhance water, energy and food security by increasing efficiency, reducing trade-offs, building synergies and improving governance across sectors. The approach may be of specific relevance for Myanmar in its strive for a green growth and a green economy using a broad view in analysing problems faced and in finding integrated, multi-purpose solutions. The combination

of actual solutions is stronger than the sum of single-purpose solutions. Where 91% of Myanmar's water use is in agriculture and the need for hydropower energy is high, the interrelation between water, food, and energy security provides a useful framework to analyse trade-offs. Food and energy production will have a highly significant impact on the water resources and vice versa. Diversification between regions requires special attention: rice production may be best in regions with abundant water, where regions with dominant drought periods may specialise in less water consuming production.

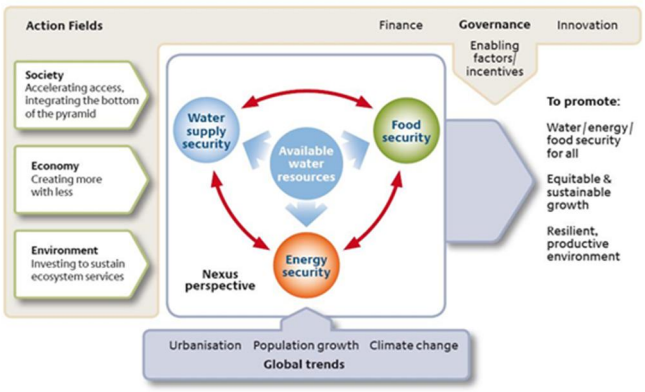


**Figure 17** **The Water – Food – Energy Security Nexus will keep on playing a dominant role in Myanmar's water resources management**

## Ecological protection and adaptation to climate change

A serious challenge will be to bring further deterioration of Myanmar's water resources to a standstill. Prevention is better than cure. A lot of the water bodies of Myanmar are still relatively unspoiled; hence Myanmar could build forward on having relatively clean water instead of going through a long period of contamination, like so many industrialising countries. Drawing from international experience on this issue is relevant. The *principles* as set in the EU Water Framework Directive will be equally instrumental for Myanmar: establish database on water quality (1), monitor, maintain and enforce water quality (2), implementation of no-regret measures, projects *starting incrementally with rehabilitation and improvement of what is already there* parallel to master planning for longer-term development (3) and adaptation to climate change including disaster risk reduction (4).

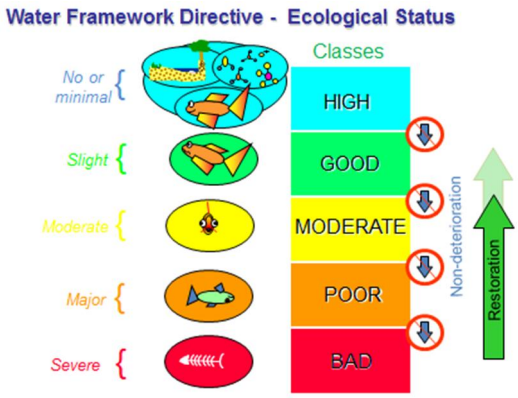


**Figure 18** **European Water Framework Directive**

# 7 Building blocks for Myanmar's strategies in IWRM

The aim of this 'Strategic study' has been to develop building blocks for integrated water resources management strategies. These building blocks must help the Government of Myanmar, and particularly the National Water Resources Committee and its Expert Group in their challenge to formulate these strategies.

The implementation of Integrated Water Resources Management uses a 'top-down' and a 'bottom-up' approach. Certain building blocks need to be developed everywhere and under all circumstances (top-down), other elements can be approached 'bottom up', be project based, on the basis of 'learning by doing'.

## 7.1 Myanmar's water resources management needs a stronger base

In the previous chapters the Study Team presents an inventory and an assessment of the status of Myanmar's water resources and how they are managed. The most salient challenges as well as opportunities for the future planning, development, implementation and management have been described from both a physical perspective and, not less important, from a perspective of good water governance. From these challenges and opportunities the Study Team has formulated building blocks for water resources management strategies.

From the physical perspective Myanmar faces major challenges: in the water-food-energy nexus the provision of safe drinking water and using the opportunity for sustainable energy production through a balanced approach towards development of hydropower systems cannot be overstressed and should go together with integrated watershed management. In view of droughts and salinisation fresh water resources for food production, irrigated agriculture remains a key issue. Disaster risk reduction needs serious and increased attention: flood protection (both urban and along rivers) as well as protection against more frequent occurrences of cyclones. Climate change adds to these challenges.

From a governance point of view, capacity building is the first, very important challenge to be addressed. This is at all levels and in all water-related sectors. Well-integrated water resources management benefits from well-prepared sector knowledge. This capacity building should aim at the present-day staff in all water sectors as well as at future staff by well-structured professional academic and vocational training. Data acquisition, data management and analysis must provide a sound engineering base for administrative and political decision making.

The development of an integrative Water Framework Directive and Water Law needs to provide a long-term consistent approach throughout the country. A policy of good coordination of national and international funding organisations may well contribute to this consistency.

## 7.2 First building blocks to form the base are independent of scenarios and fit any strategy

The conclusion can be reached that it is too early to define specific scenarios for specific regions. The challenges for water resources management are, in a certain way, very basic. The coming years much effort will be needed to provide no-regret measures in maintaining and upgrading existing infrastructure and prevent deterioration. Regardless the scenario as it will unfold in the coming years, the Myanmar Government has already a clear long-term vision with respect to its water resources development: a water efficient nation in 2020 with well-developed and sustainable water resources in a Green Economy based on Green Growth and guiding principles to follow (See page 20). Without formulating generic or regional strategies yet, the many above-mentioned challenges (chapter 4 Challenges and opportunities and Figure 15) form elements to be pursued in the strategies for integrated water resources management in Myanmar. They all form the basis to manage land and water in service of people's health and economic progress, whatever socio-economic scenario will develop.

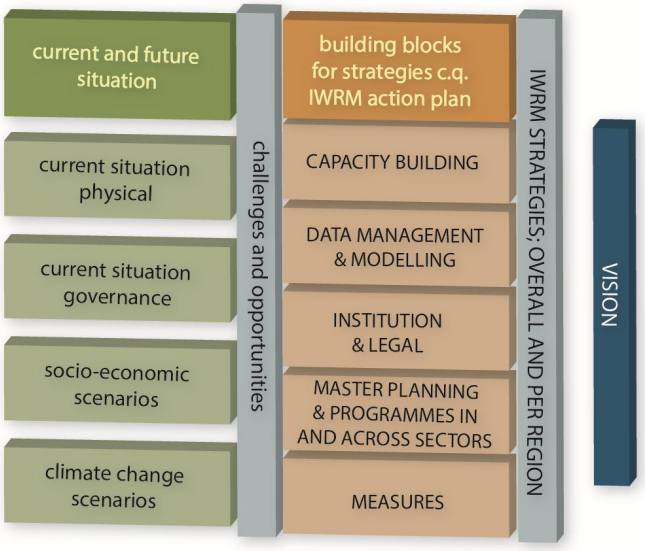


**Figure 19** Building blocks for the IWRM in Myanmar. Having analysed the present situation, described possible development scenarios and having formulated challenges and opportunities, the Study Team distinguished certain basic building blocks. Whatever scenario may develop, these building blocks form the foundation, whatever strategy may be formulated. Measures are not just infrastructural measures, but need to be effective in the above mentioned building blocks.

In the below sections these main building blocks have been elaborated. Capacity building has been given a great deal of attention.

### Capacity building

Amongst Myanmar's main challenges in preparing for a future based on 'sustainable green growth' is the lack of well trained, educated people. Almost everybody receives some kind of primary education (4 years), but only 43% of the population receives further education.

At the moment, several initiatives are being formulated, under the auspices of different donors and funds, to improve schooling, capacity building and education in the field of Integrated Water Resource Management. Two main principles are important: IWRM professionals should acquire the

necessary 'broader view', e.g. learn to look at water issues from different perspectives and learn to cooperate with other professionals, and IWRM professionals need to deepen and broaden their own specialist knowledge. This need for knowledge/cognitive competency in the water sector can be drawn according to the following lines:

- disciplinary knowledge in one scientific field (e.g. hydraulic engineering, irrigation, aquatic ecology or governance) (the vertical leg of the T-shape in Figure 20), and
- integrative requirements for the new water manager which are key to integration and working in multi-disciplinary teams (the horizontal bar of the T-shape in Figure 20).

  Through the horizontal leg IWRM professionals are able to build bridges to other disciplines.

  The horizontal bar stands, on the one hand, for knowledge and competencies outside a professional's own discipline, on the other hand, for functional and personal competencies including e.g. project management, negotiation skills, leadership.

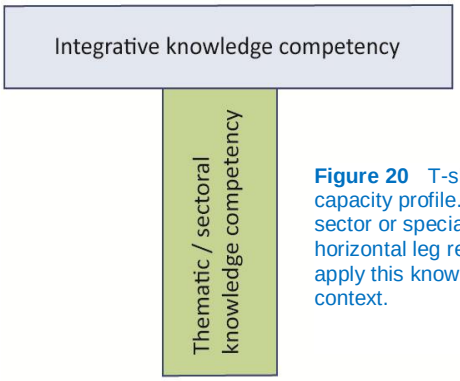


**Figure 20** T-shaped knowledge or capacity profile. The vertical represents sector or specialist knowledge. The horizontal leg represents the ability to apply this knowledge in a broader context.

IWRM professionals will benefit from a T-shaped profile where a mix of competencies is required that will vary with their individual level (position) and organisational level. The width of the horizontal leg will depend both on the individual level and the organisational level, e.g. a member of the NWRC will need to have a wider scope than an agricultural engineer involved in IWRM at the Ministry of Agriculture and Irrigation who will need a more solid vertical leg.

The first steps towards improving capacity building are being made. The following advice was given:

1. Strengthen existing capacity of key Ministerial departments. In the short to medium term (between now and 5-10 years) immediate and focussed action is required to facilitate the required changes in water management in Myanmar as stipulated in the Myanmar water policy. Water related departments should invest in their collaboration. Training can be used to form communities of practise. More profound knowledge of technical expertise will be relevant, but priority should be given to developing broad IWRM capacity. Capacity development needs to be done at all levels (local-regional-national) and all positions, although in different intensities and through different learning modalities. Human resources development (HRD) policy of the key ministries involved should facilitate staff in starting an IWRM track. One of the crucial success factors will be:
   - Selection of candidates. A sensible mix of personal ambitions, drive and capabilities of the candidate on the one hand, and organisational development plans and requirements on the other hand must be found.
   - Creation of job- and career opportunities. In order to nurture the 'change agents of the future', without frustrating their ambitions, it is important to plan and discuss in advance

what (young) professionals will do when they finish their training or education. Close collaboration with donors and private partners will broaden the scope, both of funding of educational programmes and for offering career opportunities.

2. Enhance awareness of local water users. Enhance the awareness of local water users, of which 51% are female, in the importance of freshwater, sanitation and hygiene practices and advocate the sustainable management of freshwater resources.

3. Develop capacity at Universities and/or Ministerial training centres. For the longer term the universities and/or Ministerial training centres should have sufficient teaching staff and state-of-the art teaching materials to train the water professionals of Myanmar. To achieve this universities and/or training centres will need to offer the relevant training courses.

4. Roll out capacity development through Training-of-trainers. As the capacity development demand is high, use should be made of the groups of experts trained in the first years. They should become groups of experts who can also deliver targeted trainings. This fits well with the principles of 'training on the job'.

5. Capacity building on water governance. Strengthen capacity of selected professionals in Water Governance through a dedicated programme (already initiated by ADB) based on a mix of plenary sessions, parallel sessions, group assignments in case study areas and field visits and well defined coaching. An added advantage of this approach is that the professionals will also be part of a 'learning community', or 'community of practice', whereby they can learn from each other.

### Action plan capacity building

As is made clear above; capacity building needs are large, the Myanmar infrastructure for – higher – education is weak and needs strengthening, educational programmes are being developed and offered by several donors, partners and initiators. Since integrated water resource management and good water governance requires the integration of several fields of expertise and close collaboration between practitioners, both on a higher theoretical level and as a basis for 'learning by doing' in projects, IWRM offers excellent opportunities to formulate an integrated, comprehensive training programme. This can be executed by several centres of learning, both in Myanmar and abroad.

### Data management & modelling

Good water governance is based on knowledge, data and facts. Understanding how the physical and the environmental or socio-economic systems work is crucial for policy formulation, implementation and monitoring. Standards, both for water quality and quantity, are required. This applies for project design, but also for law making, monitoring and implementing rules and regulations. It is impossible to make environmental or social impact assessments without models. Therefore, data management and modelling are the first requirements for integrated water resource management.

There are a lot of data 'floating around', but these are not collected, validated or managed in an integrated, organised manner. The establishment of the Hydro Informatics Centre, under guidance of the NWRC, is a first step towards remediating this situation. In a parallel project on data collection and model development carried out by Deltares good progress is being made in developing IWRM decision support systems for Myanmar, using models such as WFLOW, RIBASIM, SOBEK and DELFT2D or 3D.

## Institutional, Legal and Financial development

Integrated Water Resources Management will need to be embedded within a country's administration. For Myanmar the framework is well instituted with the establishment of the National Water Resources Committee. One of the first challenges the departments and government institutions of Myanmar face is to close their 'policy gaps' and improve cooperation between government levels and layers. Furthermore, all government departments will need to coordinate and be connected to universities, knowledge institutes and the private sector. Proper mapping of all stakeholders and creating cooperation mechanisms will be important aspects for realising fully supported planning for water resources development in Myanmar.

**Figure 21** **Boat landing in the Ayeyarwady Delta**

Legal: Institutionalisation or rationalising the current institutionalisation of water governance is an important issue for actually making things work. Of course new laws, adapted to the new and future challenges are important, but they usually *follow* the existing way of operation and existing policies. The actual 'workability' of a policy and a law depends very much on the force, monitoring and enforcement power of the distinguished institutions and their capability of collaboration.

Financial: It seems a separate issue, but the role of the international financing and donor community is at least as important as the institutional setting of Myanmar itself. The distinguished international partners set all their own policies, restrictions and opportunities for financing projects in Myanmar. How Myanmar can organise and steer its donors and financers is important. Donors also have a shared responsibility to fill this building block in a coordinated way. Donors are omnipresent in Myanmar (Figure 22), the necessity of coordination of their activities is obvious, but not natural. Both the Myanmar Government, NWRC (especially in the water sector) and the donor community will need to make a great effort and shared strategies.

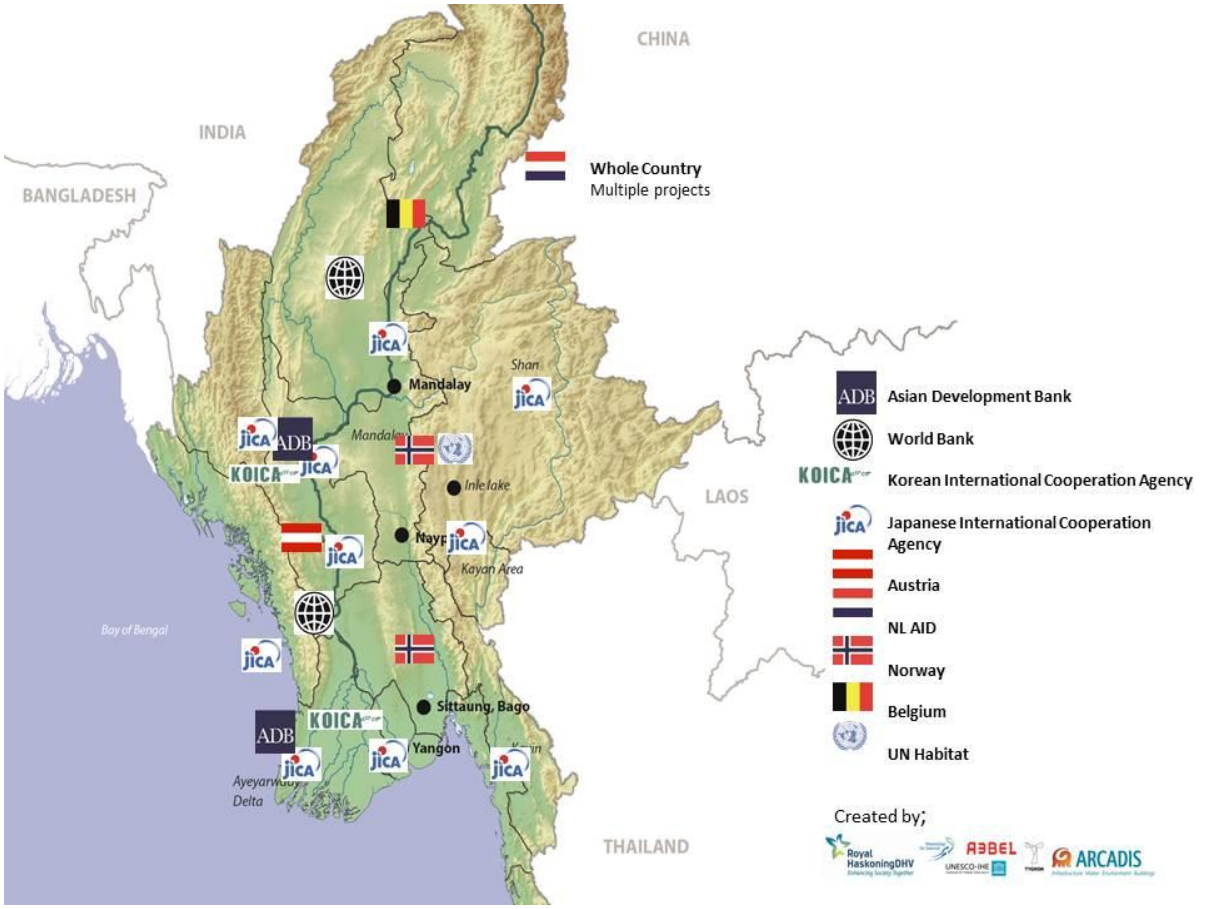


**Figure 22 Main international donor activities in Myanmar**

### Strengthening master planning & programming in and across sectors

Each sector has its specific challenges, problems to solve and opportunities for further development. Therefore the time is not right for the development of a nationwide, overall master plan for IWRM. The 'bottom-up' approach is recommended, grounded in 'learning by doing', whereby principles of IWRM are customised for Myanmar. After which, in the long term, an overall master plan can be considered. On the other hand, well-considered master plans to solve the more specific, regional problems project-wise need to be developed. Programmes with a series of similar or related projects need to be established, including a financing plan for the longer term. If the 'community of practice', mentioned above under 'capacity building', uses IWRM master plans as course material, insights into the do's and don'ts of integrated water management in Myanmar can be shared and improved upon.

## 7.3 Immediate strategy and key messages

The above has been synthesised in three key messages. Both the Expert Group of the NWRC and the Dutch High Level Experts have presented to the National Water Resources Committee as immediate strategy for Myanmar's IWRM in September 2014. These Key Messages have been presented to President U Thein Sein during his visit to the Netherlands in September 2014.

## Key messages

Based on the findings of the strategic study, discussions between the Expert Group of the NWRC and Dutch High Level Expert Team IWRM for Myanmar led to three core messages for supporting the decision making process. To bring the process from "abstract principles" to "concrete actions". Their wording is presented below.

### Key Message 1: Optimising what you have

Myanmar already has important water infrastructure, such as dams, canals, sluices and pumping stations, dykes and river training works. However, there is a large potential for improving, upgrading and redesigning the functioning of this infrastructure. Thus it can become a substantial base for the development in Myanmar. It is recommended to take the current infrastructure as a starting point and give priority to make them greener and more productive small short term actions with quick wins toward provision of clean drinking water, food and energy production and navigability of the rivers. For example, if any development work situated in the Delta area or Tidal Region, the environmental conservation department under MoECaF will take the lead in introducing suitable sustainability measures such as replantation of mangroves, conservation of coral and aquatic marine habitats and numerous tangled roots, etc.

### Key Message 2: Taking a "broad view" in the analysis of the problems

Looking into other interests, including future developments, in a well-considered integrated way is essential for successfully solving water problems and developing water resources. This approach will deliver solutions which are more robust and give a better cost - benefit balance and attract broader support from stakeholders. For example, when planning for or redesigning dams, in particular large ones, reservoirs, embankments, sluices and canals for irrigation or drainage, and river works, it may well pay off to consider watershed management or irrigation, to avoid (further) erosion, possibilities for flood management, sediment management to help navigation, reduction of salt intrusion and nature development rather than e.g. single sector hydropower. The rapid degradation of water quantity and quality will spoil the efforts to bring development if IWRM is not wholeheartedly handled. Focusing on silo (or) compartmental development in the Agriculture, Industry, Hydropower, and Service sector will lead to real conflicts among line ministries and create tensions with other stakeholders. To avoid that possible damage and envisioning for equitable water sharing it is essential to give priority to IWRM through dialogues within NWRC. Such a "broader view" is also likely to be more robust with respect to shifts in socio-economic development.

### Key Message 3: Focus on education, capacity building and training

Capacity building is a key success factor for integrated development of water resources in Myanmar. Increasing capacity building is required at all levels, from gate-keeper to high level civil servants. It should consist of a multi-year programme for young and senior professionals, improvement of curricula at universities, establishment of vocational education, training at local level etc. It should stimulate the cooperation between ministries in policy and decision making processes, including the cooperation with regions. Cooperation in this field between programmes of different donors in Myanmar needs to be stimulated.

Special attention is needed for learning by doing. IWRM is only useful in real-world cases. Capacity building programmes should be connected with projects. The projects described below offer opportunities for capacity building for students and professionals. Special attention is therefore also needed for the creation of real career opportunities for IWRM professionals. Only by practicing what they will be taught to preach will they be able to act as the ‘change agents’ Myanmar so urgently needs.

# 8 Learning by doing – no-regret projects

Special attention is needed for learning by doing. IWRM is only useful in real-world cases. Capacity building programs should be connected with projects. The projects described below offer opportunities for capacity building for students and professionals.
Implementation of an integrated approach needs to be started through no-regret projects. It is through these kinds of projects, with utmost care during the planning and selection process, that IWRM can be best developed for Myanmar and the required human resources. These projects need to be carefully designed based on the "broader view" as mentioned in one of the "Key Messages", and closely monitored to see how they develop in the coming years under changing circumstances so that plans can be evaluated and adapted again from there. A continuous cycle of planning action, monitoring and evaluation is required to gain experience and to achieve the vision.

Pending the formulation of the Myanmar National Water Framework Directive and enactment of subsequent Water Law in 2015, it seems advisable to start projects that are in line with the National Water Policy. The projects can be implemented in different regions e.g. the Mountains, the Dry Zone, the Rivers, the Cities and the Delta as a preparatory work for development of a Myanmar IWRM Master Plan with measures for country-wide implementation. Good practices used in these projects can be replicated throughout the country. In these projects the inclusion of good water governance, capacity building, development of monitoring networks and financial arrangements are key for success.

The strategic study report on "Research and Analysis, Strategies and Measures" provides a long list of no-regret water projects. In cooperation with the relevant departments of Myanmar several quick-win projects have been identified to be implemented in the short term. Technical assistance and capacity building under the umbrella of the MoU between the NWRC and the Netherlands Ministry of Infrastructure and Environment could support the implementation of selected projects.

- *Meiktila Lake Area Development as catalyst for Integrated Regional Master Planning (Mandalay Region)*: improved watershed management to reduce silting up of the lake, dredging of the lake, urban and rural drinking and irrigation water supply, water-shed management, water quality control and pollution prevention, inter-departmental cooperation and people's participation. Cooperating agencies: a.o. MoAI, MoECaF, MoLFaRD, Mandalay Region, Meiktila Township Municipal Committee. In the short term a combined study for an integrated problem definition, joint fact finding should provide a perspective for an integrated long-term solution.
- *Bagan Multi-Purpose Pilot River Beautification (Mandalay Region)*: river training for improved navigability, irrigation water supply, mini hydropower, river embankment beautification, Cooperating agencies: MoT/DWIR, MoAI, General Administrative Department, Bagan Township, Private Partners.
- *Pan Hlaing Control Sluice cum Navigation Lock (Yangon Region)*: drainage control for an area of ca. 70,000 hectares, irrigation water supply, flood control, sediment management,

improved inland water transport facilities for industrial zone, ecological protection. Cooperating agencies: MoAI, MoT/DWIR, YCDC, MPA.

- *Feasibility Study Mandalay-Bagan navigability improvement*: tendered study on river training works for improved navigability of Ayeyarwaddy River. Cooperating Partners: MoT/DWIR, IWT, Netherlands Government, World Bank
- *Bago-Sittaung Canal Integrated Water System Analysis*: Operational improvement of integrated water system including dams, canals and rivers in the Bago Region for improved irrigation, drainage, flood control, hydropower development and inland water transport. Cooperating agencies: MoT/DWIR, MoAI/ITC Bago, MoEP, Bago Region, etc. Excellent opportunity to help support existing efforts to be more effective in creating sustainable development. For example, DWIR has done survey works up to Bago from mouth of Bago River already as existing activity and a plan has been set up to develop a 'salinity barrier' to support freshwater for Thilawa SEZ. A Myanmar PhD student supported by a "scholarship from Shell" is studying multi-purpose water management with geographical focus on the Bago river. There are also a few other agencies engaged in other silo activities. Therefore, all water related agencies should FOCUS on "multipurpose water management in Bago-Sittaung River Basin" under the auspices of NWRC.
- *Capacity Building*: It cannot be overstated how important the development of human resources with respect to IWRM is at every level. The Young Professionals Programme is the first step with which the Netherlands government supports capacity building in Myanmar. Capacity development for Water Governance in Myanmar targeted to senior and mid-level government officials, academia and senior level CSO leaders have been discussed and it has been agreed that a project concept note will be drawn up. A special request has been made by the NWRC for legal/policy assistance on the Water Framework Directive that is currently being drafted. This will be part of the Water Governance capacity building proposal. Additional programmes at academic level (NUFFIC) will be launched soon. The Netherlands has a long tradition in training water specialists from around the world in Delft (UNESCO-IHE, TU Delft), Wageningen (WUR), Enschede (ITC) and the World Water Academy (Stichting Wateropleidingen).

**Figure 23 Meiktila Lake**

**Figure 24 Bago-Sittaung water system Ramsar Site Moyingyi Wildlife Sanctuary**

# 9 Financing Mechanisms

After decades of isolation, Myanmar is currently undergoing a rapid political transformation towards a democracy based society accompanied with major economic and social reforms. Capitalising on these developments, most development partners have re-engaged with Myanmar and embarked on the formulation and implementation of programmes in support of the reform measures.

Private business (developers, financiers) have also found their way to Myanmar, with a view to taking advantage of the many opportunities. Because the country is developing from a very low base after decades of neglect, almost all sectors require massive investment. After the enactment of a new foreign investment law in November 2012 foreign direct investment surged as project initiatives were actively encouraged by the Government. High added value / high revenue potential sectors such as oil & gas, power generation, industrial zone development and related port and maritime infrastructure attracted massive foreign investor interest.

The water resources sector has also attracted wide interest. Financing in this sector mainly comes from public sources, as most measures aim at fulfilling public needs and have limited direct revenue generating potential. Funding for these projects can come from the following sources

(i) government budget, through taxes or government bonds;
(ii) grants from development partners;
(iii) loans made available by development partners at concessional terms or commercial banks with sovereign guarantees
(iv) available cash within government / utility companies from internally generated funds through user fees; and
(v) private finance (equity, loans, bonds, funds).

The Myanmar government budget, specifically its capital expenditure budget is constrained; hence other sources of finance are targeted. So far development partners – both bilateral and IFIs - have shown wide interest in the water resources sector. It is therefore expected that this will constitute a major source of finance.

Where – elements of – water resources management need a long-term investment, and where they need a more or less 'de-politicised' and sustained effort, establishment of a dedicated financing Fund could be considered in analogy of the Dutch Delta Fund. This offers the country the potential to work on a continuous and sustained development of basic infrastructure for vital elements of the country's economy and welfare. A typical source for such fund could be rooted in the income from Myanmar's natural resources in oil and gas.

Another approach to mobilise targeted, earmarked funding for water resources projects is the establishment of a fund mechanism. At the national level this can take the form of a dedicated national investment fund, which sources its funding from environment-related taxes and/or an allocation from concession fees from the natural resources extraction industry. Or, at the regional level, an Eco–compensation fund could be established, which would be funded directly by one or

more (big) infrastructure projects. This fund could then be used to fund environmental mitigation measures with regard to impacts on natural resources caused directly by said infrastructure projects as identified in an EIA.

The engagement of private finance (equity & debt) through PPP arrangements or other forms of private sector participation is rapidly developing. A healthy PPP enabling environment is critical for the successful engagement of private finance sources for infrastructure development. The GoM is receptive to the idea of PPPs, either on the initiative of private proponents through the Foreign Investment Law, or via a competitive public procedure with the GoM in the driving seat. Although the PPP environment is far from complete and many risks and (legal) uncertainties exist, both modalities offer opportunities to develop projects in the IWRM sector – specifically projects with a clear revenue generating potential, sufficient to make a viable business case.

# Colophon


## Myanmar IWRM Strategic Study

| | |
|---|---|
| assignment | RVO, Netherlands |
| partners Netherlands | Ministry of Infrastructure and Environment<br>Embassy of the Kingdom of the Netherlands, Bangkok<br>High Level Expert Team IWRM Myanmar |
| partners Myanmar | Ministry of Transport<br>Ministry of Agriculture and Irrigation<br>Expert Group of the National Water Resources Committee |
| collaboration | Ministry of Environmental Conservation and Forestry, Ministry of Livestock, Fisheries & Rural Development, Ministry of Electric Power, etc…. |
| production | Consortium Royal HaskoningDHV (lead firm)<br>Arcadis, Rebel Group, UNESCO-IHE, Dutch Water Authorities, Tygron |
| project | BC6929 |
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