

# **VERY-LOW-COST DOMESTIC ROOFWATER HARVESTING IN THE HUMID TROPICS: ITS ROLE IN WATER POLICY**



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## 1. INTRODUCTION

Global demand for good quality water is increasing, yet changes in climate are reducing yields from some water sources. The resource availability to cater for all the demand is already limited. The potential for new *large-scale* water resource development in poorer countries is meanwhile declining due to financial constraints and donor policies. Therefore, interest is growing in improving household water availability via the development of *small-scale* water sources.

People have their own ways of developing such small-scale sources. Localized ground water recharge, collection of surface run-off and rainwater harvesting are some of the interventions adopted by communities. These are interventions people traditionally resorted to when there was a crisis and the affected communities always knew the technology that would bring them most benefits with least cost. Among the options available, rainwater harvesting, including roof water harvesting have become very popular among rural and semi-urban low-income communities.

Domestic Roof Water Harvesting (DRWH) is often considered to be a traditional method of water collection and storage. The practice of DRWH can be traced back many centuries, especially in countries like Sri Lanka and India where DRWH is mentioned in ancient inscriptions as far back as 5<sup>th</sup> century BC. However, types and methods of DRWH have changed over time and many different systems are now available all over the world.

After a relatively long period in oblivion, domestic rainwater harvesting (or DRWH) is currently making an impact in many countries (especially in the developing world) as an alternative household water supply option. A number of reasons can be attributed to this resurgence, the more important of which are as follows:

- 1) Decrease in the quantity and quality of both groundwater and surface water
- 2) Failure of many piped water schemes due to poor operation and maintenance of infrastructure.
- 3) Improvement in roofing material from thatched to more impervious materials like tile, corrugated iron sheets and asbestos.
- 4) Increased availability of low cost DRWH technology
- 5) Shift from more centralized to decentralized management and development of water resources.
- 6) Increase in importance of community ownership of development infrastructure.
- 7) Increase in competition between different water sectors and the global trend towards rural to urban migration.

During the past two decades significant development in rainwater harvesting has taken place both in the developed and in the developing countries. The growth in uptake of rainwater harvesting in the developing countries has been most significant in Thailand, Sri Lanka, Kenya, India, Ethiopia, Uganda and Brazil. In all these countries rainwater harvesting had been developed as a means of increased household water security, mostly for the rural communities. This is understandable as rural poor are the most vulnerable in water scarcity situations. Interestingly, excepting in the case Thailand, in all other countries development and promotion of rainwater harvesting or DRWH has been done by either development NGO's or special projects which deals mainly with rural water supply. In Thailand, however, the development of domestic roof water harvesting programme, which commenced during

the United Nations declared ‘Water Decade’ in the 1980’s, was fully supported by the government. However, in all these situations there was no clear evidence of any National Policy to strongly support DRWH. What did happen specifically in North East Thailand was a high level of commitment by the NGO’s, universities, private sector and the government at local, provincial and central level. However, there were other environmental conditions that were specific to North East Thailand that contributed to the success of the programme.

Therefore, development and fostering of rainwater harvesting or DRWH thus far have little to do with country-specific National Policies.

This report, examines the current status of National Water Policies with respect to development of rainwater harvesting including roof water harvesting. The study examines the policies of Sri Lanka, India, Bangladesh and Thailand from the Asian continent and Kenya, Ethiopia and Uganda from the African continent.

The report is part of a larger study on “Domestic Roof water Harvesting for poorer Households” coordinated by Warwick University and supported by DFID.

## 2. DIFFERENCES BETWEEN RWH AND DRWH

The Traditional Wisdom of water harvesting refers to rainwater harvesting. This includes

- collection of surface run off from a prepared catchment, commonly found in Sri Lanka and South India,
- collection of water from rock catchments, found in some parts of Africa,
- collection of water from trees, popular in tropical Asia and occasionally practised in Africa,
- direct catchment of falling rain as found in the deserts of India and Pakistan and
- roof water harvesting which is fast becoming popular round the world as a household water source.

DRWH is only a sub set of rainwater harvesting: policies and legislation mostly refer to the generality. The popular means of water harvesting is surface run-off which provides a large quantity of low-quality water mainly for agriculture. In the water policies of the African countries, especially Kenya, mention of RWH as a means of poverty alleviation refers to harnessing water by constructing appropriate dams and pans for collection of water for small-scale agriculture and livestock. Reference to DRWH is limited; it comes under “water and sewerage development” mainly as a source of household water for urban and rural households. Though ‘rainwater harvesting’ refers to harnessing rain in any form, its meaning differs from country to country. In Kenya, it can mean both surface run off and roofwater harvesting while in Sri Lanka it means only roofwater harvesting (harvesting surface run off for food production is referred to as ‘irrigation under minor or major reservoirs’). In Thailand the term also refers exclusively to roof run-off harvesting.

Due to recent rapid development of roof water harvesting in some countries, some policy documents now distinguish between roof water harvesting and rainwater harvesting. In Thailand, where the largest development of roof water harvesting took place in the 1980’s, neither rainwater harvesting nor roofwater harvesting are mentioned in the current Water Act. Bangladeshi water policy clearly identifies the problems associated with over-use of surface and ground water, which has been causing depletion and pollution of ground water resulting in salt-water intrusions and arsenic threats. While the policy recognizes sustainable development of surface, ground and *rainwater* as a possible solution, it

does not refer to roofwater harvesting though what is intended in developing rainwater use is nothing but roofwater harvesting.

Therefore, the implementation of policies is subject to interpretation, depending on the need of the hour.

### **3. SURFACE AND GROUNDWATER DEVELOPMENT**

Conventional recognition of water-resource development limited to surface and ground water. Therefore, most of the resource allocations and development incentives have been channelled towards these two forms of water source. Water legislation in Kenya and Uganda clearly identifies surface and groundwater as the sources of water resources development, where user rights to water is only limited to these two sources.

In Sri Lanka and India emphasis still lies with surface and ground water for all water resources development but rainwater harvesting including roof water harvesting has been included as a ‘non conventional’ resource to supplement conventional sources. Given the severe water shortage conditions experienced in many parts of India, not surprisingly policy documents categorically mentions bringing all water resources into the category of “utilizable water resources” to the maximum possible extent. This clearly emphasises the gravity of the water crisis and the commitment of the government. India is a large country and water development is largely devolved to individual states. Some states like Tamil Nadu and Andhra Pradesh have included roofwater harvesting in their local statutes as a source of domestic water supply (Sethi 2002). However, states like Maharashtra, still consider surface and ground water as the only resources for development. Bangladesh, while recognizing surface and groundwater harnessing for future equitable and efficient water utilization, acknowledges conjunctive use of rainwater, surface and ground water in the preparation of drought monitoring and contingency plans. Thailand is the only country among the seven countries examined under this study, which recognizes atmospheric water in their Water Act. However, there is no recognition given in that Act to the development and utilization of this source even under emergency situations.

### **4. RAINWATER HARVESTING AS A “TRADITIONAL PRACTICE”**

Despite the role rainwater harvesting can play in improving household water security, it has always been considered as a “traditional practice”. This thinking has pushed rainwater or DRWH into a technology of the past. The Indian National water policy clearly mentions that rainwater harvesting as traditional practice. Though the Sri Lankan National Water Resources Policy does not give such reference to rainwater harvesting in its policy, the recognition of many policy makers with respect to rainwater harvesting or DRWH is still very much “traditional”. The Ethiopian water policy, specify, refers to “promotion and enhancement of traditional and localized water harvesting techniques which depends on local resources and indigenous skills”. In the Kenyan water policy, rainwater harvesting is referred to as an appropriate or alternative technology, which in away a graduation in the thinking towards positive development of rainwater harvesting technology.

The “traditional” thinking of rainwater harvesting is an impediment to development of the concept of roofwater harvesting. There is a tendency to think that modern day centralised engineering

technologies are more superior to traditional technologies. This invariably has originated from a service and a coverage point of view rather than from a point of sustainability and household water security.

However, as indicated by Smet and Moriarty (2001) there is a great resurgence of rainwater harvesting as a domestic and a productive water use in the recent past.

## 5. WHAT DO THE POLICIES SAY

Every policy under this study clearly indicates the growing need for safe or portable water to meet basic human needs. It also mentions of water resources scarcity in the aggregate or spatially and temporarily. Statistics have been presented to indicate the large number of population affected due to lack of safe water, specially the rural poor.

The solution to most of the water problems appears to be “water resources management and re allocation of water”. While development of water resources have been mentioned, there is less emphasis given to small-scale water resources development and community management. This approach can be attributed to “water sector reforms” which has been advocated by many donor agencies. It is unfortunate that most of the donor assistance comes with a “package” with little room for deviation. This could be the reason that one observes a “blue print” in most of the National Water Policies in these countries. Some times the blue prints have been strong enough to influence countries that are not directly under donor support but yet follow the “blue print” approach in formulating their policies. Kenyan policy is a good example of this situation but the policy makers have made a concerted effort to include small-scale water resources management and community development as a part and parcel of over all water resources development.

Therefore, development of rainwater harvesting or DRWH for domestic use has to be viewed within the larger context of water sector reforms. However, what is encouraging is that most policies have allowed adequate provision to included options/technologies like DRWH in interpretation of policy into practice.

Policies have to be viewed only as a guideline to select essential options to be used as instruments for achieving intended goals and objectives. As such policies only serve as a directive principle.

The current water situation in many countries provides the opportunity to develop a “third” source for household water security. In Kenya, the available fresh water is only 647m<sup>3</sup>/per-capita/year and this is expected to decline to 324m<sup>3</sup>/per-capita/year by 2025, in Ethiopia, only 17% of the population has access to clean and safe water, the situation in India is that by 2025, nearly 2/3 of the population will be living in areas with less than 1000m<sup>3</sup>/per-capita/year, too little to sustain economic growth (the economist 2002) and with predictions of no significant water scarcities in the aggregate terms even by 2025, only 60% of the rural population in Sri Lanka has access to safe water. All these assessments are based on the availability of surface and ground water. None of the policies reviewed impose an exclusive ban on developing other sources of water including DRWH to meet the present and future requirement. However, policies of Ethiopia and Thailand does not mention RWH or DRWH as an option for water supply, nevertheless the policies are “open” to adopt any suitable technology to attain household water security.

## 6. COMMUNITY VERSES STATE OWNERSHIP IN WATER RESOURCES DEVELOPMENT

This apparently is the current debate in the water sector reforms. The presumption of most activists is that water resources development should be transferred to community ownership for it to serve the communities and attain sustainable development. All water policies contribute to this view but are still engrossed in the conventional state ownership of water resources. This unclear attitude in most policies has contributed negatively to development of DRWH among many other user-friendly technologies. Countries like Kenya, Uganda, Bangladesh and Thailand explicitly states that the ownership of water resources development vests in the state but mention the intention of decentralizing decision making authority with river basin committees (RBS), which are water user communities. This type of transformation may not help to achieve the intended benefits in water resources development. In many of the committees, the state representation out numbers the water user representation.

In Thailand, all water resources including atmospheric water belongs to the state or “under the care of the government agency”. State holds the power to develop water resources for the benefit of the people. Even though Thailand too follow the concept of river basin development, representation in the RBCs is totally dominated by government officials. This type of water resources development decentralization will not promote concepts like DRWH. However, as mentioned before, Thailand is the only country in the world where DRWH has developed and expanded to unprecedented levels during the 1980’s. This brings us to issue of National Water Policies and “Government Policies” of the day. The present “water act” (1997) does not mention about development of small-scale water resources including DRWH. However, respective governments have the authority to prioritize water development depending on the need and requirement of the time.

Indian policy does not refer to either state or community ownership of water resources but adopts the concept of river basin management as the legitimate unit for future water resources development. The anticipation of the policy is that water resources planning at basin or sub-basin level will take into consideration best possible options for sustainable water resources development. If this approach succeeds, DRWH as an option for household water security should take priority. Taking into consideration the history of rainwater harvesting in different states of India, prioritizing DRWH within a basin plan should be a reality. However, experience from states like Andhra Pradesh indicates that though the “Water Land and Tree act” of 2000, (Down to Earth 2002) delegates powers to local authorities in decision making regards to water resources development, their representation in the committees or authority is merely recommendatory with designated government officials taking all the decisions. Such implementation of policies will not benefit development of non-conventional water supply options like DRWH. While policies emphasis on “community participation and management” in implementation what matters is the commitment of the “officials in soliciting community participation and “willingness” to transfer systems to beneficiary communities.

The same sentiments have been expressed by none other than the Prime Minister Of India on the “National Water Policy” of India. He was of the opinion that the policies should be more “people centred” recognizing communities as the rightful custodian of water. Further he has emphasized the need to slacken the “exclusive control of water development by the government machinery” thus paving the way to a new paradigm shift in “local management of water resources”( Devraj 2001)

The Kenyan “water bill” of 2002, clearly mentions that the country’s water resources are vested with the state and the minister in charge has the right to control over every water resources. However, water

resources in the context of the Kenyan water bill refers only to surface and ground water. Therefore it is not clear whether the water bill covers rainwater as well. The water bill also gives preference to “state water supply schemes” over “community schemes”. This can hinder the development of DRWH, which are essentially community schemes. Under the description of state schemes given in section 19 (2) rainwater harvesting or DRWH has not been mentioned as a source of water supply for “public purpose”. Therefore, the water bill does not encourage the concept of RWH/DRWH. However, contrary to the water bill, the “National Policy on Water Resources Management and Development” explicitly mentions on the development of DRWH in urban and rural areas as a source for domestic water supply. The policy also gives recognition to community management of water resources and emphasizes the importance of decision making at various management levels including river basins and sub basins. Therefore, it is evident that sustainability of DRWH in Kenya will depend to a large extent on resolving the conflict between the “policy” and the “bill”. In Uganda too water resources are vested with the state and all right to develop water is vested with the minister in charge and the Director, Directorate of Water development (DWD). Here too, water refers only to surface and ground water and the status of rainwater before it reaches the ground is not explicit. However, according to the act the minister has right to declare and define “water” from time to time (Gama 1999). The development of rainwater harvesting or DRWH in the Ugandan context can be covered under section 18 of the act, where the Director DWD can exempt persons constructing/improving/maintaining any water works, from the provision of section 18 of the act as he deemed necessary. Most NGOs and local community organizations operate under this clause for development of water resources for community purposes.

In Sri Lanka, the “National Water Resources Policy” and the “Water Act” are consistent with development of non conventional water resources. Policy specifies DRWH as a means for household water security and poverty alleviation, while DRWH is one of the components listed under the “Water Resources Plan” in the water act section 54 (3) (b). This will give legitimacy to DRWH in future water resources development and also sustainability of hitherto developed DRWH systems. Sri Lankan water act, also lay emphasis on decentralized decision making at river basin level, where the representation of water users in river basin committees constitute more than 50% of the total membership. This will give more authority to water users in selecting options of their choice. With vast proliferation of DRWH in rural areas during the past decade, the possibility of it becoming a sustainable source of household water supply is encouraging.

Of the country policies examined, Sri Lankan policy recognizes “private water use rights”. This is certainly a DRWH friendly policy issue, where roof water collection will be classified as one's own private water source. Thus, there should not be any legal obstacles in development of DRWH. Incidentally, DRWH appears to be the only “private water” one can claim for when “water” is declared as public property. In the recent trends in globalization of water, DRWH will be the only source that could remain as “free”.



## Ownership of water and its impact on development of DRWH

Country	Status	Description
Sri Lanka	Public ownership	No restriction on development of DRWH
India	Not specified	Water is a state subject. No potential threat to development of DRWH
Bangladesh	State ownership	No constraints on development of DRWH
Thailand	State ownership including atmospheric water	Storage of water requires a license as decided by the river basin committees
Kenya	State ownership	Requires a permit to construct water works. Not clear whether this includes DRWH. No restriction on water for domestic use.
Uganda	State ownership	Requires a permit for water development but not clear as to whether this includes DRWH. No restriction on water for domestic use.
Ethiopia	Public ownership	No permit is required. But large scale water development is not permitted without permission. Status of DRWH is not clear. No restriction on water for domestic use.

## 7. PROMOTERS OF DRWH

Though no policy gives a clear mandate to development and management of DRWH, the concept has been accepted by millions of people round the world. In the absence of a policy there had been strong “promoters” of the concept of DRWH in the countries where it has been successful.

In Thailand, the success of the million rainwater jar programme was due to dedicated commitment of the government machinery at the time. The environmental condition too supported the rapid spread of DRWH, specially in North East Thailand.

Though the Indian policy mentions of DRWH, there is a strong lobby that campaigns for further recognition for DRWH as a sustainable household water supply option. These lobby groups accuse the National Water Policy being biased towards dam building and costly irrigation and water supply schemes, ignoring the traditional methods of rainwater harvesting.

Widespread rainwater harvesting including DRWH in Kenya is also due to strong NGO movement in support of rainwater harvesting. The Kenya Rainwater Association (KRA) has been the prime mover of the concept of rainwater harvesting in Kenya. Result of their lobby is reflected in the budget speech of 2002/2003 where the taxation policy proposes to impose an additional tax of 1 Kshs per liter of kerosene, which would raise a total of 600 million Kshs for development of water harvesting, flood control as well as dam construction (budget speech 2002/2003).

Sri Lanka is another country where DRWH has been promoted by an NGO (Lanka Rainwater Harvesting Forum). The large-scale adoption of DRWH in Sri Lanka is solely due the efforts of LRWHF and donor supported rural water supply projects, which adopted the concept as a viable option.

This clearly indicates that the “neighbours tank” or the demonstrative effect has been the key to development and promotion of DRWH in the absence of an enabling policy and legislation.

Subsidies to the poor and the disadvantaged are highlighted in Asian water policies. In the development and promotional process of DRWH, it is vital that respective governments (specially in

developing countries) subsidise DRWH. This strategy was adopted in Thailand during the rapid development phase of DRWH. Commercialization of DRWH in North East Thailand is the successor to the initial subsidized phase.

Water policies of India and Sri Lanka clearly mention the commitment to subsidize water resources development for the poor and disadvantage groups. The National Water Supply and Drainage Board (NWSDB), in Sri Lanka, offers a 80% subsidy for DRWH mainly to promote the concept as a household water security option. Therefore, if subsidies can be properly targeted and well focused the desired results of improving household water security can be attained.

## 8. POLICY CONSTRAINTS TO DEVELOPMENT OF DRWH

One of the main reasons for lack of support expressed in most National Water Policies towards DRWH is due to sectoral water development thinking. The old school theory of water development was unisectoral with least respect to other water sectors. With no competition for available water resources, this approach was sustained in the past. However, with increased socio economic development, demand for fresh water has increased. To cater to the demand, most countries have adopted Integrated Water Resources Management (IWRM) strategies, which considers “water resources management” rather than “water Management”.

Due to single sector development approach in the past, professional outlook was limited to only surface and ground water development. This was highlighted as a policy constraint by the General Secretary of the KRA, where he emphasizes the lack of trained and skilled persons in DRWH as a problem to promote the technology as a viable sources of water supply.

Simplicity and community orientation of DRWH technology has also been highlighted as another constraint in developing DRWH. According to Wanyonyi (2002) the western educated professionals find it difficult to understand the appropriate technologies like DRWH for rural poor, thus, it becomes difficult to promote such technologies at national level.

This situation can change with respect to different countries. In Sri Lanka, there are no visible constraints to development of DRWH. However, the older generation of water professional are ignorant or reluctant to appreciate and adopt DRWH. The new generation of water professionals are more alive to new innovations and have been a major contributory factor to the development of DRWH in Sri Lanka

The paragraph 251 of the Building code (city council by-laws) in Kenya, specifies action to be taken with respect to roof run off. The Building code specifies effective disposal of roof water but do not give any reference to storage and utilization of rainwater.

The Thai water act, section 9, stipulates that anybody in possession of stored water during times of drought is expected to share it for public utilization. If unreasonable quantities are stored the minister or his representative has the right to take the surplus water for public utilization without any compensation to the owner of such water. Such punitive regulation can be hostile towards development of DRWH. According to section 38 of the Thai water act, storage of water (including atmospheric water) for any purpose shall require a license.

Such regulations if enforced can be very harmful to the development of DRWH. However, implementation of these laws can be difficult due to vagueness of some of the laws.

According to the Kenyan water bill, a permit is required to extract water from a water resources except for domestic purposes without “employment of works”. However, as the water bill does not refer to DRWH it is not clear whether this provision applies in the case of community DRWH systems. The water bill stipulates that the “authority” will not approve any community project unless the person/s owning or occupying at least two third of such land approves the project. These laws if interpreted to include DRWH can be a constraint to development of the concept of rainwater harvesting for domestic use.

The National Water Resources Act of Sri Lanka allocates water to “bulk user” through a system of permits. At present this system refers only to surface and ground water. Therefore, collection and storage of roof run off is not affected by this system of permits.

## 9. INSTITUTIONAL WEAKNESSES

One on the fundamental factors for the success of any technology or a concept is its “ownership”. There should be an institution that takes the ownership to develop and foster the technology. While both surface and groundwater are owned by their respective institutional mechanisms, DRWH has no such owner. Both Kenyan and Ugandan policies have identified number of organizations at various levels responsible for water sector development and management. However, none of these organizations are responsible for development and promoting DRWH. Lack of quality standards and poor operation and maintenance, lack of allocation responsibilities and unclear definition of sector development roles are direct result of lack of an adequate institutional mechanisms for DRWH. Inadequate professionals and lack of awareness on DRWH in many countries is a result of institutional weaknesses. Poor institutional structure is sited (Wanyonyn 2002) as one of the major causes threatening the sustainability of DRWH. It has been pointed out as a reason hindering the widespread development of DRWH.

However, the situation is expected to change with the current water sector reforms where development of water resources will be taken up as an integrated approach. It is expected that water in all its forms will be considered for development and management. With renewed interest in DRWH, it is expected that DRWH will be taken as a major source for development. Such development will essentially need institutional ownership if the technology and the concept are to be developed to serve as a means of household water security.

## 10. CONCLUSION

With global water sector reforms, water policies are changing their scope of development and management. Many National Water Policies, Sri Lanka, India, Bangladesh and Kenya have recognized the role DRWH in domestic water supply. These policies have supported enabling legislations in countries like Sri Lanka to adopt DRWH in water sector implementation plans. Polices which do not directly support DRWH (Ethiopia and Uganda) provide provision for inclusion of DRWH.

The success of DWRH in the past has not been due to strong policies but for special reasons and circumstances. However, it is widely believed that enabling policies and legislation will be vital for the sustainability of DRWH in future. Currently, it is the NGOs and special projects that foster DRWH. This trend can’t continue unless there is state commitment. It has also been recognized that

the ownership of water should be handed over to the water user communities, while demand responsive approaches should be adopted in selecting water supply options. This will naturally pave the way for development and promotion of DRWH where the need is felt most.

With the current prices of construction material, DRWH will have to be subsidies for it to be popular among the poorer section of the population. Except for Thailand, commercialization of DRWH is not within close quarters in the seven countries studied. Therefore, the role of the state in sustaining the concept is very important. Besides the Thai water legislation, all other policies and acts do not discourage the concept of DRWH. Certain clauses in the Thai legislation can discourage future development of DRWH if the legislation is enforced as it is.

Most countries have number of legislations and institutions dealing with water sector development. Uncoordinated distribution of functions and responsibilities among these institutions has been recognized as major institutional weakness in development of DRWH. It is strongly believed that Integrated Water Resources Development, which is the basic principle of current water sector reforms, will minimize the sector bias development of water resources. Thus, encouraging water development as a whole. With the mandate of water development given to water users, DRWH, no doubt will form a part in this process of development.

## 11. RECOMMENDATIONS

- National Water Policies should recognize rainwater as the third source of water for development and management
- Rights to develop “private water” should be established.
- Development of water should be decentralized and communities should be empowered to select the best option depending on the demand
- Water sector reforms should minimize conflicts among different policies for water development
- Water legislations should reflect the country policies for water resources development and should not contradict each other.
- Development of National Water Resources policies under sector reforms should be consistent with other existing policies and repeal any objectionable clauses for development of DRWH
- DRWH should be given equal priority in establishment of new institutions for water resources management.
- Education and Awareness on DRWH should be taken as priority for all water professional
- Institutional responsibility for development and sustainability of DRWH should be included in future water sector institute development plans.
- Household water supply through multiple water sources should be encouraged.
- Policies should include a subsidy for the poor and the disadvantage to adopt DRWH with suitable community contributions as equity.

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