CUVEwaters integrated water resources management

Initial check list for rain- and floodwater harvesting (roof and ground catchments, oshanas)

If you want to proceed with rain or floodwater harvesting at the envisaged location, you need to answer 'YES' to each of the questions:

- ☐ Is there an interest in the community/some households to grow vegetables in irrigated gardens?
- ☐ Do some householders think that the current water provision is thought to be seriously inadequate in quantity, quality, reliability or convenience to realise a gardening project?
- ☐ Does the capacity to design and construct rain or floodwater harvesting systems in the area exist, or could the capacity be developed in a suitable time or could external trainers be hired?
- ☐ Are there suitable roofs for rainwater harvesting or suitable oshanas for floodwater harvesting?

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Checklist for assessing feasibility of RFWH system

Technical feasibility

- ☐ Is rainfall and catchment/roof surface area or usable oshana water volume sufficient to meet the demand?
- ☐ Is the design appropriate (e.g. easy to maintain)?
- ☐ Are materials available?
- ☐ Are skills locally available?

Social and economic feasibility

- ☐ Is there a real need for producing vegetables (for subsistence or the market)?
- ☐ Is the design affordable and cost-effective?
- ☐ Is the community enthusiastic and fully involved?

Environmental feasibility and health

- ☐ Will rain/floodwater harvesting improve both the quantity and quality of the available water?
- ☐ Do we expect a positive impact on the users' health (food provision)?

Reasonable combinations of water sources

- ☐ Have we investigated all reasonable alternative means of water provision (including tap water)?
- ☐ Have we considered other options in combination with rain/floodwater supply?

If you cannot answer all of the questions above, please contact Issac Kariuki.

Technology Toolkit for Rain- and Floodwater Harvesting

Main decision steps towards running a sustainable rain- or floodwater harvesting facility for gardening

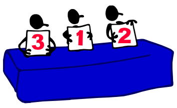
Julia Röhrig and Alexander Jokisch

Precondition:

Desire to improve water supply for gardening

1. Is rain or floodwater harvesting a feasible option?

yes ↓ — no → Other options should be followed.



2. Is the intended use of the harvested water to irrigate a garden?

yes ↓ — no → Other options should be implemented.

3. Will we implement rain or floodwater harvesting?

yes ↓ — no → Other options should be implemented.

4. Which design of RFWH is feasible?

↓

5. What is necessary to construct RFWH structure?

↓

6. What is necessary for sustainable operation and maintenance of RFWH structure?

Technology Toolkit for Rain- and Floodwater Harvesting

Main decision and action steps towards running a sustainable rain- or floodwater harvesting for gardening

Julia Röhrig and Alexander Jokisch

Problem

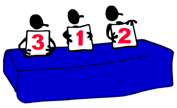
water scarcity,
unreliable water supply,
food insecurity, etc.

Goal

improve water availability,
improve food security due to own gardening,
overcome poverty,
generate income, etc.

Data/Information

current water sources,
rainfall data,
water demand,
rainwater harvesting options,
gardening options,
availability of labor,
financial options, etc.



Understanding

integration,
evaluation of feasibility, etc.

Alternatives

cost-benefit analyses,
scenario analyses,
advantages/disadvantages, etc.

Decision

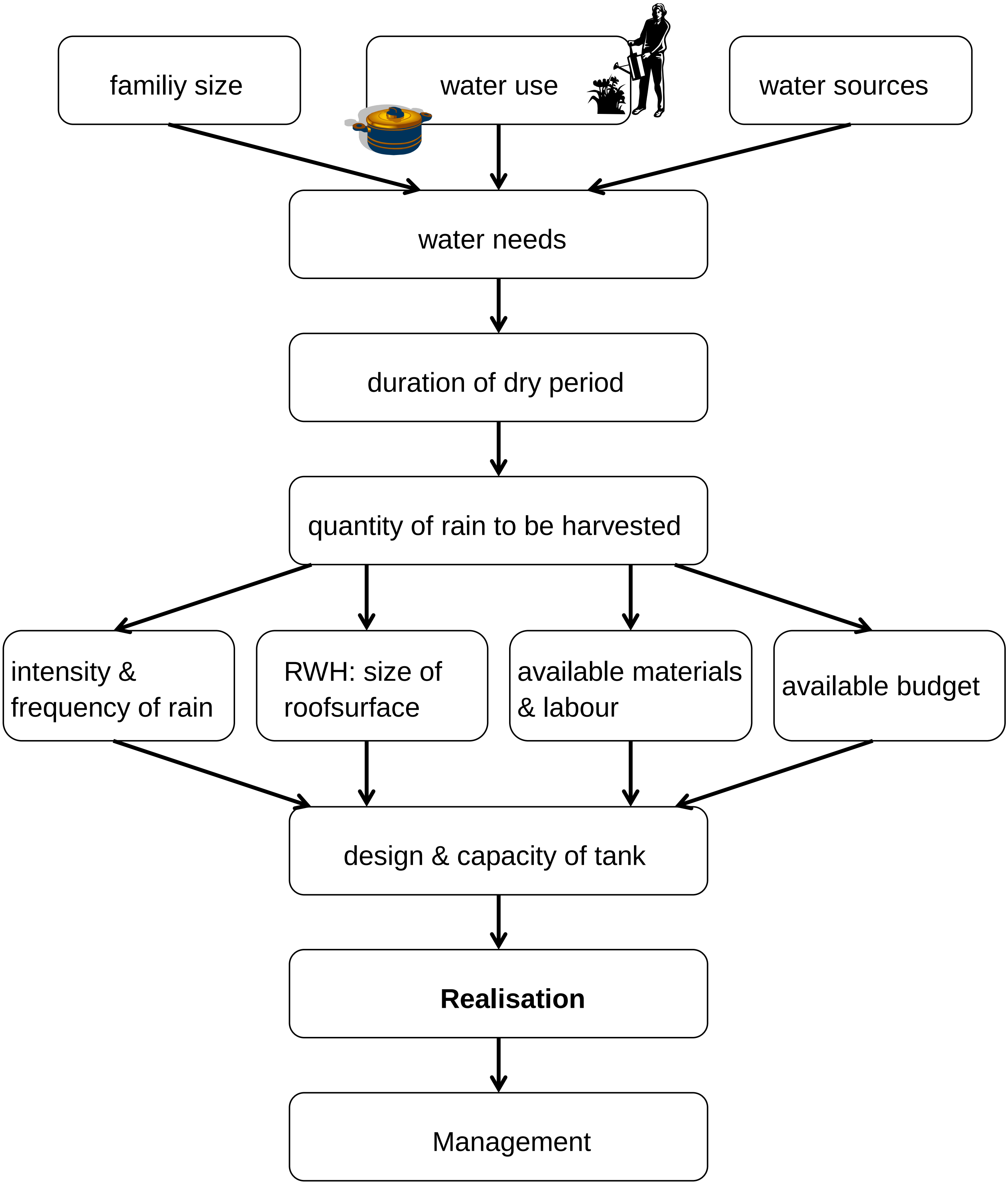
evaluation of alternatives,
preferences, etc.

Action

designing of feasible structure,
capacity development,
construction,
operation and maintenance, etc.

Technology Toolkit for Rain- and Floodwater Harvesting

Issues which you need to consider designing your rain- and floodwater harvesting system



Source: J. Röhrig, adapted from Worm & van Hattam (2006):26

Designing a rainwater harvesting system (RWH)

This document illustrates the major steps for designing a rainwater harvesting structure. Information needed for the determination are marked by the pen-symbol .

5 steps to design your rainwater harvesting facility

1. Step: Estimate your water demand

2. Step: Determine the total amount of available rainwater

3. Step: Select and design your catchment area

4. Step: Determine the possible size of the tank

5. Step: Select suitable shape and materials for your tank

1. Step: Estimate your water demand

The estimation of the water demand is a helpful first step in designing a rainwater harvesting system. This determination of water needs is often difficult and should be assessed within a participatory process, while some guiding numbers are given here.

The following issues should be considered:

a) For what do you want to use the harvested rainwater?

- Gardening
- Domestic use, such as cooking or cleaning
- Drinking, etc.

➔ **Estimate the average water demand for all purposed uses for each day by one person.**

The use per day for one person is: _______ litres

b) How many people will use the water?

➔ **Determine the number of users, who will use the water for purposes mentioned above.**

The number of users is: _______

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c) Over which time rainwater shall be used?

- Water shall be used only in the dry period
- Water shall be used over the whole year for gardening or domestic uses, such as cleaning (other reliable water source is available)
- Water shall be used over the whole year for gardening, domestic uses and drinking (there is no other reliable water source permanent available).

➔ **Determine the period, for which rainwater is needed**

The DAYS per year harvested rainwater is needed: ______

Now the total water demand can be determined.

➔ **The total water demand over a year can be calculated using following equation:**

DEMAND = USE x USERS x DAYS

The DEMAND of harvested rainwater is: ______

2. Step: Determine the total amount of available rainwater

To determine the total amount of available rainwater you have to know the total amount of average yearly rainfall as well as the timeframe when rain falls.

The average annual rainfall in central-northern Namibia is 470mm (0.47m), most rain falls between November and March with little rain also in October and April. From May to September it is normally completely dry. Rain often falls in very localized scattered thundershowers. If you want to know the yearly average rainfall for other regions in Namibia you can check the homepage of the Namibian Meteorological Service: http://www.meteona.com/.

3. Step: Select and design your catchment area

To harvest sufficient amounts of rainwater you need a suitable catchment area. For good water quality the best catchment areas are the roofs of houses, schools, clinics etc. Ideally these building have roofs made of corrugated iron sheets which have comparable high runoff coefficients. That means that most rainwater that falls on this material is running to the tank and only a little fraction of the water evaporates or is lost. The runoff coefficient of corrugated iron can be set at 85% or 0.85. That means that at least 85% of the rainwater reaches the tank.

4. Step: Determine the possible and necessary storage capacity of the tank

To determine how much water can be harvested in a year you also have to measure the size (in m^2) of the catchment surface. Once you have measured the catchment surface area you have to multiply it with the yearly average rainfall (from Step 2) and the runoff coefficient (from Step 3) using the following equation:

Catchment surface (in m^2) x Yearly average rainfall (m/m^2) x Runoff coefficient

= Amount of harvested rainwater (m^3)

The following example shows a simple measurement of rainwater that can be harvested from a rural household in central northern Namibia. For this example the surface area of the roof (catchment) is set at 100 m^2 and the roof material is corrugated iron:

Catchment surface 100 m^2 x Yearly average rainfall 0.45m/m^2 x Runoff coefficient 0.85

= 38.25 m^3

Please note that other materials such as thatched roofs can have much lower runoff coefficients!

5. Step: Select suitable shape and materials for your tank

The selection of a suitable material for tank construction depends mainly on the availability of material as well as the skills of the tank construction technician(s). Tank materials for household use that were successfully tested in central northern Namibia by the CuveWaters project where

- Ferrocement
- Brick
- Polyethylene

Instead of storing the water in an above surface tank the water can also be stored in underground tanks in round or rectangular shape. Another successfully tested storage option for rainwater is ponds made of dam liner. Ponds are generally easier to construct and are also cheaper. Main advantage of tanks compared to ponds is that they have longer lifetimes and are easier to maintain.

Basic requirements for Rainwater Harvesting (roof catchments)

If these requirements are fulfilled rainwater harvesting structure can be designed.

Environment

- General rule concerning rainfall amount: rainfall should be over 50 mm/month for at least half a year or 300 mm/year (unless other sources are extremely scarce) to make RWH environmentally feasible
- If possible there should be no vegetation cover directly over the roof

Technology

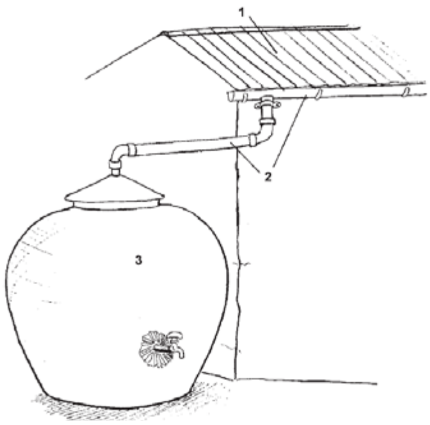
There are three basic components of a rainwater harvesting:

1.) catchment

2.) delivery system, and

3.) storage reservoir

- roof should be constructed by an impermeable material such as iron sheets, tiles or asbestos cement,
- local availability of construction material and tools
- availability of an area of at least 1 m² near each house for the construction of a storage tank
- knowledge about required storage capacity



Source: Worm & van Hattum (2006):12

Human resources

- community should be enthusiastic and fully involved
- availability of labourers with technical building and reparation skills in or nearby the community
- availability of people taking care for maintenance measures, such as regularly cleaning of the structure

Economy

- availability of financial resources or support to implement and operate it

Specific requirements for related gardening activities

- if RWH is planned for private households, than there should be a market to sell the products in the accessible surrounding

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Quality control checklist for tank construction

To make sure that the tank was well constructed you should check the following:

1. Was the tank carefully sited in the compound and in a firm stable soil?
2. Was the cement stored on a platform, covered in a shed, protected from moisture?
3. Were there no lumps in any of the cement bags when the bags were opened?
4. Was the sand used in the cement plaster clean?
5. Was the cement and sand mixed thoroughly until the mixture was all one color before adding water?
6. Was the water used in the cement plaster clean?
7. Was the plaster fairly dry, with just enough water added to make it stick together?
8. Was there no more plaster mixed than could be used within one hour?
9. Did the chicken wire overlap by at least 15cm?
10. Was the final coat of plaster trawled on smooth?
11. Was the final coat of nil inside pressed firmly with steel?
12. Is there more metal reinforcement, protruding from the finished plaster?
13. Are there no cracks in the nil layers of more than 5mm after one week of curing?
14. Was the tank splashed with water 4 hours after each of the plaster or nil, and covered with plastic sheeting, and kept moist, never allowing the cement to dry to a light gray color until for at least 4 weeks?