AN INNOVATIVE WATER TANK PROJECT
CHUMPUANG, THAILAND

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Directed by Hans Wamsler

KULeuven-PGCHS
Sponsored by
PROTO

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Marleen Iterbeke and Paul Jacobus are staff-members of the Post Graduate Centre Human Settlements (PGCHS) of the Catholic University of Leuven (KULeuven) in Belgium, seconded to the Division of Human Settlements Development (HSD) of the Asian Institute of Technology (AIT) in Thailand in the framework of a cooperation project on Low-Cost Housing, directed by Dr Han Verschure

This project is sponsored by the Flemish Inter-University Council (VLIR), funded by the Belgian Development Cooperation (ABOS) with assistance of the Flemish Association for Educational Programs Abroad (VVOB) and the KULeuven Although the know-how is developed within the framework of the Low-Cost Housing Project, the NGO 'PROTOS' has seperately sponsored the construction of 25 water tanks

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CHUMPUANG, THAILAND

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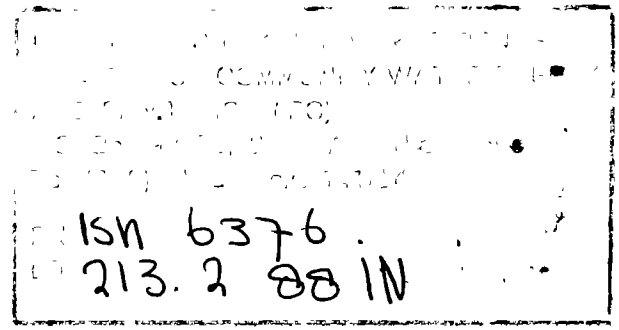

Sponsored by
PROTOS-Belgium

Implemented by
KULeuven-PGCHS

In Cooperation with
ALRO-Khorat

As a follow-up of the
KUL-AIT LOW-COST HOUSING PROJECT
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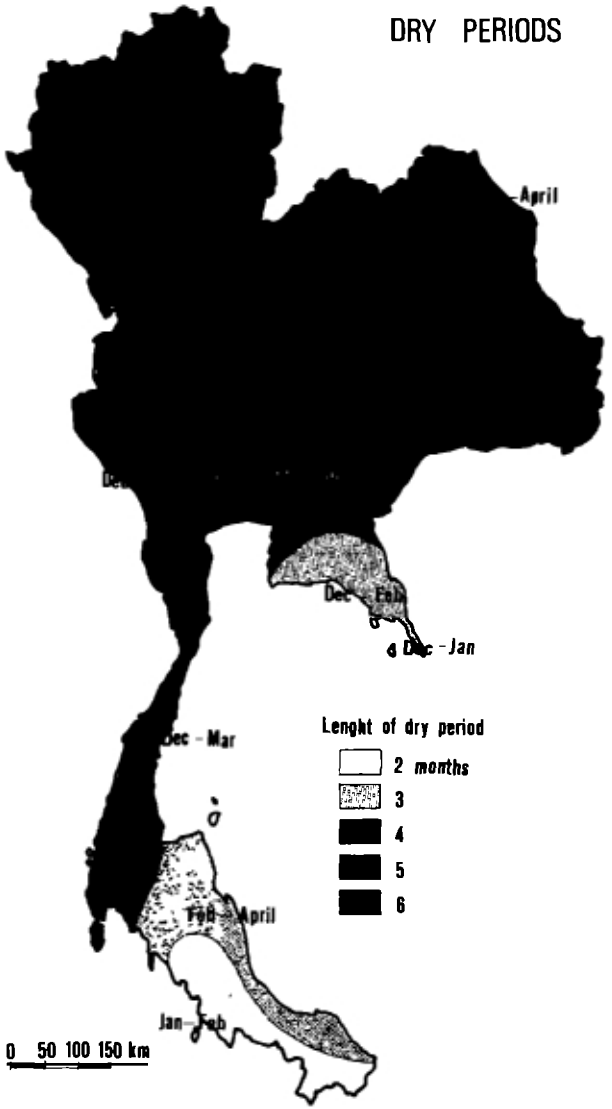
VLIR, ABOS and VVOB

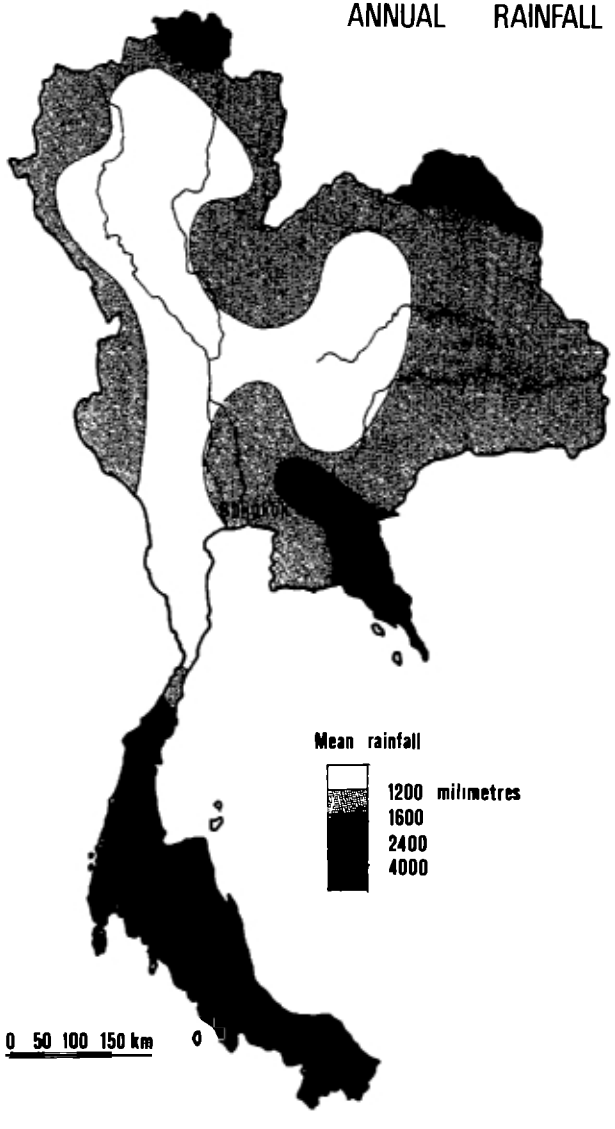
1. THE **PROBLEM OF WATER SUPPLY** IN THE NORTH-EASTERN PROVINCES OF THAILAND



Length of dry periods in Thailand. A dry month receives a mean annual rainfall of less than 60 millimeters. (source; Thailand, the Environment of Modernisation, L. Sternstein, 1976).

In the Northeastern provinces of Thailand, water supply is a more serious problem than elsewhere in the country. In spite of a considerable amount of rainfall, large-scale deforestation together with arid soil conditions turned the Northeast into a problem area for water supply. Hence, clean water is scarce in many rural areas in the Northeastern region. In the dry season of the year, a lot of villagers have to walk many kilometers, pushing their carts which carry plastic water containers, and wait for hours in order to get some water from a well or a pond. Although such water may contain undesirable substances or diseases they have to use it because it is all they have.

During the wet season, from May to October, rainfall is abundant. For example, the average amount of rainfall in Khorat Province is 1.146 mm. This amount of rainfall on one square meter of roof area will provide enough drinking water for one single person over a period of 300 days at a rate of approximately four liters of water per day. With a large roof area, a villager could store enough water for drinking and other purposes for his whole family throughout a dry period of six months. Therefore the villagers should have large tanks which can store sufficient rain water for consumption throughout the dry period. Since most villagers are very poor the cost of the tanks should be as low as possible. An estimate of the water requirements of a family throughout a dry period may be derived from the product of family size, the amount of water each member requires per day, and the number of days in a dry period. For an average family of 7 persons and a dry period of 180 days the following consumption estimates are found in various publications (see bibliographical references):



Annual rainfall in Thailand. (source; Thailand, the Environment of Modernisation, L. Sternstein, 1976).

- source 1.
  18 liter per capita per day (lpcd)
  if carried by hand 22 680 l/year

- source 2.
  4 lpcd/drinking 5 040 l/year
  55 lpcd/total domestic
  consumption 69 300 l/year

- source 3.
  6 lpcd/drinking and cooking 7 560 l/year

- source 4.
  15 lpcd/total domestic
  consumption 18 900 l/year

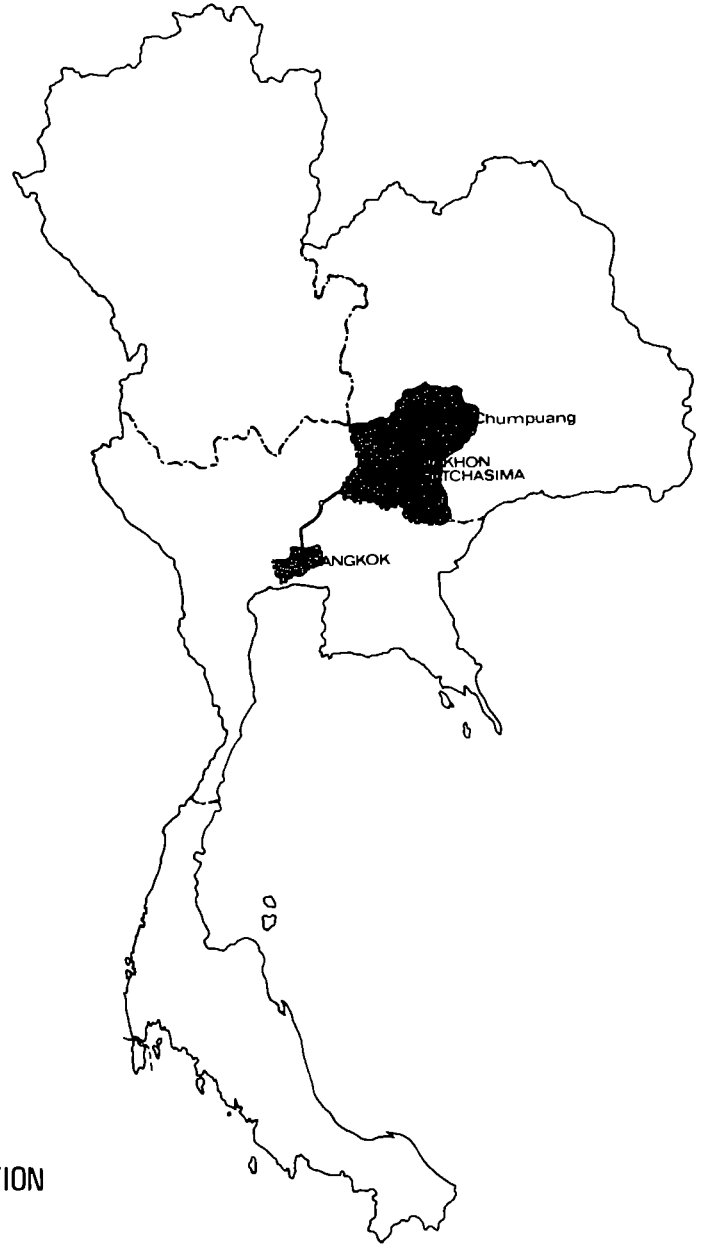
- source 5.
  20 lpcd/total domestic
  consumption 25 200 l/year

Various types of water tanks have been developed over the years. Many have been used successfully but their cost is still rather high.
The cost of a water tank per cb.m. decreases with the size of the water tank. The bigger the tank, the cheaper the storage cost per cb.m. of water.

For example:(1983 prices, 25 Baht = 1 US$)

Type of tank	Content in cb.m.	Cost/cb.m. in Baht
concrete, bamboo reinforced tank	5 21	491,- 248,-
plastic tank	1	2700,-
steel tank	1,5	1400,-
ferro-cement tank	1,2	580,-

2. KUL/AIT LOW-COST HOUSING PROJECT FRAMEWORK



LOCATION

Location of Chumpuang District in Northeastern Thailand.

In May 1987, a rural demonstration house was built in Chumpuang District, Khorat Province, as part of the Low-Cost Housing project which was set up in 1985 by the Post Graduate Centre Human Settlements, Catholic University of Leuven, Belgium (PGCHS-KULeuven) in cooperation with the Human Settlements Development Division, Asian Institute of Technology (HSD-AIT). **

The main aim of the demonstration project was to demonstrate alternatives in terms of design and building technology at affordable costs, while encouraging cooperative and self-reliant building practices and income generating activities. At the same time, this project was also integrating some of the national policy goals with regard to rural development in Thailand. The use of wood for house construction was as much as possible substituted by locally available low-cost building materials and techniques. A low cost solution was proposed to ease problems of sanitation and water supply. People were also trained to produce building materials under cooperative management in order to generate additional income.
The technology adopted was simple, labour intensive but not capital intensive, of relatively low cost and high standard.

(**) see Iterbeke, M., Jacobus, P. and Verschure, H. Rural Demonstration House, Chumpuang, Thailand, PGCHS-KULeuven and HSD-AIT, May 1987, pp.16.

The production and application of three 'new' building components was introduced: an inter-locking soil-cement block, a prefabricated concrete joist and an interlocking concrete door/window frame. The two-storey dwelling having 42 square meters floor space and basic sanitary facilities, was designed according to Thai rural life-style and housing customs, with a sleeping area on the upper floor and a kitchen that opens out into the yard.

The overall cost of the house, excluding labour, was 24,600 Baht (approx. US $ 950). A 14 cb. meter water tank was built making use of the same building components i.e. soil-cement blocks and concrete flooring system.

Top left : traditional rural houses. Rainwater is stored in ferrocement jars.

Bottom left : the KUL-AIT demonstration house and water tank in Chumpuang.

3. THE WATER TANK PROJECT

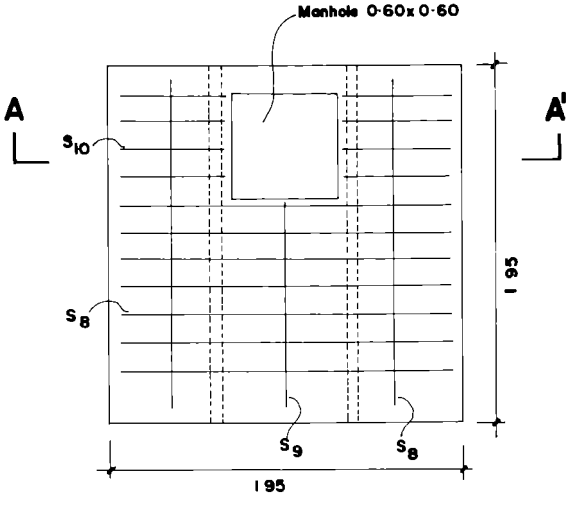
Upon completion of the demonstration project in Chumpuang, it became clear that not only the house but even more so the water tank attracted a lot of attention from the villagers living in the area.
Indeed, the soil-cement water tank provided a simple and low-cost solution to one of the villager's most urgent problems : water shortage.
A Belgian NGO 'PROTOS' (Project group for Technical Development Cooperation) was approached and agreed to sponsor a project to construct 25 water tanks in Chumpuang District. In cooperation with the Agricultural Land Reform Office in Khorat, the KUL/AIT Low-Cost Housing Project took the responsibility for further research and design, institutional set-up, training and supervision during the implementation of the project.
This year 25 households from villages 2, 6 and 8 in Chumpuang obtained an interest free loan. 25 water tanks were built over a five month period by a locally based Building Cooperative of villagers who had received technical training in the framework of the KUL/AIT Low-Cost Housing Project.

4. DESCRIPTION OF THE WATER TANK SYSTEM

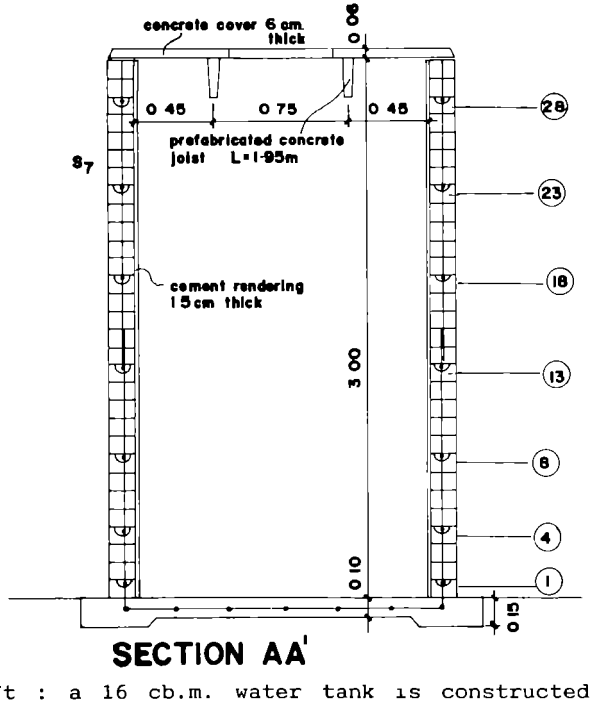
4.1 Design

Two different designs have been proposed, a 8200 l. tank with tap and a 16250 l. tank which is built partly under ground surface.

	16250 l.tank	8200 l.tank
Height	2 m.(1 m. under ground surface)	3 m.
Width	3.15 m.	1.95 m.
Length	3.15 m.	1.95 m.



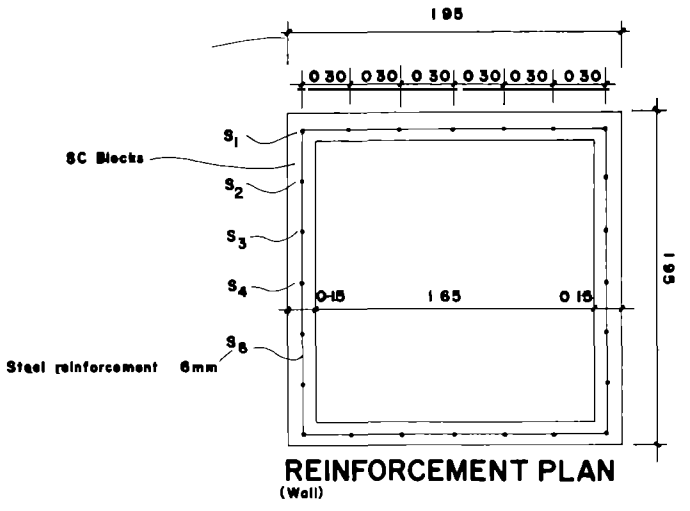
REINFORCEMENT PLAN
(Cover)

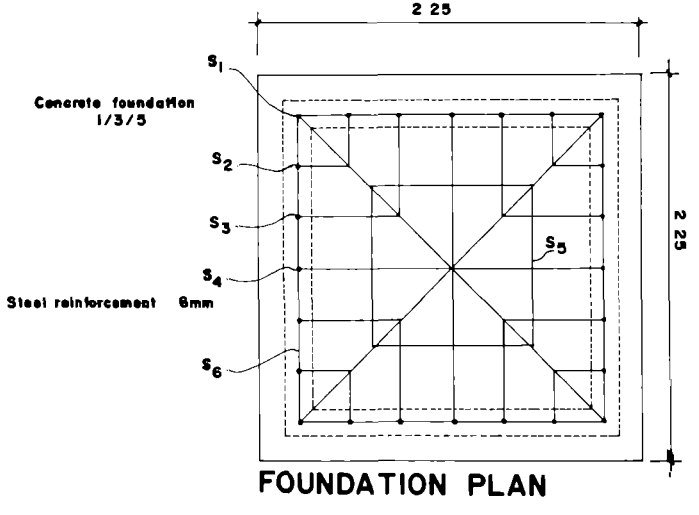


SECTION AA'

Top left : a 16 cb.m. water tank is constructed half under ground surface.

Bottom left : the wall of the water tank is built with interlocking soil-cement blocks.





Foundation and wall reinforcement plan of a 8200 l. water tank.

They are basically made of interlocking soil-cement blocks and prefabricated concrete components:

- the interlocking soil-cement blocks are used to built the walls of the water tank. They are produced through compression of lateritic soil mixed with 10-15 % of cement and water, using a modified CINVA-Ram press. After moulding, the blocks need to be air cured for at least 7 days.

- prefabricated concrete joists form the major component of the concrete cover which is built using the same techniques as the concrete flooring system of the demonstration house. The joists are prefabricated by means of a simple steel mould. A thin reinforced concrete slab is poured once the joists are in place.

All these components are produced in the village with simple tools and equipment.

4.2 Construction

The construction of the tank involves the following stages:

- earth work: the site of soil excavation for the production of the soil-cement blocks is further dug out (if required).
- foundation: a steel reinforced concrete slab is cast in situ.
- walls: interlocking soil-cement blocks are laid dry and reinforced with steel every 30 cm., liquid cement grout is poured to achieve a permanent bond. Every 3 to 5 layers a 'ringbeam' is built by means of soil-cement channel blocks and reinforced concrete.
- rendering: a 15 mm. cement rendering is applied to water-proof the walls.

- cover: light, prefabricated concrete joists are placed 60 cm. on center. A 6 cm. steel reinforced concrete cover is cast on top with the use of light, re-usable wooden form work.

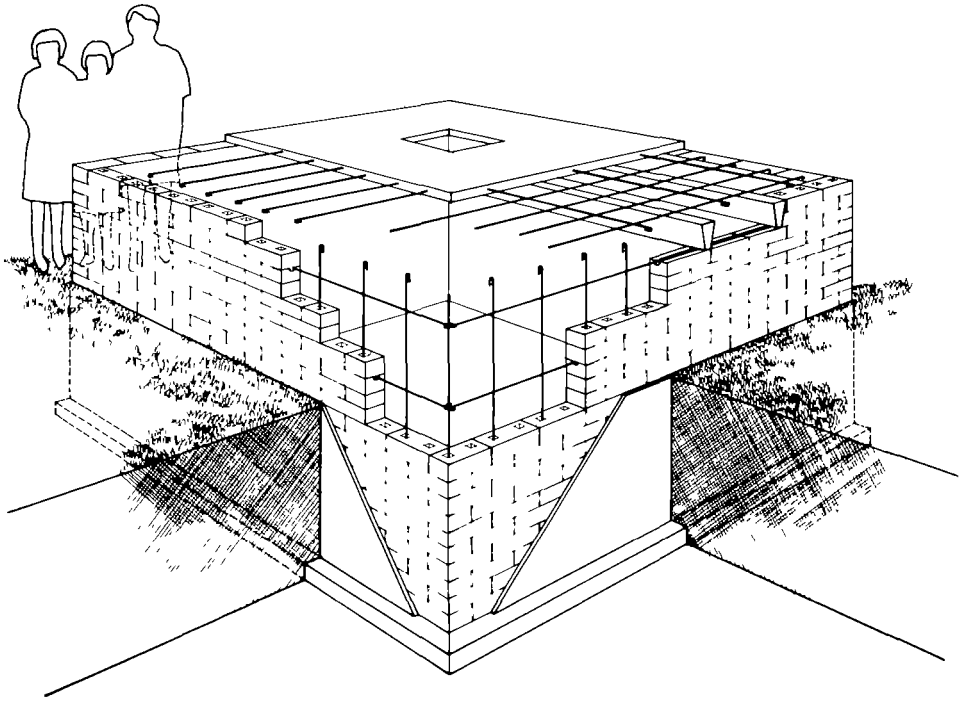
4.3 Cost

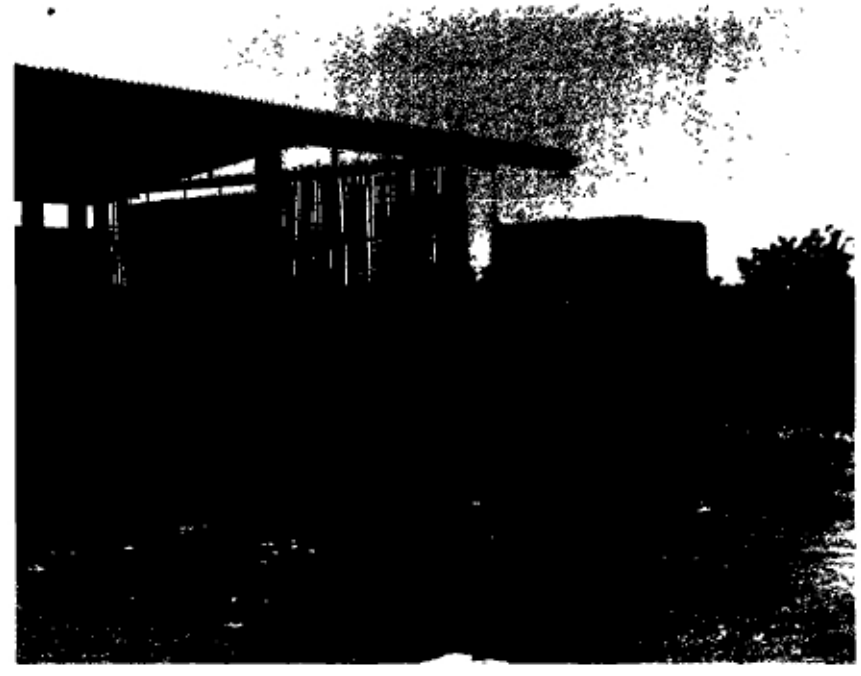
The cost of the water tank with a storage capacity of 8200 l. is estimated at 3,500 Baht and the tank of 16250 l. at 4,900 Baht. Part of the construction cost, 2,400 Baht (8200 l.) or 3,600 Baht (16250 l.) is repaid by the beneficiary to the sponsor into a revolving fund. The repayment is started immediately after the completion of the water tank at a rate of 100 Baht per month over a 2 year (8200 l.) or 3 year (16250 l.) period.

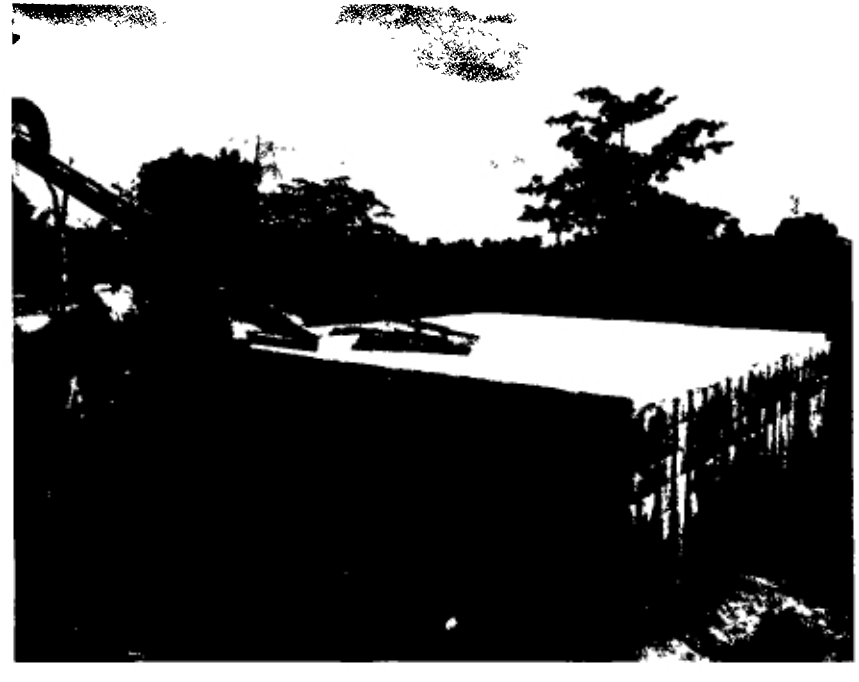
Comparing costs with other water tank systems, the soil-cement water tank is certainly competitive in the market with an average price of 427 Baht (8,200 l.) and 302 Baht (16,250 l.) per cb. m. Moreover the investment cost will partially return to the village. Indeed the labour-cost, 42 % of the total cost of a 8,200 l. water tank and 33 % of a 16,250 l. tank will be paid to the villagers working for or member of the Building Cooperative. The people buying a water tank, also take part in the production process and in this way there is little draining of resources, both monetary and non-monetary outside the community.

Top left : the water tank is rendered to water proof the walls.

Bottom left : a 16 cb.m. water tank nearing completion. A layer of channel blocks is being laid and will be reinforced and filled with concrete to form a 'ringbeam'.







Top left : perspective of the 16000 l. water tank illustrating the steel reinforcement grid inside the soil-cement walls.

Top right : a 8200 l. water tank was constructed near the workshop of the Cooperative.

Bottom right : rainwater is collected from the roof by means of galvanised iron sheets or plastic tubes.

5. A BUILDING COOPERATIVE, RESPONSIBLE FOR PROJECT IMPLEMENTATION

A Building Cooperative was formed immediately after the completion of the demonstration house. The Cooperative (representing 20 members and share holders of villages 2, 6 and 8 in Chumpuang) was the main actor responsible for the implementation of the water tank project.

The Cooperative proposed a list of beneficiaries with adequate affordability to repay the loan. Furthermore its members were responsible for project management including accounting, purchasing of construction materials, supervising construction work, organizing labour, collecting the monthly repayments from the water tank owners etc. According to the designs which were provided by the KULeuven staff, the group completed the construction of 15 water tanks and a Workshop for the production of building materials.

6. SOME REFLECTIONS ON IMPLEMENTATION PROCEDURES

The Village Cooperative was building the water tanks under contract for a fixed price agreed upon by the project sponsors. Supervision of the construction was done by the future tank owner and a technician trained by the Low-Cost Housing Project. When a package of five water tanks was built, the work was evaluated by the KULeuven staff and another set of five water tanks was implemented.
At first, it seemed that the Cooperative, working on a profit basis, bargained for the best deals at the local building material shops and that work got organized efficiently without much time delay. However, no profit was being made and although the water tanks were being built, the Cooperative never operated on a real cooperative basis. The Village Headmen, also members of the

A proud family in front of their new water tank. This 8200 l. tank's capacity equals the capacity of 5 to 6 popular 'red jars' as seen on the foreground.

Cooperative, took full responsibility for the construction of the water tanks, employing labour, purchasing building materials etc. They managed everything without any control on their decisions by the other members of the Cooperative because of their position in the social hierarchy of the Village. As a result there grew some mistrust with the other cooperative members.

Hence, a new organisational set-up was proposed in which full responsibility was given to the future water tank owner to manage and supervise the construction of his water tank. Before, the total budget for a set of five water tanks was transferred to the Cooperative. Now, the budget for one water tank was allocated directly to the water tank owner. He himself, was to manage purchase of building materials, labour etc. Cooperation between the applicants of the same village was still encouraged but not imposed. The Village Headman of each village retained his responsibility in selecting the applicants and collecting the monthly repayments against a small fee. It was also decided that fulltime technical supervision was no longer needed as many people in the villages had become familiar with the building techniques.

It can be concluded that the overall approach resulted in the successful implementation of a low budget project with a clear institutional set up, little overhead and a high impact on short-term basis. Moreover, villagers learned how to manage a project and developed construction skills that will generate additional income for their families.

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