An Innovative Water Tank Project in the Northeast of Thailand

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Clean water is scarce in many rural areas in the northeast of Thailand. The innovative water tank project was undertaken to solve this problem. The project consists of constructing 25 low-cost water tanks for 25 households under interest free loan scheme. The tanks were constructed of soil cement interlocking blocks used for a low-cost housing project. The paper give the technical details, construction procedure, cost analysis and technology transfer technique used.

WATER SUPPLY IN THE NORTHEASTERN PROVINCES OF THAILAND

Clean water is scarce in many rural areas in the northeastern region of Thailand. In the dry season, many villagers have to walk many kilometers, and wait for hours in order to get water from a well or a pond, their only source. In some cases, such water is contaminated.

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 1 m^2 of roof area will provide enough drinking water for a single person over a period of 300 days for a water consumption of approximately 4 l/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 avearge family of 7 persons and a dry period of 180 days the following consumption estimates are found in various publications [1-5]:

*	18 liter per capita per day (lpcd) if carried by hand [1]	22.68 m^3/yr
*	4 lpcd/drinking	5.04 m^3/yr
	55 lpcd/total domestic consumption [2]	69.30 m^3/yr
*	6 lpcd/drinking and cooking [3]	7.56 m^3/yr
*	15 lpcd/total domestic consumption [4]	18.90 m^3/yr
*	20 lpcd/total domestic consumption [5]	25.20 m^3/yr

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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 cubic meter decreases with the size of the water tank. The bigger the tank, the cheaper the storage cost per cubic meter of water. Cost of some types of water tanks are given in Table 1.

Table 1 Cost of Water Tanks

	Type of tank	Content (m^3)	Cost per m^3 (Baht+)
*	concrete bamboo-reinforced tank	5.0 21.0	491 248
*	plastic tank	1.0	2700
*	steel tank	1.5	1400
*	ferrocement tank	1.2	580

+ 1 US$ = 25 baht, cost figures in 1983

KULEUVEN/AIT LOW-COST HOUSING PROJECT

In May 1987, a rural demonstration house was built in Chumpuang District, Khorat Province, as part of a Low-Cost Housing Project which was set up in 1985 by the Post Graduate Centre Human Settlements of the Catholic University of Leuven, Belgium (PGCHS- KULeuven) and the Human Settlements Development Division of AIT (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. For house construction, locally available low-cost building materials and techniques were used. 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 is simple, labour intensive but not capital intensive, of relatively low cost and high standard. The production and application of three 'new' building components was introduced: an interlocking soil-cement block, a prefabricated concrete joist and an interlocking concrete door/window frame. A two-storey dwelling having 42 m^2 floor space and basic sanitary facilities is 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, is 24,600 baht (approx. US$ 950). A 14 m^3 water tank was built making use of the same building components, i.e. soil cement blocks and concrete flooring system.

PROJECT TO BUILD 25 WATER TANKS

Upon completion of the demonstration project in Chumpuang, it soon 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) sponsored the project to construct 25 water tanks in Chumpuang District. 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 will obtain an interest free loan to construct 25 water tanks over a five month period. A locally based Building Cooperative of villagers, who received technical training in the framework of the KUL/AIT Low-Cost Housing Project, will construct the tanks.

THE WATER TANK SYSTEM

Two different designs have been proposed, a 8.2 m^3 tank with tap and a 16.25 m^3 tank which is built partly under ground surface. The dimensions are as follows:

	16.25 m^3 tank	8.2 m^3 tank
Height	2.00 m (1 m under ground surface)	3.00 m
Internal width	2.85 m	1.65 m
Internal length	2.85 m	1.65 m

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

* The interlocking soil-cement blocks are used to build 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 those of 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 equipments.

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 (Fig. 1).

Walls. Interlocking soil-cement blocks are laid dry and reinforced with steel every 300 mm, liquid cement grout is poured to achieve a permanent bond. Every few layers, a 'ringbeam' is built by means of soil-cement channel blocks and reinforced concrete (Fig. 2).

Rendering. A 15 mm cement rendering is applied to waterproof the walls.

Cover. Light, prefabricated concrete joists are used. A 60 mm steel reinforced concrete cover is cast on top with the use of light, re-usable wooden formwork (Fig. 3).

The cost of the water tank with a storage capacity of 8.2 m^3 is estimated at 3,500 Baht (US$ 135.19) and the tank of 16.25 m^3 capacity at 4,900 Baht (US$ 189.26). Part of the construction cost, 2,400 Baht (US$ 92.70) for 8.2 m^3 or 3,600 Baht (US$ 139.05) for 16.25 m^3 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 (US$ 3.86) per month over a 2 year (8.2 m^3) or 3 year (16.25 m^3) period.

Comparing costs with other water tank systems, the soil-cement water tank is certainly competitive in the market with an average price per cubic meter of 427 Baht (US$ 16.50) for 8.2 m^3 and 302 Baht (US$ 11.66) for 16.25 m^3. Moreover the investment cost will partially return to the village. Indeed the labour-cost, 42% of the total cost of a 8.20 m^3 water tank and 33% of a 16.25 m^3 tank, will be paid to the villagers working for or members 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.

PROJECT IMPLEMENTATION

A Building Cooperative was formed immediately after the completion of the demonstration house. The Cooperative, representing 20 members and shareholders of villages 2, 6 and 8 in Chumpuang, is 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 are 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 will complete the construction of 25 water tanks and will conduct a workshop for the production of building materials.

REFLECTIONS ON IMPLEMENTATION PROCEDURES

Before the end of the 1988 rainy season, 25 villagers will be the proud owners of a water tank built by the Building Cooperative (Fig. 4-5). The Cooperative is building the water tanks under contract for a fixed price agreed upon by the project sponsors.

It is interesting to see how the Building Cooperative is currently managing the purchase of building materials, the production of building components and the construction of water tanks. Since the Cooperative is working on a profit basis, it is bargaining for the best deals at the local building material shops and work seems to get organized efficiently without much time delay. Supervision of the construction work is being done by the future tank owner and a technician trained by the Low-Cost Housing Project. After a package of five water tanks was built, the work was evaluated by KULeuven staff and another set of five water tanks was implemented.

This 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 got organised in a Cooperative, learned how to manage a project and developed construction skills that will provide additional income in the future. This year, even more than other years, people in the villages of Chumpuang are looking forward to the rainy season to come and fill their new water tanks.

Fig. 1. A steel reinforced concrete slab cast in the excavation hole dug for the production of soil-cement blocks. This slab will serve as foundation for the 16 m³ water tank.

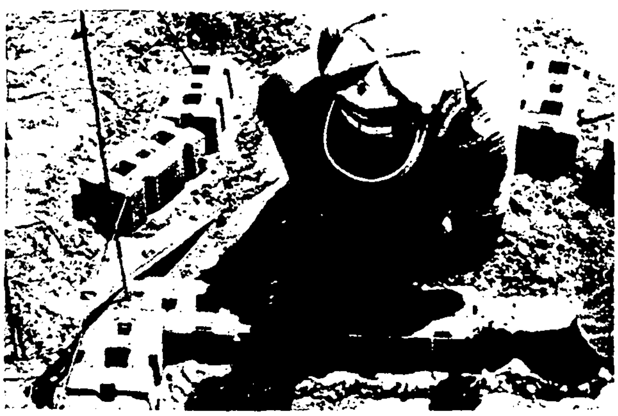

Fig. 2. The walls of the water tank being built wih interlocking soil-cement blocks.

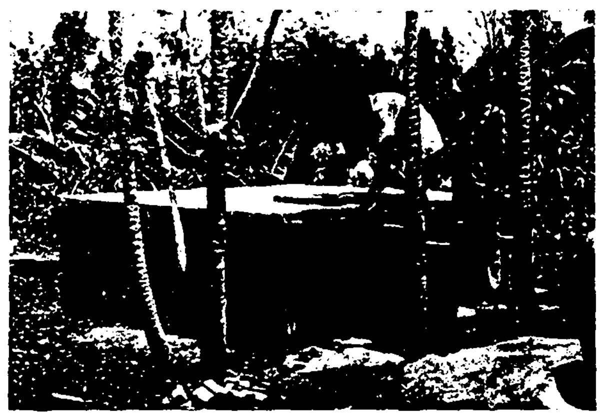

Fig. 3. A 16 m³ water tank built with half of the tank underground.

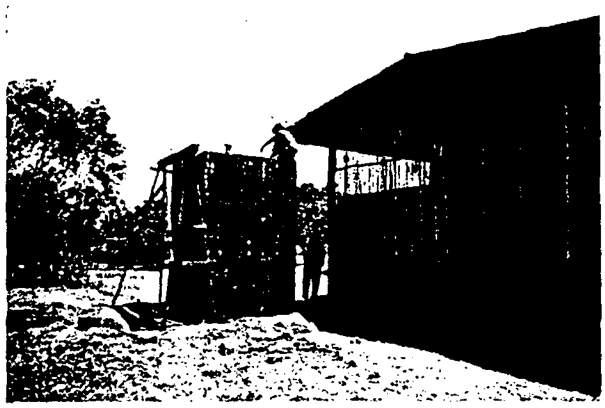

Fig. 4. A 9 m³ water tank nearing completion close to the building workshop of the Cooperative.

Fig. 5. A proud family poses in front of their new water tank. This 9 m³ tank's capacity equals the capacity of 5-6 popular red jars as seen on the foreground.

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