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A Study of Brick Production in Thailand*

(Issues on Women, Energy, and the Environment)

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At present, there are at least 700 brick manufacturing plants in Thailand, directly employing over 20,000 people (50 percent of whom are women) and indirectly employing over 100,000 workers. Most of these plants are situated in rural areas, although due to high growth rates and the booming construction industry, larger plants are being built in suburban areas. Most of the rural plants are owned by successful farmers, while most of the urban plants are owned by entrepreneurs who have gained experience through working in other brick plants. There are very few brick plants owned by corporations or by very wealthy entrepreneurs. Information gathered from informants indicates that there are at least 200 other very small brick plants that are run on a part-time basis by families who live in small villages. These brick industries produce less than 500,000 bricks in total and the income is used to supplement their farm income.

Many of the bricks are used in rural townships and urban centers. Overall, the brick industry contributes approximately 2.8 billion baht to the rural economy. Our survey results indicate that much of the money made in the brick industry flows to the rural landless and to farmers who own the clay and the wood that is used in the production process. Many of the rural brick owners use clay dug from their own land and wood harvested from their own plantations (although this is much less common in the Northern and Central regions, where there is a real shortage of wood), wood purchased from wood sellers, or rice husks gathered after milling their rice. The brick industry uses approximately 1.4 million tons of wood per year and is probably the largest industrial fuel wood user in Thailand. To provide this amount of wood, approximately 875,000 rai of plantation and forested land must be harvested annually on a sustainable basis.

In the South, it appears that all industries use wood as their only source of fuel, although in the Northern and Central regions both rice husks and wood are used to fire bricks. A specially designed vertical shaft kiln, known as a clamp, is used when it is fired by wood. There is little standardization in this kiln's construction. The kiln for firing with rice husks is usually made from the bricks that are to be fired, although there are some fixed wall rice-husk-fired clamp kilns in use in Chiang Mai. From the limited survey, it appears that most of these industries have changed or are in the process of changing from the husks to wood. It is difficult to accurately determine why this is occurring, especially since wood is becoming scarce. The reasons include the present high transport cost of husks; their relative scarcity, as mills are changing over from diesel power to rice-husk-fired steam engines; and difficulty in hiring laborers to work in the highly polluted environment that exists around kilns fired with rice husks.

The clay brick product has long been the traditional building material in Thailand. These bricks are fired at a relatively low temperature, leading to low strength and a high moisture absorption capacity. Consumer preference has led to a range of different brick sizes being produced in different areas of Thailand.

Over the past 15 years, cement blocks have taken over approximately 50 percent of the market for wall infill material. Although cement block is more expensive to purchase, bricklayers find it easier and quicker to lay (since it is a larger, more regular shape), and less mortar is required to cement the blocks together.

Thus, contractors will purchase cement blocks in preference to clay brick. On the other hand, consumers still prefer clay brick, as they can place nails through it and believe that the walls are cooler and more substantial.

The study indicated that the continued growth of the brick industry in Thailand is essential for the following reasons:

- to meet the increased housing needs in both rural and urban areas;

- to use locally available resources in an environmentally sound manner;

- to provide skilled work for women;

- to reduce the need for imported building materials;

- to help promote local rural industries that can provide skilled employment.

Data collected from this study strongly indicate that the industry is under threat. It is predicted that many enterprises will close in the near future. This is due to:

- The predicted increase in the price of energy;
- The industry's future inability to hire labor;
- Continued use of thermally inefficient, slow kilns, which in turn ensures the continuation of inefficient material handling practices;
- Continued acceptance of the very small brick module, resulting in poor productivity by brick-layers compared to laying cement blocks;
- Competition from the cement blocks due to their larger module, more efficient manufacturing processes, and capability to respond to market surges for building materials;
- Production of low-quality bricks due to a lack of technical knowledge and inefficient kilns.

However, because the country is facing a cement shortage, more and more people will substitute bricks for cement blocks, and the price of bricks could increase to meet the increasing demand. This will enable the industry to survive due to a higher profit margin.

STUDY OF THE CLAY BRICK INDUSTRY IN SURAT THANI

The province has an established clay brick industry, with approximately 20 brick-making plants of widely differing capacities (from 700,000 to 13,000,000 bricks per year). Approximately 700 people are directly employed in the industry and at least another 5,000 indirectly (bricklayers, woodcutters, clay miners, retailers and transport workers). Income from the production of bricks is approximately 40 million baht per year. Naturally, the larger output plants are located near the town centers, with minor plants in the less populated areas. Overall indicators suggest that the manufacture of clay bricks is viable and presently, the demand for the product is buoyant due to an active and expanding construction industry. A number of brick plants have shut down recently, but these have been replaced by two new plants, one medium-size and the other very small.

Technique of Brick Production

Raw clay preparation machinery was not in evidence, with most extruders being fed from a pug hole, which served as a crude clay temper. Clay was fed to the extruder by hand, shovel, and hoe. Some of the larger plants had the assistance of a small bulldozer. The raw clay as dug was generally very wet and was sometimes further tempered with additional water. The presence of roots and stones in the raw clay was evident in one plant, and an additional machine was being installed to reduce the extruder's downtime.

The production from the extruder was stacked on flattop, two-wheeled barrows and transported to the

drying areas, where the product was stacked on the ground for natural atmospheric drying. As the extrusion is very soft, handling damage occurred. The bricks are allowed to dry for approximately one week and are then transported by the same barrows to the kilns.

All inspected plants employed heavy masonry, single-pass, updraught kilns, fired with rubber wood, in simple fireplaces set at ground level. No attempt was made to employ fire bars or to control primary or secondary air entry into the kilns. Generally, kiln firing cycles were of six to seven days' duration, leading to large thermal losses from the thick masonry walls surrounding the brick payload. As mentioned before, control of the combustion process is nonexistent, and in many instances, the rubber wood is combusted in a wet or green state, adding further thermal inefficiencies.

Generally, the layout of the inspected brick plants was logical. In the majority of plants, the kiln must dry the bricks as well as fire them. This is one of the reasons that the time between loading, firing, and unloading is two to three times that of a modern brick kiln. Additionally, these periodic kilns have become larger over time to increase output, requiring stronger, thicker masonry walls to prevent structural failure from the constant heating and cooling, further decreasing their thermal efficiency.

Socioeconomic Profile

It is extremely important to note that the present brick industry is not controlled by wealthy entrepreneurs in Surat Thani. Much of the income derived from the sale of bricks is distributed to either landless laborers (mainly women) or to local farmers. Most of the profits that are generated are returned to further local agricultural development. (This is in contrast to most of the other rural industries, which are controlled by wealthy entrepreneurs, some of whom live in Bangkok).

The owners of all the rural plants use both the cash flow and the profits from their brick-making operation to pay for other types of agricultural development. One owner had converted his disused clay pits into fish ponds and was replanting some of the degraded area around these ponds with fruit trees. Most of the rural factory owners have sufficient rubber plantation area and paddy field area to supply the necessary wood and clay for the plant. A twenty-year-old plant owner told us that his supply of high-quality clay will be soon depleted, and he is nowforced to purchase clay from other farmers to mix with his high-quality deposits. One of the entrepreneurs had built and experimented with a different type of kiln. This experiment had not worked, and he wanted the consultants to design him a new kiln. He had also operated a small machine workshop that produced equipment for his and other brick plants, as well as other local industries. Most of the owners of these brick plants are innovative and are leaders within their own communities.

The owners of urban plants have learned their trade by working in other brick plants. To obtain the necessary capital to build the plant, to start operation, and to market their product, the owners have borrowed money from the government, family, and private lenders. These people ran their plants much more efficiently than the rural entrepreneurs did, because the costs to operate the rural ones are higher, as they do not have their own land to mine clay or to cut wood. At present, there appears to be very little profit reinvestment for upgrading these urban plants or for developing new clay products. This is mainly because the brick industry owners are not being provided with extension services from either the government or universities. It appears that a number of these urban plants are also exporting their products to other provinces in the South and to Burma.

Bricks are sold either to retailers, directly to contractors, or to individual end users. In many cases, bricks are made to order, and most brick makers try to keep the stocks as low as possible.

Four of the six plants are making a good profit (40 to 60 percent on the wholesale price of the brick). One of the plants, which was showing a loss, had just commenced operation. The owners of the other plants were aware that the brick plants were not making a profit and were unable to respond to market demand. An owner who has several businesses said that he was keeping it in operation to ensure that he had sufficient labor throughout the year to harvest his crops, to maintain his social standing within the

community (it would be considered a loss of face to close this plant), and to provide his wife with a satisfying management position.

Division of Labor in Brick Production

At present, labor is a major constraint for the brick manufacturers, as it is the major cost in the manufacturing process. Most of the unskilled labor is provided by immigrants from the Northeastern provinces, since local people can find similar or greater remuneration in jobs that are less arduous and not as messy as brick production. One brick plant owner was unable to run his plant at more than 50 percent capacity because he could not get labor. He was considering a trip to Taiwan to buy a fully mechanized plant, even though we found that this type of plant was totally unsuited to the production conditions in the province.

Most of the unskilled laborers are women, many of whom are married and reside around the factory area. Some migrated with their family from other provinces, and others are local people who did not want or could not migrate to work elsewhere. Unskilled female laborers will perform all the various tasks, which are very hard and labor intensive. They spend most of their time carrying bricks from the extruder to the drying area and from the drying area to the kiln. To carry bricks, they must bend and lift several bricks and place them on a small pushcart. In the long run, this type of work is injurious to their health. Some women bring their children to the factory and spend part of the time caring for them as well as working (this work pattern is used by the factory owner to justify paying all women less that male laborers and below the basic wage). Most plants are registered under a man's name. While family businesses are co-managed by husband and wife, we also found that some of the plants are managed by women alone. In many brick factories, women also carried out the skilled work of setting up the kiln. These women set the kiln during only part of the week, and they received nearly double the wage of their unskilled counterparts at that time. When they were not setting up a kiln, they were performing unskilled manual labor. Men usually receive 6 to 35 percent more pay than women (see details in Table 2). They carry out the skilled work of operating the extruder and firing the kiln. In urban plants, men usually fill management and supervisory positions.

Energy and Environment

The response to the closing of the national forest has varied according to area. In the South, the shortfall for fuel wood has been met by rubber wood. Rubber wood is widely available because the government has been giving incentives for replanting and because the 1989 typhoon uprooted many thousands of hectares of trees. Not only is this surplus of trees meeting the local demand, it is also meeting the demand for fuel in other provinces to the north.

At present, total wood use (mainly low-quality rubber wood) in Surat Thani industries is estimated to be 590,000 tons (green), of which 50,000 tons are used in the brick industry (see Table 1). Some of this wood is used to make charcoal, and some is exported. At present, fuel supply and price are not major constraints for the brick manufacturers. Until mid-1990 there will be surplus of rubber wood, cut from trees that were uprooted in the recent typhoon. Wood, presently about 250 baht a ton, represents approximately 23 percent of the production cost of brick. Both the wood sellers and the brick manufacturers estimate that the price will jump to approximately 500 baht a ton once the supply of typhoon-affected trees is depleted. Wood will probably then account for approximately 35 percent of the cost of producing a brick.

The Forestry Department officers and brick plant owners both believe that once the supply of rubber wood from the typhoon-affected regions is used, demand will outstrip supply, and there will be a large increase in the price of this fuel (from 260 to 520 baht a ton). This will probably lead to further illegal cutting of fuel in forests (with the consequent degradation of land) and a reduction in the tree cover around farms. Although there has been limited success with replanting programs, senior officers from the Forestry Department believed that more immediate environmental benefits could be gained from fuel conservation in industries. Replacement of all the existing kilns with either new, more efficient, or modified traditional kilns could lead to a reduction of 500,000 tons of wood per year. The total investment by enterprises and

the government to achieve such a reduction would be in the area of 5 to 8 million baht. To meet an equivalent demand for fuel wood, 312,500 rai of land would need to be planted, at a total cost 70 million baht. It should be noted that there are other environmental benefits from tree planting, such as a reduction in soil erosion and a regeneration of degraded land.

CONCLUSIONS

The above analysis strongly indicates that rural brick factories are an important industry that provides construction materials made from local raw material and that they provide rural employment, especially for women. However, it also indicates that the brick industry is facing a major hardship. In order for the brick industry to expand and to be beneficial to rural areas, the following constraints need to be overcome:

- A forecasted substantial increase in the price of rubber wood as a result of the ban on forest clearing;

- Competition from other industries for the availability of laborers who are not willing to work under unpleasant, arduous conditions;

- The use of slow turnaround kilns, which prevents brick makers from reacting to market fluctuations;

- Rising living standards, which will affect consumer preference for alternative building materials and will also increase the relative cost of laying clay and cement bricks;

- Temporary and long-term cement shortages.

For the clay brick manufacturers, the major future constraint is the design and operation of the kiln currently used. For the small rural enterprises, efforts are needed to reduce fuel consumption and the pollution level of the existing kilns. For the larger enterprises, a new kiln needs to be introduced. These are two elements required to achieve a significant advance in kiln technology and efficiency. Because new kilns actually reduce the labor burden and number of workers, they should provide an opportunity for laborers to undertake more skilled, better-paid employment.