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ASSISTANCE IN DEVELOPMENT OF BUILDING MATERIALS FOR LOW-COST HOUSING

DP/INS/81/006/11-50

INDONESIA

Technical report: An analysis of experience in establishing model production units for building materials

Prepared for the Government of Indonesia
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Keith Rowland, consultant on policy formulation for upgrading the small-scale building materials industry

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Explanatory notes

The monetary unit in Indonesia is the rupiah (Rp).

Besides the common abbreviations, symbols and terms, the following have been used in this report:

CIRU	Ceramic Industry Research Unit
CRDI	Ceramic Research and Development Institute
FRC	fibre-reinforced cement
NSC	National Steering Committee
RPOT	Regional Planning and Operation Team
RSC	Regional Steering Committee

Mention of the names of firms does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO).

ABSTRACT

The purpose of the project "Assistance in Development of Building Materials for Low-cost Housing" (DP/INS/81/006/11-50) for which the United Nations Industrial Development Organization (UNIDO) is the executing agency on behalf of the United Nations Development Programme (UNDP) was to ensure the availability of building materials in adequate quantity and quality to meet the demands for low-cost housing in Indonesia.

The consultant (see annex I for job description) analysed the experience gained in establishing model production units set up as industrial village co-operatives. He made a broad assessment of the present status of the building material industries in the small-scale rural sector and assessed the potential of the institutional infrastructure. He also inspected the model units and made recommendations on their linkages to markets, financial viability etc.

He concluded that the units established previously under the project showed that background experience and entrepreneurship were essential for successfully upgrading manufacturing capacity.

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INTRODUCTION

One of the reasons for the project in the first instance was a potential shortage of building materials in Indonesia. This would cause a delay in the Government's programme for low-cost housing. It was believed that small-scale industries in the villages could be expanded to manufacture building materials, and prevent shortages occurring.

The experience gained from this project, together with the factual information gained in producing a data bank showed that there is sufficient manufacturing capacity which can supply the government's requirements for its low-cost building programme.

It was also demonstrated that even if there were a shortage of building materials, village small-scale industries would not be able to supply the requirements of Perumnas and other government building programmes.

The reason is that small village industries do not have the financial ability or capacity to produce large quantities of materials in a short period of time. Furthermore, if they were to be up-graded, when the large-scale local government project was completed, these industries would be faced with the problem of a capacity larger than required for their share of the normal market.

In spite of the above conclusions the project has proved without doubt that small-scale industries (particularly in clay tiles) can be up-graded to produce better quality and sized tiles together with a significant increase in volume and income.

This improvement has been shown to be possible within the demands of the natural requirements of the local building industry; it also offers a constant output and a constant improvement in income.

Four model clay products units and two timber units were set up during the life of the project. The clay product units were set up using identical sizes and quantities of machines as in the previous project at Solo.

The four units were located at different locations and proved that while the techniques were identical, each local district needed to be studied in depth; the background requirements of each area provided the inputs necessary to modify the original model.

Because of the variations among the units, together with a change in emphasis with respect to the supply for the local market, rather than for large government projects, the total needs for machinery as used in the models needed to be modified. To enable the project to be replicated and made viable the machinery would have to be smaller, and with fewer presses (particularly with respect to the tile units).

The models have proved that correct techniques have been employed and that these can be adapted without any reservations. Only the number and size of the equipment needs to be varied. To be successful within a relatively short period of time it was shown that an entrepreneur with a background knowledge of the industry was essential.

The model has attempted to carry out the government's desire to combine small-scale industries within a co-operative format. When the model was successful (because of the input of an entrepreneur or craftsman) it was found

that his philosophy did not allow him to accept fully the social concept of the co-operative movement.

The replication of the two timber projects is unnecessary. The background, expertise etc. have been well used, tried, and established in Indonesia. It is doubtful if the project would ever be competitive in the supply of transmigration houses.

The terms of reference of the project were to up-grade the small-scale building material producers. This was mainly achieved in the clay industry. Some consideration ought to have been given, however, to such products as lime and cement.

Marketing of the products produced by the model units was a major problem. The terms of reference were changed and the units were sized to supply large-scale government building projects and the rated capacity of the units were adjusted to suit.

To supply the normal building materials market with a standard output is not difficult; the normal factors of supply and demand will govern output.

RECOMMENDATIONS

A. Completion of units already established, together with reports, training and production of manuals

1. Samarinda wood unit - Completion of buildings and installation of machines already on site. Complete the run-in of the equipment.

2. Samarinda clay unit - Restoration of kiln and solution of kilning problems. Promotion of the use of clay tiles in the district.

3. Pakis tile unit - Solution of kilning problems, sales training of KUD staff. Exchange visits of staff from other successful units, particularly Solo, where the co-operative in conjunction with entrepreneur/craftsmen is working well. Supply of motor cycle to KUD for sales visits. Repair of Perumnas damaged roofs in Malang.

4. Hand over of the data bank to the appropriate government department.

5. Follow-up and use of experienced personnel from successful units to cross-fertilize the knowledge gained from all the units set up.

6. Preparation of simple technical and management manuals.

B. Implementation of new proposals

1. Sample listing of small-scale building material manufacturers by size, product, quality, and KUD affiliation.

2. Application of the above samples to the use of Perumnas local government, Ministry of Industry etc.

3. Prepare sample procedures to enable KUD small-scale industries to be set up on future government building sites.

4. Set up model Foster Brother units in conjunction with the Pakis unit.

5. Set up model mobile tile demonstration unit.

6. Set up model mobile conblock and lime block demonstration unit.

7. Investigate and set up model for making cement roofing tiles - mobile unit.

I. ESTABLISHING AND OPERATING MODEL PRODUCTION UNITS

The project was divided into (a) production of clay bricks and tiles, and (b) finished timber building elements.

Clay brick and tile industry

Project INS/74/034 had earlier set up a clay products unit at Solo (see annex II for a review of the model after four years of operation). This acted as a model for the four units set up by the present project, INS/81/006, except that two of the units produced bricks and tiles, whereas the Solo model produced tiles only.

The main point of this study was that the clay industry was not new to Indonesia. The techniques, machines, and methods were available before the present units were established. In actual fact, the techniques and workmanship displayed in the building of ancient monuments showed a high degree of skill in the use of clay.

It was originally thought that there would be a shortage of building materials for the low-cost building programme under Repelita IV. It was believed that by upgrading the village building industry the needs of this programme could be met. During this project, however, it was proved that there was no shortage. This fact, together with the restraints on government finances has altered the concept and the project could be described as upgrading of small and informal building material producers by utilizing the opportunities presented by the low-cost construction market. The original Solo model was extremely successful in its operation, its relationship with the KUD, and in the supply of some of the products required by the local Perumnas contract.

Each of the units set up under the present project has used this model but have amply demonstrated how each of them must be modified according to local conditions.

For example, Solo was installed in an area where there was a large demand for clay tiles of all types. Therefore, selling to the market was no problem, and buyers flocked to Solo to buy their tiles. This was not the case elsewhere, and marketing was one of the main problems. The four units were:

(a) Samarinda: A new isolated location with little experience in the brick industry and little acceptance of clay tiles as a roof covering; no operative KUD;

(b) Palembang: A small market established by entrepreneurs using clay bricks and sufficient clay tiles to make the project viable; entrepreneurial distrust of KUD;

(c) Turen: An area well established in clay tile production by the traditional process. However, the co-operative system was not well accepted by local craftsmen;

(d) Pakis: A totally new project using a site well away from and not involving craftsmen. KUD has taken over the management and production. Located not too far from the factory is the village clay industry, and although described as a "factory", it is more like a village industry.

It is recognized that a standard model cannot be used for each unit, but adaptations have to be made in each instance.

Summary

The large potential of Perumnas and other government programmes should not be used as an inducement to village craftsmen to upgrade their products or increase their volume. This could be counterproductive if it raised expectations too greatly. For example, the model units have a through-put potential of 120,000 tiles per month. However, the normal market offtake has never been higher than 30,000 to 40,000 per month.

If this fact is kept in mind, capital required is reduced by the use of a simple mixer valued at Rp 2 million compared with one worth Rp 8 million together with two small presses rather than the five large presses used by the model units. The experience has also shown that, in general, the upgrading of brick production is not a viable proposition as (a) the local traditional bricks meet local requirements and cannot be replaced by higher priced products, and (b) government low-cost housing prefers to use conblocks. Any new unit must take into account local market requirements. Although it was agreed that upgrading of materials as to size and quality was desirable, if lower-priced tiles were excluded the project would not be viable, especially if the unit were to buy its own equipment and not obtain it free of cost from UNIDO.

Background information and an entrepreneurial spirit is a prerequisite for the establishment of a successful viable village unit. One of the main objectives of the project was to encourage other craftsmen in the area to copy the methods used. A successful unit is absolutely necessary in such a case.

Craftsmen, entrepreneurs and independent workers are also a prerequisite. Government policy is to unite these individuals into a co-operative, but such people are not among those who take easily to such a social structure, and one might say they are diametrically opposed in their approach. A great amount of work is therefore required as the KUD moves into construction material manufacturing in the villages. Training of KUD members, particularly in marketing, would be advantageous. Cross referencing of the successful KUD at Solo with other KUDs in the same business would be helpful.

Another point brought out forceably by the experience is that the project has concentrated mainly on clay tiles with some bricks in the most successful areas of Solo and Turen. The supply of local clay has now been exhausted and the units have been forced to buy their clay. As time goes by, distance will increase together with the costs involved.

Alongside this is the fact that the environment is gradually losing its agricultural "soil", and the use of firewood is depleting the forests, particularly in Java. It has also been found that other products, of good dimensions and quality, are becoming more competitive.

Wood-working units

The wood-working units that have been set up do not fall within the category of industrial village co-operatives. The units were basically established in order to utilize a lower grade of timber that had previously been wasted. The units will provide a model for the production of finished wood products, although their financial viability is in doubt. The equipment and technique are not new, and their viability is dependent on the guidance and financial help from local government and local firms.

These units are well supplied with the necessary equipment and will become a guide to the timber finishing industry. They are useful in that they represent small businesses that would not have been in existence if it were not for the input of machinery under UNIDO leadership.

II. PLANS FOR LOW-COST HOUSING CONSTRUCTION IN INDONESIA

Introduction

The problems of housing the poorer segment of the community and the huge increases forecast in population are ones in which the Government must be congratulated in addressing a forthright manner.

The demand for better quality walls and roofing materials for low-cost housing construction compels consideration of price in relation to low cost. There must be a compromise between quality and price, and there is no doubt that upgrading the quality of building materials in general will be of benefit. Some examples include:

(a) The use of concrete columns and ring beams. The problem of earthquakes has been investigated by the Department of Human Settlement, but are the specifications now too high, especially with respect to small houses? Many small brick buildings still remain. Perhaps only a little brick reinforcing would be necessary for them to withstand the force caused by an earth tremor;

(b) Infilling of the panels between columns and ring beams is now specified for bricks of a given dimensional tolerance and compressive-strength - however, the better the specifications the higher the price.

Visits were made to a few of the existing Perumnas housing estates; and the development of a core house was particularly impressive. It was also noted that the older houses using Bataco blocks in Jakarta seemed to be in excellent condition, with very few cracks.

It was also noted that the roofs of the older houses had been built with uncured timber which had been used to support asbestos cement. Major problems are a result of this practice.

In some instances the local population have not accepted the four-storied Perumnas blocks of flats, presumably due to local preferences.

Transmigration houses

Drawings of transmigration houses give the impression that they are well laid out. One is aware that social conditions must be taken into account and that the houses are built in such a way that people are encouraged to move. On the other hand, it has often been said that the structures are not considered permanent and that the occupiers are expected to raise their standard of living in order to obtain better houses within a period of five years - which causes one to observe that perhaps the standard is higher than can be afforded, particularly in hard economic times.

The private sector appears to be efficient, and, indeed, it must be in order to operate on the small margin of profit available in the low-cost sector. Perhaps this sector could be involved even more than it is at present?

III. THE PRESENT STATUS OF THE BUILDING MATERIAL INDUSTRIES IN THE SMALL-SCALE/RURAL SECTOR

The documentation with respect to this and earlier projects stated that there could be a shortage of building materials because of the needs for housing under Repelita III and IV.

This particular project was directed to small-scale rural sectors. After visiting local small-scale construction material businesses it can be said that the natural forces of supply and demand control this particular sector very well, especially in the heavily populated areas of the country.

Small woodworkers, brick, tile, and metal workers, as well as block makers are in business because they can make a living. The market requirements provides the opportunities for them to meet their family's needs. If the market became larger, they either get larger, or more people set up similar businesses. The natural forces within the market help balance it. The woodworker can be helped by being encouraged to use small electric hand tools, the block maker can be helped to tamp his blocks better or make a better mix using better equipment or techniques. They must not, however, be upgraded too fast in order that their hopes remain within the boundaries of achievement.

The possibility of doing a large volume of business as a result of government projects is considered to be counter-productive. Larger requirements for building materials can be met at present by the medium tc large sector of the industry. The natural forces in the market-place, based on supply and demand, balance out the country's requirements.

The objective in developing the very small rural informal sector is not to ensure better and economical building materials for large-scale government projects, but rather to develop these small industries so that the general quality of life of the workers is improved and that they are able to achieve this under the existing co-operative system. The use of large-scale projects gives temporary help to small industries but should not be the basis of their existence. They depend for their day-to-day living on supplying the local market. The demand for better quality products is based on the need of government projects - a demand which will upgrade small industry as it strives to sell more products - it will be a natural evolution helped by co-operation with the Ministry of Industry etc. The know-how and methods must be made available to these industries but the process cannot be forced if the results are to be lasting.

IV. THE POTENTIAL OF THE INSTITUTIONAL INFRASTRUCTURE

The ministerial infrastructure is basically sound. Research and Development, and the design and service ministries are extremely well set up with knowledgeable and organized staff and facilities. They are well interlinked by committees and subcommittees.

Because of the huge distances and large populations to be controlled, these organizations become large and to a certain degree unwieldy. Ministries tend to overlap and it was for this reason that the present project was commissioned to co-ordinate these various activities. To impose another co-ordinating facility, however, on top of a large interconnected group of committees and subcommittees of the various government's departments was doomed to only mediocre success. In retrospect, the location of single minded "experts" within these ministries etc., working outward rather than inward, as has been the case, would have been more productive.

The supply and expertise have been more than adequate, with respect to the local manufacture of equipment, particularly in the brick and tile industry.

The new units purchased all their requirements from local suppliers. For the wood-working units, machines were either purchased locally or assembled in Indonesia; only the size of the market controls the natural growth of locally manufactured machines.

V. TECHNICAL AND MANAGEMENT MANUALS

Technical and management manuals have not yet been compiled. The adequate reports of the project give government departments and officials a full picnture of the work done during its history. They are of little use, however, to the industrial leader of a KUD as they are not sufficiently basic. It is to be hoped that the manuals now in the course of preparation will fill this need.

VI. LINKAGE TO THE MARKET AND FINANCIAL VIABILITY

Palembang - S. Sumatra

Clay brick and roofing tile unit Talang Kelopen

This unit operated well under the guidance of Mr. Wahid and his sons. It supplied tiles of good quality but the bricks were not of such a high standard, particularly as regards dimensions. The reason was the cutting of the tiles as they moved out of the extruder. Despite this they were sold and were acceptable to the local building trade.

The tiles were marked KUD, which was reported to be a good selling feature. The local Perumnas office knew of no new project in their area.

This unit was engaged in supplying bricks and tiles for the local construction market. It was well satisfied with its monthly output of 72,000 bricks and 20,000 tiles all of which were sold to customers who came to the plant. There were many other producers in the area but the volume was sufficient to make this unit viable.

Three presses are in excess of requirements (leaving two) and these should be withdrawn and relocated elsewhere by the Regional Steering Committee (RSC) for use by other manufacturers in the area.

The question of KUD management etc. has yet to be finalized by the RSC.

Palembang, wood-working unit Sungai Buayu

This unit was ready to begin operating. Local government has provided land, building, transportation of machinery to the site, start up, and working capital, and it also paid for the staff, including the manager.

It represents a local government project set up with UNIDO expertise and equipment. As far as UNIDO is concerned the object was to provide a pilot plant for the use of lower-grade timber to be made into doors, frames, windows, and perhaps prefabricated buildings. As far as the local government was concerned, an alternative was to provide a pilot plant for the use and training of local saw millers so that they could finish timber for export. This is a government requirement to be implemented within the next seven years.

Both purposes are excellent concepts, and there remains only the question of handing over of UNIDO equipment to the government authorities. No KUD has been formed at present and the chairman of the RSC is keen to have local government interests in this project protected. He has been told, too, that these problems must be resolved quickly.

It is a worthwile project and UNDP input of machinery can be handed over to the government at the conclusion of the project.

Pakis KUD, Malang

This unit only produced tiles as its bricks were not competitive. The unit was unlike the other models tested. It started up from new, without clay, property or craftsmen. Land was brought by the KUD at an approved clay source. The buildings were installed together with the necessary machinery - one mixer/extruder and five presses; a kiln was also built.

The unit was operated by staff from the local KUD and consisted of one supervisor with two assistants, and 30 other employees. The unit is in production and has supplied 81,400 tiles to the Malang Perumnas project. However, there is a problem. Approximately 20 per cent of the tiles which have been installed have cracked and will have to be replaced. The kiln also has a high rate of rejects.

The unit claims to sell 20,000 tiles each month, but the figure could not be checked and is probably too high. If the sales were only 10,000 per month it would be good considering that the unit is unknown and is not sited in a known village of tile producers.

However, as there are no experienced craftsmen the KUD supervisor believes that he is filling a social need by employing 30 staff.

When asked how orders were obtained the answer was that customers simply arrived with their orders; but it appears that they would have difficulty even in finding the unit. To the suggestion that three supervisors from the KUD seemed too many - the reply was that they were all needed. It was also suggested that two of them could perhaps obtain motor cycles from the KUD and look for future business.

Because of the early start-up costs for land, buildings etc., the KUD is now short of funds, and if they were to be charged for replacing the Perumnas damaged tiles they could be in a very bad financial situation.

This unit is a good model for verifying whether a unit could be viable with normal start-up costs and run by KUD salaried staff.

Turen KUD, Malang

It was anticipated that this unit would be either dormant or out of operation. The unit was established at the request of the local government authority to help the KUD, and from this point of view it was a failure, however, from the point of view of improving the status of the craftsmen, and improving the materials it is a thorough success.

The unit was shared by five craftsmen who were accustomed to producing traditional tiles, with access to kilns and drying sheds. The UNIDO mixer/extruder is located with the manager, Mr. Tarmidji.

When the five members receive an order from the KUD they distribute it among themselves. However, when an old customer arrives or they obtain an order themselves, they consider it their personal order. They produce traditional tiles and their own type of pressed tiles made with their own dies installed in the UNIDO/KUD press. They also produce KUD-marked tiles from UNIDO dies when the KUD gets an order. Hence there is a separation of the two philosophies: the co-operative with everybody sharing, and the private entrepreneur.

The KUD equipment is often used for mixing clay supplied by others, in this case a charge of Rp 4 to 6 is made for mixing, depending on the amount of clay. This charge is credited to the KUD funds.

Turen has a problem in that all clay is purchased from a supplier who transports it to the village. Grey clay is often mixed with red clay on a 50:50 basis, as recommended by the Ceramic Research and Development Institute (CRDI).

The members sell to all sectors of the market from Rp 38 to Rp 85 per tile. They do not make bricks as these are not competitive. There are approximately 50 small tile units in the area.

The monthly sales of non-KUD tiles total approximately 7,000, which gives them an adequate return. There is no sale of upgraded UNIDO-type tiles through the KUD at present, although a few were originally sold to a Perumnas project in Malang.

The unit has been a success because:

(a) The system has been accepted as worthwhile (a mobile mixer that was available in the village but not used, is now being utilized by others as a result of the example);

(b) The members' income has increased because of the UNIDO system.

The relationship of the KUD to the craftsmen, however, will have to be improved.

Samarinda - Sepaja village tile and bricks project

This project has an input both from local government and Mr. H. A. Rauf. It would appear that the history of brick making in this district is fairly recent. For some years, buildings were of timber and the roofs were of wooden shingles.

Subsequently, as the area developed, corrugated-steel roofing became the most common roofing material. This background indicates that the market for tile roofs is not yet established as in Java and in other areas.

The fact that most of the workers in the tile unit were migrant workers from Madura indicated a rather unstable condition for the industry. It was also noteworthy that the trained staff were not working at the unit. It was understood that the clay at the site was tested by the Ceramic Industry Research Unit at Bandung and found to be satisfactory. The kiln was built according to the design provided by the CRDI and its staff have been at the site during production and firing. Nevertheless, the kiln is not producing satisfactory bricks or tiles. A major effort will have to be made immediately to rectify the production problems. With respect to the viability of the unit once good bricks are produced, the unit will be able to sell bricks in competition with other hand-made bricks. However, the tile market will still have to be established, and government projects will help to establish the use of tiles and sales for the unit's production. Although a KUD is in existence it is not yet in operation.

The project has five tile presses which is in excess of requirements. However, because the industry in the area is at an early stage there seems little possibility of using them elsewhere.

It is important that local officials from the Ministry of Industry, Ministry of Co-operatives, local government etc. take careful note of this unit and follow its progress in the next few months. The co-operation that will be provided by the CRDI is of particular importance.

With this background in mind, the equipment should be capable of being transferred to the Government at the end of the project.

Samarinda - Segihan village wood component and preservation unit

This unit is identical in layout and equipment to that in Sumatra. Its location in Segihan village was decided upon in order to be nearer to a timber source and to the transmigration housing area. As a result it is located a long way from Samarinda and it is difficult to service with its daily requirements.

A loan was expected in February 1987 to enable P.D. Parymida, the company involved in the joint venture with the KUD, to complete the buildings and install the machinery which has been at the site for some months.

It seems doubtful with normal accounting practices that the transmigration houses the unit hopes to supply will be competitive with those now being sold by companies which cut and erect houses at the transmigration site. Other established prefabricators in Samarinda will also not be in a position to compete.

The advantages of local government support together with a business-oriented joint venture partner who is also involved in contracting and is a forest concession holder, will ensure a successful outcome for this unit as part of the local KUD.

A further advantage is that a biogas electrical generating unit will also be installed which will double the capacity of the present diesel generator. Such organizations as INHUTANI, at Samarinda, which process and treat timber, produce prefabricated houses, and have carried out training of UNIDO project staff provide the expertise which will be needed in the future.

The installation of machinery and the completion of the building should be proceeded with as quickly as possible. A completion date of 25 February 1987 was proposed by the production manager but it is doubtful if this could be accomplished by then. Because of the back-up available and the degree of local government involved the UNIDO machinery should be transferred to the Government at the conclusion of the project.

VII. IMPROVING THE LINKAGE BETWEEN SMALL AND INFORMAL BUILDING MATERIAL PRODUCERS

General

The problems which have become apparent in the six units established under the UNIDO project as well as the project at Solo have involved the linkage between the production units and the large projects.

Commonly called marketing or selling, the linkage involves direct selling, without the use of a middleman. The objective of the UNIDO project was to set up and upgrade small and informal construction material producers and to form them into KUDs.

Although it was first thought that there would be a shortage of construction materials for low-cost house construction under Repelita IV, a survey showed that this was not the case. Construction materials produced in Indonesia are in excess of requirements.

The decrease in activity caused by financial restraints makes this now even more the case. The proposals, therefore, are being made in order to assist small village production units to obtain a share in the government's low-cost housing projects with special reference to strengthening the concept of co-operatives which have been formed in this sector.

In formulating these proposals, the lessons learned from the model units shows that small-scale manufacturers cannot be expected to supply all the requirements of large government projects. Neither can they supply large quantities quickly, nor have they the cash flow to do so.

It is suggested that they be permitted a fair share, in manageable quantities, which will help them with respect to profitability but will not cause them to have too great an expectation which would be counter-productive if a large government scheme is not set up in their area. Their functions would be to supply the basic needs of the local market.

The methods for upgrading quality and production volume have been indicated and the following proposal has been suggested for preliminary study.

Instead of production units selling their products to large government projects the process should be reversed - the government constructors should look to the small-scale units for some of their requirements. This is already done at times but the process should be regularized.

All small producers manufacturing building materials should be registered as to their type of product and output capability. KUD producers should always be given preference in the total process so that others are encouraged to form KUDs. An assessment of their production quality and dimensions should be indicated.

Early in the life of a new scheme, when it is being designed, Perumnas and other government authorities should call for a list of all those producers and products that are available in the area. The mix of designs, products used etc. should then be combined in the original layout and documents in order to accommodate the producers as far as is practicable.

The small producers should be advised of their allocations, quantity, time schedule etc. and asked for quotations. The prices should be reviewed, and if a production unit's price does not conform to the average price it should be made a counter-offer. KUD members should be given preference.

The project should arrange to stockpile products on the site in order to prevent bottlenecks. This assures them of payment and a flow of cash on delivery.

The remainder of the products needed for the project (which cannot be obtained from the small-scale co-operatives and small-scale industry) should be obtained from the private sector or produced on site by the contractors.

By following this course of action the Government has within its power the ability to assist the small-scale building material industry.

On the assumption that the Government wants to increase the number of small producers of building materials, the following is suggested:

(a) Of the remaining materials required on a site that cannot be supplied by small-scale units, the successful bidder should be contracted to produce as many products on the site itself;

(b) An area should be set aside from the building site, preferably on the approach road. If, for example, concrete blocks and door frames were the chosen "on site" production products, two buildings should be erected on the site, the first to store timber and finished door frames, the other to house concrete block machinery and woodworking equipment;

(c) Early in the project the contractor should begin to manufacture products for stock purposes, and to train local people to carry out most of the work;

(d) Because the contractor has produced products directly on the site, his machines should be written off during the duration of the contract;

(e) At the end of the contract the buildings housing the production units, together with one block machine and one each of the timber working machines, should be handed over free to a KUD formed from among the best local people who have been working in the production units. (The Government will also have to transfer the land to the KUD.).

In this way a further small-scale unit has been formed of trained people, without capital outlay for machinery, building, or land, and with a future in providing the needs for local requirements, particularly if the project has core buildings for further expansion.

Although the above suggestions are based on the tile market, they can be extended to other materials.

General

It has been noted that in the mandor system there is a problem with the standard of workmanship because of the lack of training of the workers. As a result, in the course of the UNIDO project, sample houses for training were used to ensure that the tiles provided a good water-tight roof. This enabled good quality tiles to be installed correctly. It was suggested that:

(a) Local co-operatives form small application groups, called "Foster Brothers";

(b) The groups should consist of young men who had dropped out of school rather than older construction men who were set in their ways;

(c) The groups should be trained to apply roofing tiles properly;

(d) On any contract site (including government sites) the co-operative should give quotations not as a price per tile but on an applied price per square metre or per house;

(e) The production unit would be the contractor, while the Foster Brothers would be part of the production co-operative;

(f) The Foster Brothers would be paid a percentage of the applied cost by the contractor for the value of their labour each week, as is common in the industry (paid via the co-operative). The full quoted price (preferably per house) to be paid to the co-operative on the completion of each house;

(g) This system, direct from the factory to finished roof eliminates the middleman, gives training and work to young people, permits undivided responsibility for a good job, and increases production for the factory (with a good cash flow). The system has worked well elsewhere, however, it would have to be developed further as it is a new concept in the construction industry in Indonesia.

Another alternative which might be considered to be too costly would be the formation of a Bulog for building materials; but a less costly alternative would be the establishment of a warehousing or selling outlet in the large centres which would sell or distribute KUD building materials on behalf of the units. There are, however, insufficient units or co-operatives in the construction materials field at present to make this alternative viable. It is also noted that there are many building supply retail outlets operating in the private sector which would be in competition with a government/KUD outlet.

VIII. APPLYING THE EXPERIENCE OF MODEL TILE UNITS

The experience gained by the project's tile models has shown that the mechanical mixing and pressing of tiles is acceptable to established craftsmen in the tile industry. The following suggestions should enable many craftsmen to assess the operation of these machines and to learn how they may acquire them:

(a) A portable simple clay blender as used at Solo is acquired;

(b) A small tile press with easily changed dies is added to the mixer;

(c) The two pieces of equipment are loaded on a truck to make them fully transportable;

(d) Print simple instruction pamphlets with diagrams;

(e) To answer the question "How can I afford these?", demonstrate the advantages of the KUD movement together with the opportunities for obtaining loans through the KUD.

A unit manned by experienced personnel in tile making and financed by the KUD should arrange, through the Ministry of Industry and local government officials, to set up a demonstration unit in the villages. Local craftsmen could supply the small quantity of clay required and they could be given the completed pressed tiles to dry and kiln. The actual demonstration should take no longer than one day.

Follow-up and information on successful units such as that at Solo should be given, so that craftsmen can be made aware of the long-term success of such methods.

IX. BROADENING THE PROJECT TO INCLUDE OTHER BUILDING MATERIALS

Clay tiles, rather than brick, have been proved to be the main area of endeavour that is acceptable to upgrading. Although the earlier project considered other products, clay products were concentrated on in this project.

The clay industry has developed over many hundreds of years, however, it involves the largest number of operations of any small building materials production unit, and therefore provides a large number of possible problems.

In fact there are six operations:

(a) Choice of clay;

(b) Removal of clay and transporting it to the unit;

(c) Mixing clay;

(d) Forming the clay;

(e) Drying;

(f) Kilning.

In addition to the above operations, in successful and well-established areas the clay has been depleted near the unit, with the result that greater transportation costs cause concern.

The clay used in the industry is good agricultural "soil", and there is an environmental problem, particularly in such densely populated areas as Java.

A further problem is the inefficient use of wood for firing the kilns. Although quite plentiful in the outer islands, wood is becoming scarce in Java and its acquisition also causes environmental damage.

Three alternative materials are considered worthy of consideration:

(a) Lime-based blocks;

(b) Conblocks - cement-based blocks;

(c) Cement tiles - hand-made.

These materials have the following operations:

(a) Obtaining aggregate (non-agricultural);

(b) Mixing with cement/lime (the cement is of a constant high standard);

(c) Tamping;

(d) Drying/curing.

These are simple operations, with no damage to the environment.

Hand-made cement tiles

It is not known if hand-made cement tiles have been considered in Indonesia; however, they are well-accepted in Africa and other countries (see annexes III and IV). The tiles are similar to traditional tiles although they could be moulded into any shape required. The manufacturing process is as simple as the hand-made traditional tile and the cost of setting up would be small.

It is recommended that the production of such tiles should be investigated and two models set up during the life of the project. This process would be excellent in areas which do not yet produce clay tiles, especially in the outer islands.

X. REQUIREMENTS FOR COMPLETION OF UNITS

Samarinda - Segihan village wood project

This project needs to be completed and the equipment needs to be installed. The UNIDO national staff member is already on location to ensure the commissioning of the unit. The training of staff is completed.

Samarinda - Sepaja village tile and brick unit

This unit has major problems in producing good bricks and tiles from the kiln. The UNIDO national staff member at Samarinda must obtain the collaboration of the CRDI to overcome this problem. The kiln may have to be rebuilt.

Turen - tile unit

This unit has problems with regard to quality. It is essential that the problems be solved as soon as possible; the help of the CRDI should be obtained.

Pakis-tile unit

The project should take particular note of the help needed at Pakis, over and above the technical requirements of kilning.

This is an exceptional unit in that it is not located in a village cluster; it is new, and it is managed by KUD members who have no entrepreneurial drive or experience.

The KUD staff, in co-operation with the Ministry of Co-operatives, need guidance - the broadening of the KUD into construction materials is in contrast to the background of village agricultural requirements.

In general the KUD does not seem to be integrating with the craftsman/ entrepreneur. Pakis could prove to be a model of how to overcome this problem. Among other things the project should co-ordinate the training of staff in salesmanship. They should visit other units such as Turen and Solo to compare the number of workers with their own. They should take structured salesmanship courses. The KUD should consider the use of motor cycles, to enable the staff to make sales calls after training.

This unit is a real challenge in getting a KUD to act as an entrepreneur. It is hoped that what is learned in this model could be used in the development of the KUDs in other areas of the village informal building materials sector.

In co-operation with the Ministry of Co-operatives, Industry, and others, sufficient funds would have to be made available for training.

Other problems

Simple technical and management manuals still have to be compiled; the preparation of documents is needed for handing over of equipment to the Ministry of Industry, and the transfer of the data bank to the Ministry of Housing must be undertaken.

Each of the units in the project has been developed with the local Regional Planning and Operation Team (RPOT), RSC, the National Steering Committee (NSC), UNIDO experts etc., although it is clear that no use has been made of the entrepreneur's experience, craftsmen, or the successful KUD at Solo. It is absolutely necessary to visit successful units and use their personnel to explain and help the units that need help.

XI. COMPLETING THE PROJECT

Listing of small-sized building materials manufacturers and KUD producers

(a) The size and output of manufacturers must be defined within certain limits. It is suggested that the number of employees and output per unit should be the criteria;

(b) The schedule of the materials, output per month - average and maximum, should be obtained. Details of KUD affiliation and quality of products should be shown;

(c) The production of such data may be difficult to obtain, particularly in the small informal sectors. The co-operation of all ministries and local government departments will be essential;

(d) When the methods have been determined, one or more samples should be undertaken immediately;

(e) The computer used for the building materials data bank within the present project should be used for the collation of information;

(f) On the successful completion of the sample data the information should be given to the Ministry of Industry (Small Industries Department) for future expansion and use by Perumnas and other government construction agencies. This data could also be used to distribute information regarding the building standards required by the Government.

Its further use would be in arranging seminars and training for selected groups.

Methods and systems required

Investigate the possibility of providing a model to enable Perumnas to implement the recommendation in chapter VII with respect to small producers of building materials.

A model group of Foster Brothers should be set up which uses the requirements for the Pakis project to replace the poor tiles on the Perumnas Malang project. This model should begin immediately as the tiles are extremely bad; water is damaging the houses, and Perumnas intends to sell them shortly.

If repairs are not carried out by Foster Brothers, Perumnas will charge the Pakis KUD for repairs and perhaps for water damage. The charges cannot be sustained by the weak Pakis KUD, and must be kept to a minimum.

The implementation of a mobile clay tile unit

The project staff is well informed with respect to the suppliers of equipment needed for the mobile clay tile unit. This equipment, preferably on preferred terms, should be obtained from the manufacturers. It should be mounted on a truck to be taken to demonstration sites in liaison with the Ministry of Industry as to location of such sites. The project staff should

initially provide the leader of the demonstration unit; the other members should be drawn from KUD Pakis and other KUDs nominated by the Ministry of Co-operatives.

The model should be operated and refined so that it may be handed over to the Ministry of Industry for future use.

Broadening the project to cover other building materials such as cement and lime

Training equipment should be purchased and set up on a vehicle for easy transportation. Manufacturers should be approached with respect to simple moulds and presses. The Institute for Human Settlement unit, at Bandung, as well as the CRDI should be contacted for information as to mixes and equipment. They have done research on these materials and methods.

Demonstrations should be arranged through the Ministry of Industry at selected locations. The system, mixes and information, together with the advantages of forming KUDs should be passed on in the same way as with the mobile demonstration unit of clay tiles.

Hand-made cement tiles

The project should check to see if investigations have already been made in Indonesia regarding these tiles.

A model should be set up with the help of a local conblock manufacturer to prove the methods and system.

International expertise is available.

Annex I

JOB DESCRIPTION

Post title: Consultant on Policy Formulation for Upgrading Small Scale Building Material Industries

Duration: Two months

Duty required: As soon as possible

Duty station: Jakarta, with possibility of travel within Indonesia

Purpose of project: To ensure the availability of building materials in adequate quality and quantity and at the required time and location to meet the demands of low-cost housing and other building constructions in the country.

Duties: The consultant will work in co-operation with a team of international and national experts functioning under the overall co-ordination of a National Director supported by an international Chief Technical Adviser and will specifically be expected to:

1. Analyse the experiences gained by the project in the establishment and operation of model production units set up as Industrial Village Co-operatives.

2. Undertake a perceptive overview of the plans and projections for low-cost housing construction in Indonesia, including transmigration housing, privately constructed low-cost housing, and also Neighbourhood Improvement Schemes etc.

3. Make a broad assessment of the present status of the building materials industries in the very small-scale/rural informal sector through sample visits.

4. Assess the potential of the institutional infrastructure available through visits and discussions with, inter alia, Ministry of Housing, Ministry of Industry, Institute of Human Settlements, Ceramic Research and Development Institute, local equipment manufacturers etc.

5. Review the technical and management manuals produced by the project and based on experiences in establishing and operating the Industrial Village Co-cperatives.

6. Inspect the units already set up and operating, and in particular, their linkages to market, financial viability etc.

7. Propose an overall plan for a study to elaborate policy elements of national relevance based on the above. The intention of the study is to suggest policy actions for upgrading the small, informal building

material producers so that they are able to make acceptable quality standardized building materials through economically viable operations using the opportunities presented by the massive low-cost housing construction market.

8. Recommend in detail what additional data should be generated before such a study can be meaningfully mounted.

9. Suggest how best such data can be generated, using the project resources, and propose a work plan.

Annex II

REVIEW OF THE SOLO MODEL

This model was located in a village that only produced tiles. The model had a mixer/extruder and five tile presses. Fortunately there was a local Perumnas project which was persuaded to roof some of its houses with clay tiles from the unit which were new in size and compressive strengths.

The unit was part of a KUD which consisted of eight tile producers. The new UNIDO-type tiles sold at double the price of the standard hand-made conventional tile, with only a little increase in production cost (if the depreciation of the machines were to be ignored).

An enormous number of tiles was being produced in the village, every house was making them, and half the streets were covered with drying tiles. There was no problem with marketing as customers flocked to the village to buy them. One problem was the supply of clay; all the procducers bought it from suppliers as the clay source became located further and further away from the village. It was this that made bricks too expensive to compete with those made in the paddy fields. In the case of tiles, the value added is far in excess of that of bricks.

Four years after its completion, the KUD with its eight members is well organized and run by people who are well-oriented in the construction materials business; they are also good businessmen. This makes them acceptable to the entrepreneurial craftsmen who formed the KUD.

The location of the original unit has changed over the past four years. The KUD manager has located the mixer/extruder in his unit together with one press. The other presses have been distributed among the other members. There are now less expensive mobile mixers in the village which can be moved and used by all members for a fee.

The manager is an excellent example of the success of this model because he uses the UNIDO large extruder and also contracts for mixing on the portable mixer when he needs extra mixing capacity. He owns a small tile press in addition to the UNIDO one and presses out smaller and thus cheaper tiles than the UNIDO type. He also still makes traditional tiles. He supplied the following information regarding his equipment:

Extruder/mixer	UNIDO type, Rp 8,000,000	Smaller unit, Rp 2,000,000
Press	Rp 2,000,000	Mixer only, Rp 350,000

These models are extremely successful both in upgrading the industry and in the effectiveness of the KUD.

The success of this unit was as a result of:

(a) The unit was established in an area which was strong in the entrepreneurial making of clay tiles;

(b) The system of kilning, mixing and drying were well known;

(c) The clay was already proved as good tile clay;

(d) The upgrading of the tiles in quality and shape has been proven;

(e) The new tiles could not cater for all the business available; there was a good market for conventional tiles as well as a middle grade of tile. Hence, KUD members being aware of market requirements, have benefited from all categories of the market;

(f) The model has strengthened the KUD;

(g) The model has made the system acceptable to many, and as a result they have purchased their own machines;

(h) The model has been very successful.

Even though this model has been a success, it should be noted that in the four more recent units the model has had to be modified to suit the local.

A smaller mixer and two smaller presses for a maximum output of 40,000 tiles seems to be the most economic and viable size of installation for tiles only.

Annex III

ESTIMATED FIBRE-REINFORCED CEMENT (FRC) ROOF SHEET PRODUCTION COSTS

Products measuring 1 m x 0.77 m (approximately 0.75 sq m or 8 sq ft).
Reference data collected 1979-1980.
Costs in £ Stg.

	Labour			Materials (maximum requirement)			
	Work hours per sheet	Rate per hour	Costs	Cement 10.0 kg	Sand 10.0 kg	Fibre 0.2 kg	Total cost per sheet
Fiji, Taveuni*	0.8	0.44	0.36	0.70	-	0.13	1.21
Java	1.6	0.09	0.14	0.41	-	0.02	0.57
Timor	1.6	0.09	0.14	0.55	-	0.05	0.74
Bangladesh*	1.6	0.06	0.10	0.50	-	0.03	0.63
Malawi*	1.0	0.16	0.16	0.57	0.02	0.11	0.86
Honduras*	1.6	0.23	0.37	0.50	0.02	0.06	0.95
St. Vincent	1.2	0.33	0.40	0.49	0.01	0.01	1.00
Dominica*	1.6	0.22	0.35	0.49	0.01	0.01	0.86
Sri Lanka*	1.3	0.10	0.13	0.60	0.05	0.20	0.98
UK*	0.5	2.00	1.00	0.50	0.03	0.20	1.75
Average of 10 locations	1.3	0.37	0.32	0.53	0.02	0.10	0.96

*Based on actual production experience in commercial or pilot plants; others from feasibility study estimates from local cost data.

Annex IV

COST COMPARISON: ASBESTOS CEMENT, GALVANIZED IRON AND FRC SHEETS

(Costs in £ Stg per sq ft).

	Asbestos cement	Galvanized corrugated iron	Fibre reinforced cement	Aluminium	Onduline
Fiji, Taveuni	0.40	0.27	0.15	0.60	-
Java	0.25	0.10	0.07	-	-
Timor	0.50	0.18	0.09	-	-
Bangladesh	0.14	0.23	0.08	-	-
Malawi	-	0.15	0.11	-	-
Honduras	0.33	-	0.12	-	-
St. Vincent	-	0.23	0.13	-	0.34
Dominica	0.40	0.32	0.11	-	-
Sri Lanka	0.11	0.16	0.12	0.36	-
UK	0.60	0.25	0.22	-	-
Average cost					
per sq ft	0.34	0.21	0.12	0.48	0.34
per sq m	3.54	2.24	1.25	5.00	3.54