

Improving productivity in low cost housing projects through technology transfer (African experience)

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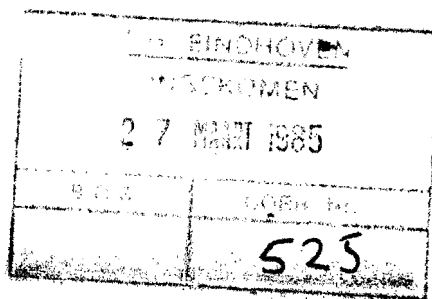
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IMPROVING PRODUCTIVITY IN LOW COST HOUSING PROJECTS THROUGH TECHNOLOGY TRANSFER (AFRICAN EXPERIENCE)

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0. Summary

Most of the problems encountered with the realization of (low cost) housing projects can be addressed to lack of technical knowledge and of training of participants in the building process.

As a result, the productivity - here generally defined as the ratio of output and input is low and consequently the annual number of housing units produced. Governments, being aware of these problems, developed aid programmes in consultation with donor countries.

A range of actions were put into effect. Solutions like: foreign expert assistance, technical assistance and the construction of prototypes. The author spent a number of years in Kenya. Therefore the examples originate from this country.

- Foreign experts were employed together with local counterparts in Ministries, housing organizations and contracting firms. The counterpart was trained during a certain period after which the expatriate left. In other organizations like technical schools and the University, experts were employed as a teacher, without a counterpart.
- Technical assistance was given in the form of machines. (block making presses etc.)
- Prototypes were constructed at specific places (e.g. new building sites or demonstration sites).

Some of the described solutions were successful while others were not. This paper will analyse the backgrounds.

1. Productivity in low cost housing

Low cost housing can be defined as housing for low income groups costing not more than a maximum of twenty percent of their income for rent or mortgage. All over the world is an ever increasing low cost housing shortage. One of the reasons on the demand side is the rapid population growth (absolute and relative) and on the supply side the limited number of annually completed housing units. This paper deals with this supply side.

The production of low cost housing units by both the construction industry and the individual is low and so is also the productivity. Productivity can be defined as the ratio of output and input. The output can be m^3 of house, m^2 of floor area and the input is a combination of the factors labour, manhours, machine hours, materials (m^3 , kgs) and capital. Single factor productivity is for example labour productivity or capital productivity while total productivity takes into account all the input factors. (1)

Total productivity can be increased in two ways:

- by increasing the output with a constant input
- by decreasing the input with a constant output
- by a combination of increasing output and decreasing input.

The effect of the first option will be, more housing units for the same amount of input. The second option gives a constant housing output for a lower amount of input.

Factors which influence input and/or output are called productivity factors: skills of artisans, knowledge of building techniques, availability of suitable tools, organization, continuity, motivation etc. Technology transfer is one of the ways and means to influence and improve these productivity factors. This paper describes some techniques of technology transfer and reviews some good and bad cases of technology transfer.

2. Techniques of technology transfer

Technology Transfer (TT) can be defined as the transfer of practical knowledge of technical processes from one country to another country. For the benefit of the building industry, this transfer can take place at different levels:

- government: ministries, local authorities, governmental building organizations
- semi-government: housing corporations, cooperatives, research institutes
- private: contracting firms, design firms, aid organizations and individuals.

The following methods of TT can be distinguished:

1. The use of expatriates (-properly trained foreigners), who can train people "on" the job. These people - so called counterparts - can take over this job after the training period. Secondly, expatriates can train teachers, researchers, etc. during short or long term courses, or they can teach students for longer periods at schools and universities.
2. To send employees overseas for advanced courses or for training on the job.
3. To set up demonstration projects. These projects can show other technologies so that people can get an impression of its potentials. E.g. the 'Karen Village Technology Unit (Kenya) has a permanent show of prototypical buildings and building technologies (2).

4. To transfer "hardware" through the installation of machines. These should be accompanied by proper technical support. A bigger transfer can be the installation of a complete factory with all the foreign know how of production processes etc.
5. To establish local research & development institutes, which can search for (local and foreign) appropriate technologies. The main tasks are the collection, translation, testing and dissemination of knowledge and technologies. A good example is the Housing Research and Development Unit (HRDU) of the Nairobi University. The Unit managed to employ expatriates for a long period, did much research and prepared numerous publications.
Also the cooperation with foreign research institutes can be of advantage for both parties (3). In particular we can think of cooperation between research institutes of other third world countries (so called south-south cooperation).
6. To exchange information like magazines, books, films, slides, video tapes etc. Also the invention of the personal-computer provides excellent opportunities. Interactive educational computer programmes can improve the quality and the amount of knowledge.
7. To exchange information in seminars, workshops etc. (UNCHS: Habitat is a good international example).
8. To give technical advices in writing as is being done by the Intermediate Technology Development Group (ITDG), the TOOL Foundation and universities etc.
9. To promote cooperation between a foreign organization and a local one. For important construction projects, foreign contractors can be forced by governments to create in a joint venture with a local contractor.

The list above gives just a brief view of possibilities for transfer. When considering technology transfer, one has the following constraints:

- Transfer of technology should not mean the transfer of unsuitable, too costly, inappropriate technologies to receiving countries.
- Moreover these countries should not be made dependent on donor countries and they should not become a dumping place for technologies refused in developed countries.
- The third world should not become a research area for technologies only appropriate for donor countries.

3. Case studies of technology transfer

Some examples of unsuccessful and successful case studies will be presented in this chapter.

- Technology transfer through institution building.

At the end of the sixties a Dutch mission developed a technical assistance programme for solving the problematic housing situation in Kenya. This resulted in the appointment of 11 expatriate housing- and infra structural experts at key positions in ministries and semi-governmental bodies: Ministry of Housing

(building statistics and planning) Works (roads, materials) Physical planning (Urban Development), The National Housing Corporation and the University of Nairobi (HRDU).

The expatriates had to work in these organizations and they should also coordinate as a team the activities of these organizations for the development of infrastructural & housing projects. This ambitious project worked out the other way.

The above organizations had serious staffing problems at all levels and were therefore not ready for cooperation with others. The expatriates were too busy with running of the daily matters and didn't have enough power to create any type of a team. This type of aid programme lasted just a few years and was changed into individual expert assistance for "institution building" at the various organizations.

This brings us to this second form of technology transfer:

- Expatriates for institution building

Another method is the use of expatriates for "institution building". Through technical assistance, governments may be helped on short notice but they are not stimulated to seek for long term solutions.

After departure of the last Dutch expatriates from the various ministries (in 1980) the personnel situation was not improved it was even worse, as too much was relied on expatriates. Positive however was their influence on the formulation of an overall infrastructural and housing policy.

- Technology transfer with counter parts.

One of the requirements for aid (of the Dutch Ministry for Development Cooperation) is the appointment of one or two local counterparts to be employed with each expatriate, working in an organization. In this way knowledge of technology can be transferred.

In order to understand the problem around counterparts, the Kenyan situation must be known: There is a great shortage of well educated & trained personnel. Those who qualify are usually absorbed by the private industries - mainly because of great differences in payment. Therefore those counterparts which could be attracted by the governmental organizations were limited in number and in qualifications. After a short period of working together with an expatriate the counterparts were usually sent overseas for advanced courses for a period of 6 - 24 months. Meanwhile the expatriate had to continue the work alone, and no transfer could take place. After their return the now trained counterparts often left the Governmental organizations for private business and the expatriate could start from "square one".

A solution for this problem can be found in the employment of a larger number (5 - 10) of counterparts with one expatriate. He can train them better and they can jointly do a lot of work. Training overseas - when necessary - can take place alternating while the actual work is not discontinued. More strict regulations of the government may also limit the easy transfer of counterparts to private industries.

- Technology transfer through training local or overseas

Personnel is often trained overseas in institutions to prepare them for their work in their home country. In a number of cases this method can be successful. However it also happens that these persons do not return to their home country after completion of the course. This can be caused by attractive contracts

offered abroad or by the better social security when not employed in this country (compared with wages when employed in the home country). This so called brain drain can be limited by offering training courses in the home country or in the region. The Netherlands Bouwcentrum Institute for Housing Studies (IHS) has set up regional training courses in Tanzania, Sri Lanka and Indonesia. These proved to be very effective: The course members remained in their own social and cultural environment.

- Technology transfer through building methods, techniques and industries.

A good example of technology transfer is the development of the "Brepak" blockmaking machine as developed by the British Building Research Establishment and the testing and introduction through local institutes in Barbados, Jamaica, Kenya, Thailand etc. The local requirements and circumstances were considered and this has resulted in a fool proof appropriate machine at reasonable low cost.

A bad example is the design of a rural clinique as developed by an expatriate, unaware of the local circumstances. (Fig. 1,2)

A prototype was erected at the University of Nairobi Campus and shows all advanced techniques which are available in the home country.

The idea is to prefabricate all the building components and to transport them to the rural building site. Steel as a building material is only limited available, and so are trained welders. The erection requires exact construction of the foundation and skilled site labour.

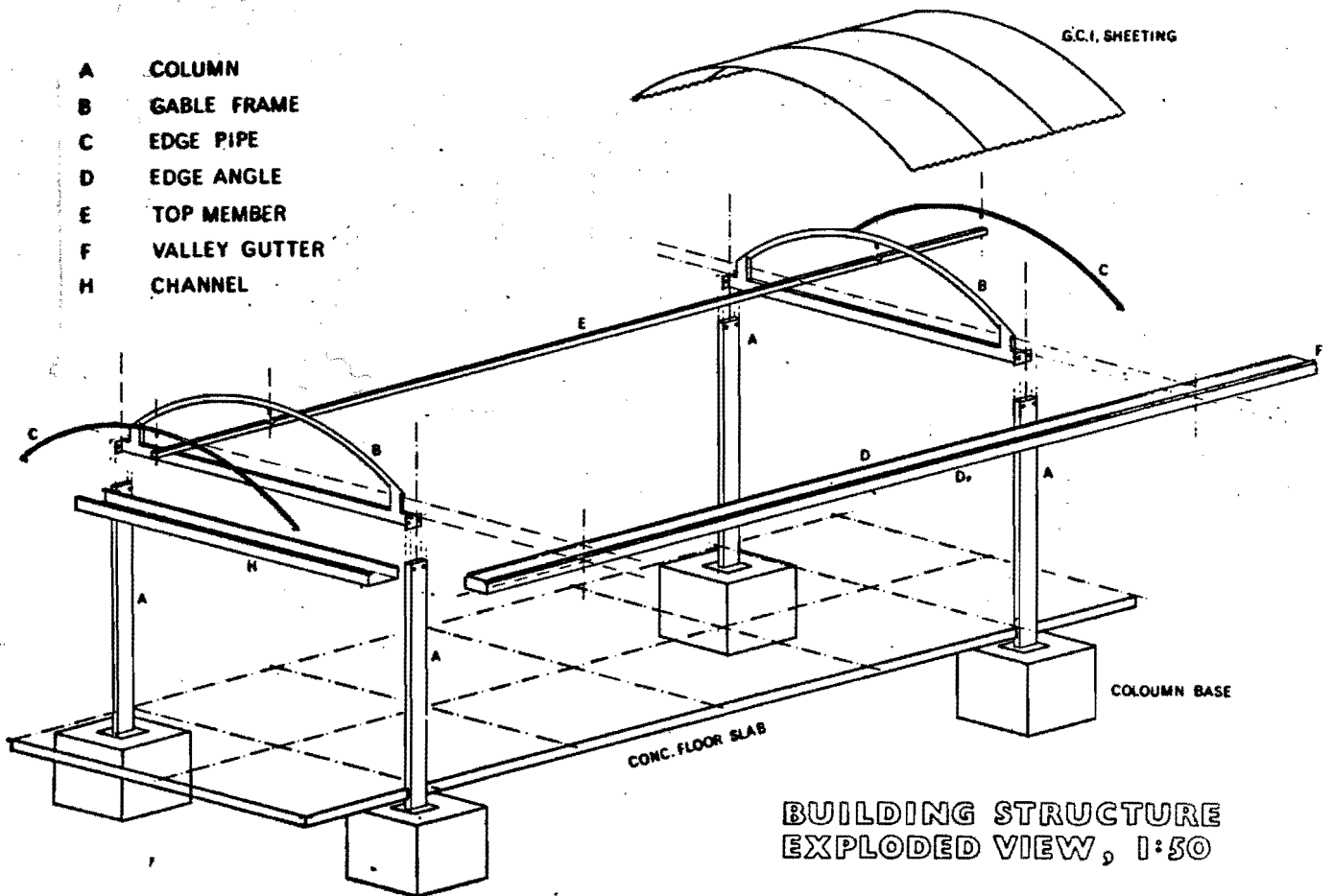


Fig. 1. Example of an inappropriate building (4)

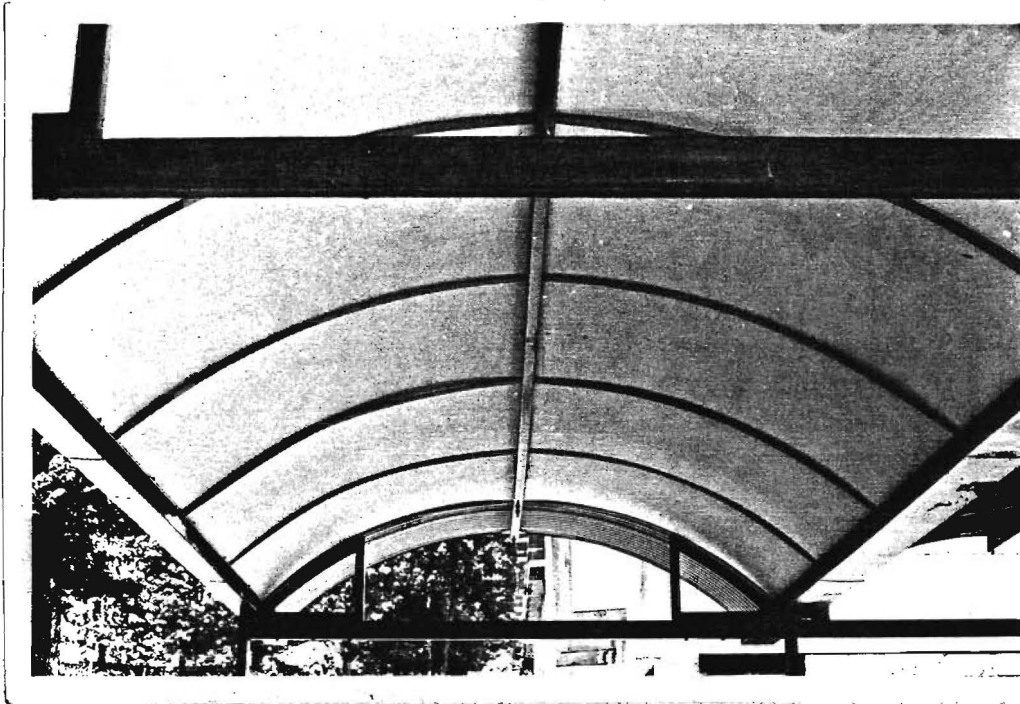


Fig. 2. Roof and part of the frame, note the window details. (4)

The transfer of a complete factory and production process is often impeded by local market conditions. The Government of Kenya received an offer to install a complete housing factory. Though the production process was quite appropriate, the basic requirement was an annual market for at least 1000 units in its vicinity. In a country like Kenya this will cause complete interference of the construction market which caused the project to be dropped.

4. Conclusions and recommendations

- Productivity in the housing sector can be increased through proper transfer of technology: increasing labour productivity and capital productivity. This results in a higher output of housing units.
- Transfer of technology is only effective when the receiving country has the suitable infrastructure where this technology can be implanted. Sometimes it is better to introduce a technology not before local constraints are removed.
- Not all technologies are appropriate enough to be transferred. Governments can play an important role in the selection process. It can be of advantage to prefer (improved) old skills above modern oriented ones. Governments can set an example by using (upgraded) appropriate techniques instead of more advanced "high-techniques" (e.g. Hospital in Djenné, Mali, (5)).

5. References

1. Sikkel L.P. & Erkelens Peter A.
"Productivity and Productivity factors in the Building Industry"
IABSE Journal J-25/84, November 1984.
2. Unicef Kenya.
"Appropriate village technology for basic services"
Unicef Eastern Africa Regional Office Nairobi, Kenya.
3. Erkelens Peter A.
"The economics of building materials research"
Appropriate Building Materials for Low Cost Housing, p. 321-325
E & M.M., Spon, London, New York, ISBN 0419 - 132805, 1983.
4. Frijdensberg Ole
"Alternative design for remote regions"
Ministry of Health, Nairobi.
5. Schijns Wolf
Local Architecture in Mali, West-Africa
Seminar Klimaat, Habitat & Kultuur, Eindhoven 1982.