

SUSTAINABLE LOW-COST HOUSING: NEW TECHNOLOGY AND ATTITUDES - THE IMPORTANCE OF CREATING AWARENESS. A DISCUSSION BASED ON RESULTS OBTAINED IN A PRE-STUDY

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Summary

One of the most serious problems in Ethiopia today is the rapid pace of de-forestation. The consequences are well-known: soil-erosion, shortage of fire-wood and, to a certain extent, lack of timber for construction. In Ethiopia some of the most durable indigenous species have been almost eradicated due to de-forestation.

Against this background a research project named "*Sustainable Low Cost Housing – needs, possibilities and attitudes. A project with focus on the Kambaata Region in Ethiopia*" has been initiated at Halmstad University. The aim of the project, which is interdisciplinary, is to develop and introduce a new low-cost housing technology and to analyse attitudes towards low-cost housing. This project has been preceded by a pre-study which forms the basis for this paper. The aim of the pre-study was mainly to gather necessary information on which the planning of the major project could be based

One of the main conclusions of the pre-study is that developing a new technology alone is not enough. An introduction of a new technology must take societies' attitudes into account, if it shall be successful. This can be done by an active and systematic awareness building. This, in its turn, must however be based on further research about attitudes towards low-cost housing technology.

1. Background

1.1 General

Ethiopia has a high population growth-rate as most of the developing countries. High population density and a high population growth like that in Kambaata Region in South Central Ethiopia contributes to a rapid pace of de-forestation. Consequences of such deforestation are soil-erosion, environmental degradation, shortage of fire-wood and scarcity of timber for construction. These problems are presumably accentuated in this region in recent years. Even if the de-forestation and erosion problems have not yet had a severe impact on the region, the high population density (300 persons/sq. km) and the high population growth-rate put a very high stress on the natural resources in the region. (Bielie et al 2001)

Some of the most durable indigenous species in Ethiopia such as *Juniperus Procera Hochst* and *Hagenia Abyssinica* has been almost eradicated due to de-forestation. Lack of timber for construction has made the construction of durable houses expensive and unaffordable for the low income group. Therefore, ordinary people are forced to almost entirely depend on fast-growing Eucalyptus which is less resistant to termite-attack and which has much lower durability. The effect of this in the long run is shorter lifetime for the houses, further deforestation and generally speaking, a lower level of standard of living.

Against this background a research project named "*Sustainable Low Cost Housing – needs, possibilities and attitudes. A project with focus on the Kambaata Region in Ethiopia*" has been initiated at Halmstad University.

1.2 Pre-study

The above mentioned project has been preceded by a pre study which forms the basis for this paper. The general aim of this pre-study was to gather information on which the planning of the major project could be based. An important part of the study was a visit field-study in Ethiopia with focus on Kambaata.

In this pre- study, the following four methods have been used:

1. Literature survey,
2. Structured and spontaneous interviews. These were held mainly in Southern Ethiopia. With some exceptions these interviews were held in the native language of the interviewed person. All interviews were recorded.
3. Observations. The research group made study-visits to completed and ongoing low-cost housing projects. Observations were documented in photographs.
4. A minor survey, based on ocular observations and interviews was made as regards dwelling houses in Durame in the administrative centre of Kambaata.

The results from this pre-study are mainly as follows:

- Several attempts have been made, and some are still being made, to introduce new, sustainable, low-cost house building technologies in Ethiopia. Neither of these attempts seem however to have had a greater impact, at least not on a regional or national level.
- The attitudes of involved parties, i.e. Governmental Organisations, NGO:s and above all of the final users, towards the concept "low-cost housing" seem to be decisive for the outcome of a project. In accordance with this it is important with research efforts in order to shed light on this specific field.
- As regards the Kambaata Region it seems appropriate to try to introduce new house building technology based on adobe blocks (mainly for rural areas) and cement stabilised soil blocks (mainly for urban areas). The development of these technologies must however take into account the availability of local materials and the application of them must take into account local traditions and the local culture

2. Aim and approach

The aim of this paper is to present and discuss some information obtained at the pre-study described above. This information will focus on the role of attitudes, from different parts, in connection with the introduction and implementation of low-cost housing projects. Furthermore, the intention is to discuss the importance of taking attitudes into account when planning, introducing and implementing low-cost housing projects.

The basis for the discussion mentioned above is obtained by presenting some cases of low-cost housing projects. In addition to this the following is presented: view-points forwarded at interviews, observations made in the field and information found in the literature.

3 Limitations and concepts

Generally speaking, sustainable construction is a construction that asserts human dignity, asserts environmental soundness, assures longer durability and is sustainable towards wear and tear. However, in this paper we have to introduce the following limitations: Firstly, when we speak about sustainable low-cost housing, we mean dwelling houses affordable for ordinary people whose annual income is between 5.000 - 10.000 Ethiopian Birr. Secondly, we have limited our study to two well-known wall-building technologies in connection with low-cost housing; i.e. the use of sun-dried adobe blocks (AB) and the use of cement stabilized soil blocks (CSSB). Other kinds of wall-materials as well as different materials for roofing etc are excluded.

4 Some results of the initial study

4.1 Discussion of some cases

The concept "Sustainable low-cost housing" is not new in Ethiopia. Several attempts have been made, and some are still being made, to introduce new, sustainable, low-cost house building technologies. There are examples of such projects from as early as the middle of the 1950s. However, neither of these attempts seems to have had any impact on the society.

4.1.1 Alemaya elementary school building

In the middle of 1950s, Swedish Mission BV constructed an elementary school building with adobe blocks in Alemaya about 500 km east of Addis Ababa. According to Nilsson (1954) the building was the first of its type in Alemaya to be built entirely with mud blocks and therefore the project aroused big interest among the inhabitants in Alemaya. Some persons tried to adopt the new technology which means, the project had a demonstration value.

The walls, which were founded on a stone-masonry wall, were plastered, presumably with lime-cement mortar. Nilsson (1954). This building was used as an elementary school up to 1990, when it was converted into a dwelling house.

Although this building was repaired and maintained during the years, it clearly shows that such buildings built from adobe blocks can function very well and really be durable, if the walls are provided with a proper foundation, a sufficient roof overhang and a suitable surface covering.

The organization, Swedish Mission BV., which erected this building, did not however follow up this elementary school building with other buildings built according to the same technology. Instead, when the school had to be expanded some years new buildings were erected with the use of concrete hollow blocks. That means that the potential of using this school as a demonstration project for sustainable low-cost building technology was not utilized as it could have been. It is reasonable to anticipate that this step had some influence on the attitudes of the people in the vicinity towards the new building technology. They who had adopted the technology were discouraged and they who were sceptical were strengthened in their scepticism.

4.1.2 Jinka elementary school building

As stated by Asplund (1997), the first building erected with cement stabilised soil blocks (CSSB) in Ethiopia was a school building in Jinka, about 800 km south of Addis Ababa. This building, which was built in 1968, is still in use, and in good condition, although according to Andersson (2003) the walls were not plastered, either externally or internally. The walls were provided with reinforced tie-beams and the building had a normal overhang Andersson, who was responsible for the project, asserted that the aim was to test a new technology and compare it with the more conventional technology based on concrete hollow blocks. One important aspect was the possibility to reduce the use of cement and thereby to reduce the high cost of transport.

This school was erected by the Elementary School Building Unit (ESBU), an organisation that during the late 60s and early 70s constructed hundreds of elementary schools in different parts of Ethiopia. ESBU did not however continue to use this technology in other parts of the country; instead it used a more conventional building technology based on concrete hollow blocks and pre-cast reinforced concrete elements fabricated at the building site.

Without doubt it would have been possible for ESBU to use the CSSB-technology at many places all over Ethiopia. This would have been a tremendous possibility to introduce and demonstrate a more sustainable technology in many parts of the country. It is reasonable to anticipate that if a respected and well know organisation had widely used this technology it should have had a great positive affect on peoples attitudes towards this new technology.

4.1.3 Ijaji low-cost housing project

More than ten years ago, the Ethiopian Evangelical Church Mekane Yesus (EECMY) started a low-cost housing project in Ijaji in Western Ethiopia. According to Johansson (2003), from a technical point of view, this project was a successful one. However, the new technology was not accepted by the local population, which to a great extent preferred to build the dwelling houses according to the traditional method, i.e. with a timber framework covered with mud. In his view, the reason for preferring timber was because at the time supply of timber in the area in question was sufficient and the price was reasonably low. Instead of trying something novel and untested, the people stuck to the traditional and well known.

4.1.4 EECMY South Central Synod appropriate technology work

In 1992, EECMY trained some people in low cost housing technology. One of them was Ato Senbato Wolaamo. According to Senbato (2003), after the training he started with adobe block technology work in the South Central Ethiopia Synod of EECMY. The main focus became making beehives and houses from mud blocks. The impact of this project on the regional community or the Synod seems to have been rather marginal and the project has been stopped.

Mud blocks are apparently associated with a low quality material. In an interview, Senbato (2003) explained about the negative attitude of the South Central Synod leadership of the EECMY towards adobe block housing. These people generally regarded adobe blocks as a quality building material. He further noted that they were not willing to test if the technology is advantageous or not. Due to this the project had a marginal effect on the development in the area and use of the mud based building material within the Synod.

4.1.5 Selam Technical and Vocational Centre

In the early 1990s, Selam Technical and Vocational Centre in Addis Ababa tried to introduce and commercialize sun-dried adobe blocks in the markets in Addis Ababa. But the centre dropped the idea because it could not find a market. As stated by Mokonen (2003), Selam Centre had problem not only in finding market but also in finding people who were willing to work with mud blocks.

Reluctance with stabilised mud blocks as a building material is not specific for Ethiopia. According to Mitchell & Bevan (1992) a study conducted by Kumasi University showed that people in urban areas in Ghana, West Africa looked down on stabilised earth blocks. Its economic advantage over the concrete blocks did not change their attitude, because this material was "regarded as rural or 'bush' by the new urban migrants." However, when houses built from the same material "were plastered and painted white", the same people accepted it.

Even if using mud in house construction is not new for Ethiopia, people in urban areas are reluctant to speak about it. When one speaks about building a modern house from mud blocks, people seem not to be enthusiastic to discuss the issue. People in Kambaata also reacted in a similar way when the study group discussed the matter. However, government officials in Durame town had a different view

Selam Technical and Vocational Centre was one of the organisations, which continued developing mud based building material. The centre changed its main production from adobe blocks to using cement and soil to make blocks, i.e. cement stabilized soil blocks. Since then, Selam Centre has developed and is marketing both cement stabilised soil blocks and ordinary concrete blocks. The first type contains 5% cement, 15% sand and 80% soil. The second type is made of 20% cement and 80% sand. Here soil is replaced by sand in making these blocks to meet the quality demanded by market. Mekonen (2003) declared that cement stabilised soil and sand blocks became very attractive when painted with varnish and people want to use these material. In view of Asplund (1997), this organisation is in the forefront in Ethiopia for cement stabilised soil blocks. It is developing, testing and experimenting with mud based technology, both as regards adobe technology and cement stabilised soil blocks.

Office, workshop, and residence buildings at the Mekane Yesus Appropriate Technology Centre and an office building for the Swedish Save the Children in Addis Ababa are two examples, where the CSSB blocks manufactured at Selam Technical and Vocational Centre have been used successfully. However, these buildings cannot be regarded as low-cost in the context of this study.

4.1.6 Soddu Habitat International

In Wolayta Soddu, about 400 km south of Addis Ababa, there is an ongoing project based on CSSB technology. This house building project is connected to Habitat Humanity International financial system. According to Yeayneabeba Mamo (2003), this project was started in 1995. Up to now about 90 dwelling houses, which have a size of 35 sq. m, have been erected using CSSB in the walls and corrugated iron sheets for the roofing. During a study-visit to the place, some individuals were interviewed. Although there were some complaints on the houses from a technical point of view, the project seems to be a successful one. As the cost level is relatively high, it is difficult to define it as a low-cost housing project in the context of this study.

During the site-visit mentioned above, some differences on the external appearance of some of the houses could be noted. It was interesting to know how and why these changes came about. All the houses were built from stabilised earth blocks according to standardised plan. The cost, the size, the design etc., were similar for all the houses, but some of the owners had modified the external façade of their house. Some have painted their houses with different colours to give an impression as if the house was provided with column and beams of reinforced concrete. We assume that such modification of stabilised mud block houses is thought to improve its acceptability and to give a better social status over those who did not do this. When one looked at this building from a distance one could assume it to be of a different quality compared to the other houses, which was not the real case!

4.1.7 Spontaneous low cost house construction at the Meki-Zway area within the Rift Valley

In recent years what can be described as a spontaneous development of low-cost housing based on adobe technology has taken place in the Rift Valley, about 150 – 200 km southeast of Addis Ababa. The main driving force behind this spontaneous development is a shortage of construction timber due to severe deforestation.

People's choice of stabilized mud blocks over stabilized cement blocks, naturally depends on the level of their income. One of our respondents in Zway, Gebre (2003) told the study group that mud blocks are cheaper compared to other material. He does not afford to buy stabilized cement blocks or concrete hollow blocks and there is acute scarcity of timber for house construction in the region. He could reduce the cost of his house by doing most of the work himself. Appropriate type of soil for mud block making is at his disposal and he need not pay for it.

In connection with a Ph.D. study regarding integrated rural development, Wudenesh Hailu (1991) made the local people in Awassa (in the University compound) to build a dwelling house in a traditional way. Mud block technology was used in order to demonstrate the possibility of using it for erection of a dwelling house in a traditional way adapted to a modern life. Dr Wudenesh used a design that took gender aspects in to consideration. One important aspect of this project was to design the house, in order to give proper place for animals, proper sitting place for household, shelves, beds and kitchen. In-door environment was seriously considered in her design and construction of this house. Economically, this house could be considered as a "low cost and sustainable". According to Hailu (2003), the intention of the project was demonstration and it had fulfilled its aim.

Inspired by the Awassa demonstration project, individuals had copied the design and constructed similar houses in other areas. Furthermore, Hailu (2003) underlines that the visible impact of mud block technology development in the Rift Valley region such as in the Meki-Zway area (see above), to a great extent is a result of this demonstration project

4.1.8 Ongoing project - Western Wollega

The study group during its field study was informed by Domianos (2003) about an ongoing low cost house construction project in Western Wollega in Ethiopia. Western Ethiopia is relatively well covered with natural and planted forest. People in the area were not ready to move from timber to mud block for house construction. The German Mission that was responsible for that project was ready to pay part of the cost (500 ETB) if people there were prepared to build a house from adobe blocks. According to information received some had taken the money and started to use the adobe blocks for house construction. Domianos (2003) indicated that the intention of this payment was to attract people away from cutting down forest for house construction and also to provide some initial help to cover construction expenses.

4.2 Obstacles related to attitudes in connection with the introduction of a new technology

As has been stated earlier the pre-study comprised both a literature survey and a number of interviews. Both the literature survey and the interviews have underlined the fact that there are several obstacles related to attitudes in connection with the introduction of a new house building technology. The obstacles which can be considered to be the major ones, are discussed below.

4.2.1 Prejudices and reluctance

Mud as a building material has been used for centuries in many parts of the world. Agarwal (1981) stresses that "*Of various types of traditional building materials available mud is the most widely used and will remain so long into the foreseeable future*". However, development of other building materials has taken over the new constructions. As a consequence, soil stabilised building material is seen as low quality material and is associated with poverty. Production and use of stabilised soil as building material has benefits such as low cost, low energy, low transportation cost and environmental soundness. Nevertheless, researchers, house planners, governments, banks and individual house builders had not given attention to its development

A common reason for reluctance seems to be uncertainty about the strength and durability of buildings based on soil block technology According to Rydland (2003), "*Most of the people (in Ethiopia) we deal with have a retrospective perspective on their doings. They replicate rather than invent, simply because replication is much safer.*" Therefore, many could choose to "wait and see", rather than taking a risk. According to Rydland (2003) most of these people live on a very narrow margin and dare not to take the risk involved in adapting a new technology.

4.2.2 Stigmatization

The pre-study study has shown that a building material/adobe based on soil-straw combination has bad connotation. Gooding & Thomas (1995) stated that "*Sandcrete use is widespread and increasing: it has good popular image. Soil-cement by contrast carries an association or stigma linking it with unstabilised soil and simple adobe construction which has much limited its popularity.*" Gooding & Thomas (1995) further explains a change of attitude as a result of demonstration undertaken in countries like Tanzania, Kenya, Ghana etc. In their view, even if soil-cement blocks cost 30% less than sandcrete walling by using low-pressure production, it may not encourage the uptake of the technology due to social stigma.

4.2.3 Insecurity

Uncertainty to the strength and durability of a new building technology could be one of the factors for people avoiding to use soil stabilised blocks. When one talks about adobe blocks people react by saying "*It is easy for thieves to break it*". According Johansson (2003) this fear is strongly exaggerated. However, the question of security must be taken into consideration in its development and testing.

4.2.4 Status

For many, choice of a building material is not only a matter of its strength, durability or price, but also a matter of social status. Not only building houses from mud but also working with clay has low status in Ethiopia. In other words social stigma is attached to working with clay or mud. As stated by Agarwal (1981) "*Status is at the root of the problem of non-acceptance. Mud houses are associated with poverty*".

One important factor that has contributed to the negative attitude towards a adobe based technology is the a positive attitude people has developed to cement as a building material. Former Tanzanian President Julius Nyerere as quoted by Agarwal (1981) said, "*The widespread addiction to cement is a kind of mental paralysis.*" Therefore, reducing the use of cement by a change of technology, e.g. from concrete hollow blocks to cement stabilised soil blocks or, even more, from concrete hollow blocks to adobe blocks, may face resistance.

5 Attitudes and low-cost housing projects – a concluding discussion

The cases described earlier in this paper, information found in the literature as well as viewpoints obtained at interviews, strongly underline the importance of attitudes in connection with the launching and the implementation of a low cost housing project.

The attitude of officials and persons responsible for a low-cost housing project is of course very important. They must believe in the cause and also be ready to show and demonstrate their belief in practise. An organisation which is trying to promote a new technology among the local population, but at the same time is not willing to use the technology for its own buildings, at least to a certain extent, will forward an ambiguous message to the surrounding society. Such a message will not change the attitudes of the surrounding society in a positive direction.

However, the most crucial point in this context is the attitude of the potential users. As has been mentioned and described earlier in this paper, factors such as prejudices and reluctance, stigmatization, insecurity and status are important and must be taken into account in connection with the planning, launching and implementation of a low cost housing project. Our hypothesis is that two important measures can be taken in order to overcome these obstacles. These two measures, which preferably could be used in combination, are awareness building and the use of demonstration buildings.

5.1 Awareness building

Scepticism towards building materials based on soil will remain intact, if we cannot make people be aware of the benefits of this old but renewed technology. People have to realise that the new technology is intended to improve their health and their environment. As Holmqvist & Rehnström (1992) see it, awareness building plays very important role in the process of introducing the new technology.

To change peoples' scepticism towards new technology, local community needs to take active part in developing, testing and demonstration of the new building material. A future research must combine practical work and demonstration rather than pure theoretical discussion to exert the best impact on the attitude of people who are supposed to adopt the new technology. On the other hand, to develop a positive attitude, the new technology must appeal to their need and social status.

A proper communication with words and action is important to encounter against possible stigma attached to mud technology. According to Rydland (2003), making a low-cost housing technology acceptable is a matter of words, communications and attitudes more than knowledge about how to build a house. Every future research need to find out how people conceptualise their own importance in relation to their houses in order to catch their interest. According to Rydland (2003), to ignore this fact makes it difficult to introduce a new technology.

In view of Holmqvist & Rehnström (1992), "*The skepticism among the population to use non-traditional building materials can be removed by spreading information about advantages. Participation from the tenants during construction leads to increased knowledge and responsibility.*"

5.2 Use of demonstration buildings

The main purpose of using demonstration buildings in this context is first of all to give practical examples regarding how to use a new technology. However; in addition to this demonstration buildings must have two other purposes:

1. To be a tool by which the attitudes towards a the new technology can be changed in a positive direction
2. To show a way through which ordinary people can improve their standard of living by offering them a technology which can provide them with sound, healthy, durable and sustainable dwelling-houses.

This means that designing and planning a demonstration building is an advanced and complex task. The first point implies knowledge about the local culture and tradition, and above all, knowledge about negative attitudes this culture and tradition may contain towards the new technology. The second point implies knowledge about important technical details such as design of the foundation, material requirements, mix-design and requirements on roofing. In addition to this a good knowledge is required about how to obtain a good and healthy indoor climate with regard to local climatic variations.

Once a demonstration building has been erected it will of course be used for information purpose. However, it ought also to be used as a way for getting a deeper understanding about the attitudes of the society. This can be done in a systematic way by using the demonstration project as a reference in connection with interviews with representatives from the local, ordinary, population.

In addition to this a demonstration building shall fulfill the purpose of testing durability of materials as well as cost levels

6. Further research - planned project

Based on the findings in the pre-study and based on the considerations described and discussed above, the project "*Sustainable Low Cost Housing – needs, possibilities and attitudes. A project with focus on the Kambaata Region in Ethiopia*" has been formulated.

The aim of this project is:

- To develop and test new, sustainable, low-cost, house building technologies intended for ordinary people
- To map out, explain and if needed, influence, the attitudes of the local population towards a new building technology
- To give guide-lines for an implementation program through which ordinary people can have access to a new house building technology.

The project will consist of three main parts, which are strongly interrelated to each other:

1. Development and testing of new house building technologies
2. Demonstration projects
3. Attitudes towards new house building technologies.

The over-all intention of part 1 is to study and develop a new, sustainable house building technology with a very low "timber content". In accordance with this the sub-project will focus on two wall-building technologies, namely use of cement stabilized soil blocks (CSSB) and use of adobe blocks (AB). Dwelling houses based on these technologies and adapted to Kambaata traditions and ways of living will be designed. Material testing and development will also be included.

The aim of part 2 is to demonstrate the new technology for the public by erecting dwelling houses at three localities, one urban and two rural. At each locality three dwelling houses with three different standard/cost levels shall be erected. These demonstration projects will function as reference objects in connection with part 3. They will also function as a full-scale test of the new technology. A main issue will be to counteract the negative stigma presently attached to mud-block technology.

In part 3 reference will be made to demonstration projects; see above. The work within this part will mainly consist of in-depth interviews with ordinary people. The interviews will be conducted in local language Kambaatinja and comprise different strata of the population. These interviews will take into account the following factors: the influence of tradition, in-door environment of the traditional dwelling house, cost-levels, security – protection, status and gender perspective.

The entire project will be concluded by a synthesis of obtained results aiming at the formulation of guidelines and recommendations for an implementation program.

The project is interdisciplinary, with a technical and a social/sociological approach. This will make it possible to develop a sustainable house building technology adapted to local traditions and needs. Furthermore, this approach will make it possible to study the processes at the introduction of the new technology.

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