PRACTICAL ACTION
Technology challenging poverty

NASHETU E MAA

Building in Partnership with the Maasai

stories of change

Introduction

Since the early 1980s Practical Action East Africa has been involved in participatory technology development as a means of tackling the challenge of securing livelihoods and increasing access to decent and affordable shelter.

This document tells the story of work in the district of Kajiado, Kenya which has a largely Maasai population of approximately 120,000 in an area of 22,000km^2 The Maasai are traditionally a nomadic people but currently face pressures from agriculture and the sub-division of land which have resulted in permanent settlement and changes in lifestyle.

In 1991 Practical Action East Africa (then known as ITDG Kenya) received a request to give technical assistance to project efforts developed by the Arid and Semi-arid Lands Programme (ASAL), working in partnership with local women's groups in Kajiado. Eleven groups registered with ASAL had identified housing as a priority issue. Practical Action East Africa's role was to give support in developing appropriate shelter strategies and new technologies in response to the changing environment and housing needs.

Traditionally the division of labour between Maasai women and men meant that women were, and often still are, solely responsible for the construction of family houses. A Maasai house, known as an *enkaji*, was a temporary shelter that was made low to the ground so as to be inconspicuous on the landscape; given the nomadic lifestyle of the builders, structures did not need to last long.

Marisiet Polong drawing water from a rainwater storage container. Photo: Practical Action / Simon Ekless.

Projecting into the future

After early involvement as technical advisers, Practical Action's work in Kajiado district evolved and grew into a distinct project which became known as the Maasai Housing Project (MHP). Since 1991, various funders have given financial support which enabled staff:

- to stimulate housing improvements that meet the changing needs of Maasai communities;
- to facilitate the optimum use of local materials and skills in construction;
- to maintain or strengthen the status of women in house building and management and
- to encourage local organisations to develop the capacity to support shelter focused initiatives within the Maasai community.

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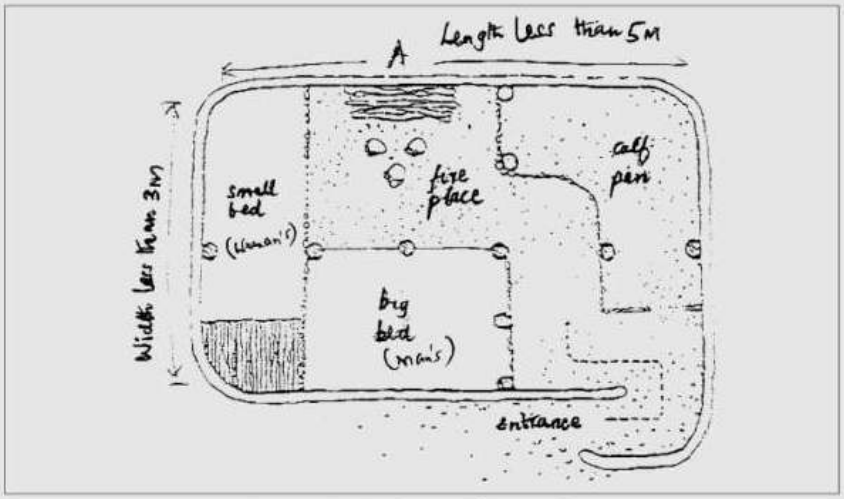
Drawing out dreams – a participatory design workshop

A participatory design workshop was held in August 1991, to enable women to present their ideas on appropriate housing design and construction. This drew on the experience of Kenyan staff as well as their colleagues from Practical Action offices in Peru and the UK, and was organised to work with members of 9 women's groups from the project sites. The women's preference for simple improvements to existing housing technologies and designs became apparent from the plans they produced.

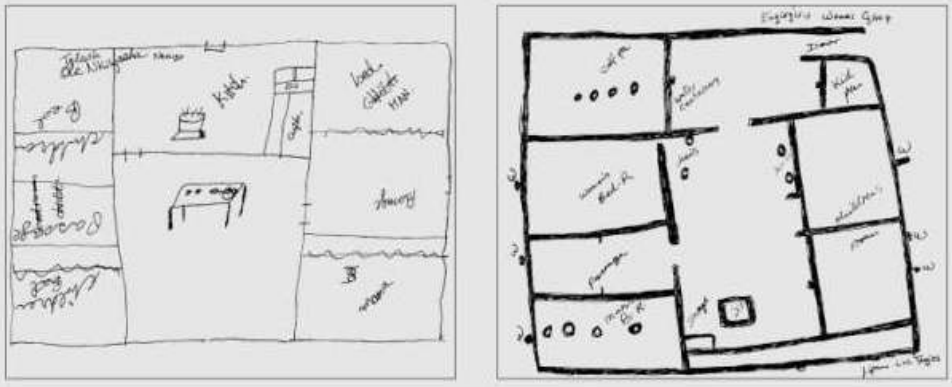
Maasai women, many of whom are illiterate, are adept at drawing plans; their traditional role as house builders means they are practised at defining and locating new houses by laying out plans on the ground using sand. This ability means they are able to use pen and paper to illustrate their own ideas; thereby expressing their aspirations for housing.

During the workshop Practical Action and ASAL staff left the women to work on their own for an hour before discussing the outcome of their efforts: their own, ideal house plans. The resultant designs highlighted the women's aspirations and concerns. Clear linkages with household activities i.e. cooking, socialising, food and fuel storage, working and washing, were evident as were other concerns of theirs:

- ventilation – *enkajis* (the traditional house structures) rarely have windows and only one door opening; smoke from the cooking stove (traditionally an open fire) results in respiratory complaints;
- natural lighting – the lack of structural openings reduces the available light inside the *enkaji*;
- maintenance – the traditional cow dung, mud and ash plaster needs constant attention, especially during the rainy season, this is a very time consuming activity for women;
- space – desirable features of a permanent house include increased ceiling height, enabling people to stand up inside, and separate rooms e.g. for children, for sleeping, for cooking.



Traditional house plan



House plans drawn by workshop participants showing new ideals.

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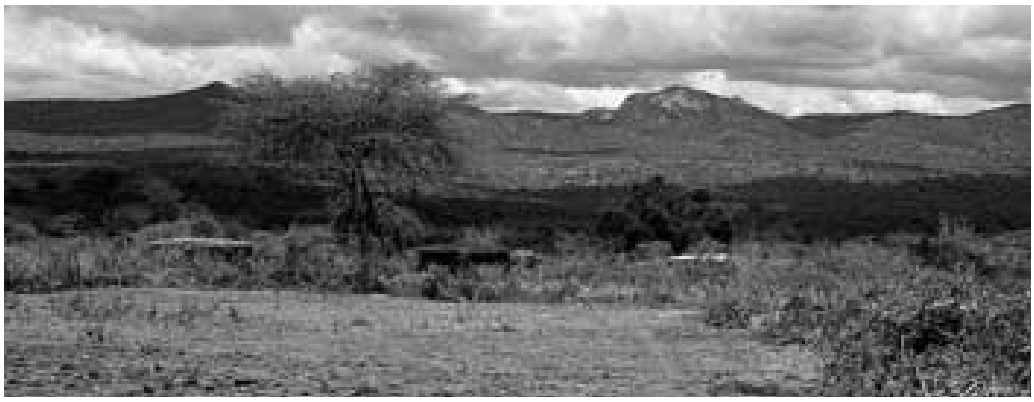

Traditional Maasai house – an enkaji stands low to the ground and is inconspicuous on the landscape. Photo: Practical Action / Lucky Lowe.

Developing technologies in partnership with the communities of Kajiado has been a complex, dynamic process involving home owners and builders, artisans and various local organisations which have an interest in improving the standard of living of the Maasai people. Practical Action's work has focused on housing technologies: new options evolved through collaborative research and development in the regional training centre, at demonstration sites and whilst building people's new homes.

Research, liaison and technology development with members of the Maasai communities were critical in ensuring a clear understanding of the needs, the available resources and potential for adapting technologies.

Maso Munyere, a young Maasai woman, builds her first house. Maso learnt the necessary skills from watching her mother. Photo: Practical Action / Lucky Lowe.

Learning together: participatory research and development

The research and development of appropriate construction technologies and the initial trial construction activities (adapting known technologies to local needs and resources) were undertaken in collaboration with the Maasai Rural Training Centre. This organisation is concerned with the training of artisans, primarily men, in construction craft skills.

The following housing options were developed through participatory processes and are discussed in more detail later.

House construction technologies:

- rammed earth construction;
- ferro-cement skin roof;
- ferro-cement panel walls;
- stabilised soil block (SSB) walling.

Housing design and additional features:

- higher ceilings;
- larger windows;
- improved sanitation
- rainwater catchment and storage;
- increased workspace;
- smoke extraction.

At the Maasai Rural Training Centre demonstration site, Practical Action staff and local artisans, built four new types of housing enabling skills to be developed and providing physical evidence for others to see. Photo: Practical Action / Dave Mather.

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Maasai women do not usually benefit from secondary education and would not normally choose to study construction subjects. Practical Action's project explicitly aimed to train young women in craft subjects. Practical Action staff and local women faced practical and cultural obstacles such as a lack of facilities for women at the training centre, the cultural unacceptability of women travelling alone or leaving their domestic responsibilities.

Training 'on the job' is therefore critical in supplementing the formal training efforts especially as a means to including women, enhancing their skills and achieving further outreach into the local community of self-help, female builders.

Learning in practice, building homes to demonstrate options

A programme of construction was devised with project partners and beneficiaries to refine technologies and to promote improved housing options. Establishing linkages with individuals and community based organisations was a primary concern to ensure Practical Action's small team of staff could have the biggest impact possible.

Maasai women being trained whilst preparing and moulding rammed earth walling. Photos: Practical Action / Neil Cooper.

Participants from women's groups, and local artisans chosen by them, were trained by Practical Action staff in the skills and techniques required to plan and manage the construction process. This process begins with choices being made about the design and technologies to be used; the planning of activities; estimating quantities; purchasing and transporting materials; employing artisans and engaging family, neighbours, and friends to build the structure and apply the finishes.

Practical Action aimed to ensure that benefits accrued to trainees from both the process and the content of training. Programmes were designed to involve as many stakeholders as possible whilst keeping in mind that women were the primary target beneficiaries of the project.

Women's groups would themselves identify who was to take part in the training sessions and who was to benefit from the house building itself. The demonstration house built during training would belong to someone who was chosen based on the criteria derived by members of the community:

- having no source of income;
- having no member of family working and supporting the family;
- owning less than 10 cows and 5 goats;
- being a widow/widower with no income and no animals;
- being orphaned children, below 18 years, with no inherited wealth;
- being an old, childless spinster with no animals;
- suffering from mental illness;
- being blind with no source of income;
- having a family of over 7 children and 3 wives with

In training sessions representatives from several local groups would attend and participate in exchange visits to other local sites to see alternative designs and technologies, to hardware merchants to gain knowledge of market prices and materials availability. Staff would discuss the benefits and techniques of new construction methods and would undertake, with participants, the complete process of house building from laying out the foundations through to applying the final finishes.

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Whilst Practical Action provided some of the materials for the demonstration houses the women provided local materials such as timber or river sand, as well as the labour required for construction. Most of the women's groups were actively involved in fund raising through traditional gatherings known as *harambees*, where invited guests would be amply entertained in return for donations. Group activities and savings would also be used to support new housing initiatives.

Training programmes often required a high degree of flexibility from Practical Action staff, who would camp out on site to ensure that they did not waste time and resources travelling to and from remote places which were often difficult to access.

Sharing experience with the wider world

Practical Action's small-scale project activities aim to learn lessons and share these with others in order to increase the impact of local initiatives. A programme of dissemination continued with the aim of spreading information about shelter options to other people in Kajiado district and beyond. Practical Action maintained a presence in Kajiado with the capacity to respond to technical enquiries and to give advice to individuals and organisations. But the emphasis shifted towards enabling others to do the work and sharing information with people locally, nationally and internationally.

Maasai women traditionally come together to offer each other social and practical support. Photo: Practical Action / Neil Cooper.

The demonstration house built at the Ngong agricultural show-ground has become a home. Photo: Practical Action / Lucky Lowe.

Sharon Looremetta and Elijah Agevi, representing the people of Kajiado at the UN conference on Human Settlements, Istanbul June 1996. Photo: Practical Action / Neil Cooper.

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Taking an inclusive view of the built environment

Housing technologies cannot be considered in isolation from people's lives. Project training needs to be clearly aimed to meet people's broader needs. Practical Action staff often worked in partnership with other governmental and non-governmental bodies to cover a variety of topics highlighted by community members as important priorities. One workshop considered several issues which enabled the quality of the built environment, that we call home, to be improved.

House layout and design:
Participants identified the following as key features in an improved house:

- spacious room/large open spaces;
- privacy/separate rooms;
- keeping small livestock out of the house;
- raised beds easy for cleaning;
- dish racks;
- improved *jiko* (stoves) to ensure less or no smoke;
- firewood storage;
- spiral entrance – a significant feature in traditional ceremonies;
- improved height;
- leak-proof roof;
- kitchen garden;
- free from rodents & vermin;
- rainwater harvesting;
- a clean compound;
- should have large windows;
- waste disposal pits.

Household energy: discussions were held on the type of fuels used and its storage.

Nutrition:
Input by the local government
Health Officer enabled participants to gain an increased understanding of the types of food currently cooked, their nature – i.e. whether they are 'building, protective or energy foods'. The increasing need to generate cash, for example to pay for school fees, means that people may sell foods such as milk which they would previously have consumed themselves. Emphasis was given in discussions to the need to continue to provide a balanced diet; changing life patterns make it important to ensure that people understand the impact on the traditional diet.

Health education:
Discussions covered a wide range of issues looking at good and bad practices in house keeping, personal hygiene, cooking etc.

Enterprise development and management:
Community group activities often aim to generate income to support development of members' homes and livelihoods: on enquiring how they invested their money the participants responded that they kept their groups' money in the bank which they later share equally or pay to meet their members' needs. Practical Action staff call on others' expertise to facilitate the development of all the necessary skills in house building. Understanding and managing finances is critical to successful house building which is a significant investment.

A variety of activities has been undertaken to share project experience, these include:

- organising exchange visits between rural and urban communities within and beyond investment. the district boundaries enabling people to learn first hand about alternative housing options;
- creating local linkages; Practical Action staff have increased awareness of new housing options among local and regional decision-makers. For example, school construction using stabilised soil blocks has been approved by the Ministry of Education and has proved to be an affordable option for parents, who pay for building activities (see page 20); _ interactive communication tools have been developed to assist in working with

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communities to understand the issues surrounding technology choices and to facilitate debate (see Figure 4);
- production of technical publications to offer guidance on the construction techniques developed;
- one in-depth research study showed the significant impact improved housing has on health and another explored the role and housing needs of women and children. These studies have informed the development of new areas of work;
- distribution of promotional materials to Government of Kenya officials, institutions and individuals in the community which helped to create greater awareness;
- radio coverage in the local language, including interviews with staff and project beneficiaries generated interest and resulted in several enquiries being received;
- attending national and international conferences and workshops, exhibitions and displays enabling project staff to inform and influence policy and decision-makers on pertinent issues. An example, above, is the construction of a demonstration house at Ngong agricultural show-ground; for several years this has provided the caretaker with a home and acted as a permanent display of the technologies;
- collaboration with public sector and community based organisations (CBOs) has enabled the project to create synergy and widen its sphere of influence.

Building on tradition

The range of building materials and designs used by people in any one location will be the result of a combination of many factors:
- local climate and natural resources;
- locally available materials;
- traditional skills;
- cultural preferences;
- the functional requirements of the structure;
- the resources available to, and personal choices made by, the builders and the end-users…

… a host of variables which will be context specific and reflect the ongoing influences forcing changes in people's lives. The Maasai people have had to adapt and continue to

A comparison of materials used in house construction

Component	Indigenous materials	Modern materials	Improved materials
Walling	cow-dung on twigs twigs alone posts	dressed stone timber concrete blocks stone fill	stabilised soil blocks ferro-cement mortar mesh mud & wattle rammed earth
Roofing	animal hides cow-dung & ash on grass soil	GCI sheets tiles	ferro-cement skin GCI on traditional structure
Floor	Soil Ash dung	cement screed floor tiles	rammed earth tiles stabilised soil blocks
Door shutters	twigs	Timber sheet steel	timber framed timber with GCI infill
Window	Cloth Glass wire gauze	steel/glass timber/glass	timber shutters wire gauze

Source: Maasai Housing Project impact assessment survey for improved houses, Building Materials & Shelter Programme, July 1995.

embrace and make changes in their ways of living and building homes. The new methods of building that the project has been promoting aim to improve on traditional techniques. There are more, contemporary, options but often these are beyond the purse of the majority of people.

By recognising the need for cost-effective solutions Practical Action offers an intermediate step that reflects existing resources and acknowledges the desire for improvement by means that are accessible. The table above shows traditional, modern and improved housing technologies used locally.

Indigenous housing technologies

As a nomadic people, the Maasai traditionally drew on the natural resources available locally. Maasai homesteads (*boma*) formed a base from which the families earned their living and met their needs for shelter from the elements; a place for people and their livestock to be secure from predators and to grow. Men traditionally take responsibility for livestock, which require grazing and health care. As well as offering protection to people's livelihoods, structures built within the *boma's* boundaries reflected practical needs, social needs and status, available skills and resources.

Figure 5: Illustration of the main shortcomings which improved design and technologies aim to rectify.

A typical traditional house was designed for people on the move, temporary in nature; the structural framework, formed of timber poles, was fixed directly into the ground, interwoven with a lattice of smaller branches and plastered. Small in size, 3m x 5m x 1.5m tall, the traditional shelter provides space for cooking, sleeping and some storage to protect people and their few possessions from the elements. The change in land ownership patterns, is perhaps the most significant factor in changing housing needs and aspirations.

Some of the disadvantages of traditional designs that the new technologies aim to rectify are:

- the constant need for maintenance, especially replastering the roof, during the rainy seasons;
- a low roof, which means standing erect is impossible;
- poor ventilation due to insufficient openings;
- insufficient openings also restrict the amount of light inside houses;
- susceptibility to termite attack which is a significant problem in many areas.

During their early efforts Practical Action staff had to learn to recognise and appreciate the significance of certain design aspects of existing housing e.g. rounded corners or an offset entrance play a part in traditional ceremonies; 'rituals associated with the creation of femaleness

and reproduction'. Such hidden meanings may not be visible or easily understood but often affect technology development by influencing the options that are considered desirable. Practical Action staff also learnt that changing the plan design has other implications such as the need for modern furniture, which further increases the cost of the house.

Timber posts

In an *enkaji* timber posts are used to create the structural frame. Since greater durability is desirable a species called *oiti* is valued for its termite resistance. The *oiti* tree grows, both in the highlands and the lowlands, to a maximum diameter of 150mm and a maximum length of 2.4m. Those trees that grow in the lowlands are shorter and rarely straight. The demand for timber from rural and urban settlements means that the *oiti* is becoming increasingly expensive. Timber often has to be purchased and transported from distant sources.

A builder pauses by the structural framework of her traditional house before plastering it. Photo: Practical Action / Lucky Lowe.

Twigs

The timber framework is overlaid with twigs (*fittos*) which are spaced close together and tied or nailed to the posts to form a matrix, which is then plastered. On roofs the *fittos* are overlaid with dried grass before plastering. Straight, long *fittos* that do not split upon nailing, can only be found in the highlands. Roofing grass is abundant in the rainy season but becomes quite scarce in the dry season.

A builder uses a traditional plaster mix incorporating cow dung to maintain her house. Photo: Practical Action / Neil Cooper.

Soil

Soil has properties which mean it is used in construction for many purposes in every continent of the world. There are particular types of earth which are more suited for use in building: a balance of clay, sand and silt is required for most purposes. Amongst a survey of 28 householders it was found that 3 used the earth from termite hills for plastering their roofs. This earth has improved cohesion and, through practice, people have found that when applied in a plaster mix it increases impermeability, acting as a better barrier to rain.

Cow dung

Cow dung is used in its natural state and also in conjunction with mud and ashes as a plaster for floors and walls, both internally and externally. The fibrous nature of cow-dung means it acts as a reinforcing agent reducing the soil's tendency to crack when the plaster dries.

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Animal hides

Every family that has livestock will use the hides of those animals when they are slaughtered for meat or die of natural causes. Without any other treatment than scraping and drying the hides are used as a walling and roofing material. A traditional Maasai bed structure is built into the house walls, a hide will be stretched over this platform as the 'mattress'. Hides will also be used to form shelters in the interim period when people relocate, before their *boma* is constructed.

Ash

Ashes often contain calcium carbonate and may have stabilizing properties and reduce shrinkage and swelling. Added to soils, ash is also known to act as a termite repellent.
The workability of the plaster mix is improved through the addition of ash.

Collaborative technology development and adaptation

Rammed earth

Early experimentation and demonstration initiatives included the construction of a rammed earth house (also known by its French name of pisé) measuring 7.5m x 4m. The production of rammed earth was found to be arduous and, despite adaptation of the tools used during production, this technology was never popular with Maasai women. Popular perceptions are that this building technology is lacking in strength. Since women know that the timber structures of their traditional houses carry the loads; i.e. are the house's strength, they feel rammed earth must be weak since it has no timber elements. They also feel that if an intruder wanted to gain access through a rammed earth wall it would be easy. Whilst popular perceptions do not always reflect the 'technical reality' (there are pisé houses of several storeys which have been functional for hundreds of years) it is difficult, if not impossible, to persuade people of the merits of a technology which they find unattractive.

Ferro-cement housing – a lightweight option

In some areas of Kajiado black cotton soils are prevalent. These soils do not make suitable building materials and have poor load-bearing capacities; the need for lightweight housing options is therefore evident. It is difficult to trace the origins of ferro-cement technology since it has been used in several countries to produce all kinds of structures such as bridges, boats, pipes etc. A well-known technology in one location may be considered as a totally new idea in another.

Practical Action staff, in collaboration with artisans working at the Maasai Rural Training Centre (MRTC), experimented with ferro-cement technology which consists of chicken wire or mesh (the 'ferro') coated with a thin layer of cement and mortar. This enhanced understanding and developed the necessary practical skills in order to build a housing system that would create a more permanent, weatherproof house that could also be used to catch rainwater. The same technology is used to construct water storage jars. One version of ferro-cement housing employs a structural timber frame across which chicken wire is stretched before both sides are plastered. Another version of ferro-cement technology, called 'mortar mesh' eliminates the need for posts by using slightly larger steel reinforcing mesh and formwork during construction.

Ferro-cement skin roofing

The chance invention of a ferro-cement roof covering was followed up by project staff and refined through a process of methodical experimentation i.e. trial and error! The initial idea arose from interaction between project staff and a woman living in a traditional house within a *boma* where a demonstration ferro-cement house had just been built; she complained about her leaking roof. Together they decided to try putting a sheet of plastic over the existing structure, followed by some chicken wire and plastered it with a cement render. Subsequently this technology has been refined to improve its performance i.e. by taking greater care over the supporting framework; by

using more closely spaced battens; by testing the strength and reducing any tendency to deflect under load and by ensuring the roof slopes from the centre down to the guttering. This somewhat crude intervention has the advantage of being relatively low cost whilst offering the benefits of rainwater catchment and reduced maintenance. No one community is homogeneous; there are significant differences in assets held and income earned among the people who make up the Maasai communities of Kajiado. Project workshops and reviews highlighted the fact that project interventions should include improvements to existing houses in order to address the needs of poorer people.

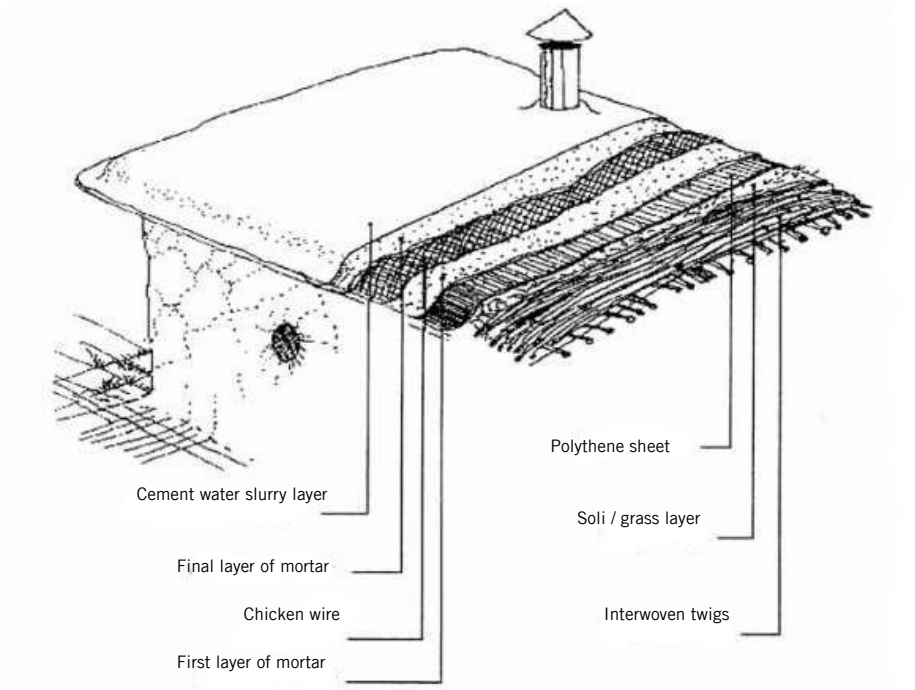

Figure 6: Illustration of the layers required to build a ferro-cement skin roof.

Subsequently, 6 MRTC staff, 4 local artisans and 30 women were trained in the skills necessary to upgrade existing roofs.

Mrs Silole Malipe Empariya built her own ferro-cement skin roof. Photo: Practical Action / Lucky Lowe.

Construction of houses in this way, without any project involvement, suggests this minor intervention can have a significant impact on people's lives. The inclusion of gutters and water storage has also resulted in additional benefits for the women such as the increased freedom a store of water gives them from the daily chore of water collection and transportation. Even this small intervention had wider ramifications '...it is not easy to alter one aspect of the design in isolation. The new roof worked extremely well and rain could not get in but neither could the smoke get out. ITDG [Practical Action] immediately had to consider a new design of chimney. The way forward was obviously by

consultation.' Other new houses then incorporated improved stoves, with better energy efficiency, cowlings and chimneys to improve smoke extraction.

Harvesting from the skies

The inclusion of water harvesting in housing design has been a major benefit and crucial to the success of ferro-cement technology. The incorporation of a gutter and storage jar has brought many benefits in to alter one aspect of design in particular to women, who carry the responsibility for providing water for their families: 'I used to spend a lot of time fixing my walls and roof and the trek to get water from long distances was very tiring. When we all have houses like mine, we shall be able to find solutions to the other problems, which face us' said Nolari N'Kurana of Naning'o Women's Group.

Stabilised soil block walling

Early initiatives taken by ASAL and the Ministry of Public Works working with women's groups to address their housing needs led to the construction of modern houses using stabilised soil blocks (SSBs) but these were felt to be unsuccessful due to their inexperience with this technology. SSBs are produced by careful selection, extraction, sieving and mixing of soil with a small percentage of cement, which is then compressed in a moulding machine.

Stabilised soil block machine and stack of blocks curing in the shade of a tree. Photo: Practical Action / Theo Schilderman.

The blocks are then cured and laid in a bed of mortar to produce walling. This technology has become more popular as people have come to appreciate the quality of walling that can be produced and begun to equate it with high status cement based products. It is now being used to build schools and appears to be popular with artisans since they are able to make a reasonable living from producing and building with it. It is not possible to say whether the technologies which have been developed are affordable in comparison with existing technologies which are not cash based. However, *Stabilised soil* relative to other options such as stone or burnt brick the technologies being developed and promoted by the project in Kajiado are more affordable and thereby accessible to the majority of people.

The project has developed a range of technological options in order to create choices, not to impose solutions. It has become apparent that to meet the needs of the poorest members of the Maasai community small improvements to existing houses and housing practices have been the most accessible, and therefore, most popular housing options. Other elements of design, such as increased roof height and larger windows have been taken up by people who continue to use traditional methods of construction and in that way, small incremental improvements have resulted in some benefits.

Building skills, demonstrating and developing livelihoods

Amos was trained on the job, by his brother, who had been trained by ITDG. Amos has been involved in constructing 3 school buildings and 7 houses; he feels there is an increasing demand for SSB technology and is able to command a daily wage of 200 Kenyan Shillings – which compares well with market rates for skilled manual work in Kajiado.

Mr Moinket, the headmaster of Ibisil Primary School, saw the demonstration SSB structure at the nearby primary school of Lenkishon and liked it. The Parent Teachers' Association at his school subsequently approached Practical Action for help in building 2 classrooms and a storeroom, which ultimately cost 300,000 Kenyan shillings. The same structure, built in stone, had been estimated to cost 580,000 Kenyan shillings. Now the PTA has commissioned a 40 bed dormitory for girls. Construction proceeds slowly since parents are funding the work and are not able to pay the whole amount required at one time but incremental improvements lead to the desired end in an affordable manner. 'staff have been very much available to us, checking construction as it reaches each new level' said Mr Moniket; Practical Action also relied on inputs from the Ministry of Public Works to ensure public safety requirements are met.

Amos Sikishoi and his assistant Oloongida Molel in front of the new girls' dormitory being built at Ibisil Primary School. Photo: Practical Action.

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How costly is 'affordable'?

Practical Action aims to increase access to affordable shelter but what is affordable to one is expensive to another. The estimated cost of some of the technology options outlined above are given below at 1999 prices, when the exchange rate was about 100 Kenyan shillings to 1 pound sterling.

Ferro-cement panel wall under G.C.I sheet roof: 3 roomed house.

Description of materials	Quantity	Unit Cost (Ksh)	Total Cost (Ksh)
GCI sheets	20	310	6200
Building posts	35	120	4200
Roof ridges	5	150	750
Chicken wire 6' x 1"	2 rolls	3000	6000
Ordinary Portland Cement	35 bags	430	15050
Roofing nails	5 kgs	160	800
Ordinary nails	15 kgs	55	825
Timber cypress 3" x 2"	200ft	9	1800
Timber cypress 2" x 2"	200ft	7	1400
Timber cypress 6" x 1"	100ft	9	900
Wood preservative	5 litres	150	750
Door frame (external) T-door	1	1600	1600
Internal doors and frames (Batten)	2	1100	2200
Timber windows and frames 2 1/2" x 2 1/2"	4	650	2600
Binding wire	3kgs	70	210
Gloss paint	4 litres	550	2200
Undercoat paint	4 litres	350	1400
Sand	2 lorry loads	5,000	10,000
Hard core	1 lorry load	2,000	2,000
Hinges 4"	9	40	360
Pad and tower bolts	6	40	240
			_____
		Costs	61,485
		Labour	15,000
		Total	76,485

Calculated in a similar manner a 3 roomed rammed earth house under GCI sheet roof costs 44,840 KES; a Stabilised Soil Block walled house under a GCI sheets roof costs 48,050; a ferro-cement skin roof and walled house costs 47,675 KES. The addition of a ferro-cement skin roof costs 15,210 KES whilst a water storage jar is estimated to cost 7,680 KES. These costings will vary quite considerably, apart from variations in house size, costs incurred in transporting materials to site can be a significant portion of overall costs.

So what? Project impact and sustainability

Having intervened in housing development and worked in partnership to develop new technological options the Practical Action team has been considering the effect of its work and has been asking what happens next, when the project ends. There are encouraging signs of people's increased ability to fund their own housing improvements and to take the initiative in improving their built environment. During an impact study 9 out of the 28 project beneficiaries questioned had built separate new kitchens and 8 had improvised guttering to improve their rainwater catchment.

The capacity of women as individuals and collectives has developed considerably as the project activities have progressed. The following are some of the benefits, which are now evident:

- the increased ability of women to fund their own housing improvements. The Naning'o Women's Group improved their houses in 1992/93. They were subsequently given a blockmaking machine and have been producing blocks in order to build rental housing on a collectively owned roadside plot;

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- the enhanced skills base means project trained women have the ability to provide training for others; enabling broader dissemination of the technologies;
- an increased awareness of housing issues and the options available to address them. Within groups decisions are made as to whose housing problems are prioritized and how labour is shared and organised to carry out the construction work. For example the Kumpa Group have been collaborating with Practical Action since 1992; they now have their own procedures for assisting members, banking and accounting for monthly contributions from members and materials purchasing for house improvements without input from Practical Action;
- the enhanced technical knowledge and improved linkages between the women, hardware merchants and local artisans have resulted in the development of new, trusting relationships that enable women to access building materials at a fair price and to control the process of acquisition and construction;
- artisans are finding new opportunities to generate income; housing and social infrastructure markets are continuing to develop and alternative technologies are being considered more often;
- the increased confidence and ability to seek government services has led to women's groups approaching the Health Department for assistance in the provision of latrines or solicitation for inclusion in Community Based Health Care Programmes;
- many of the women's groups' members now sit in a number of development fora, land boards, parent teacher associations and other development organisations.
- improvements in health are a significant benefit of the technological changes made in housing. A reduction in chest infections and eye illnesses has resulted from improved ventilation; 'I can cook the whole meal inside the house without taking a break outside to get some fresh air'. The associated improvements in lighting levels have also resulted in a reduction in the number of accidents that occur in the home. The impact on health of the various design changes are outlined in the table below:
- the reduction in time spent by women repairing houses and fetching water has led to an increase in other productive activities such as:
    - small kitchen gardens improving the diversity of food available and generating income;
    - small scale enterprises e.g. building and renting rooms, manufacturing craft goods, transport and sale of charcoal to urban markets, retailing foodstuff such as milk, sugar, maize flour etc.

Elements of House Improvement	Effect	Health Benefit
Better ventilation	Reduces air pollution	Reduced respiratory infections
Wire mesh in windows/eaves closure	Limits entry of mosquitoes and sand flies	Higher birth weights Reduce incidence of malaria and kalaazar
Corrugated iron roof	Eliminates hiding places of mosquitoes	Reduce incidence of malaria
Ferro-cement wall panels or SSB	Eliminates hiding places of peri-domestic pests	Reduce transmission of diarrhoea diseases
Compacted floor	Reduces flea population	Reduce incidence of jiggers
Cupboard for storing utensils	Limits access to food by vectors	Reduce incidences of diarrhoea diseases
Guttering on the roof	Water harvesting	Increased personal and domestic hygiene

Source: Health Impact Study on Improved Housing in Kajiado, Patrick Wanjohi, August 1997.

Many women are also seeing tangible benefits for their families. Girls and boys are benefiting directly from the improved domestic environment and also from the improved conditions which

enables them to do their homework more easily i.e. with improved lighting levels, reduced smoke pollution and sufficient space to work indoors.

One woman said that her own children, and their neighbouring friends, did not want her to move into her new improved house since 11 of them met there to do their evening studies. A teacher working with families in a project area confirmed the apparent improvement in pupil performance.

A key element in establishing sustainability has been the creation of linkages among local nongovernmental organisations, community-based organisations and local government. Partnerships with others have stimulated interaction in a variety of development initiatives e.g. involving staff from the Ministries concerned with child health, nutrition, kitchen gardens, sanitation, income generation and so on.

The traditional skills associated with Maasai housing belong to women. Project staff recognise the challenges in adapting to the continual social, economic and environmental changes as well as those in developing and employing new technologies. Maasai women's expressed desire is to involve men more in the house building process, but project staff continue to face the challenge of how not to undermine the role played by women. It could be considered patronising and/or ineffectual for Practical Action to deal with people's relationships on their behalf when they are much better at doing so themselves. Nonetheless, staff awareness of gender issues is high and has been critical in ensuring Practical Action's effectiveness in delivering over a hundred houses in the district of Kajiado and influencing the production of several hundred more. The need for more improved housing remains evident in Kajiado and many neighbouring locations. Practical Action staff believe that further technology dissemination is dependent on training more artisans and sharing the experience they have gained more widely in Kenya and internationally. Project staff continue to face the challenge of assisting others to build local technological capacity and enabling others to access decent, affordable housing for themselves.

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