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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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COOPERATION BETWEEN DEVELOPING COUNTRIES IN TECHNOLOGIES AND STANDARDS FOR LOCAL BUILDING MATERIALS

Background Paper***

Prepared by

UNHCS (Habitat)

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I. THE SIGNIFICANCE OF TECHNOLOGIES AND STANDARDS IN THE WIDE ADOPTION OF LOW-COST BUILDING MATERIALS

1. Experience in several parts of the world, mainly in developing countries has proven that in the delivery of basic shelter for the low-income population, building materials constitute the single largest input, sometimes accounting for well over 60 per cent of the cost of construction. In fact, where relatively easy construction processes are adopted and where self-help labour or community-participation modes of construction are adopted then building materials become the main cost component in the erection of shelter. Unfortunately the majority of the population in most developing countries are faced with an unfavourable market for building materials:- the options are either to compete for popularly adopted materials which are invariably unaffordable and scarce in supply or to stick to materials of traditional origin which have proven to be undurable and have no organized mode of production. Given this situation, most governments will be faced with the challenge of promoting low-cost and good-quality building materials, in sufficient quantities so as to attain the targets of the Global Strategy for shelter by the year 2000.

2. The basic building materials which are likely to have the desired impact on shelter requirements for the majority of the population are those for walling, binding and roof-cladding. It is thus important to identify and promote low-cost options for these categories of building materials. Fortunately, there exists a wide variety of matrials, especially for walling and binding, that have been tested and proven as low-cost and durable and moreover in almost every country there are prospects for promoting one option or the other so that the prospects for

actually improving the building materials situation are good. Notable examples of basic building materials for the attainment of targets in low-income shelter delivery are: (i) walling: fired clay bricks, soil blocks, monolithic soil construction, timber cladding, composites of timber, building stone, and concrete blocks (ii) binding - building lime, lime-pozzolana composites and blended cements (iii) roof-cladding-wooden shingles, thatch, fired-clay tiles and cement-composite tiles. Through research and development efforts several innovations have emerged over the years which even though not yet commercialized, offer prospects for an eventual breakthrough in low-cost building materials technology and make the list of options almost inexhaustible.

3. For almost all the materials identified above, there are alternative scales of production technology available. A material as basic as soil block can be produced from rudimentary technologies requiring no equipment through small-scale technologies to rather sophisticated industrialized-scale technologies. Similarly, a material such as building lime can be produced from a scale of less than 1 ton capacity per day to well over 500,000 tons capacity per day. Large-scale technologies are intended to have cost advantages over smaller-scale options based on the economic rational of unit cost of output. However, for a variety of reasons large-scale building materials technologies have operated with severe diseconomies in most developing countries: most large-scale technologies are installed at prohibitive costs and operate far below the installed capacities. The tendency is to import machinery and labour for most large-scale building materials installations utilizing scarce foreign exchange so that prospects for additional installations to

satisfy the market size are limited due to unavailability of foreign funds. Again large-scale building materials technologies tend to depend on scarce factor inputs for production, notably expensive fuels for energy and the exploitation of large-scale deposits high-quality raw materials.

4. On the contrary, small-scale technologies are suited to the resource profile of developing economies and are thus able to operate with a cost advantage. Most small-scale building materials production technologies are capable of operating with locally available factor inputs which invariably optimizes their installed production capacities: small-deposits of raw materials which in most countries are often abundant but ignored are particulary suited to small-scale poduction and this includes agricultural or industrial bi-products; cheap and renewable forms of energy and low-grade fossil fuels can be utilized as energy; professional skill are not usually necessary and the basic technical skills required can often be obtained locally or acquired with relative ease; and most of all, machinery can be installed at relatively low cost with little or no dependence on foreign exchange so that propsects are immediately created for wide adoption of the production technologies.

5. There are two additional advantages of small-scale building materials technologies over large-scale technologies. The first is related to distribution of the materials for ultimate use on construction sites. By its very nature, building materials have to be distributed from a single production point to multiple construction sites often scattered over a wide geographic space covering the entire span of a country and this makes building materials a transport-intensive commodity. In most developing

countries, a single large-scale installation is responsible for the entire construction market, so that with the high cost of fuel and the under-developed transportation infrastructure, the cost of distributing building materials becomes prohibitive with some examples where cost of transportation per unit of a material exceeds the unit production cost. Small-scale technologies tend to serve relatively small markets including on-site production technologies which limits the demand or cost for transportation of materials. Another advantge of small-scale technologies over large-scale installations is in the area of employment and skill generation. Large-scale building materials technologies tend to be capital-intensive. Small-scale technologies however operate on manual principles with a large demand for unskileld and low-level skilled labour, so that they are relevant for tackling the crisis of unemployment and underemployment facing most developing countries.

6. In assessing the viability of small-scale technologies the co-existence of two contrasting options should be recognized: the traditional/rudimentary small-scale technologies vis-a-vis the improved or appropriate small-scale technologies. For most of the basic building materials suitable for low-income shelter delivery, the prevalent production systems are based on traditional technologies characterized by low-output, low-quality and relatively high cost of production. Typical examples of deficiencies in rudimentary technologies are in soil blocks, lime and fired-clay bricks: soil blocks produced in the traditional context are deficient right from the point of soil selection through all the production modes and end up with untolerable shrinkage cracks, low compressive strenoth and predictable short-life span in use; fired-clay bricks and building lime, which are

by definition energy-intensive products are produced with the most inefficient energy-systems. In fact, it can be argued that the prevalence of traditional technologies is a significant factor, which has limited the prospects of promoting otherwise viable low-cost building materials on a wide scale. The viability of small-scale building materials technologies is thus strictly within the domains of proven appropriate options with characteristics of both cost-efficiency and good-quality products.

7. Standards and specifications for building materials are relevant for the promotion of the respective materials in much the same way as the adoption of appropriate technologies. In principle, standards and specifications for building materials ensure good-quality, durability, cost efficiency and above all wide acceptance of products on the market. In this way, standards and specifications become even more relevant as corrective measures to overcome the deficiencies in the traditional building materials production technologies. For instance the low-strength, high shrinkage soil blocks currently produced at the cottage-scale can be improved without any additional investment in technology but by simply adopting basic quality control measures in soil identification, soil preparation and moulding, admixture with suitable stabilizers and curing of blocks. Again the relatively high cost of products from the traditional-scale technologies can be minimized if basic standards and quality control measures are promoted. In production of fired-clay bricks, for instance, rural artisans utilizing rudimentary technologies commit fundamental effors in all the stages of production which unvariably predetermines unrealistic production costs: efforts in water mix with clay and preparation of clay as well as drying of green bricks all lead to

excessively high energy consumption, but these could all be corrected were there basic standards and specifications in the form of artisanal guidelines.

8. Most developing countries have not as yet formulated any standards and specifications for building materials. In cases where such standards exist they are normally restricted to materials from large-scale technologies or imported items and even there the tendency is to reproduce a foreign standard which is hardly enforceable. There exists a clear gap regarding standards and specifications for those building materials which have been identified as basic and srategic for the shelter requirements of the majority of the population. There are hardly any standards and specifications to guide artisanal production of materials such as soil blocks, timber, fired-clay bricks and even lime. This gap has in a large measure contributed to the fading popularity of potentially viable low-cost materials and undue preference for high-cost import-based materials even within the low-income earning group.

9. When standards and specifications are available for locally-available building materials, an opportunity is created to incorporate such standards in building codes, regulations and contract procedures and in this way the materials gain acceptance and wide adoption. There is evidence that the lack of standards and specifications for low-cost building materials has contributed to the inappropriateness of existing building regulations and other regulatory instruments. What happens in practice in most developing countries is that the regulatory instruments tend to specify high-cost and often inappropriate building materials simply because standards are available for then so that there is a bias on the construction market for such

materials. In fact, in several countries the regulations actually stipulate a ban on the use of those local building materials which are of relevance to the needs of the low-income population. Thus, standards and specifications are relevant for promoting low-cost building materials by providing a basis for incorporating such materials into regulatory instruments and ultimately ensuring that contract specifications and tender documents adopt the materials in practice; professionals in control of building permits accept the materials; architects and Engineers specify the materials in design schedules and finance institutions accept the viability of the materials as preconditions for loans and credit for their use.

10. Despite the gloomy picture regarding promotion of low-cost building materials in developing countries there are a few examples in Africa and Asia but mainly Asia, of demonstrated breakthrough to the point where some local building materials have had a measurable impact on low-income housing. Agreeably this is no easy task and requires painstaking effort in several areas. The key to these successful examples is the adoption of appropriate technologies, invariably small-scale technologies: not just small-scale technologies for the sake of it, but rather a small-scale technology which encompasses local innovations, utilizing local resource inputs and consistent with local infrastructure plus adequate back-up services to the point of easy replication. Measurable indicators of such a breakthrough are that the installed technologies should lead to good-quality, durable yet cheap building materials available in sufficient quantities. It is precisely in this context that technologies and standards become inseparable and the basis for promotion of low-cost building materials.

II. BARRIERS IN TECHNOLOGY TRANSFER AND PROMOTION OF STANDARDS FOR LOW-COST BUILDING MATERIALS

11. Over the years, the strategy that most developing countries have adopted for local production of building materials has been a conventional process of technology transfer from an industrialized country to a developing country. To a smaller extent the newly emerging industrialized countries within the developing world such as Brazil, China, India and Korea have also transferred building materials technologies to other developing countries following the same conventional principles as with the former. Technology transfer within this context has largely been focusing on large scale installations such as those for cement, ceramic products wood processing, metal-based products and plastics to name a few. Some small-scale technologies have also been transferred in the conventional manner but mainly to do with the same high-technology building materials and certainly not the ultimate low-cost building materials.

12. The conventional process of technology transfer in the building material sector revolves around the sale and installation of plant equipment and machinery on either a turn-key basis or the recipient country bears the responsibility of installation and initial production activities. Apart from the fact that commercial transfer of technology is prohibitive in cost there are other crucial defects notably (i) the technologies are dependent on imported inputs for both recurrent and replacement items (ii) there is inadequate local capacity for repair and maintenance of machinery (iii) very often the machinery design disregards the specific local requirements and ends-up operating with frequent breakdowns, or failing prematurely. (iv) there are no opportunities to adapt the technologies to local conditions and eventually to replicate the

technologies on a wide scale. Standards and specifications which usually go to support and sustain technology transfer are equally approached in the conventional process of replicating standards between the origin of the technology and the recipient country regardless of peculiarities of the latter. Technology transfer between developing countries for high-technology building materials, faces the same problems as with the conventional processes described above: far too often the installations are technically inappropriate for replication. Worse still, the commercial outlet for transfer of technologies from developing countries is relatively underdeveloped.

13. Technologies exist for promotion of local building materials so as to have an impact on the low-income population. These are quite distinct from those building materials technologies which have been established over the years with channels for commercial transfer of technologies between one country and the other. However, a disturbing factor is that in most recent times attempts have been made to develop small-scale machinery for relatively simple technologies such as stabilized soil blocks and fibre-concrete roofing for purposes of transferring the technologies from industrialized or emerging industrialized countries to developing countries. Unfortunately, the same conventional processes of technology transfer as is normally used for high technology building materials, has been applied to the low-cost building materials and no doubt that there have been disasters and repeated failures in several developing countries. It is likely that attempts at formulating standards for materials such as stabilized soil blocks and fibre-concrete roofing will follow a similar process of adapting an international standard of a comparable industrial product. All these discrepancies are

taking place with disregard to the fact some developing countries such as China, India, Thailand, Ghana, Malawi and Kenya, to name a few, have actually developed and sustained local capacity to produce selected local building materials such as soil blocks, lime, clay bricks and fibre-concrete roofing tiles consistent with the requirements of the shelter needs of the majority of the population.

14. Even though successful cases of promotion of selected building materials for the benefit of low-income shelter has been achieved in only a few developing countries the issue worth capitalizing on is that the remaining developing countries do not have to invest in any primary research but simply to build upon the existing innovations. For almost every conceivable building material which is likely to have an impact on low-income housing, there is a proven and appropriate small-scale technology. Despite this, the majority of developing countries are still stuck with huge resource outlay on fundamentals of research into innovations in low-cost building materials and often achieving results of no consequence at all to the worsening shelter crisis. The logical step, following the few correct approaches to promotion of low-cost building materials would have been a process of transferring the successes from these countries to the remaining developing countries. Within the Asia region for example, there is a definite gap between countries such as China and India vis-a-vis the majority of the remaining countries in respect to local technological capacity for promotion of low-cost building materials. The gap is even wider between the Asia region and Africa as a whole even though there are isolated cases of relative technological advancement in Africa.

15. One justification for approaching the low-cost building materials problem through a process of transferring experiences

between developing countries in a collaborative manner is simply that most developing countries have the same fundamental problems in the building materials sector. Moreover, developing countries by definition have similar resources for promotion of local building materials i.e., (i) raw materials which are either scarce or abundant (ii) renewable energy resources (iii) abundance of unskilled labour, scarcity of professional and skilled labour and a crisis of unemployment or underemployment (iv) dependence on foreign machinery (v) under developed technological infrastructure and back-up services and (vi) shortage of foreign exchange. The obvious minor differences between the countries in resource capacity can be adjusted through a process of adaptation consistent with any local peculiarities at the individual country level.

16. Technology transfer between developing countries for promotion of low-cost building materials in its comprehensive and ultimate context is only a theory and is yet to be realized. The fundamental issue here is that it is a complex and resource-demanding task at both the national and international level:- the methodology for this type of initiative has been developed to some extent but it requires to be demonstrated and rehearsed quite effectively for easy replication. Nonetheless, this is an indispensable process which holds the key to fulfilling the building materials requirements of the majority of the population. Some interaction has already taken place between developing countries regarding low-cost building materials technologies but those types of activities fall far too short of technology transfer. Notable examples of inter-country co-operation are (i) information exchange between two research institutions (ii) twining arrangements between the building

materials research institutions in two respective countries involving attachment training of expertise or technical assistance to develop a specific research output.

17. The first barrier to be overcome if technology transfer between developing countries is to be effective is to tackle some outstanding problems of the recipient country. Some of the small-scale building materials technologies in question notably for soil blocks, fired-clay bricks, building like and fibre-concrete roofing are relatively simple and within the reach of national technological capacity for most developing countries with marginal or no external intervention whatsoever. Even if external intervention is required, the prerequisite is that the recipient country should have attained some basic infrastructure and shown readiness to receive a technology transfer in order for the whole exercise to be meaningful. What happens in reality is that most of the developing countries which are deficient in specific low-cost building materials technologies do not possess the requisite data to initiate any serious programme. Information on basic raw materials such as soil, limestone, clay deposits natural pozzolanas timber resources and energy resources to name only a few is either not available of if available not covered adequately. Very often information available is restricted to large deposits ignoring the abundant reserves of small-scale deposits: in principle small-scale deposits are only viable for small-scale technologies and therefore are strategic for promoting low-cost building materials. Similarly, there is hardly any useful data on rather innovative raw materials mainly of agricultural and industrial bi-products such as husks of rice groundnut and coffee, bagasse, grass for thatching, coal or bagasse ash, blast-furnace slag and fired-clay bricks and tiles rejects.

18. Countries in need of technology assistance or technology transfer have also been handicapped by inadequacies in their own programmes of research into low-cost building materials. Most local research institutions have not as yet undertaken the basic investigations which should form the framework for any realistic progamme of attaining national capacity with respect to specific low-cost building materials. The common trend is that there is inadequate work done on raw materials characterization and some basic tests which could then facilitate any form of external inputs. Sometimes in the absence of appropriate tests on raw materials and products, researchers in the recipient countries resort to guess work or adoption of some test results from foreign sources which may be totally inappropriate. Under these circumstances, machinery is supplied from the donor of technology without any basic data on the characteristics of the raw materials to be processed by the machinery. The net result is that the machinery proves inappropriate, and this minimum approach to technology transfer is prematurely halted and worse still an otherwise viable low-cost technology gets discredited. One example of a discrepancy of this nature is transfer of ceramic technology from Brazil to some African countries. Even though the Brazilian innovations in clay mixers and extruders have been performing well in Brazil, they have been a failure in some African countries partly for the above reason.

19. Another discrepancy with local building materials research institutions is that their approach to research disregards the complexity and multiplicity of activities required in the filed of low-cost building materials. It is not uncommon to find a research programme on an energy-intensive material such as lime or fired-clay bricks which completely ignores investigations into

the thermal performance of alternative fuels. There is hardly any investigation or programme on the machinery and equipment component of low-cost building materials: sometimes there is complete ignorance about the existence of local engineering manufacturing companies which even though not geared to manufacture of machinery specifically for small-scale building materials production could nonetheless be adapted to such a purpose. Wrong assumptions are made about labour-capital substitutability and without the necessary investigations, research programmes jump into conclusions about promoting either labour-intensive or capital-intensive production processes only to find out at the time of pilot demonstration or initial commercialization, that a non-economic option has been promoted. Again, research programmes tend to be biased towards the production of the low-cost building material itself, without interest in the complementary component of the use of the material in construction plus life-cycle performance. However, most of the basic low-cost building materials such as soil blocks, timber for walling and roof-cladding and fibre-concrete roofing tiles are extremely sensitive to appropriateness in design and construction aspects.

20. The extent to which inadequate data-base and national preparedness in the country in need of technology assistance can render any effort in technology transfer ineffective can be illustrated with the following example. In 1976-1977, a technical co-operation agreement between the Government of Ghana and the Government of Egypt, with funding from a donor agency, provided an expert from egypt to assist the Building and Road Research Institute of Ghana in its programme of promoting low-cost fired-clay bricks. The programme ended at the point where the expert replaced the existing deficient clamp kiln with a more

efficient and higher capacity permanent kiln plus introduction of improved clay mixing, moulding and green-brick drying devices. All these innovations centred on the twin philosophy of dependence on entirely local inputs and small-scale technology. In over ten years after the transfer of an appropriate technology, the programme has not had the desired impact on the brick industry in Ghana:- (i) there has been a gradual increase in the number of brick manufacturing plants but the bulk of these are either utilizing imported technologies which have all faced persistent disasters (ii) the price of clay bricks remains uncompetitive to concrete blocks thus defeating the original objective of the programme (iii) bricklayers are in extremely short supply on the market and (iv) the demand for bricks remains unfulfilled.

21. From the international perspective, one main barrier in technology transfer between developing countries is related to information flow. Most developing countries have over the years been engaged in various levels of activity to promote low cost building materials, sometimes involving projects which could serve as complementary to one another in two respective countries or even sometimes involving a straight forward duplication of project initiatives between two countries. The absence of any systematic information exchange between developing countries has led to a trend of wasting scarce resources and general lack of progress in the area of low-cost building materials. What ought to be borne in mind is that information exchange is a vital component and sometimes the backbone to technology transfer between countries. A classic example of wasting resources due to lack of information exchange is a case in an African country where resources have been pumped into a research programme to

determine the suitability and longevity of fibres in fibre-concrete roofing technology. Meanwhile, some countries in Africa have clearly demonstrated that the longevity of fibres is a non-issue in the technology and the trend has even shifted to production of tiles without fibres.

22. There is abundant information on low-cost building materials technologies in both developing and developed countries which should be sufficient enough to promote the wide adoption of the building materials. However, the bulk of the information originating from developing countries is not processed or published. The dissemination of the information is yet another key problem. Even where the information is well-processed and published, there are deficiencies in the eventual dissemination: this problem is common to information on low-cost building materials originating from all sources, developing countries, developed countries and relevant international organizations. The information is hardly disseminated to the target group: those who would ultimately make practical use of the information such as site foremen, technicians in charge of machine fabricating workshops, small-scale entrepreneurs and practitioners who are actually involved in day-to-day operations in production and use of building materials. There is also the question of how to step the information down to a comprehensible level for the artisans who may not understand the rather complex technical publications which characterize most available information on low-cost building materials.

23. Despite the fact that the basic low-cost building materials technologies have all bee proven and established there are still some technical problems which deserve special attention in the process of technology transfer. In principle, the design of a technology for building materials production, especially the

machinery or equipment component, is governed by factors such as the characteristics of the raw material inputs and the type of energy available. Unfortunately, for a material such as clay there could be wide variations between two countries in physical and chemical properties and even if there were similarities, the locally available fuels could vary. Again in stabilized-soil technology, apart from variations in soil profile, countries could vary in terms of available stabilizers. Such variations in local production factors tend to put undue pressure on the technical criteria for technology transfer.

24. The extent to which technical factors could affect technology transfer is more pronounced with low-cost binders. Unlike technologies for stabilized soil blocks, clay bricks and fibre-concrete roofing, technologies for low-cost binders are relatively sophisticated and it is precisely in this area that most developing countries in Africa and Asia, especially Africa, need technology assistance. Pozzolanas are either natural or artificial and there are several varieties of artificial pozzolanas each with a peculiar requirement for processing. On the one hand, the variability of raw materials which can be used for the same end-product is an asset to the theory of low-cost building materials technology. On the other hand, there is a problem of getting a perfect match between the origin of technology and the recipient of technology in terms of raw materials and energy resources. In fact, the search for a perfect match could limit opportunities for easy transfer of technologies and even if the match was found there still has to be some adjustments in technology in the recipient country. In a majority of cases, there will be wide variations in raw materials and energy profiles so that substantive adjustments in technology

would have to be made:- in-situ design, fabrication and trial-run of machinery which is both resource consuming and time-demanding.

25. As mentioned previously, standards and technologies are inseparable issues with regard to promotion of low-cost building materials. If standards were to be effectively promoted for the respective materials, some of the persistent technological problems will simultaneously be tackled. Unfortunately, standards for materials such as soil blocks and fibre-concrete roofing in the realities of developing countries is a complex subject and until most recently when UNCHS pioneered a breakthrough into the methodology, the subject has remained illusive to researchers and professionals in general. The formulation of standards for such materials if it has to prove useful, should be based on authentic country-specific data rather than the normal practice of adapting a comparable international standard:- this in itself is an intricate and technically demanding task. Very often there is no basic data to start with in the formulation of standards. Formulation of standards is one problem but promotion of the standards to the extent where it will have an impact on the ultimate producer of materials or artisan on site is yet another problem, requiring multiple activities and an entirely innovative approach.

26. There is a danger that once standards have been formulated in one developing country for specific low-cost building materials, it would be transferred and replicated in another country. This approach sounds attractive from the point of view of resource savings on behalf of the recipient country. However, it is technically faulty and could retard the process of technology transfer. The main reason is that there are variations in raw materials properties and existing levels of development in production technologies from country to country,

so that standards which could be attained by one African country may not necessarily be the same in another. Methodologies for formulation and promotion of standards can be transferred between developing countries, however there is a problem in that some of the recipient countries do not possess the basic national data which is a pre-requisite for the transferred methodologies to be put into any meaningful use.

27. Most of the barriers to transfer of technologies and standards between developing countries can be resolved at least from the technical point of view, with concerted effort and initiative from developing countries. However, the resource implications to accomplish such a task are massive and for most developing countries in need of technology assistance, they simply cannot afford the foreign funds required to implement an effective programme in attainment of local building materials technological capacity. The areas where foreign funds are bound to be prohibitive are for cost of moving expertise from one country to the other, cost of services of expertise in the country receiving assistance in technology, cost of procurement of unavailable inputs either from the origin of the technology or other relevant foreign sources, and cost of logistics and local supplies to develop and sustain the programme.

28. Assuming international funding is made available to support a programme of technology transfer between developing countries, then the logical step is to adopt a collaborative approach to the programme i.e. groups of countries coming together to participate in a joint research and development programme. The justification is that most of the opportunities and problems of these countries are similar and moreover, a joint-venture approach could optimize available local resources and conserve the scarce funds from

international sources. However, the crucial challenge to a collaborative programme among developing countries is the political goodwill for countries to co-operate effectively without undue political/inter-country administrative bottlenecks. At the national level, the respective participating governments will be confronted with the realities of providing inputs of one type or the other as a prerequisite to international support.

III. REVIEW OF UNCHS DEMONSTRATION OF TECHNOLOGY TRANSFER AND PROMOTION OF STANDARDS

29. UNCHS (Habitat) has over the past decade devoted considerable effort towards finding solutions to the barriers in development of national capacities in technologies and standards for low-cost building materials. After an initial progamme of research, the problems were analysed in a comprehensive manner leading to preparation of strategies and guidelines first to create awareness and response from national governments and secondly to initiate intervention from the international community. Following this initial phase, UNCHS embarked on three sets of projects aimed at a practical demonstration of problem solving with the ultimate aim of creating successful pilot studies in selected countries which could eventually form the basis for replication in a wider network of developing countries. The three sets of projects are (i) network of African countries for collaboration in local building materials and technologies through information exchange and related strategies (ii) promotion of standards for soil blocks and building lime in Ghana, soil blocks in Kenya and fibre-concrete roofing tiles in Malawi (iii) methodology for co-operation between African countries to transfer of technologies and standards for local building materials.

A. Network of African countries for collaboration in low cost building materials and technologies

30. The Network of African countries for collaboration in local building materials and technologies started in 1985 with a workshop jointly organized by UNCHS (Habitat) and the Commonwealth Science Council in Kampala, Uganda. The workshop was attended by 11 developing countries - Cyprus, Ghana, Kenya, Malawi, Malta, Mauritius, Nigeria, Sierra Leone, Tanzania, Uganda

and Zimbabwe. The workshop achieved two of its key objectives (i) that is, to identify local institutions which could play a coordinating role in the promotion of local building materials both at the local level and through international collaboration (ii) to appoint a resource person in each of the participating countries to act as a national co-ordinator and contact point for international correspondence in attaining the objectives of the Network. Over the years the network has promoted information gathering and processing in the respective countries and this has all culminated in the publication of a journal of the Network of African countries on local building materials and technologies. The journal will be published twice yearly and the second publication for 1989 is expected to be ready before the end of the year.

31. Information for the journal is provided by the national co-ordinators, for review assessment and processing by UNCHS (Habitat) so that the eventual publication fits into a well-defined strategy of not only information flow between countries but more importantly providing relevant data for those countries facing certain crucial issues of technology to initiate some action. Using guidelines provided by UNCHS (Habitat) each national coordinator is expected to collect specific data on a nation-wide basis to reflect a comprehensive range of issues but only those deemed to be relevant for promoting low cost building materials technologies. Typical issues on which information is gathered are (i) research and laboratory activities (ii) actual production of selected low cost building materials (iii) promotion of standards and other appropriate regulatory instruments (iv) machine and equipment fabrication (v) use of the materials in construction (vi) role of the private sector (vii) institutional support and policy matters. For every publication,

one or two themes are featured covering vital information on low-cost building materials technologies from outside the Africa region.

32. Within its limitations, the UNCHS Network of African countries has proved viable, barely 3 years after its inception. There has been an increase in the number of participating countries - namely Egypt, Ethiopia, Gambia, and Zambia. Activities are in progress to ensure active participation by all English-speaking African countries by the end of 1989. Similarly, the relevant international organizations, notably, ECA, UNIDO, Shelter Afrique, Appropriate Technology International (ATI), G.T.Z., USAID, Swiss Centre for Appropriate Technology (SKAT) the Building Research Establishment of UK and ITDG have all expressed willingness to use the Network and its journal as a medium of providing vital information on low-cost building materials and more so creating a useful link between the participating developing countries and the international community. After a short period of disseminating the journal to the respective participating countries one important objective has been realized: the untapped potentials and otherwise unretriavable but vital information on the local level is beginning to emerge through responses from readers.

33. Despite the achievements of the Network and the journal the project needs to be strengthened in some particular aspects in order to accelerate progress in promotion of low-cost building materials. In the first place, the Network has to expand to cover as many developing countries as possible, in Africa, Asia, Latin America and the Carribeans, which means the publication should be in at least 3 languages - English, French and Spanish. In the second place, the target group for the journal should

systematically be broadened from its current focus on professionals to cater for middle-level technicians and the ultimate artisan. Thirdly, there should be an active network for receiving and providing information within the respective participating countries. Fourthly, the co-ordinating agency with the support of other relevant international organizations should ensure an uninterrupted schedule within the stipulated number of publications of the journal per year.

B. Case Studies on Standards and Specifications for Local Building Materials

34. In 1987, UNCHS (Habitat) with the support of the Commonwealth Science Council and the African Regional Organization for Standardization (ARSO) organized the first regional workshop on standards and specifications for local building materials. The workshop was limited to about 25 African countries, both French and English speaking and the discussions focused on what could be classified as the most basic low cost building materials i.e. (i) fired-clay bricks (ii) soil blocks (iii) fibre-concrete roofing tiles (iv) building lime (v) low-cost binders - predominantly pozzolana composites. The significance of standards and specifications in the entire framework of promoting low-cost building materials was amply stressed. Similarly, the main constraints making it difficult to formulate and promote standards for local building materials were analysed in a comprehensive manner. However, success of the workshop can be attributed to the formulation of a pragmatic recommendation which requested UNCHS to demonstrate innovative methodologies for dealing with the lack of standards for the stipulated local building materials. It is upon this basis that UNCHS in collaboration with the Commonwealth Science Council organized three respective workshops on (i) the Ghana Standards

and Specifications for Soil blocks and building lime (ii) Malawi standards and Specifications for fibre-concrete roofing tiles and (iii) Kenya standards and specifications for soil blocks.

35. The strategy adopted by UNCHS (Habitat) in achieving a breakthrough in the formulation and promotion of standards in the above 3 case studies hinges around the following issues (i) a good assessment of the local conditions to identify all the key institutions and resource persons that are concerned in one way or the other with the promotion of a specific local building material (ii) preparation of an authentic national study on the specific local building material focusing on precise field and laboratory measurement of raw materials, production characteristics, tests on end products at the market place and an account of the level of local technological development for the production of that material (ii) organizing an action-oriented workshop which seeks to bring together all those who matter in the national context as far as promotion of the specific local building material is concerned i.e. policy makers, researchers, professionals of the construction industry, finance and credit institutions, regulatory authorities, user agencies both private and public, tools and machine fabricating mechanics or engineers and the ultimate producer or user of the specific local building material (iv) identifying key issues for discussion and providing guidelines to the discussions so that by the end of the workshop a consensus is reached in terms of approving a technical basis for a draft national standards plus recommendations on activities to promote effective adoption of the standards (v) a strategic field visits to complement the workshop which ultimately seeks to promote the acceptability of the specific local building material amongst the workshop participants.

36. The success of the UNCHS (Habitat) project on standards for local building materials can be measured in several ways. In the first place, draft national standards have been formulated for soil blocks, building lime, and fibre-concrete roofing tiles. The important thing is that each national standard is peculiar to local conditions so that the draft Ghana standards for soil blocks and the draft Kenya standards for soil blocks are not the same. However, there exists a sound methodology for formulation and promotion of standards for local building materials which can be replicated in several developing countries. In the second place, the respective regulatory authorities in all the 3 countries have accepted the viability of the respective local building materials for which standards have been formulated and this has paved the way for incorporating the materials in existing building regulations. Thirdly, in a relatively short period after the projects were implemented in the 3 countries, there is ample evidence of increased activity in the production and use of the materials. Finally, several other African countries have requested for assistance to replicate the experiences of Ghana, Kenya and Malawi in formulation and promotion of standards for selected local building materials.

37. The UNCHS (Habitat) demonstration of an effective methodology for promotion of standards for local building materials is only a vital means to achieving the ultimate target of wide adoption of local building materials. In the three countries where the methodologies were demonstrated, namely Ghana, Kenya and Malawi, there is still need to implement and sustain follow-up activities to ensure that the standards actually influence production practices by the ultimate artisans. There is also need to ensure that the standards become instruments to facilitate provision of credit to small-scale

entrepreneurs to expand production. Similarly, there is need to ensure that, the standards influence the choice of the respective materials in on-going and pipeline construction projects for both the public and private sectors especially with regard to shelter requirements of the low-income population.

C. Co-operation in the Africa region on technologies

38. Ten African countries were identified for this project namely (i) Botswana, (ii) Ethiopia (iii) Gambia (iv) Ghana (v) Kenya (vi) Malawi (vii) Mauritius (viii) Nigeria (ix) Uganda and (x) Zambia. UNCHS initially commissioned detailed country case studies to be prepared on any of the following local building materials (i) soil blocks (ii) fired-clay bricks, (iii) lime (iv) low-cost binders mainly pozzolana composites (v) timber as a low cost wallrug or roofing-cladding material and (vi) fibre-concrete roofing tiles. The main objective of the country studies was to identify on the one hand the state-of-the-art in local technological development for the relevant building materials with a focus on, innovations worth replicating in other african countries and on the other hand an account of deficiencies in promotion of local technological capacity which could be rectified through transfer of relevant experiences from other African countries. A workshop was organized jointly by UNCHS (Habitat) and the Commonwealth Science Council in May 1989, bringing together all the above-mentioned African countries together with relevant international organizations notably, ITDG, GTZ SKAT, BRE and ATI/USAID for the purpose of discussing the country papers and working out a methodology for collaboration among African countries in promotion of technologies and standards for low-cost building materials.

39. The project was successful in as far as achieving its initial objectives i.e. to formulate a framework for co-operation among African countries. More specifically, the following were the achievements of the project (i) through discussions on the country reports it was proven that despite the common trend of deficiencies in local technological capacity for local building materials among several developing countries, there were isolated examples of breakthrough in selected technologies which could form the basis for a programme of technology transfer between African countries. For instance Kenya is technologically self-sufficient in soil block and fibre-concrete roofing technology, Ghana is self sufficient in soil blocks and fibre concrete roofing technology and Malawi is self-sufficient in fibre-concrete roofing technology. (ii) the gap between African countries is in relatively simple building materials technologies was clearly demonstrated. Countries such as Gambia, Botswana, Sierra Leone, Liberia, Ethiopia and Zambia are at very early stages of the process towards sufficiency in soil blocks and fibre-concrete roofing technologies and could therefore benefit from a programme of transfer of technologies from Ghana, Kenya and Malawi (iii) All the countries participating in the project are deficient in technologies for low-cost binders i.e. lime and pozzolana composites even though a few notably Ghana and Nigeria had advanced in laboratory activities. A framework for collaborative projects with assistance in transfer of appropriate small-scale technologies from outside the Africa region was rehearsed, and this could eventually be elaborated and implemented at the sub-regional level.

40. Clearly the UNCHS search for a methodology for co-operation between African countries in technologies and standards for local

building materials only goes to reveal the intricacies and resource-demanding procedures required to tackle a rather indispensable task. Several gaps remain to be filled if this UNCHS initiative is to bear fruits. Firstly, the methodology has to be reviewed with the aim of expanding the scope of collaborating countries to stretch beyond the African region and incorporate the vital experiences of other developing countries notably from the Asia region. Secondly, a pilot research and development project focusing on the most critical of all the low-cost building materials namely low-cost binders should be implemented based on the principles of technology transfer between developing countries. Finally, a programme of replication of a successful pilot project on technology transfer between developing countries should be drawn up for systematic implementation, monitoring and evaluation.

IV. TECHNICAL CRITERIA FOR TRANSFER OF TECHNOLOGIES AND STANDARDS BETWEEN DEVELOPING COUNTRIES

41. Before the theory of technology transfer between developing countries can be translated into reality it is paramount to fulfill some basic technical criteria as a pre-condition to a successful implementation programme. As is evident from the following checklist, the criteria are in the first place interrelated and secondly are applicable to both the origin of the technology to be transferred and the recipient of the technology.

A. The appropriate building materials

42. It is important to identify the appropriate building material in the recipient country upon which the technology transfer programme will eventually be designed. The basic question that ought to be asked is has the material got any opportunity to compete favourably on the market if eventually promoted? This means there must be a thorough assessment of the supply and demand of those building materials which are technically comparable to the specific material to be promoted. There is always the danger of promoting low-cost building materials simply for the sake of innovation and personal research interests regardless of local realities and unless this tendency is avoided the entire exercise will be fruitless. It is for instance unlikely that stabilized soil blocks will stand a favourable chance of promotion if the market is already saturated with supply of building stone, fired-clay bricks and concrete blocks. One also has to find out whether there are locally available inputs for the production of that specific building material to be promoted. A technology as seemingly simple as fibre-concrete roofing tiles is only viable if Portland cement is

locally available in sufficient quantities, easily accessible to the entire population and most of all at an affordable cost. Similarly if good sands are not readily available then the technology is doubtful. Errors have also been committed in the past in attempts to promote energy-intensive building materials such as fired-clay bricks with gross-under estimation of the supply and cost of available fuels.

43. Bearing in mind that the ultimate target of technology transfer and promotion of local building materials is to meet the needs of the low-income population, the final cost of the material at the market place becomes the single most important factor in identifying which material to promote. In this case, if even the market was saturated with building stone, fired-clay bricks and concrete blocks, there could still be a chance for promoting stabilized-soil blocks for as long as there is a clear cost advantage in favour of stabilized soil blocks. However, in such circumstances the promotional exercise should be carefully targeted to the low-income population, not just leaving the material to compete on the open-market and expecting the target group to opt for it. Unfortunately, this requires additional intricate processes and there is a cost to it.

B. Technological capacity of the recipient country

44. A good assessment of the level of development of the recipient country in terms of the selected building material to be promoted is required. One has to find out what basic research and laboratory work have already been accomplished - have all the basic tests been performed on the material, or should technology transfer start right from the inception with the donor country performing such basic tests. Again one has to find out the level of local manpower available and to what extent external manpower

will be required. If the material is to be promoted on a nation-wide basis then the assessment has to go beyond the specifics of a localized research/laboratory activity and cover basic infrastructure for promotion of the technology in several parts of the country particularly the regions remote from the building materials research institutions: for instance, is there sufficient local capacity to assess raw materials on a nationwide basis including small-scale deposits and agro-industrial residues? is there sufficient local capacity to disseminate the technology to the target group?

45. Equipment and machinery are most often central to the entire process of technology transfer or development of local technological capacity. The tendency is to import machinery from the country of origin of the technology but this may not always be the best option. The first step is to assess the conditions of the recipient country in terms of labour-capital substitutability- the extent to which labour is relatively cheap and abundant could influence decisions in the extent to which machinery should be imported. In the fired-clay bricks industry for example, a technology transfer could imply the importation of a whole array of vehicles, and machinery - namely excavators, tipper trucks, clay crushing machines, pug-mull, extruder, conveyer belt device, fork-lifts drying racks and pallets for loading. However, a good assessment of local conditions could lead to the elimination of several machine-assisted processes to be substituted with manual-processes. Similarly, an assessment of local capacity to fabricate machinery or components of machinery for the building materials industry is vital - often one may not be able to find an engineering firm in the recipient country devoted to fabrication of machinery specifically for the building materials industry but there is always the possibility

of a basic fabrication unit which could be adapted to produce simple equipment such as wheel-barrows and manual-presses.

46. In promoting local technological capacity for the building materials industry, efforts have often been committed by dwelling strictly on the production component rather than the end use of the material in construction. A good assessment of the local technological capacity in preparation for a programme of technology transfer should pay actual attention to both production and use of the materials. Failure to recognize the significance of local skills for use of an innovative material in construction, could render an otherwise viable technology-transfer programme worthless. There have been cases where availability of local skills have been taken for granted in the transfer of technologies for the brick industry and by the time that the recipient country had successfully acquired the technology innovation, it became difficult to popularize the use of the bricks simply because, there were not sufficient good brick-layers in the system, the few available were too expensive and there were a few under-skilled bricklayers whose shoddy performance discredited the whole technology. It may sometimes prove difficult to have the exact artisanal skills available in the recipient country at the time of assessing local capacity but this need not be a problem so long as one bears in mind that it requires an effort and commensurate resources to adapt available skills to new techniques, particularly bearing in mind that most of the artisans to be converted normally stick to traditional practices and are resistant to innovations.

C. The choice of a correct technology

47. Among all things the choice of the technology to be transferred or promoted must be correct right from the start.

The simplest indicator of the correct choice of technology in this process is the scale of the technology. As previously mentioned, most small-scale building materials technologies would be viable for transfer to developing countries. However, the notion of small-scale requires verification and cannot be taken for granted. Fibre-concrete roofing technology in its commercial package for transfer to developing countries was designed as a relatively simple technology-process, utilizing a seemingly rudimentary battery-operated vibrator. The design of the vibrator did not take into account the realities of life in remote areas of most developing countries:- an assumption had been made that the ultimate user of the vibrating machine would have easy access to battery charging equipment but this was never the case so that over a period of time the technology proved disastrous to the point where local initiatives had to set in to fabricate local machinery based on manual operations. Closely linked to the scale of technology is the source of technology to be transferred. There is a good chance of successful transfer if some basic conditions and infrastructure are comparable between the origin and destination of the ultimate technology.

48. In the final analysis a good choice of technology to be transferred will be judged by a combination of technical and economic factors. In technical terms, one has to find out issues such as the relative ease of installation, operation and repair of machinery, the relative ease of production processes, the minimal dependence on imported inputs to sustain the technology, possibilities for producing local components to sustain the technology, and possibilities for eventual replication of the technology for wide adoption in the recipient country. In economic terms, the technology should not be a deterrent to the

objectives of low-cost building materials: - the initial cost of acquiring the technology should be relatively low so that if there are no opportunities for replication or local adaptation then there still is a chance for popularization.

D. The correct option of technology transfer

49. There are several models or variations of transfer of technologies and standards for local building materials from industrialized countries to developing countries which can be adapted to suit the objectives of technology transfer between developing countries. Notable examples take the form of commercial packages either on turn-key basis or simply supply of machinery without any installation and trial-run component. Sometimes the main item of transfer becomes expertise rather than machinery and equipment, but still on a commercial basis. Non-commercial options also exist for both supply of machinery and supply as well as providing training for expertise from the recipient countries in formal institutions or on-the-job attachment programmes

50. The extent to which the above options, singly or collectively, will be applicable to the theory of technology transfer between developing countries will largely depend on some of the criteria already mentioned above, in particular, the state of the art with respect to the specific local building material technology in the recipient country. What ought to be borne in mind is that none of the options has got exclusive merits: even the seemingly unfavourable option of commercial turn-key operations can be successfully adapted to a programme of technology transfer between developing countries. The key thing is to support whichever option or combination of options with a set of back-up services and sustainable complementary activities

to the point where the recipient country attains adequate local capacity.

E. Back-up activities

51. Unlike technologies for conventional or high-cost materials such as Portland cement and galvanized-iron roofing sheets, technologies for low-cost building materials can only be effectively transferred to the target group if a comprehensive set of back-up activities is implemented alongside the purely technological component of the process. As mentioned previously, all the basic low-cost building materials technologies i.e. building lime, fired clay bricks and tiles, soil blocks fibre-concrete roofing and timber for roof and wall cladding have all been proven and established in a few developing countries. What remains to be properly rehearsed and established is the back-up activities which will not only ensure that the technology spreads to the majority of the population, but in addition ensure that the quality and cost are favourable to the target group. The extent to which back-up activities are more significant than purely technological issues can be found in countries which have made reasonable progress in low-cost building materials technology innovations:- in countries such as China, India, Malaysia and Pakistan, the majority of the population are yet to benefit from the low-cost technology innovations to the extent where basic building materials will be abundant and affordable to meet their shelter requirements.

52. In a programme of transfer of technologies and standards or development of local capacity for low-cost building materials, the basic back-up activities worth exploring are as follows:

(i) information package - relevant information on the technology innovation - i.e. production procedures, standards and

quality control, codes of practice in machine installation and use, code of practice in use of materials in construction, should all be prepared in the most simplified manner than would be relevant to the target group.

(ii) extension services: once the technology innovation has been demonstrated, it is important to disseminate such technologies in an aggressive manner on a nation-wide basis. The concept of extension services/field staff, as found in the agriculture sector is worth emulating. In the context of the low-cost building materials sector, the extension unit will deal with the basis of raw-materials assessment, identification, training in production and use of materials, adherence to quality control and continuous advisory services to sustain the technology innovations in the most decentralized manner.

(iii) demonstration projects: the low-cost building materials should be promoted in construction projects at a scale that will directly break the barrier of acceptance and at the same time demonstrate improvement of shelter conditions of the target group. Projects located within existing slum/squatter settlements or projects aimed at upgrading such settlements on a relatively large-scale could prove useful.

(iv) Solid local research infrastructure: the failure of existing building materials research institutions to have an impact on low-income population has created the impression that they are irrelevant - on the contrary they need to be re-oriented and reinforced to provide targeted research and monitoring of activities.

(v) credit support: there must be avenues for credit to the small-scale artisans/entrepreneurs specifically designed to facilitate requirements for production and use of low-cost building materials.

(vi) institutional support:- an untapped avenue for wide adoption of low-cost building materials is through non-conventional shelter delivery systems. In most developing countries, there exists community participation programmes, self-help programmes and a multitude of grass-roots non-governmental organizations serving the interest of low-income housing, but there is lack of a strategic institutional-support programme to make them have the desired impact.

V. PLAN OF ACTION

STRATEGIES FOR CO-OPERATION IN TECHNOLOGIES AND STANDARDS FOR LOW-COST BUILDING MATERIALS

A. Information strategies

53. There should be a system of information exchange between developing countries, aimed at promoting transfer of technologies and standards. So far, a useful start has been made two different sets of information exchange, i.e. (i) the UNCHS journal of the Network of African countries on local building materials and technologies and (ii) the UNIDO/UNDP Regional Network in Asia for low-cost building materials technologies and construction systems. Both information systems for Africa and Asia respectively need to be strengthened in order to accelerate the pace of wide-adoption of low-cost building materials. It is also of strategic importance to link up the two systems into a well-processed network of countries in Africa and Asia on low-cost building materials technologies. It is also important to improve dissemination strategies: a package of information kit ranging from technical publications, newsletters, simplified manuals, audio-visual material and seminars or workshops could all be considered.

54. The implementation of an information network of countries in Africa and Asia will require first and foremost a methodology for effective local participation. Here, there are two issues at stake: (i) ensuring adequate and regular information gathering at the individual country level and (ii) disseminating any information supplied through the network in such a manner that it has an impact on all the local grass-roots participants. The support of the international community is vital in such a venture. There has to be an international organization to co-ordinate such activities and above all, bear the technical

responsibility of collecting, processing and disseminating information throughout the network. The interest and commitment of the participating national governments should not be taken for granted. It is a pre-requisite to information gathering at the local level to give assurance to individuals and firms who may possess information of commercial value that their inputs would be safeguarded and rightly acknowledged.

55. If the theory of t hnology transfer between developing countries will have to be translated into reality then it requires at least one successful demonstration project. A demonstration project of this type will have to cover the entire range of processes - identifying the correct technology putting the technology in place at the recipient country and implementing all the requisite back-up services to the point where there is measurable indication of the programme having had an impact on the low-income population. One way to approach this demonstration process is to transfer the relatively proven experiences from Asia to Africa. However, it is necessary to design the demonstration as a collaborative research effort bringing together a number of recipient countries in a single programme so as to optimize the use of resources.

56. The initiative and actual implementation of a collaborative programme to demonstrate technology transfer between developing countries should be the responsibility of an international organization: it requires creativity to work out the methodology and it requires considerable effort including coordinating arrangements to actually put the programme to test. Moreover, there is need for huge resource outlays in foreign exchange to cover the cost of procurement of machinery and inputs or the design and fabrication of prototype machinery at the destination

of technology transfer plus cost of foreign expertise and sometimes supplementing the cost of local expenditure. The huge resource outlay need not be a deterrent because the demonstration programme is by definition a viable investment strategy: one only needs to test out the methodology once and get it right once and for all.

C. Replicating the demonstration project

57. A successful pilot project, demonstrating the theory of technology transfer between developing countries for low-cost building materials will have to be replicated in as many developing countries as possible. The strategy for replication should aim at one thing. The resources required to replicate the innovation should be progressively low from one country to the next, implying that the initial huge investment would be showing results increasingly over a period of time. For instance, if machinery is imported for the initial pilot project there must be evidence of a local adaptation or replication of the machinery by the end of the project, and the participants in this collaborative demonstration project who originate from potential recipient countries, should have acquired sufficient know-how so that replicating the technology in their respective countries would be relatively less resource-consuming.

58. The selection of countries to participate in any collaborative project to demonstrate technology transfer should as far as practicable be based on sub-regional groupings. The likelihood is that a success in one country within the sub-region could be spread faster and in a more cost effective manner than if it were introduced from outside the region. Normally, countries within the same geographical sub-region have some similarities which facilitate a common approach to low-cost

building materials promotion: raw materials, climatic features, history of construction technology institutional arrangements and level of local skills could all be identical. Besides, movement of goods and people could be relatively in-expensive. It is even possible for countries within a sub-region to pull their resources together and facilitate the transfer of technology to a designated country within the group for eventual replication in the rest of the countries.

59. The resource requirements for replicating a successful demonstration project on transfer of technologies are equally important and of a magnitude beyond what developing countries can afford. But even more important than the resource requirements is the political implication of inter-country collaboration. Ironically, there is no guarantee that governments will easily co-operate simply by virtue of being in the same sub-region. Even where there is political co-operation it is strategic to design a collaborative programme using international institutional arrangements which have already been established. In this connection the role of non-governmental organizations should be explored especially those with experiences relevant to promotion of low-cost building materials.

D. Co-operation between the private sector in Africa and Asia

60. The actual commercialization of technology innovations will be enhanced if the role of the private sector is promoted. However, the private sector will only be attracted when the technology has been successfully demonstrated and also when the basic infrastructure for commercialization of technology innovation has been laid. Particularly for low-cost building materials, special effort has to be made to attract the private sector's participation because it is not a proven profitable

venture relative to other enterprises of the national economy. While the attraction of private investment is desirable, measures should be taken to ensure that commercialization does not become a deterrent to attainment of the objective of low-cost and good quality products. The promotion of the private sector in technology transfer for low cost building materials could start from the time of carrying out the pilot projects, by allowing selected entrepreneurs to participate in seminars and workshops. The target of private sector promotion, should however be the identification of a pool of entrepreneurs in the recipient countries and a similar process in the country of origin of the technology so that an exchange of business contacts is established. A special newsletter could be established in support of this venture focusing on collaboration between the private sector in Asia and its counterpart in Africa.

VI. Points for discussion

61. Discussions on this paper should focus on two main issues:

Issue No. 1

The significance of appropriate technologies and standards as factors limiting the wide adoption of low-cost building materials. That is can the significance of technologies and standards be justified bearing in mind that:

(i) the high cost of and inadequate supplies of basic building materials in most developing countries are due mainly to lack of appropriate technologies?

(ii) most small-scale technologies are cost-efficient and generally suited to the resource capacity of developing countries for production of local building materials?

(iii) appropriate standards and quality control measures can promote good-quality yet low-cost products without necessarily investing in hardware of technology?

(iv) the incorporation of relevant standards into building regulations can on its own lead to wide adoption of low cost building materials?

Issue No.2

What criteria and measures are required for transfer of technologies and standards between developing countries for wide adoption of low-cost building materials, in particular

(i) to what extent the conditions, in the recipient country including the identification of the correct type of material to be promoted, facilitate or retard process of technology transfer?

(ii) how relevant are the scale of technology and choice of mode of technology transfer relevant to attainment of local capacity?

(iii) how strategic is the role of the private sector in promoting wide adoption of low-cost building materials?

(iv) how can an effective system of information exchange between developing countries be established and sustained?

(v) what will be the most suitable methodology for developing to demonstrate an innovative approach to transfer of technology between developing countries?

(vi) how can a successful pilot project in technology transfer between developing countries be replicated in several countries of Africa and Asia?