UNITED NATIONS

ECONOMIC and SOCIAL COUNCIL

Distr.
GENERAL

E/CN.14/524
E/CN.14/HOU/87
15 April 1971

Original : ENGLISH

ECONOMIC COMMISSION FOR AFRICA

REPORT OF THE AD-HOC EXPERT GROUP ON CO-ORDINATION OF BUILDING RESEARCH IN AFRICA

(Addis Ababa, 22-26 March 1971)

M71-918

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REPORT OF THE AD-HOC EXPERT GROUP ON CO-ORDINATION OF BUILDING RESEARCH IN AFRICA

PART I

ORGANIZATION AND ATTENDANCE

Opening meeting and statements

1. This meeting was called in accordance with the established practice of holding ad-hoc meetings of Directors of Building Research Organizations in Africa, Asia and Latin America for which ECOSOC has a standing budget. It was convened by the Centre for Housing, Building and Planning of the United Nations Headquarters with the collaboration of the Housing, Building and Physical Planning Section of the Industry and Housing Division of the Economic Commission for Africa. The Directors of the Building Research Organizations were invited by the Centre for Housing, Building and Planning.

2. A representative of the ECA secretariat in a welcome statement indicated the importance the secretariat attached to the questions of building research co-ordination and pledged the full support of the staff of the housing section to the successful conclusion of the deliberations.

3. He pointed out that the building sector was always closely involved at all stages of economic development. By its nature, it was largely dependent on domestic economic conditions for financial and other resources and its level of development reflected the level of the economy in which it found itself.

4. Because of the need for rationalization and the desire to use more durable materials, people had tended to look abroad for solutions, in both materials and techniques, to these problems. This had meant a substantial outflow of hard currency so acutely lacking in these countries. In order to extricate their countries from this dilemma, building centres should take action to develop local construction materials, to train men to use these materials and to help organize local housing conditions in such a way that they reflected the economic circumstances of the country.

5. The Housing Section of the ECA was aware of these problems; its activities in this area were designed to resolve them. There was therefore scope for co-operation and co-ordination of all efforts not only between the Research Organizations themselves but also between the organizations and the Housing Section of the ECA. In view of the limited resources and the size of the tasks, such co-operation was essential to reduce wastage and optimise returns on investments in the various centres, whose initial capacities might exceed the needs of the territories in which they were situated. One of the objectives of the meeting was to bring together people who were daily engaged on these problems and to define areas in which co-operation might be organized to the benefit of the region.

6. The quality of this co-operation and co-ordination would depend on a clear appreciation of each centre's fields of activity, its resources and its problems. With this knowledge the work of each centre might be designed to complement that of the others, where this was feasible.

7. In conclusion he suggested practical steps by which co-operation might be started; a system of reporting and exchange of information was needed. One such system might be the establishment of a periodical in addition to personal contacts, another might be the arrangement of seminars and discussion groups.

8. The Housing Section would do all it could to interest the Centres in its activities by encouraging them to contribute their local knowledge and experience by participation in the section's programmes in the sub-regions.

9. A representative of the Centre for Housing, Building and Planning expressed appreciation for the promptness with which the Directors of the Building Research Organizations responded to the invitations given at such short notice. He expressed his gratitude to the Director of the Industry and Housing Division for arranging for the facilities and to the staff of the Housing Section for organizing and preparing for the meeting.

10. He expressed the need for co-operation among building research organizations and pointed out the methods by which such co-operation would be realized, viz. personal contacts, correspondence, seminars, exchange of research workers, etc.

11. The Copenhagen Seminar on the Contribution of Building Research to Housing Programmes in Developing Countries in 1961, was the first attempt at starting co-operation in building research. In spite of the efforts of the C.I.B. (The International Council for Building Research and Documentation) through its various working groups, achievements in this area of activity had been minimal in the developing areas of Africa, Asia and Latin America. Causes of this lack of success were slowly being eliminated by the rapid developments over the past decade.

12. In order to promote rational development of the construction sector in developing countries the United Nations Committee on Housing, Building and Planning had recommended that there should be co-ordination of Building Research among developing countries during the second Development Decade. The implementation of this recommendation by building research organizations added new tasks to those normally undertaken by these organizations, the justification for the assumption of those new tasks was the eventual improvement of the construction industry and of housing conditions, in Africa.

Attendance

13. The ad-hoc Group comprised the Directors of Building Research Organizations in Ghana, Sudan and Togo, the Associate Dean of the College of Technology, Faculty of Engineering, Haile-Selassie I University, Ethiopia, and the Director of the Regional Educational Building Institute for Africa, Khartoum, Sudan. The Centre for Housing, Building and Planning of the United Nations Headquarters was represented by a senior staff member forming part of the secretariat.

Election of officers

14. Mr. R.E. Fitchett, Regional Advisor, Housing Section, ECA, was appointed Chairman of the Group. Mr. A. Gonzalez-Gandolfi, Chief, Building Section, Centre for Housing, Building and Planning, UN Headquarters was appointed Vice-Chairman. The Rapporteurs were assigned as follows:

Dr. J.W.S. de Graft-Johnson (Ghana) - Monday sessions;	for	Agenda	Items	1 to 5
Mr. Ibrahim Mohamed Ibrahim (Sudan) - Tuesday sessions;	"	"	"	6(a) to (f)
Mr. K. El Jack (Sudan)	"	"	"	7(a) and (b)
Mr. Josia Kouassi (Togo)	"	"	"	8(a),(b) and (c)

Work programme

15. The Group examined the Work Programme and adopted it as follows:

Monday, 22 March 1971

1. Registration of participants
2. Opening addresses by:
   (a) The Representative of ECA
   (b) UNCHBP Representative
3. Election of officers
4. Adoption of work programme
5. Statements:
   (a) Report on the similar Group of the ECAFE Region,
   (b) Major problems confronting building research organizations in Africa.

Tuesday, 23 March 1971 - 6. Review of current and long-term building research programmes in the African region by groups of sub-disciplines as follows:

(a) standards, regulations, codes;
(b) building materials;
(c) building techniques including soil mechanics, foundations;
(d) building operations and costs;
(e) building physics and installation.

Wednesday, 24 March 1971 - 7. Main topics to be co-ordinated:

(a) Research items;
(b) Organization, equipment and research methods;
(c) Dissemination and application of research results.

Visit to College of Technology, Addis Ababa.

Thursday, 25 March 1971 - 8. Machinery for co-ordination of building research activity at national, regional and inter-regional levels:

(a) Role of the UNCHBP and ECA for promoting and steering co-ordination;
(b) Systematic procedure for co-ordination.

Friday, 26 March 1971 - 9. Adoption of Report.

PART II

ACCOUNT OF CONSULTATIONS

Report on the Ad-hoc Meeting of Directors of Building Research Organizations of the ECAFE Region

16. The Representative of the UN Centre for Housing, Building and Planning reported on the proceedings of the recent ad-hoc Group of Directors of Building Research and Development Organizations in the ECAFE Region, 3-12 March 1971. This Group was organized by the United Nations Economic Commission for Asia and Far East in co-operation with UNIDO, the UN Centre for Housing, Building and Planning and the Government of Australia.

17. There were fourteen participants and three UN staff members. The Group discussed the following topics: Problems on building research confronting the countries in the region; Co-ordination and integration of programmes of activities; Machinery for improving co-operation and co-ordination; Collection, documentation and channels or means for the dissemination and exchange of research information; Promotion and co-ordination of fire research.

18. On problems of building research; The Group noted the following common problems in building. The need for new substitute building materials, the improvement in the quality of traditional building materials and the need for a reduction of building and maintenance costs; the conference recommended that in view of the vital role of housing and buildings in the national economy, funds for housing and building research should be given a high priority and a higher share of the national income; the Group recommended adequate incentives to attract prospective research workers and retain those already in the job; and Recommended the maximum use of research equipment in each country by the various institutions in order to avoid costly duplication.

19. On co-ordination and integration of programmes; Each organization within a country should use the experience and facilities of other organizations as much as possible; the Group was informed of the organization of similar meetings in other regions by the UN Centre for Housing, Building and Planning with the Regional Economic Commissions. It acknowledged and welcomed a possible inter-regional exchange of information and co-ordination; as a first important step the Group decided that there should be exchange of information on research programmes. The programmes should provide the following information on eadh project: main title of the project; name of the project leader; brief report of the present status; and reference to work planned in the forthcoming year. In addition, the research programmes should include a reference list of research published.

20. Ten working groups on important areas of common interest were designated:

(a) Low-cost housing;

(b) Light weight aggregate concrete and cellular concrete;

(c) Bricks and other clay products;

(d) Housing developments and physical planning;

(e) Organic building materials and industrial wastes;

(f) Building economics and management;

(g) Building environment: (i) Heat transfer; (ii) Acoustics, ventilation and illumination;

(h) Fire research;

(i) Calcium silicate products.

Each working group will have one co-ordinator and a number of interested members. The members of each working group should report to the co-ordinator on 1 May and 1 November each year. The co-ordinator should reproduce the reports with his comments and circulate to all organizations in the region as well as to ECAFE, UNIDO and the UN Centre for Housing, Building and Planning by 31 May and 30 November each year.

21. The first reports should be circulated in November 1971. ECAFE will co-operate with the co-ordinators to ensure the punctual submission of the reports.

22. The Group recommended that the UN should provide four fellowships each year for advanced studies in specific fields of building research. Countries in the region have facilities for training in specific fields of building research should provide training to other countries under bilateral agreements. It was recommended to establish through the respective governments an exchange of scientists for short periods. The UN should provide funds for travelling fellowships to be awarded to senior scientists to enable them to visit other research institutes in the region.

23. ECAFE machinery for improving co-operation and co-ordination. There should be a meeting of directors of building research once every three years. New building research institutes established in the near future may be invited to participate in the next meeting. ECAFE should make the necessary arrangements for the meeting.

24. The Group recognized the importance of a classified catalogue of building research projects. It was agreed that ECAFE should be requested to prepare such a catalogue if and when resources should permit.

25. Collection, documentation and channels or means for dissemination. The Group recognized the need for a better dissemination of research information. It recommended that research institutes should give the highest priority to the collection of up-to-date information on known research results of value; adopt the results of research from other countries to meet local needs; and undertake thorough documentation work.

26. Research information should be disseminated widely in such a form that it could be readily used, keeping in mind that the users are of different levels of literacy and interest. Building research institutes or building centres should provide information not only through publications, but also through demonstration projects, lectures and seminars.

27. A link should be established between building research and the industry for the provision of up-to-date information and technical advice and also as a means for obtaining feed-back information from actual practice. The Group recommended the establishment of building information centres in co-operation with manufacturers to provide guidance and advice to interested parties.

28. The results of building research have a valuable contribution to make in both the establishment and the continuous up-dating of building codes, bye-laws and regulations.

29. The Group suggested the execution of pilot projects and the construction of pilot plants to show new materials and techniques and overcome the initial resistance to change.

30. Promotion and co-ordination of fire research. The only countries of the region which have fire research establishments were Japan, Australia and India. Though all countries of the region appreciated the need for research facilities on fire they could not set up the appropriate laboratories because of the high capital cost involved. The Co-ordinator of the newly established working group on fire research would be the Director of the Central Building Research Institute, Roorkee, U.P., India.

Major problems confronting Building Research Organizations in Africa

31. The Directors of Building Research Organizations from Ghana, Sudan, Ethiopia, Togo and the Regional Educational Building Institute for Africa (REBIA) presented problems confronting their organizations.

32. All the research organizations had similar problems of lack of finance, shortage of professional and technical staff as well as shortage of equipment. These had been aggravated by significant salary differentials which tended to attract both professionals and technicians from the research organizations into industry.

33. The Building and Road Research Institute (Ghana) and REBIA (Khartoum) felt that the full potentialities of the organizations were not currently being fully exploited while the Togo Building Centre (Cacavelli) which concentrated on rural development, found that the people were anxious to implement ideas even before they had been fully proved.

34. There were problems associated with establishing criteria for identifying and selecting research projects for execution in the BRRI. The BRRI's predecessor, the West African Building Research Institute, had been greatly concerned with testing imported building materials in order to determine their performance under tropical climatic conditions. The BRRI is presently concerned with finding out new sources of raw materials for building materials manufacture as well as their properties. The projects of the Institute are required on the one hand to provide data required by professional groups in the building industry and, on the other, to give support to the majority of low grade technicians as well as the village contractors with no professional skill at all, who form the majority of builders in the country. This problem extended to the establishment of the level of execution of the research projects and to the methods of dissemination of the research results.

35. The BRRI had to have both national as well as international recognition. Projects which were executed at the "frontiers of knowledge" were designed to establish a rapport with the international research world while the others were designed to satisfy local needs. This 'bifocal' policy, in the view of all the directors, was necessary for growing research organizations.

36. The lack of rapport between the executive agencies of government and the research stations was a problem for all directors; generally, the means by which research knowledge was consumed needed improvement.

37. The BRRI had organized significant exchanges with research organizations abroad. They were currently engaged on work in building climatology and road pavements in collaboration with University College, London and the British Road Research Laboratory, respectively.

38. Their survey on lateritic soils had been done with the collaboration of USAID. They were also conducting research on termite resistance of building materials with the British Museum. Other current work in hand was on the development of building clays.

39. The assessment of the impact of the BRRI on industry presented problems. It was difficult to assess the degree of success which went with the dissemination of research results from the BRRI, in particular its impact on the building construction industry.

40. In addition to the common problems outlined above, the National Building Research Station, University of Khartoum, Sudan, was in the process of finding suitable building design types to cater for all the climatic and local conditions which existed in Sudan. Termite attack was a common problem in all areas.

41. Because of the large distances which had to be covered in Sudan and the high costs of transportation the development of building materials locally had become imperative.

42. A major constraint on the work of NBRS, Sudan, was the lack of experience in problem formulation; since the research station is only five years old this problem might be eliminated in the near future. Current research projects covered clay bricks, the design of local kilns, behaviour of concrete in very hot climates like that of Khartoum, and the use of sea water for mixing and curing concrete. Work was also proceeding on gypsum and it uses in building, and on investigations of foundations for light structures built on expansive clays. Contacts with foreign research organizations had just been started.

43. The REBIA(Khartoum) had the same general problems as those of BRRI(Ghana). In the execution of pilot projects, administrative problems were presented through rigid adherence to central tendering. The training at under-graduate level had taken the attention of REBIA(Khartoum) for some time now and the REBIA was refining methods by which under-graduate architects made full use of their local knowledge and culture in the design of school buildings.

44. The engineers, architects and technologists trained in Europe were only given the training suitable for highly developed industrialized communities and were not always prepared to deal effectively with problems within an African setting. Thus in many cases solutions to problems had been recommended which did not take account of local conditions and needs. The training programmes in institutions in Africa being recently established were also largely oriented towards the training for industrialized centres. They had not been fed with sufficient research data on the African environment which would permit more comprehensive training, taking account of the needs of the region. The need to step-up building research activities in the region which would provide the information required for correct under-graduate training of engineers and architects was emphasized.

45. The lack of properly trained technicians to support the work of the professional staff was recognized as one of the major problems facing the research organizations. It was recognized that research organizations might have to organize the internal training of such technicians.

46. While REBIA was concerned with long-term school building programmes, emergency programmes were also catered for. The documentation and dissemination of information was proving very expensive; each name on their list of correspondents was costing approximately £5 a year in postage alone. In order to cater for design problems which had been ignored, an attempt was being made to set up inter-disciplinary teams of engineers, architects and all the other disciplines connected with school buildings to collaborate in the design. The problem of preventive maintenance of school buildings was tackled by teaching the subject in teachers' training courses.

47. The Building Materials Research and Testing Department - College of Technology (Southern Campus) of Haile Selassie I University, Addis Ababa, was established in 1955 as a part of the former Ethio-Swedish Institute of Building Technology. It was orginally intended to be an educational laboratory for the Building College students. However, the absence of a testing laboratory in the country at that time compelled the Institute to carry out tests of building materials and ground investigation for outside clients.

48. Later on, research on indigenous building materials were added to its activities. Investigations on the resistance to termite attack and the mechanical properties of Ethiopian timbers were made. Research topics undergoing investigation at present were discussed in item 6(a) to (f) in the Work Programme (paragraph 56 et seq below).

49. The main problems confronting the BMRTD were stated as follows: shortage of finance; lack of qualified staff; lack of appropriate laboratory equipment; and lack of appreciation by both rural and urban population, of the advantages of using improved traditional building materials and new ones. Because of the lack of adequate financial support, the BMRTD found it difficult to retain qualified staff and acquire the necessary laboratory apparatus. It was sometimes difficult to convince people to shift from using traditional building materials to building materials of improved quality and longer durability, but slighly more expensive than the traditional building materials. This was specially true to the rural population. They did not seem to appreciate the long range economical advantage of using such materials.

50. The Building and Housing Centre, Cacavelli, Lome, Togo, had problems grouped under three main headings, namely, personnel problems, relationship between the Centre and the Government, and the relationship between the Centre and the people. Inadequacy of personnel and finance were two important problems of the Centre. Training at graduate level at the Centre was intended to finish off a personnel training programme which would normally have started at Cacavelli. It was essential to have the graduate training adapted to local conditions and needs.

51. The Centre was autonomous in the sense that it managed its own internal affairs and took decisions independently on the use of financial resources available to it. This autonomy created some problems in relations with government; for example, government was reluctant to make more funds available for employment of more staff, the reason being that as an autonomous institution, the Centre could finance such increase in staff from its own resources. In this way the Centre might run the risk of becoming a consulting firm rather than a research organization. It was expected that these problems might be overcome as government confidence in the Centre grew and as government made more demands on the services of the Centre.

52. The Centre had a good relationship with the rural people in whose communities the Centre had concentrated its activities since its inception. People were often prepared to adopt new techniques established by the Centre before they were fully proved. In the field of urban and other physical planning the attachment of the people to the land had created difficulties in zoning and government help would be needed to execute the zoning plans which might require some re-settlement. Inspite of these difficulties the Centre was increasingly becoming the main government agency for setting standards in the field of building and housing for Togo.

53. The discussions of the Group on problems confronting research organizations in the region drew attention to the need for collaboration and co-operation in the areas in which research was being carried out by most Centres at present. For example: identification of brick clays; the development of kilns for firing bricks; the foundations of light structures on expansive clays, the research on termite attack on local timbers; and the effects of local climates on concrete.

54. The need for demonstration/pilot projects to disseminate ideas on new materials and techniques was emphasized. Such demonstration projects would help the public to accept research organizations.

55. All the Directors of Building Research Organizations were concerned about the relationship between the amount of money invested in their stations and their output. It was generally agreed that there was no simple relationship between government investment in research organizations and the use to which the results from research organizations was put. The value of funds invested in research organizations would however be demonstrated by an increasing readiness on the part of local executing agencies to respond to developments in research. The Group recommended an increased co-operation with users of research results.

Review of current and long-term building research programmes in the African region

56. The Directors of Research Organizations made contributions under this topic by groups of sub-disciplines as indicated in the Work Programme [Item 6(a) to (f)].

Ghana

57. In Ghana the National Standards Board which is a constituent agency of the Ministry of Commerce and Industry was in charge of promulgating all standards covering buildings. (The Building and Road Research Institute however did drafts directly and was a member of the Committee on building regulations. These drafts were passed on to the National Standards Board). In general the Building and Road Research Institute supported the National Standards Board by providing the necessary technical information needed to establish the appropriate building standards.

58. The Building and Road Research Institute had concentrated its efforts on the identification of sources of local raw materials as well as in their testing and development. An inventory of local building materials was undertaken in 1967. This resulted in the publication entitled 'Building Materials in Ghana'. A survey of mineral aggregates for building and road construction was in hand; as part of this survey the suitability tests (such as hardness, durability, chemical reaction with cement, etc.) were being carried out to establish the quality of each aggregate, before acceptance.

59. Current research on lime for roads and buildings included the development of suitable kilns, the evaluation of local fuels, and the determination of costs of production of building lime. This work was being done in collaboaration with the British Road Research Laboratory.

60. The production of burnt clay bricks by cottage industries was being encouraged through research and development work on techniques of burning, and the economics of production. An inventory of local clays was being carried out. The purpose of the inventory was to establish the suitability of these clays as building materials.

61. In the hot humid climate of Ghana, fungus growth on coated walls constituted a major problem. Current research in this area was designed to prove germicidal washes which inhibited the growth of fungi. Investigations were being carried out on attack by termites on timber and plastics. In general the major work on timber was carried out by the Forest Products Research Institute. The Building and Road Research Institute carried out work on timber only when it was directly related to the building construction industry but always in co-operation with the Forest Products Research Institute. The Building and Road Research Institute had produced design documents on timber columns in which it established norms for design procedures, safe working loads, etc. It had also issued information sheets on the decay of timber under fungal attack as well as a research paper on tests for establishing the resistance of timber to fungus attack.

62. In the area of building techniques, soil mechanics and foundations, the BRRI had studied the properties of the expansive clays found in the Accra plains; a research paper on the physico-chemical properties of these clays as well as an information sheet on techniques for designing foundations for light structures built on these clays had been published.

63. Four papers had already been published on the swell characteristics of Ghana clays, a study designed to obtain the maximum swell pressures of heavy Ghanaian clays under changing field moisture conditions. A study on the distribution of laterites and lateritic soils was being done in collaboration with USAID.

64. In order to save on costs of conventional methods of site investigations, the BRRI is paying increasing attention to geophysical methods.

65. A review of foundation failures in the Accra district was being carried out in order to identify the causes of failure and to formulate design codes for foundations in the Accra area.

66. A survey of traditional dwellings was being carried out in order to incorporate the findings into the designs of new pilot projects. The factors which contribute to slum conditions in various housing estates were also being studied. The information emanating from these studies would be useful in the design of new housing estates.

67. In the field of rural housing and community development, the BRRI was carrying out the following studies: the existing socio-economic and physical conditions of rural housing estates; and the planning and the financing of rural housing development. The results of these studies coupled with those on local materials would be used in the designs for rural housing and community facilities.

68. Following the West African Sub-regional Expert Group on House-Building Costs (E/CN.14/496 - E/CN.14/HOU/81), the BRRI had encouraged the use of the standard information sheets developed by the ECA. This would be the basis on which information on costs would be collected and disseminated in the future.

69. In environmental physics, daylighting studies were yielding information for the rational design of windows. A rotating laboratory for daylight measurements was being constructed. In co-operation with the Meteorological Service an inventory of climatic data for thermal environmental design was being compiled.

Sudan

70. In the Sudan, building standards were issued by the appropriate Government agencies. The NBRS co-operated actively in the preparation and drafting of all standards affecting building.

71. An inventory of local materials was being compiled. Tests were being carried out on the use of burnt clays as aggregate for concrete in areas where sand and gravel were scarce. Studies on local timber roof designs were being carried out. Improvement and development of the quality of fired clay bricks was being carried out without going into full mechanisation which is not considered economically justifiable.

72. The main problems of foundations were those of light buildings on expansive soils where difficulties arose in balancing the bearing pressures with the swelling pressure. Short columns and reinforced concrete strip foundations had been tried, investigations were also in hand on the use of short piles.

73. Fired clay bricks were being used for low-cost houses in addition to rammed earth which had been in use in the dry areas. In such areas the walls were protected on the outside with cow dung plasters and with sand and gum Arabic plasters inside. Hollow concrete blocks were being used in areas where rammed earth could not stand the weather, or where fired clay bricks were not available for lack of suitable soils. Local timber and palm branches were being developed for use as roofing materials. It had been proposed to use light pre-stressed concrete beams instead of timber in the areas infested with termites.

74. No action was yet in hand on building operations and costs. A Section was being started to follow questions on costs. The Section on Environmental Physics which would be started soon would devote attention to questions of the protection of walls from the direct rays of the sun and indoor climates in the hot dry areas.

75. The Regional Educational Building Institute for Africa (REBIA), Sudan, started its activities about 10 years ago. Its activities were restricted to school building research and development for the African countries. REBIA had organized surveys of space utilization in secondary schools in Zambia, Morocco, Madagascar, Sudan and Tanzania and established standards taking account of the number of enrolments and the educational programmes in each country. A task force for establishing school building standards had been created in each country; two such projects had been executed in Ivory Coast and Somalia, where the standards formulated by the task forces were applied in prototypes.

76. Special studies had been mounted which yielded guidelines for the design of science, and home economics laboratories, and audio-visual centres. A combined centre for teaching of science, crafts and physical education for use by many schools was designed for Somalia.

77. Investigations on building materials covered the following areas: Prototype designs using local materials for Sudan and Mali; Building systems based on low-cost local materials and self-help labour; study on long span roof structures for classrooms. In April 1971 a report would be published on the use of timber for long span (up to 4 m) roof structures tied with rope.

78. Considerable attention had been given to the improvement of traditional building materials and techniques for school building. Where local materials were not available, judicious use had been made of imported building materials. A cadre of provincial supervisors had been trained to supervise local labour in the construction of schools with imported materials components supplied by Government.

79. Traditional techniques had been improved for use in roofs, foundations, walls and in the manufacture of materials for school building. An example was the use of graded soil in rammed-earth wall construction.

80. Surveys on the productivity of labour, and on the building market have led to cost indicators for maintenance and building management. Courses in budgeting techniques and on school building administration had been given in Mali. Investigations on daylighting, insulation, and studies on the optimum orientation of buildings with respect to critical sun-angles and prevailing winds had been carried out. Studies on accoustics were being programmed; the results of an investigation on ventilation of school buildings would be published soon.

81. The Regional Education Buildings Institute for Africa (REBIA) sought to build prototypes involving all aspects discussed above. No long-term programmes could be established because of the immediate service that the Centre had to render in response to requests by countries of the region for the solution of specific problems related to their school building programmes.

Ethiopia

82. The Building Materials Research and Testing Department - College of Technology (Southern Campus) of Haile Selassie I University was not involved in standards and regulations directly but it issued drafts to the appropriate authorities for study and promulgation.

83. Materials testing services were provided to private organizations as well as to the public authorities. Building materials surveys in hand covered the properties of scoria for use as concrete aggregates, the use of crushed stone (quarry sand) for mortars, the resistance of local timbers against termites and the effectiveness of preservatives of timber. Investigations were being carried out on burnt clay bricks, stabilized earth bricks, and straw.

84. In the field of soil mechanics and foundations, heaving under light structures was the main problem. This problem was being tackled by intensive research in the following areas: moisture variations in black cotton soils, ground water movements, and under-reamed piles. The study on indoor climates had been abandoned for lack of staff.

Togo

85. The Construction and Housing Centre had not yet established any standards through legislation. It had however adopted a module of 90 cm. for buildings; it had also adopted fixed dimensions for bricks and the Centre was sure these dimensions would eventually be adopted in National Standards. It was also foreseen that the Centre would eventually become the national agency responsible for standards in the construction industry.

86. Studies on cement stabilized soils were started 3 years ago and extensive experience had been acquired in this area. Studies on development of water proofing mixtures using local materials resulted in the discovery that a mixture of local soap and lime was suitable. This was applied directly to the walls. Investigations were in hand on the use of light-weight panels for ceilings as well as on improved thatch for roofing.

87. The development of kilns for the production of lime on an artisanal basis was being encouraged. The use of lime washes using natural clays as dyes was being developed in collaboration with the Department of Mines. It had been found that there are no extensive deposits of clay suitable for bricks. However, an attempt was being made to encourage wide use of clay bricks since this would be within the purchasing power of rural dwellers. The establishment of a large cement factory planned for Togo would not effectively change this situation since cement products would not be economical for rural dwellers. The development of roofing tiles was being encouraged, but since this requires relatively heavy timber roofing frames an attempt was being made to exploit the use of local secondary species with the help of the United Nations.

88. Granites were too hard for rural construction and there were few stones suitable for such construction. An attempt however was being made to standardize the local granite gravels and sand for use as concrete aggregates.

89. The Centre had not yet set up a team and equipment for investigations in soil mechanics and foundation engineering. In the general field of building techniques studies on roofs, walls and damp proof courses had been carried out with the aim of finding the most economic solutions. Studies on roofing vaults have shown that this system of roofing was not traditionally acceptable and it was difficult to popularize the technique. Water proofing had also proved expensive with the use of aluminium foil. Though soap-lime mixtures were suitable, the lack of public acceptance of roofing vaults may rule out further development of the techniques. Investigations on typical designs of classrooms, dispensaries as well as dwelling units were in hand to determine the economic use of space.

90. Under environmental physics, investigations on solar insulation and accoustics of buildings have been carried out.

91. A housing survey covering land use, housing demand, optimal needs of people, and tenant/landlord relationship was in progress. The information from this survey would be used to programme housing requirements, construction and financial requirements. The Centre would play the role of a technical agency to supervise this project. The survey would also identify rural and peri-urban housing needs as well as requirements for urban renewal.

92. The following Table shows research items being investigated by the Organizations represented by the Group and the opportunities for collaboration and co-ordination.

TABLE OF PROJECTS IN RESEARCH PROGRAMMES

	Ghana BRRI	Sudan NBRS	Sudan REBIA 1/	Ethiopia ESIBT	Togo Cacavelli
Regulations, Codes and Practice	x			x	
School standards			x		
Building materials					
Mineral aggregates	x			x	x
Lime	x	x			x
Bricks	x	x		x	x
Fungus attack	x				
Termite	x	x		x	
Scoria				x	
Stabilized soil	x	x	x	x	x
Building techniques					
Soil mechanics	x	x		x	
Foundation expansive soils	x	x		x	
Design of rural housing	x	x		x	x
Use of wood in roofing		x	x		x
Operations and costs	x				
Building physics		2/			
Light	x		x		2/
Ventilation	x		x		2/
Climatic data	x				2/
Accoustics			x		2/
Installations				x	2/

1/ Regional Educational Building Institute for Africa
x/ In hand
2/ Proposed

Main topics to be co-ordinated

93. It had been evident to the Group, after the listing of various research activities on which the organizations were engaged, that the research items on which co-ordination and exchange of information might usefully take place are:

- Building materials
- Building climatology
- Rural and peri-urban housing.

The Group fully recognized all the ramifications of these topics but the concensus was to concentrate on these general areas of research, as they affected each country.

94. On questions of organizations, equipment and methods of research it was recommended that, initially, all research organizations should prepare detailed basic information covering all aspects of their operations, etc.

- Short history;
- Statutes - relationship with government, etc.
- Policies of operation - possibilities of international co-operation;
- List of equipment, research programmes in hand;
- List of personnel available and their specializations.

in such a way that other institutions, on reading these reports, would obtain a clear idea on channels of co-operation and collaboration in order to complement each other's efforts. It was agreed that each research orgn. represented in the Group should report in detail to other institutes on progress in their common research projects. This first report should reach the appropriate organizations not later than June 1971 according to the list of addresses to be circulated by ECA. The process should be repeated every August of succeeding years. It would be expected in reciprocity that the other institutes would take the same action.

Machinery for co-ordination of building research activity at national, regional and inter-regional levels.

95. In order to achieve closer co-ordination of and co-operation on research irrespective of specific projects in hand, it was recommended that each director should make representation to his Board to allow of the exchange of personnel, and the United Nations be invited to help fund such exchange of personnel, by fellowships, etc.

96. It was further recommended that the Centre for Housing, Building and Planning engage during 1971 a consultant to prepare a document on Building Research in Africa, containing all the relevant information which would be required for a better understanding of each research organization's operations. This document should also contain proposals for a standard format for reporting on research programmes. This format would be revised and considered at the next meeting of Directors of Building Research Organizations.

97. The Group decided that selected areas be co-ordinated as indicated below:

Building materials	-Mr. Ibrahim Mohamed Ibrahim
Rural and peri-urban housing	-Mr. Josia Kouassi
Building climatology	-Dr. de Graft-Johnson

The co-ordinators would prepare a comparative study and review of work in their subject area. This review should point out any gaps in the programmes reviewed and suggest any necessary measures by which these gaps could be remedied. The co-ordinators should also propose regional strategy for work in their area. The reports of the co-ordinators would be sent to all other research organizations, ECA, Centre for Housing, Building and Planning, UN Headquarters, by the 1st of October each year.

98. The ECA secretariat would prepare and circulate urgently, a list of institutions in which building research was being carried out. In this list, distinction would be made between University Research Units and National Research Organizations. The Centre for Housing, Building and Planning would, through the Resident Representatives, address requests to all African Building Research Organizations for the information in the areas to be co-ordinated, and indicate in their request the co-ordinators above to whom reports should be sent.

99. On the role of the UNCHBP and the ECA it was decided that these agencies should remind the building organizations of deadlines for submitting reports. The ECA should be a central place for collection and dissemination of information on building research in the region. These two UN agencies should find means of financing the exchange of scientific personnel and obtain any other aid which the building research organizations might need. In addition they should organize meetings as required. It was recommended that United Nations support should be given to research organizations in the following areas: exchange and dissemination of information, travel of experts where an exchange of experts between institutions is found necessary: sponsoring of meetings of directors, and the appointment of experts or consultants by institutions for specific projects.

100. The Ad-Hoc Group on Co-ordination of Building Research proposed that the suggested inter-regional seminar should take place only after a regional seminar. It was recommended that regional meetings should take place once in three years, the first to take place in 1973.

101. The UN Centre for Housing, Building and Planning would disseminate information from the other Economic Commissions through the ECA to all research organizations in Africa.

PART III - SUMMARY OF MAIN RECOMMENDATIONS AND DECISIONS

102. The Ad-Hoc Expert Group on Co-ordination of Building Research in Africa meeting in Addis Ababa, 22 to 26 March 1971.

Recommends

1. that measures be established for increased co-operation not only between the building organizations themselves but also between the building organizations and the users of research results. (Paragraph 55)

2. that in order to facilitate the co-operation between research organizations in Africa, the directors of those research organizations should obtain permission from their Board of Governors to allow exchange of research personnel within Africa. (Paragraph 95)

3. that the Centre for Construction and Housing at Cacavelli, Lome, Togo, should explore all means by which its scope of operations could become international.

4. that the Centre for Housing, Building and Planning, should engage a consultant during 1971 to prepare a document on building research in Africa. This document should contain proposals for a standard format for reporting on research programmes. The scope of this document should be as set out in Paragraph 96 of this report.

5. that the United Nations Organization should finance the exchange of research information and scientific personnel. (Paragraph 95)

Decides

1. that the system of co-ordination and co-operation between the building research organizations in Africa, the ECA, and the Centre for Housing, Building and Planning should be as set out in paragraphs 98 onwards.

2. that the main research topics to be co-ordinated for the time being should be building materials, the rural and peri-urban housing, and building climatology. The co-ordinators of these topics are as set out in Paragraph 95.

3. that regional meetings on co-ordination of building research should take place once every three years and the next meeting should take place in 1973.

Expresses its appreciation to the College of Technology (Southern Campus) for the opportunity given to it to visit the Campus and inspect their teaching and research facilities. (Paragraph 100).

ANNEX I

LIST OF DOCUMENTS FOR THE GROUP

Document Nos. and titles		
1.	E/CN.14/HOU/48/Rev.1	A Review of Country Monographs.
2.	E/CN.14/HOU/58	Model Regulations for Small Buildings in Tropical Countries.
3.	E/CN.14/HOU/60	Notes on Model Regulations for Small Buildings in Tropical Countries.
4.	E/CN.14/HOU/61	Model Regulations for Small Buildings in Earthquake and Hurricane Areas.
5.	E/CN.14/HOU/51	Report of Working Group of Experts on House-Building Costs (Tangier, 1-12 September 1969).
6.	E/CN.14/HOU/80	Report of the First Regional Working Group of Experts on Improvements in Rural Housing and Community Facilities.
7.	E/CN.14/HOU/81	Report of the West African Working Group of Experts on House-Building Costs.
8.	E/CN.14/INR/107	The Role of the Construction Industry in Development Programmes in West Africa.

9. Aide-memoire for the Ad-Hoc Group of Experts.

10. Machinery for Co-ordination of Building Research Activities at Regional and Interregional Levels.

ANNEX II

AD-HOC EXPERT GROUP ON CO-ORDINATION OF BUILDING RESEARCH IN AFRICA

List of Experts/Liste des experts

Ato Mesfin Leikun
Associate Dean
College of Technology
Southern Campus
Haile Selassie I University
Addis Ababa/Ethiopia

Dr. Zawde Berhane
Head, Materials Research and Testing Department
Haile Selassie I University
Addis Ababa/Ethiopia

Mr. J.W.S. de Graft-Johnson
Director
Building and Road Research Institute
P.O. Box 40
Kumasi/Ghana

Mr. Kamal El Jack
Director
Regional Educational Building Institute for Africa
P.O. Box 1720
Khartoum/Sudan

Mr. Ibrahim Mohamed Ibrahim
Director
National Building Research Station
University of Khartoum
Khartoum/Sudan

Mr. Josia Kouassi
Directeur du Centre de la Construction et du Logement
B.P. 1762
Lome/Togo

UNITED NATIONS HEADQUARTERS

Mr. A. Gonzalez-Gandolfi
Chief, Building Section
Centre for Housing, Building and Planning
United Nations Headquarters
New York/U.S.A.

SECRETARIAT
ECONOMIC COMMISSION FOR AFRICA

Mr. R.E. Fitchett
Regional Adviser, Housing Finance
Industry and Housing Division

Mr. Max Falade
Economic Affairs Officer
Industry and Housing Division

Mr. A.B. Puplampu
Economic Affairs Officer
Industry and Housing Division