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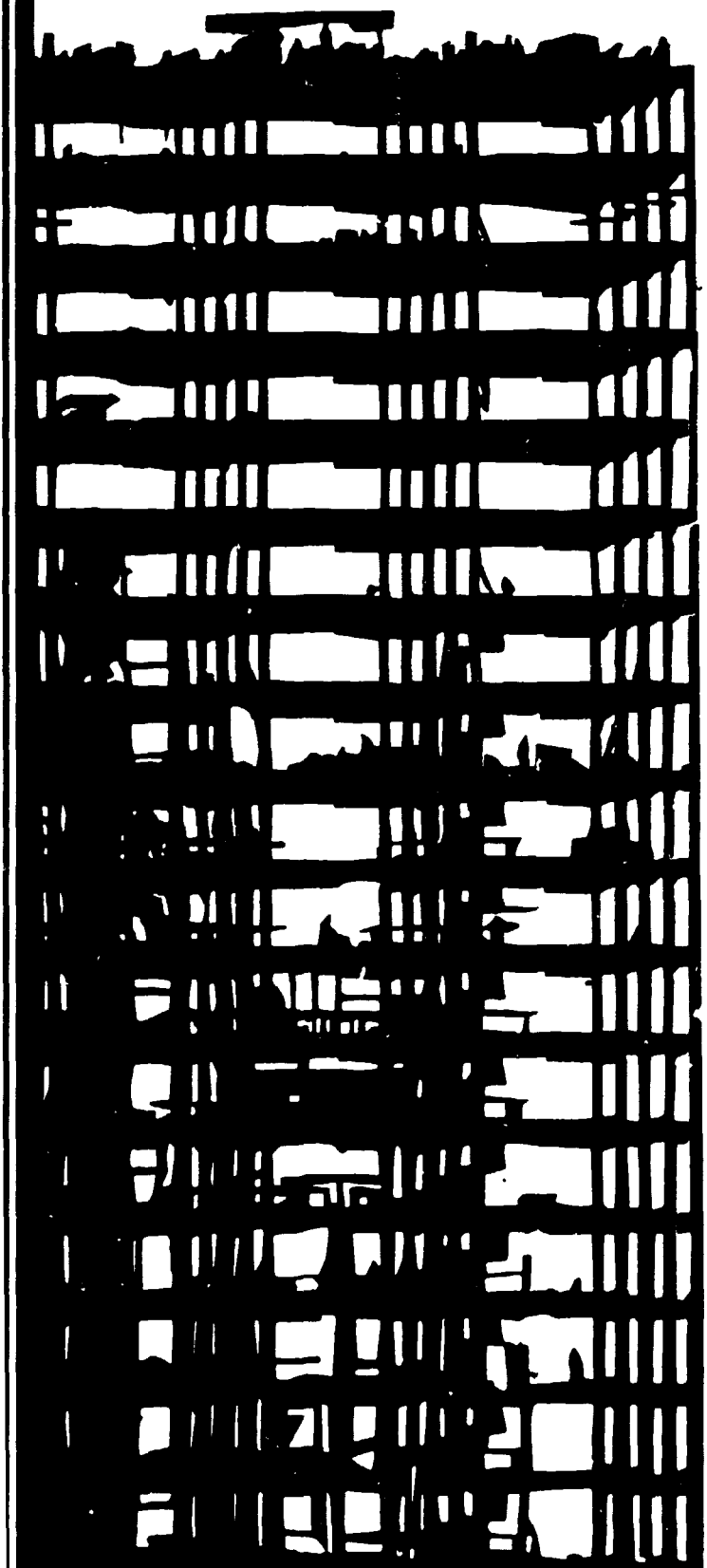

GUIDEBOOK ON TECHNOLOGY MANUAL PREPARATION

by
Arch. Geronimo V. Manahan

UNDP/UNIDO
Regional Network in Asia-Pacific for
Low-Cost Building Materials Technologies
and Construction Systems

REGISTRY

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1988

STEPS IN WRITING THE TECHNOLOGY MANUAL

Writing the technology manual may be divided into seven steps:

1. Gaining an understanding of the objectives of the manual, of the existing situation and the needs of the users of the manual.

2. Gathering and organizing the facts and information.

3. Analyzing the assembled data to the extent that proper conditions, processes, applications, alternatives, conclusions and recommendations may be reached.

4. Writing a rough draft and preparing the charts, tables, figures (photographs, sketches, diagrams, drawings, etc.)

5. Checking, revising, rearranging and rewriting the draft, tables and figures.

6. Reviewing for arrangements, style, format, mechanics and distribution of text and graphics.

7. Production including typesetting in final form, graphic reproduction, proofreading, printing, assembling, binding and distributing.

OBJECTIVES OF THE MANUAL

The main objective of the Technology Manuals is to answer questions on low-cost building materials and building technology. It is here where the technology manual must start - with a question. The author must define the question and limit the scope. it is very exasperating to a busy reader to read a lot of facts without knowing what these are all about or without first having a good orientation of the topic.

DETERMINING USERS OF THE MANUAL

The technology manual will likely have three classes of readers. First are the executives interested only in the current state-of-the-art, significance and recommendations of the technology. Next, are those who may wish to know how to apply the technology but are only after general conclusions and how these were arrived at - something about the parts that constitute the whole. These are the people who would like to utilize the materials and know their properties. Finally, are the people who must check the details, for they are interested in producing the material itself. These are the potential manufacturers and assemblers.

These three classes, decision makers/policy makers, specifiers/end-users and manufacturers/producers may be represented by a wide range of people. Each has a right to the author's attention.

GATHERING AND ORGANIZING OF FACTS AND INFORMATION

It is reasonable to estimate that organizing the facts and information will take by far the largest part of the time allotted to the preparation of the technology manual. During this stage it is best to:

a. Distinguish between the author's claims of facts and opinions from those of others. Credit should be properly given to others' opinions.

b. Distinguish carefully between direct quotations from the author's material. When quotations are used, these should be carefully marked with quotation marks. Use as little quotations as possible.

ANALYSIS OF ASSEMBLED DATA

Consider carefully the purpose and scope of the technology manual. Is it to inform, give advise, suggest alternatives and applications, or to motivate the readers? The answer to these questions will have a great influence on the degree of detail and emphasis of the manual. These are all dependent on the technical applicability of the building material or production process to the greater number of users in a developing country.

The technology manual should explain convincingly and logically what the current situation and conditions are, relative to the particular technology, what the prevailing problems are in its production and applications, and how these can be alleviated through design and should also deal with the current findings on the use of the material.

The assembled data and information should be reviewed, sorted and evaluated since they will be of varying reliability and importance for the purpose of the technology manual. It must be emphasized that the author must be objective in his writing. He should not assume that the reader will put great interest in minor issues which happen to involve the author.

The preparation of an outline always leads to a well-organized technology manual. The general outline for various materials included in this guidebook shall be used by the authors in organizing a more detailed outline of their respective topics.

PREPARATION OF A ROUGH DRAFT AND SUPPORTING CHARTS AND TABLES

The preparation of a draft set of dummy tables, charts, diagrams and drawings indicating only the general content, scheme, significant data, etc. tends to give the author a good perspective of the subject matter. This approach also insures uniformity of presentation.

Oftentimes, and in most cases, the first draft is a matter which must be written rapidly without consideration for grammar, punctuation marks or spelling. This will give more vitality and life to the text. It might also be practical to include in the first draft more material than are necessary because it is easier to remove unwanted materials than it is to expand the topic later on.

REVIEW AND REVISION OF THE DRAFT

After completing the first draft, let the material stay to "mellow" as long as time will permit. This will give the author more objectivity. After a reasonable time, the first-draft can be read quickly to check if all points had been covered. Always consider the relationship of text with tables and figure . A well-written technology manual can be spoiled by irrelevant tables and illustrations.

Carefully consider the refinement of text, tabulations and illustrations. These should complement each other. Give careful attention to the choice of words, their arrangements and proper division of subject matter into paragraphs. Check for continuity of subject matter. Make the sentences simple and use pronouns judiciously. Be careful not to confuse the reader. At about this time the materials are ready for production.

DIVISIONS OF THE TECHNOLOGY MANUAL

These divisions, while falling in a logical sequence, are not necessarily listed in the order in which they are to appear in the specific manual. However, for consistency and ease of reference, systematizing the sequence is advantageous.

TITLE:

This should appear in bold types on the first page. It should be as short as clarity allows. It should suggest as much as possible the contents and the relevance of the contents to current issues and developments.

The titling of headings should also be brief. It must also describe the content following them. Each heading should be followed by an introductory discussion or explanation before the full content is introduced.

AUTHORS:

A clear agreement of authorship at the time the work is commissioned minimizes later disagreements and misunderstandings. Editorial policy may have to be established particularly when complete editorial rewriting will have to be undertaken by others.

PREFACE:

If a preface is to be included in the manual, it should give information on the circumstances of the work. Detailed information of the work however, is not required. It may include acknowledgement of assistance, the author's explanation of purpose of the manual, a short statement on the background of the work of agencies consulted, and even the thinking that inspired the preparation of the manual. The preface should be written by another person other than the author of the manual. Do not confuse the preface with the introduction.

TABLE OF CONTENTS:

The table of contents is a topical outline of the manual while page numbers complete the information given by the list of topics. The entries of the table of contents must be exact headings which appear in the body of the manual. References, appendices, tables and illustrations should be listed in the table of contents in the same manner as the headings.

INTRODUCTION:

This is where the author explains the overall system of the manual. The introduction must fit the requirements of a particular building material or process. The introduction should be brief, concise and useful in giving the reader a brief explanation of the objective and general methods used in the preparation of the manual.

BODY OF THE MANUAL:

The body should contain all the necessary information about the building material and the processes by which it can be utilized for shelter. The body must also include information and processes for arriving at sound conclusions and/or practical recommendations.

The body consists of the main content of the manual and is composed of several parts, all of which are related. The parts may be distinct as to treatment but they must be discussed in the proper sequence in order to lead the reader through a logical stream of thought.

For the presentation of information on any building materials, see the recommended format appended in the guidebook. Besides the general information on the material, this guidebook also provides an outline of the sections which each building material should cover. Each author concerned shall have to refer to the specific outline for the building material he has to write on.

CONCLUSIONS AND RECOMMENDATIONS:

There is sometimes an enormous tendency to list results as conclusions. The conclusions should be distinguished clearly from the factual trends and the inferences drawn therefrom. When writing the conclusions, the author should put himself in the place of the readers who are not familiar with the subject. The author has to try to answer the questions such readers will ask on the manufacture, use for building construction and maintenance and cost of the building material. Conclusions and recommendations should be so clearly stated that there can only be one unique interpretation.

TABLES:

In presenting information on the qualities of the building material, the use of tables and charts shall be most helpful. The author must present his information in a form designed to convince the reader that his conclusions are right. It is important not to cloud the learning process with extraneous information. If there are more detailed data which are more than sufficient for the text, these should be placed in the appendix.

In preparing charts and tables, consistent metric (SI) units should be used throughout. SI units should be chosen to conform to those normally used with the subject.

If abbreviations are to be used, these should be clear and conventional. If it is necessary to use a non-conventional abbreviation, which the reader may not readily recognize, use a letter or asterisk and footnote of explanation. An asterisk is suitable for a single footnote; for a series of footnotes, use successive letters. Do not use numerical footnotes in tables to avoid the danger of confusing them with the data.

In most cases, it is better to present tables and charts in drafted format as most do not lend themselves to convenient typing. Whenever possible, tables should be arranged so that they appear on A-4 paper in the normal reading position. Large tables often have to be reduced from the original size to fit into an A-4 format. Therefore the lettering and lines must be proportionally large enough to be readable when reduced. If the tables do not fit in the normal reading position, they should be arranged with the title at the binding edge of the normal right hand page. Large tables beginning on the left hand or back of the page should be arranged with the title at the opposite or leading edge of the paper.

Tables should state clearly in the titles and notes the source, applicability and scope of the data so that these are clear in themselves. In referring to a table or figure in the text, always refer to the specific table.

All tables should be numbered consecutively in Roman numerals placed above the table. This is then followed in the next line by a complete title in upper case letters. A sub-title, if required, should be placed on the next line with only the initial letter of each word capitalized. All columns and rows should be labeled specifically.

In a table, ditto marks of text or numbers frequently repeated in consecutive lines are not used for this purpose. Repeat the text or numbers. However, when no data are available, use dashes to indicate the non-availability of the data or non-applicability of the particular category. Numbers in columns should be aligned by the decimal point. In numbers less than 1, a zero should always precede the decimal, e.g. 0.53.

Column heads may be separated from the columns by a line. Vertical rulings must be used in table and these should be consistent for all tabulations.

FIGURES:

A figure is a general term used to denote illustrations of any character other than tables. It may be a photograph, a chart, a line drawing or a graph. All figures in the manual should be numbered consecutively in Arabic numerals under the figure. This shall include a complete legend to explain the significance of the figure without having any reference to the text.

It is generally considered not good practice to include more than 3 curves or correlations on one graph. Coordinate scales should be chosen and labeled with care so that information is maximized and interpolation is minimized.

Confine graphs to the vertical A-4 format. If this is impossible these should be reduced to fit the page. The same margins should be used for figures as for texts, particularly at the binding edge.

Scales for graphs should be chosen with the following items in mind:

1. In general, the variable assumed to be dependent should be plotted on the ordinate (Y-axis). The abscissa (X-axis) ordinarily represents the independent variable.

2. The graphs should not unduly magnify or minimize the trend of one or more functions. If there are several graphs with one variable plotted against several operating conditions, the scale for the variable should be consistent throughout.

3. The scales chosen should be easily readable. Make the smallest scale division a decimal value of 1, 2 or 5.

When photographs are to be used, they should be properly cited. If appropriate labels (callouts) are necessary in the photographs to provide explanatory notes, the advice of a photographer shall be helpful. In the case of the photo-micrographs, if a change in the size of the original is necessary, the caption must note the change in magnification. It is advantageous to include a graphical scale when taking a photograph to show the relative size of the object being described. Retouching may also be desirable to increase the clarity of the object being described.

Drawings or illustrations prepared by a draftsman or artist contribute immeasurably to clarity of the subject matter.

In the description of a flow process or an equivalent, a flow diagram and a sketch of the equipment, even in schematic form will always be desirable. Whenever convenient, all drawings and construction details should give a reference scale.

EQUATIONS:

Equations included in the technical manual may be long and complex and are difficult to present in a neat manner. Extra care in preparing the copy must be made so that confusion in symbols are preclude . It is much better to separate the equations, formulas and chemical symbols to stand alone from the text. Greek letters and other symbols may have to be hand lettered. and if the material contains a number of these, it is better to do the whole by hand. It is also convenient for reference purposes to number the equations consecutively.

REFERENCES:

In technical writing, particularly for manuals, it is very desirable to give exact and complete references to all works that are mentioned or quoted. This will give the reader a body of knowledge in the subject matter particularly if he wants to go deeper into it. He may wish to read further on the subject or to look up additional details of the work cited. Sharing with the reader the extent of the literature reviewed also establishes confidence in the manual.

Source references should be given whenever quotations, ideas or results of other authors are used or mentioned.

The name of the author, or when [illegible] must be followed by a number in parentheses. For example:

> Boynton and Gutschick (35) cite seven properties that can be evaluated to show that the lime is of good quality.

Do not place the reference number in the heading. The reference number should appear in the first sentence of the paragraph where the previously published subject matter is discussed. The reference numbers refer to a numbered bibliography which follows the conclusions and recommendations.

The bibliography is ordinarily arranged alphabetically by senior author. If no author is available, the title should be used in an alphabetical arrangement.

When preparing a bibliography for books, the arrangements should show in the order listed: senior authors' name (surname, first), co-authors (surname, first), title books (underscored), name of editor or translator whenever indicated, edition number, place of publication, name of publication, and volume and page numbers of the citation.

When citations come from journals or periodicals, show in the order listed: the senior author's name (surname, first), and co-authors (surname, first), title of paper or article (no quotation marks), name of periodical (underscored), series or volume number (with a wavy underscore), issue number if any, page numbers, and year of publication (in parenthesis). If the journal has no volume number, the year is used instead and is underscored.

For report, show the senior author's name (surname, first), followed by co-authors (surname, first), title of report (underscored), issuing agency, date of publication, document number (in parenthesis), and page number.

When patents are cited, these should be made in the following manner: inventor, assignee, title (in parenthesis), country, patent number, filing date and/or convention date (in parenthesis).

unpublished material may come from papers presented at technical meetings, correspondence and personal tables. The citations should be given as completely as possible to give the reader a good impression of the source of information. Include in the citation the name of the person (surname, first), circumstances of the material which shall include the title (in parenthesis), if a paper presented, and the place and date of its occurrence.

APPENDIX:

All materials which are not essential to the completeness of the manuscript but which are related to the discussion of the body of the manual are included in the appendix. The appendix should also be treated as a major section of the manual with consecutive page numbers, table of contents and references. For clarity and usefulness of the manual the appendix should include the following divisions:

1. Design methods
2. Production case studies
3. Project feasibility methods
4. Marketing procedures
5. Simple Specifications
6. Applicable standards

Designation of divisions of appendices should be with its own title following the appendix designation of Appendix A, Appendix B, etc.

INDEX:

Do not confuse the index with the table of contents. The index contains an alphabetical listing with page numbers to refer to the location of the listing. By convention, the index is always located as the final division.

It is necessary for one to be familiar with the subject matter as well as with the steps in indexing for one to come out with a well prepared index. The objective is for all subjects and their subdivisions to be indexed. This can be handled by first carefully reading through the manuscript and marking all items that are to be indexed. Different colors can be used for sub-entries. When all words are underlined, these are catalogued with their page numbers. Thereafter, the entries are alphabetized for final typing. The final dummy should be verified by cross-referring the subject with the appropriate page location. If there are any paging rearrangements the final index has to be correspondingly revised.

APPENDIX A

GENERAL FORMAT FOR FILING, COMPILING AND PRESENTING OF INFORMATION ON BUILDING MATERIALS

OBJECTIVE

The objective is to set out properties of building materials and general products in an order which would be reasonably convenient in preparing statements and for those using them.

Decide which properties in the list are not relevant for the particular material. Then, eliminate those properties which are of such minor significance that information on them will seldom, if ever, be required.

OUTLINE

0 Document. Scope and information for indexing To enable ready filing and retrieving

1.0 Identification

To state the subject of the document in a straightforward manner.

1.01 Generic Name

To be used depending on whether the product has a trade name which incorporates the generic name, e.g. Cebu lime, Meycauayan adobe, or whether it is so well known by its trade name that the generic name is superfluous.

1.02 Product Name

Trade name in bold types. Give also name and address of the manufacturer.

1.03 Short Description

Highlight key issues, any special advantages or exceptional properties as well as limitations of use. Provide only sufficient information to get to know the product which could be of use without going into detail. When limitations are included, indicate also whether manufacturers produce a grade or quality not subject to the limitations.

1.04 Related documentation

Refer to documents for standards, code of practice, certifications, building regulations.

2.00 Description

Information with respect to the product as purchased. For many, it will be the same as 'when used'.

2.01 Composition

Concerns the composition of the product for the purpose of the user. Should include the finishes applied to the product or those which can be applied, unless it is to be linked up with detailed information concerning color, etc., in which case it would often be more convenient to place it in 2.07 (Appearance).

2.02 Manufacture

A brief outline of the manufacturing or production process would be relevant.

2.03 Accessories

These may be essential or optional accessories

2.04 Shape

More necessary for documents describing components. Likely to be provided in the form of a sketch or a photo. If a drawing is used, dimensioning the sketch will satisfy item 2.05: Size.

2.05 Size

Can be incorporated with 2.04: Shape.

2.06 Weight

When there is a range of sizes and the data are put in the form of a table, this can be incorporated with 2.05: Size.

3.07 Appearance, etc.

For characteristics which are evaluated or recognized by the senses, of which sight and feel will usually be the more important: smell will sometimes be significant, while hearing has been included for completeness.

3.09 Climate, Site and Occupancy Conditions

Mention where product would be most particularly useful.

4.00 Working Characteristics and/or those Relating to Behavior in Use

Can also relate performance in use. Place greater emphasis on "working properties". Much information may be given in the form of numerical data obtained as a result of tests. Identify test method, by referring to relevant test procedures.

4.01 Structural, Physical and Mechanical Qualities

Tensile, compressive, flexural properties.

4.02 Fire Resistivity per Unit Time

Fire rating

4.03 Gases

Air, water vapor, permeability, diffusivity, carbonation

4.04 Liquids

Any changes on the product caused by liquid; state the liquid. Determine change in composition, shape, size, weight, appearance.

4.05 Solids

Dirt, effect of impurities

4.06 Biological

Give information on behavior under conditions normally expected to be relevant for a building. State in certain instances the consequences of less normal condition so that damage can be avoided either by proper storage or usage.

4.07 Thermal

Qualities per unit time.

4.08 Optical

Wave length may be significant in certain instances.

4.09 Acoustics

Insulating qualities

4.10 Electrical

Electrical conductivity is measured.

4.11 Energy

Applicable only for services and components used in service installations.

4.12 Compatibility

Indicate only when special requirements needed.

4.13 Durability, Reliability

Can vary from a simple statement of a certain period of time to a detailed statement of the rate of breakdown.

4.14 Workability

Extent and manner

4.15 Maintenance

Regularity, type, procedures

5.00 Applications

Possible use of the product given in detail, presentation of working drawings or standard details.

6.00 Site Work

Instructions for working

7.00 Maintenance

Instructions for maintenance, guarantees

8.00 Prices

Indicate dates of effectivity, retail, wholesale, etc.

9.00 Supply

Condition of supply and distribution

10.00 Technical Services

Name, address and type of services and contractual obligations.

GENERAL OUTLINE FOR THE PREPARATION OF THE TECHNOLOGY MANUAL ON RICE HUSK ASH CEMENTS:

I. General

A. Botanical classification of rice
B. Characteristics and quality of rice husk
C. Uses of rice hull

1. Share of the building construction industry

D. Composition and properties of rice husk

II. Production of Rice-Husk Ash

A. Factors influencing the ashes

B. Methods of burning

1. Temperature control requirement
2. Pyroprocessing conditions

C. Properties of ash

1. Chemical properties
2. Physical properties
3. Tests and standards

D. Opportunities for utilization of rice-husk ash

1. In building construction

a. Binding material
b. Fillers
c. Silica source
d. Carbon source
e. Refractories

2. Ash reactivity requirements

III. Production of Rice-Husk Ash for Pozzolans

A. Burning procedures
B. Grinding procedures
C. Chemical properties for ash reactivity as a pozzolan
D. Physical properties for ash reactivity as a pozzolan
E. Energy requirements for ash production
F. Test procedures and standards of ash

IV. Rice-Husk Ash Cement Design Mix

A. Lime-ash mixes
B. Portland cement - rice-husk ash mixes
C. Clay - rice-husk-ash mixes
D. Characteristics and properties of mortars and mixes

1. Dimensional stability
2. Durability
3. Strength

E. Application of RHA Cement

1. Plasters and mortars
2. Block masonry
3. Blended concrete mixes
4. Cast products
5. Ferrocement mix
6. Acid resistant floors and pipes
7. road sub-base

F. Test methods and standards requirements of building products

G. Cost effectiveness and scaled production

APPENDICES

A. Design parameters and standards for RHA mortars and concretes

B. Production standards for pyroprocessing and grinding

C. Model specifications for quality assurance

D. Methods for project feasibility studies on RHA production

E. Methods for project feasibility studies on product development out of RHA cements

F. Marketing requirements for RHA production

G. Marketing requirements for products out of RHA cements

GENERAL OUTLINE
FOR THE PREPARATION OF THE TECHNOLOGY MANUAL
ON CONCRETE HOLLOW BLOCKS

I. General

A. Tradition of building with concrete hollow blocks

1. Historical precedents
2. Roots of current practices

B. Characteristics of concrete hollow blocks

1. Types
2. Sizes and modularity
3. Weights and densities
4. Advantages and disadvantages

C. Properties of concrete hollow blocks

1. Strength
2. Insulating properties
3. Acoustical properties
4. Water intrusion and permeability

D. Appropriateness for building components and building parts

1. Durability
2. Stability
3. Color and texture
4. Types of mortar joints
5. Finish and surface treatment
6. Local provisions and standards

E. Scales of production

1. Backyard
2. Medium scale production
3. Fully mechanized production

II. Material Requirements

A. Aggregates

1. Sizing
2. Mix
3. Physical properties
4. Reactivity
5. Standards and quality control

B. Binders

1. Portland cement quality
2. Water-cement ratios
3. Cement additives
4. Cement admixtures
5. Quality control

C. Processing methods

1. Storage and handling
2. Mixing procedures
3. Tests for quality (chemical and physical)

III. Concrete hollow blocks design and sizing

A. Modular requirements

1. Overall sizing
2. Face shell thickness
3. Core sizing
4. Coordination with special types

B. Handling requirements

1. Production stage
2. Storage and transporting stage
3. Job site requirements
4. Special types
5. Reinforcing requirements

C. Classification and standards

1. Acceptability
2. Cost effectiveness
3. Strength and durability
4. Appearance and finishes

IV. Production of Concrete hollow blocks

A. Plant and processing requirements

1. Plant sizing
2. Flow process optimization
3. Raw material storage
4. Equipment placements
5. Handling requirements
6. Curing requirements
7. Finished products handling and stockpiling

B. Equipment and machinery requirements

1. Production volume
2. Flexibility of machinery
3. Batch sizing
4. Cost effectiveness
5. Auxiliary equipment
6. Quality control laboratory
7. Handling equipment

C. Plant maintenance and energy management

1. Personnel safety
2. Equipment maintenance and operation
3. Energy monitoring efficiency

V. Building Design Requirements

A. Pre-construction

1. Structural design requirements
2. Site preparation requirements
3. Aesthetic requirements

B. Construction and standards

1. Materials handling at site
2. Concrete block handling by masons
3. Requirements for supports during concrete hollow blocks placements
4. Reinforcements
5. Accessories and attachments
6. Finishing and cleaning
7. Tests at site

C. Maintenance and repairs

1. Finishing
2. Defects and faults
3. Methods for post construction evaluation

APPENDICES

A. Planning and Organizing a Concrete Hollow Block Plant
B. Standard Specifications for Concrete Hollow Blocks
C. Design Parameters for Concrete Hollow Block Construction
D. Model Feasibility Studies for a Small-Scale Concrete Hollow Block Plant
E. Equipment Shopping List for a Small-Scale Concrete Hollow Block Plant
F. Construction Details for Concrete Block Works

GENERAL OUTLINE
FOR THE PREPARATION OF THE TECHNOLOGY MANUAL
ON CLAY BRICKS

I. General

A. Tradition of building with clay bricks

B. Characteristics of clay bricks

1. Types
2. Sizes
3. Quality

C. Uses of clay bricks

1. Structural
2. Architectural
3. Functional

D. Strength properties of clay bricks

E. Durability, stability and appearance of clay bricks

F. Scales of production

II. Raw Materials

A. Distribution of clay

1. Prospecting procedures
2. Sizing the reserves
3. Accessibility measures for the mine

B. Types of clay for brickmaking

1. Physical requirements
2. Mineral and chemical requirements
3. Drying requirements
4. Firing requirements
5. Standards and tests

C. Test procedures for raw material quality

1. Particle size
2. Plasticity and cohesion
3. Chemical and mineralogical tests
4. Shrinkage tests
5. Firing tests

III. Quarrying Methods

A. Organization

1. Personnel
2. Equipment handling
3. Budgeting and programming
4. Records keeping

B. Quarry operations

1. Resource allocation
2. Safety
3. Drainage

C. Clay Extraction

1. Care of overburden
2. Care of pits
3. Placement of spoils
4. Extraction rate
5. Winning methods

D. Quality test procedures

1. Mix
2. Stability of material

E. Handling and transporting of clay

1. Equipment
2. Transport system
3. Transport and handling characteristics
4. Cost effectiveness

IV. Preparing the Clay

A. Rationale for preparation

1. Advantages
2. Additives necessary
3. Tests methods

B. Sorting and washing

1. Sorting criteria
2. Equipment

C. Crushing and grinding

1. Criteria and standards required
2. Equipment and procedures
3. Cost effectiveness

D. Sieving and screening

1. Criteria and standards required
2. Equipment and procedures
3. Cost effectiveness

E. Proportioning

1. Procedures and standards
2. Equipment
3. Quality assurance

F. Mixing, wetting and tempering

1. Procedures and standards
2. Equipment
3. Cost effectiveness
4. Batch testing
5. Handling procedures

V. Sharing the Clay Brick

A. Standards

1. Modularity
2. Size and shape
3. Weight
4. Dimensional tolerances

B. Methods of shaping

1. Economics of scale
2. Mechanized system
3. Hand moulding

C. Handling of shaped products

1. Handling methods
2. Transport systems
3. Productivity requirements

VI. Drying of Bricks

A. Drying methods

1. Location
2. Environmental requirements
3. Sizing and scheduling

B. Criteria and standards

1. Quality control
2. Selection methods
3. Criteria for shrinkage acceptance
4. Disposal of sub-standard products

VII. Firing of Bricks

A. Firing standards and objectives

1. Methods and techniques
2. Rationale

B. Equipment

1. Types of kilns
2. Energy requirements
3. Accessories and auxiliary equipment
4. Handling methods

C. Quality control and test methods

D. Storage, disposal and dispatch

VIII. Building Applications

A. Pre-construction

1. Design requirements and processes
2. Site preparation requirements
3. Waterproofing/Dampness prevention
4. Fireproofing requirements
5. Aesthetic requirements

B. Construction

1. Materials handling at site
2. Bricklaying methods and workmanship
3. Supporting structures
4. Accessories and attachments
5. Plastering, painting and rendering
6. Cleaning
7. Tests

C. Maintenance and repairs

1. Component investigation
2. Defects and faults in brickwork
3. Procedures for repairs

C. Other applications

1. Paving bricks
2. Fire bricks
3. Fencing
4. Facing

APPENDICES

A. Planning and Organization of a Brickwork Plant

B. Standard Specifications for Bricks

C. Design Parameters in Buildings of Brick

D. Model Feasibility Studies for Small Scale Brickwork

E. Construction Details in Brick

GENERAL OUTLINE FOR THE PREPARATION OF THE TECHNOLOGY MANUAL ON CLAY-LIME BRICKS

I. General

A. Tradition of clay-lime block processing

1. Traditional production methods
2. Traditional building methods
3. Traditional applications in construction

B. Characteristics of clay-lime bricks

1. Types
2. Sizes and shapes
3. Quality

C. Uses of clay-lime bricks

1. Functional uses
2. Structural uses
3. Architectural uses

D. Strength properties

1. Compressive strength
2. Flexural strength

E. Durability, appearance and stability of clay-lime bricks

F. Scales of production

1. Small scale, backyard
2. Medium scale
3. Fully mechanized

II. Raw Material : Clay

A. Distribution

1. Prospecting procedures
2. Sizing of the reserve

B. Essential clay types

1. Physical requirements
2. Chemical analysis
3. Mixing and moulding properties
4. Autoclaving requirements

C. Standard tests

1. Particle size
2. Plasticity and cohesion
3. Mineralogy
4. Chemical tests
5. Shrinkage tests

III. Raw Material : Lime

A. Distribution

1. Prospecting procedures
2. Sizing the reserve
3. Ecological implications

B. Requirements for Lime

1. Physical requirements
2. Chemical requirements
3. Binding activity
4. Burning requirements
5. Grinding requirements

C. Standard tests

1. Chemical tests
2. Physical tests
3. Reactivity as a binder

IV. Extraction Methods

A. Organization and management

1. Resource management
2. Quarry organization
3. Safety of operations
4. Drainage

B. Extraction procedures

1. Care of overburden
2. Care of pits
3. Extraction rate
4. Care of derelict land

C. Handling and Transporting of Material

1. Equipment characteristics
2. Transport system
3. Cost effectiveness

D. Quality test procedures

1. Mix
2. Material suitability
3. Extraction rates

V. Production of Clay-Lime Blocks

A. Mixing of materials

1. Slaking of lime
2. Mixing proportions
3. Mixing procedures
4. Equipment requirements

B. Moulding and shaping

1. Plant sizing
2. Equipment requirements
3. Forming and shaping the bricks
4. Stacking sheds
5. Curing sheds

C. Handling methods

1. Moisture requirements
2. Curing requirements
3. Storing requirements
4. Handling equipment tools

D. Testing the Quality

1. Strength test
2. Absorption test
3. Spray test
4. Testing dimensional stability

VI. Applications in Buildings

A. Design requirements

1. Site conditions
2. Foundation requirements
3. Structural design requirements
4. Resistance from dampness

B. Construction requirements

1. Materials handling at site
2. Blocklaying and workmanship
3. Mortar joint requirements
4. Supporting structures and accessories
5. Finishing requirements
6. Maintenance and repairs

C. Uses of clay-lime blocks

1. Walls of clay-lime bricks
2. Roofs
3. Floors

APPENDICES:

A. Planning and Organizing a Clay-Lime Brick Factory

B. Standard Specifications for Clay-Lime Brick

C. Design Standards for the Use of Clay-Lime Bricks for Building Construction

D. Surface Coat-Up for Clay-Lime Bricks

E. Test Procedures for Clay-Lime Bricks

GENERAL OUTLINE
FOR THE PREPARATION OF THE TECHNOLOGY MANUAL
ON BAMBOO AS A BUILDING MATERIAL

I. General

A. Botanical characteristics of bamboo
B. Origin and classification
C. Species useful as building material

1. Distribution, supply and demand situation
2. Description of parts of the pole

II. Cultivation and Silviculture

A. Ecology

1. Climatic factors
2. Soil characteristics
3. Drainage requirements

B. Propagation methods

1. Asexual
2. Sexual

C. Planting and Flowering Characteristics

1. The rhizome
2. The nodes and internodes
3. The twigs and leaves
4. The types and causes of flowering
5. Life cycle

D. Pests and insects which attack enemies of bamboo

III. Pulp and Fiber

A. Uses of pulp and paper from bamboo in building construction
B. Useful species
C. Characteristics of fiber and pulp

1. Physical properties
2. Chemical composition

D. Production methods
E. Tests and standards required

IV. Uses of bamboo in building construction

A. Species useful for building construction
B. Mechanical and physical properties
C. Advantages and Disadvantages of bamboo for construction
D. Treatment of bamboo

1. Harvesting methods
2. Pole selection
3. Curing and drying methods
4. Defects in treatment

E. Preservative agents against rot and insect attack

1. Useful chemical agents
2. Application procedures

F. Construction requirements in the use of bamboo

1. Connection details
2. Anchorages
3. Lashing methods
4. Joinery procedures

V. Applications in Building Construction

A. Matting and walling

1. Types and uses
2. Preparation and processing
3. Preservation

B. Scaffoldings and structural supports

1. Framework systems
2. Scaffolds and temporary flooring
3. Support structures

C. Piping systems and fountains

1. Useful species and selection methods
2. Preparation procedures and treatment
3. Attachments and connections

D. Reinforcements for concrete

1. Useful species and solution methods
2. Preparation and treatment
3. Mechanical and physical properties
4. Design consideration
5. Placement in concrete
6. Test procedures

E. Roof trusses, floor framing and columns

1. Useful species and selection methods
2. Preparation and treatment
3. Connection procedures
4. Design considerations

F. Roofing and flooring

1. Types and selection procedures
2. Typical layouts and attachments
3. Design considerations

VI. Architectural Detailing

A. Building forms in relation to materials

1. Composite structures
2. Framing procedures

B. Building construction detailing

1. Column placements and supports
2. Beam and floor layouts
3. Wall and window/door detailing

a. Composite walls
b. Water proofing

4. Roofing surfaces
5. Fencing and open partitions

C. Building ornamentation and decorations

1. Laminated bamboo
2. Panels and tiles
3. Tube sections
4. Window blinds and shutters
5. Basketry weaves

APPENDICES

A. Design parameters and standards

B. Production standards for mechanical processing

C. Model specifications for quality assurance

D. Methods for project feasibility studies

E. Marketing procedures

GENERAL OUTLINE FOR THE PREPARATION OF THE TECHNOLOGY MANUAL ON COLD DRAWN LOW-CARBON STEEL WIRE PRESTRESSED CONCRETE

I. General

A. State of the art

1. Historical development
2. Scales of production
3. Viability for low-cost housing

B. Material : Steel wire

1. Cold drawing procedures
2. Prestressing characteristics
3. Protection from elements
4. Quality control and standards
5. Testing cold drawn wire

C. Material : Concrete

1. Material requirements
2. Proportioning and optimizing mix
3. Mixing requirements
4. Quality control and standards
5. Testing concrete mix

II. Design Considerations

A. Loading requirements

1. Loading factors
2. Strength requirements and standards
3. Stability requirements
4. Sizing of sections and aesthetics
5. Impact resistance and repeated loadings
6. Resistance to handling and transporting

B. Prestressing Requirements of Steel

1. Handling of steel wires
2. Steel proportion
3. Steel protection
4. Anchorages and joinery
5. Stressing requirements

    a. Initial stress values
    b. loss of prestress

6. Relation with stretching bed

C. Concrete requirements

1. Prestress requirements

a. Factors of safety
b. Initial stress values
c. Losses of prestress
d. Weaknesses and failures

2. Sizing the section

a. Size proportioning
b. Sectional transformations

3. Strength requirements

a. Flexure
b. Compression
c. Shear
d. Bond
e. Torsion

4. Stability requirements

a. Vibrational resistance
b. Deformation
c. Deflection
d. Crack resistance
e. Concrete cover of steel
f. Protection of ends

III. Production of Cold Drawn Low-Carbon Prestressed Concrete Products

A. Procedures for stressing wires

1. Tensioning of steel wire and its technique
2. Controlling stresses
3. Monitoring stresses on tensioning bed

B. Concreting techniques

1. Formwork preparation
2. Proportioning and mixing
3. Pouring and vibrating
4. Curing techniques
5. Demoulding
6. Tension releasing methods
7. Storage and handling
8. Transporting

C. Other casting techniques

1. Hollow-core
2. Extrusion methods
3. Gang-casting methods

D. Equipment and Devices

1. Production area
2. Pre-tensioning beds
3. Formworks and moulds
4. Stretching machines
5. Vibration equipment
6. Moulding devices
7. Concreting equipment
8. Demoulding equipment and devices
9. Handling and transporting equipment

E. Evaluating the products

1. Quality control

a. Sampling methods
b. Items to evaluate

2. Structural tests

a. Test samples
b. Preparation for testing
c. Methods of testing
d. Reporting procedures

IV. Applications

A. Building systems

1. Floor systems
2. Roof systems
3. Framing systems
4. Wall systems

B. Building components

1. Piles
2. Beams
3. Slabs
4. Columns
5. Curtain walls
6. Shells

C. Attachments and Finishing

1. Joints
2. Anchorages
3. Weatherproofing
4. Protection against elements
5. Finishes

APPENDICES

A. Organization of a small-size plant

B. Material specifications

C. Product specifications

D. Design procedures and standards

E. Process design and plant layouts

F. Test procedures

GENERAL OUTLINE FOR THE PREPARATION OF THE TECHNOLOGY MANUAL ON COCOWOOD

I. General

1. The propagation and extent of propagation of cocos nucifera (coconut) in the tropics
2. The coconut tree and its utilizable parts
3. Economic uses of cocowood
4. Other palm and palm wood potentials
5. Rationale for the utilization of cocowood
6. Types and characteristics of cocowood for the building industry

II. The Logging of Coconut Palms

1. The programming and systematic approach to logging coconut palms
2. Determining quality of logs to fell
   a. Size
   b. Maturity
   c. Defects to minimize
   d. Insect attacks to avoid
3. Strategies for logging coco timber
   a. Timing
   b. Personnel
   c. Selection
   d. Equipment
4. Felling techniques and hauling methods
5. Cost considerations in the logging of coconut palms

III. The Economics of Cocowood Utilization

1. The cost effectiveness of milling
2. The cost of production and processing
3. The cost of fabrication of cocowood components
4. The economics of transporting cocowood
5. Maintenance and operating cost of building components from cocowood
6. Expected problems to be encountered in utilizing cocowood and how to overcome them

IV. The Production and Processing of Cocowood

1. Milling techniques and their equipment
2. Dressing procedures and tools to use
3. The preservation, seasoning, drying and preservative treatment of cocowood
4. Finishing of cocowood for exteriors and interiors
5. Expected problems to be encountered in processing cocowood and how to overcome these

V. The Characteristics and Properties of Cocowood

1. Physical characteristics and properties
2. Structural and mechanical properties
3. Visual and textural characteristics
4. Chemical properties
5. Standards required for the utilization of cocowood in buildings

VI. Designing with Cocowood

1. Finished lumbers, mouldings and components
2. Structural framing

    1. Trussed systems
    2. Built-up members
    c. Glued members

3. Walls, flooring and panels
4. Small lathes and veneers
5. Test procedures to follow
6. Design standards to satisfy for strength and durability

VII. Connections, Attachments and Anchorages for Cocowood

1. Mechanical fastening systems
2. Anchoring systems
3. Nailing, screwing and bolting of cocowood
4. Gluing of cocowood
5. Others
6. Standards to satisfy in attaching and anchoring cocowood

VIII. Product Samples of Cocowood in Buildings

1. Structural frames and systems
2. Wall components and frames
3. Flooring and parquetry work
4. Panelling and boards
5. Architectural finishes
6. Others

APPENDICES

A. Preparing a feasibility study for a small lumber mill

B. The seasoning and preservation of cocowood

C. Construction details in cocowood

D. Standard specifications for cocowood

GENERAL OUTLINE FOR THE PREPARATION OF THE TECHNOLOGY MANUAL ON WOODWOOL BOARDS

I. General

A. Woodwool defined
B. Characteristics

1. Types
2. Sizes
3. Uses
4. Properties

C. Historical development of the woodwool industry

1. Pioneers of the development
2. State of the art
3. Production types and capacities

D. Economics of woodwool production

1. The market for woodwool
2. Methods of production
3. Experience of various processing procedures

E. Comparative product standards for woodwool

1. Chemical properties
2. Physical properties
3. Strength and mechanical properties
4. Standard specifications

II. Materials Used for Woodwool Production

A. Wood

1. Characteristic properties of wood
2. Species useful for woodwool production
3. Sizes of bolts required

B. Mineralization Products

1. Chemicals used
2. Quantities required

C. Binders

1. Characteristics

III. Equipment Used for Woodwool Production

A. Equipment for production of excelsior

1. Cutting equipment
2. Debarking tools
3. Shaving tools
4. Handling equipment
5. Test equipment

B. Equipment for Mineralization of excelsior

1. Test instrument
2. Handling equipment
3. Containers
4. Dryers

C. Equipment for moulding boards

1. Mixers of binders
2. Presses and moulders
3. Clamps

D. Equipment for finishing and storing boards

1. Curing and conditioning equipment
2. Trimming equipment
3. Handling and packing equipment
4. Others

IV. Steps in the Production of Woodwool Boards

A. Production of Woodwool

1. Quality control of bolts
2. Cutting of bolts
3. Planning of bolts for excelsior

B. Production of Woodwool Boards

1. Mixing of binders
2. Test for process control
3. Test for quality control
4. Moulding of boards
5. Pressing of boards

C. Finishing of Woodwool Boards

1. Curing and conditioning
2. Trimming
3. Marking and labelling
4. Packaging and storing

V. Properties of Woodwool Boards

A. Chemical and Physical Properties

1. Chemical contents and reactions
2. Strength and durability properties
3. Physical properties
4. Thermal and acoustical properties
5. weathering properties

B. Tests for Woodwool Boards

1. Standards used in specifying boards
2. Suggested format for specifications of woodwool boards

C. Applicable Tools in Working with Woodwool Boards

1. Cutting and trimming
2. Nailing
3. Prefining and finishing

VI. Uses and Applications of Woodwool Boards

1. Site handling of boards
2. Exterior use of woodwool boards
3. Interior uses of woodwool boards
4. Uses of boards for furniture and furnishings
5. Construction detailing of boards as components

APPENDICES

1. Feasibility outline in setting-up a small-scale industry plant for woodwool boards

2. Procedures in setting-up a woodwool plant

3. A manual of procedure for technical training in producing woodwool boards

4. An international list of woodwool products, their trade names and addresses

GENERAL OUTLINE
FOR THE PREPARATION OF THE TECHNOLOGY MANUAL
ON PARTICLE BOARDS

I. General

A. Particle Board defined
B. Characteristics of Particle Board

1. Purpose
2. Types
3. Thickness
4. Glue used
5. Properties

C. Historical Development of the Industry

1. Pioneers
2. Process
3. Types and Capacities
4. Standards and Quality

D. Economics of Particle Board Production

1. Market demand in developing countries
2. Production/manufacturing methods
3. Personnel requirements
4. Financial considerations
5. Experience on various manufacturing sizes
6. Applicability in developing countries

E. Comparative Product Standards for Developing Countries

1. Criteria

a. Manufacturing Process
b. Structure of Layering
c. Face Surface
d. Density
e. Adhesive Type
f. Type of Purpose

2. Chemical and Physical Properties
3. Durability
4. Standards Specification formats

II. Materials Used for the Production of Particle Boards

A. Particles

1. Species and characteristics required
2. Dimensional Quality
3. Types
4. Moisture Content
5. Particle Distribution
6. Handling Requirements

B. Glue

1. Types and Properties
2. Composition and Mixing
3. Polymerization Requirements
4. Handling

C. Additives

1. Types

a. Parafin
b. Hardening Agent
c. Fungicides
d. Fire Resistance
e. Insect Attack

2. Properties and Quality
3. Mixing Requirements
4. Handling Procedures

III. Equipment Used for Particle Board Production

A. Raw Material Processing

1. Storage
2. Conveyance and Handling
3. Drying
4. Classifying
5. Flaking and Chipping
6. Separation

B. Manufacturing Equipment

1. Plant Layout and Flow
2. Handling, weighing and conveying
3. Glue mixing and application
4. Spreading, forming and feeding
5. Pressing
6. Heating and boilers
7. Cooling and cutting

C. Finishing and Packaging

1. Balancing
2. Fine sanding
3. Squaring and cutting
4. Grading
5. Storage
6. Packaging
7. Handling and transporting

D. Quality Control Laboratory Equipment

1. Wood Types
2. Adhesives
3. Parafin
4. Water
5. Paper
6. Board Properties

IV. Manufacturing Process for Particle Boards

A. Raw Materials

1. Handling
2. Classification
3. Particle Processing : Flakes, sawdust, chips
4. Dosing
5. Pre-Drying and Refining
6. Drying
7. Separation
8. Quality Control

B. Board Production

1. Handling and Conveying of Materials
2. Glue Preparation
3. Glueing
4. Spreading
5. Feeding
6. Pressing
7. Cooling
8. Curing
9. Energy considerations
10. Quality control

C. Finishing and Packaging

1. Raw Board Storage
2. Sanding

   a. Balancing
   b. Fine Sanding

3. Squaring and cutting
4. Grading and labelling
5. Quality control
6. Inventory and handling
7. Finish storage

V. Properties of Particle Boards and Finished Products

A. Quality Classification

1. Structure
2. Face surface
3. Density
4. Durability/Purpose

B. Chemical and Physical Properties

1. Chemical Content
2. Strength and Durability Properties
3. Physical Properties
4. Fire-Resistance, Insect Attack Resistance
5. Thermal and Acoustical Properties
6. Weathering Properties

C. Test Procedures for Particle Boards

1. Chemical tests
2. Wood Types/Particle Dimensions
3. Moisture Content
4. Physical and Mechanical Properties
5. Suggested Format for preparing specifications for particle boards

D. Applicable Tools for Working with Particle Boards

1. Dimesioning
2. Cutting and trimming
3. Connections, nailing and glueing
4. Pre-finishing and finishing

VI. Uses and Application of Woodwool Boards

1. Site handling of boards
2. Uses and applications in furniture-making
3. Exterior applications in buildings
4. Interior applications in buildings
5. Construction detailing of boards as components

APPENDICES

1. Feasibility outline in setting-up a Particle Board Plant

2. Procedures in setting-up a Particle Board Plant

3. Procedures in operating and maintaining a Particle Board Plant

4. Procedures for technician training in the manufacture of Particle Boards

5. Notes on Indoor Pollution due to formaldehyde emissions

6. International Product list of manufacturing equipment for Particle Boards

7. International Product list of Particle Boards, their trademarks and addresses

The Regional Network in Asia-Pacific for Low-Cost Building Materials Technologies and Construction Systems (RENAS-BMTCS) is a regional project funded by the United Nations Development Programme (UNDP) and executed by the United Nations Industrial Development Organization (UNIDO).

The Network was established to facilitate technical cooperation among developing countries of the Asia-Pacific region in the development of low-cost building materials and the adoptation of appropriate construction techniques. Member countries of the Network are: Afghanistan, Bangladesh, China, D.P.R. Korea, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Tonga and Tuvalu.

This Guidebook was published by the Regional Secretariat of the Project to assist our technical writers to organize their data and to standardize the manuals of the Network.

The series of technology manuals of the Network is in line with its objective of gathering and disseminating technical information on relevant research results and technologies which utilize indigenous resources.

The manuals were written by technical experts from different Network member countries and published by the Network's Regional Secretariat, based in the Philippines. For further information, please write to:

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